



2.3.1: EXPERIENTIAL LEARNING

- ❖ **Popularisation of Science - Science Exhibition**
- ❖ **Xynergy - Arts Exhibition**
- ❖ **Department of Botany**
 - List of Projects and project report
 - Excursion/Field trip reports and photos
- ❖ **Department of Vocation Studies (B.Voc)**
 - List of Projects and project report
- ❖ **Department of Chemistry**
 - List of Projects and project report
- ❖ **Department of Life Sciences and Biochemistry**
 - List of Projects and project report
 - Excursion/Field trip reports and photos
 - Exhibition report and photos
- ❖ **Department of Mathematics**
 - List of Projects and project report
 - Exhibition report and photos
- ❖ **Department of Microbiology**
 - Project cover page and certificates
 - Exhibition photos



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

❖ Department of Physics

- Exhibition report and photos

❖ Department of Sociology

- Privilege Walk
 - ✓ List of students
 - ✓ Photos

❖ Department of Zoology

- List of Projects and project report
- Excursion/Field trip reports and photos
- Exhibition report and photos



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

POPULARISATION OF SCIENCE

SCIENCE EXHIBITION



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Exhibition – Popularisation of Science (2019-20)

The exhibition featured stalls by various science departments namely Biotechnology, Botany, Chemistry, Geology, Information Technology, Life Science and Biochemistry, Mathematics, Microbiology, Physics, Statistics, Zoology and Xavier's Resource Centre for Visually Challenged (XRCVC). The exhibits put up by each department consisted of working models, charts, real life visuals, microscopic images, foldscope, educational games and many other attractions. Some of the other highlights were Sky-on-wheels, tree walk and live demonstration in laboratories (Different techniques - protein precipitation, protein quantification by biuret method, protein separation by polyacrylamide gel electrophoresis are some examples).

Students and teachers from twelve schools from standards VIII-X (IES, St Mary's School, Champion School, and others.) and five junior college students (Wilson, Jaihind, Lilavati Dayal, etc.) among many others attended the exhibition. Some students also came along with their parents to experience the event. St. Xavier's College (junior/senior) students from Science as well as Arts were benefited from the event. The footfall was about 500.



Exhibition – Popularisation of Science



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Exhibition – Popularisation of Science



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

XYNERGY

ARTS EXHIBITION



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Xynergy Arts Exhibition (2019-20)

The exhibition featured stalls by various Arts and Humanities departments namely Ancient Indian History, Culture, and Archaeology, Commerce, Economics, English, French Hindi, History, Management Studies, Mass Media, Political Science, Psychology, Sociology & Anthropology, Vocational Studies and Xavier's Resource Centre for Visually Challenged. The exhibits put up by each department consisted of educational games, quizzes, career opportunities and many other attractions.

Students and teachers from many schools and colleges such as IES school and junior college, St Mary's School, Jaihind etc were among many others who attended the exhibition. Some students also came along with their parents to experience the event. St. Xavier's College (junior/senior) students from Science as well as Arts were benefited from the event. The footfall was about 500.



Exhibition - Xynergy



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

DEPARTMENT OF BOTANY
PROJECTS
EXCURSIONS




ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Botany – TYBSc Project Titles (2019-20)		
Name of Students	UID No.	Project Title
Lobo Zeenal	172175	Antioxidant activity of punica granatum
Almeida Glynelle	172149	Production of bioplastic from starch acquired from food waste
Bandgar Vaibhavi	162421	Formulation & in-vitro evaluation of herbal sunscreen
Carvalho Jewel	172155	The effect of cold treatment on germination of seeds
Chavan Mayuri	162109	Effects of NaCl Stress on seed germination and seedling development of wheat.
Colaco Anciya	172157	Effect of micro-plastic on germination of seed
D'souza Rohan	172164	Effect of water stress on young plants of Vigna radiata and Eleusine coracana
Gonsalves James	162135	To estimate the effects of CaCl ₂ on water lillies
Jacob Noah	172167	Growth of plants in Hydroponic system vs. Soil
Jemima Joseph	162097	Flavonoid estimation in tea
Kittykal Clarissa	172173	Germination of seeds in potted plant and packed system
Kumari Pooja	172174	Antibacterial properties of leaves of Citrus limetta on Escherichia coli & Bacillus sp.
Mascarenhas Premal	172177	Effect of glitter on the germination of seeds
Misra Gayatri	172178	Effect of microplastics on the growth of dicot seeds
Patrao Simrin	172181	Study of Salt stress on morphology and biochemistry in plants of jowar
Peje Abhishek	172182	Effect of glitter on the germination of seed
Rawat Aayushi	172184	Isolation of starch from potato peels to make bioplastic film
Tambe Akhilesh	172193	Difference in the levels of tannins between mature and young leaves
Yadav Shreya	172196	A study on anti microbial & anti malarial properties of Cordia dichotoma



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Botany – MSc Project Titles (2019-20)

Name	UIDNo	Project Title
Almeida Licy	188301	Phytochemical screening and antioxidant activity of <i>Cordia dichotoma</i> .
Anaokar Sharang	188302	Determination of Antibacterial and antifungal properties of Tartaric acid extracted from <i>Tamarindus indica</i> plant extract.
Bavi Pratik	188303	Estimation of Potassium & Phosphate from <i>Parthenium hysterophorous</i> plant extracts.
Chavan Aishwarya	188304	Preparation of taxonomic keys of genus <i>Cordia</i> based on phytochemicals test.
Damle Niharika	188305	Typification of <i>Kydia calycina</i> Roxb. of family Malvaceae
Das Adya Jyoti	188306	Anti-diabetic activity of <i>Ziziphus rugosa</i> fruit.
D'Costa Clive	188307	Relationship between diversity of birds, habitat types and plants species found in Mumbai.
Fargose Siona	188308	Typification of <i>Crotalaria leptostachya</i> Benth. from family Fabaceae.
Fernandes Valeska	188309	Effect of different plasticizers on production of bioplastic
Kathole Ketan	188310	Typification of <i>Bauhinia vahlii</i> Wight & Arn.
Longkumar Lanunchetla	188311	Estimation of flavonoid content and antioxidant activity in green tea and black tea.
Nikalje Poonam	188312	Typification of <i>Vallisneria spiralis</i> (L.) Kuntze of family Apocyanaceae.
Panicker Tapasya	188313	Cluster Analysis of Caesalpinaceae members of Palghar taluka based on their morphological characters.
Pitale Kaivalya	188314	Preparation of taxonomic key of genus <i>Ficus</i> based on phytochemicals test.
Rosario Liza	188316	Study of leaf and wood anatomy of family Rubiaceae.
S Sanjay Sasidharan	188317	An ethnobotanical data of Ashta and Kunpada villages in Palghar district, Maharashtra for their herbal drugs.
Shaikh Ena	188318	Carbon sequestration of the urban trees in Dadar Parsee Colony, Dadar (East)
Shedage Vaibhav	188319	Identification of three species of genus <i>Bauhinia</i> on basis of Morphology, Anatomy and Leaf Architecture.
Viana Maribelle	188320	Synthesis of bioplastic using different biopolymers.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Botany – TYBSc Project Titles (2018-19)

Name of Student	Sr. No.	Project Title
Shamika Gawde	142119	Effect of seed germination of plants <i>Trigonella foenum-graecum</i> and <i>Raphanus raphanistrum</i>
Rochelle Varghese	142430	Estimation of comparison of vitamin C in orange, strawberry, chikku and lemon.
Trish Gonsalves	152013	Effect of sulphuric acid and water treatment on seeds of Tamarind (<i>Tamarindus indica</i> L)
Violet Nunes	152026	Effect of light and temperature on <i>Vigna radiata</i>
Ruchira Mayekar	152030	Effect of chemicals polyethylene glycol and ferric chloride on seed germination of Moong (<i>Vigna radiata</i>).
Yashashree Naikare	152118	Effect of holi water on hydrophytes.
Magdalene D'Silva	162031	Effects of colored lights on <i>Vigna radiata</i> .
Anushia Anthony	162033	Effect of salt stress on Fenugreek seeds (<i>Trigonella foenum-graecum</i>)
Victoria Menzes	162044	Effect of KH_2PO_4 on phosphorus content of plant.
Lizanne Noronha	162060	Effect of inhibitors present in fruit juice on seed germination.
Ambrose D'Souza	162152	Effect of nitrogen on the protein content during seed germination of <i>Vigna mungo</i> .
Vidisha Bansal	162204	Effect of color pollution in soil or water on seed germination of <i>Triticum aestivum</i>
Sudipta Kalita	162226	CO ₂ uptake by monoculture and polyculture mini plantation
Nikhil Thomas	162257	Anatomical studies on water lettuce (<i>Pistia stratiotes</i> L.) on treatment with lead acetate and sodium dodecyl sulphate.
Daphisa Jana	162264	Effect of synthetic auxin on seed germination and growth of <i>Triticum aestivum</i> seeds.
Radhika Nair	162285	Effect of salinity on germination and growth of seeds of <i>Vigna radiata</i> (Mungbean)
Clarissa Rodrigues	162302	Effect of different concentration of Lead nitrate on germination of <i>Vigna radiata</i> .
Swetlena Cellini	162349	Comparative analysis of vitamin C in <i>Citrus sinensis</i> (Orange) and <i>Psidium guajava</i> (Guava) using spectrophotometry.
Reshell George	162378	Effect of salt stress on germination of Jowar (sorghum) and Wheat (<i>Triticum</i>) seeds and protein estimation of these seeds.
Alina Chettiar	162396	Effect of varying calcium concentration on seed germination of <i>Triticum aestivum</i> L.
Kim Harold D'Souza	162413	Growth and development of potato tubers at different temperature
Theresa Moraes	162423	Suitable temperatures for seed germination in <i>Cucumis pubescens</i> (Wild melons)
Mrunal Deolalkar	162531	Effect of temperature and darkness on seed germination of <i>Cucurbita pepo</i> and <i>Lagenaria siceraria</i>
Khwahish Patel	177029	Effect of organic pesticides on protein content in <i>Vigna radiata</i> L



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Alinda
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Botany – SYBSc Project Titles (2018-19)

Name (SYBSc)	UIDNo	List of herbal products prepared
Mayuri Chavan	162109	Sunthavada
Vaibhavi Bandgar	162421	Hair Pack
Glynelle Almeida	172149	Herbal run for cold
Achshah Bommera	172151	Herbal Shampoo
Jewel Carvalho	172155	Beta rootJuice for haemoglobin
Marissa Carvalho	172156	Lip balm
Anciya Colaco	172157	Anti obesity
Dabre Rose Rajesh	172158	Face Pack
Melcom Dsilva	172162	Enegry drink
Jovita Dsouza	172163	Arthritis medicine
Rohan Dsouza	172164	Cough Drop
Jacob Noah John	172167	Herbal Band Aid
Jisha Joseph	172170	Body wash
Clarissa Kittykal	172173	Heena Hair Dye
Kumari Pooja	172174	Chawanprash
Zeenal Lobo	172175	Cough Powder
Premal Mascarenchas	172177	Cough syrup
Gayatri Misra	172178	Herbal Black tooth powder
Simrin Patrao	172181	Pain balm
Abhishek Peje	172182	Cough Kada
Aayushi Rawat	172184	Exfoliating lip scrub
Rose Mary Babu	172186	Probiotic drink
Singh Alka Nihal	172189	Herbal Soap
Sneha Bince	172190	Herbal Hair oil
Akhilesh Tambe	172193	Osteoarthritis oil
Vira Bhavya Navin	172195	Shakapuspi tonic
Yadav Shreya K K	172196	Dandruff and hair fall oil
Chati Nidhi Nitin	172425	Indigestion tablet



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.




ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Botany – MSc and FYBSc Project Titles (2018-19)

Name of Students	UIDNo.	Project Title
Aishwarya D. Mehendale	178301	Cluster analysis of Convolvulaceae of Mumbai.
Vekuduto	178302	Small scale fermentation by Baker's yeast on black grapes and the effect of salt on the level of alcohol.
Raveena Biswas	178303	Antifungal activity of leaf extracts of <i>Lantana camara</i> L., <i>C. gigantea</i> L., <i>A. squamosa</i> L. on <i>Aspergillus niger</i> and <i>Aspergillus flavus</i> .
Anwesa Dutta	178304	Synthesis of biodegradable plastic using starch
Kajal Babu	178305	Study of antibacterial and antioxidant properties of floral extracts of <i>Michalia chamapca</i> .
Aroma A. Barla	178306	Milk as a pollutant: effect on water and soil plants.
Shahid Nawaz	178307	On the occurrence of <i>Dactylactenium scindicum</i> Boiss. From Maharashtra and Identification of Herbarium specimens at BLAT and BSI.
Patrisia Lobo	178308	Comparative studies of the properties of cream made from <i>Cica arietinum</i> L.(chickpea) and <i>Glycine max</i> L(Soyabean) with Traditionally used cream of egg and milk and to suggest vegan alternatives to the same.
Prakriti Tigga	178309	Evaluation of anti – inflammatory properties on <i>Adensonia digitata</i>
Priya Roy	178310	Analysis of physico-chemical parameters of water samples to assess the water quality in Mumbai.
Athira Rajan	178312	Phytoremediation of methylene blue dye from aqueous solution by <i>Salvinia molesta</i> .
Husain Bee Shaikh	178313	Comparative study of the alternation in morphology and metabolism of <i>Vigna radiata</i> L in normal and effluent water conditions.
Sharayu Dalvi	178314	Carbon sequestration of Sameshwam sacred grove in Meradpur and Girjai sacred grove in Haliv Dist. Ratnagiri.
Bushra Shaikh	178315	Effect of <i>Sorghum bicolor</i> (L.) Moench extracts on weed <i>Phyllanthus niruri</i> L.
Arati Dhanawade	178316	Comparative study of heavy metals in sewage irrigated soil and clean water irrigated soil with respect to yield.
Pranay Juwartkar	178317	Effect of Wi-fi radiation on the growth of <i>Cicer arietinum</i> L. (Chick Pea).
Kanchi Harchekar	178318	Phytochemical screening and antifungal activity of <i>Solanum diphyllum</i> L against <i>Aspergillus</i> sps.
Kiran Sharma	178319	Pollination biology of <i>Haplanthodes tentaculatus</i> (Acanthaceae), in SGNP.
Ritu Raut	178320	Comparative study of natural dye, synthetic dye and solar cell dyes absorption spectroscopy.
Trupti Tiwari	178321	Synthesis of Iron nanoparticles using green tea leaves (<i>Camellia sinesis</i> (L) Kuntze).
All Students	FYBSc	Collection and identification of algae (up to class / order) from wood bark, soil, water, crevices, wet walls, puddles, streams, and sewage.
All Students	FYBSc	Growing fungi on substrates: vegetables, fruits, eatables, milk products, raw fish and meat, and identifying them up to level of class / order.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.




ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Botany – MSc Project Titles (2017-18)		
(Specialization: Plant Physiology)		
Name of Students	UIDNo.	Project Title
Giri Varsha	168304	Assessment of antibacterial activity of synthesis of nanoparticles using <i>Azadirachta indica</i> L. against <i>E. coli</i> .
Harge Madhuri	168307	Anti-inflammatory activity, staining and quantification of secondary metabolites in <i>Blumea paniculate</i> (Willd). M. R. Almeida.
Kamale Sneha	168308	Impact assessment of silver nanoparticles synthesized using <i>Azadirachta indica</i> L. on growth of <i>Vigna radiata</i> L. seedlings.
Kazi Zoofishan	168309	Preliminary phytochemical analysis, antioxidant and antibacterial activity of various extracts of <i>Blumea paniculate</i> (Willd). M. R. Almeida.
Khawaja Faahmida	168310	Morphology, distribution and self-sowing mechanism of Awned-grass <i>Themeda tremula</i> .
Mulakkal Joel	168312	Comparative study on the activity of free and immobilized chloroplasts under storage from few plants belonging to Rubiaceae.
Shukla Alka	168318	Physico-chemical parameters of Kasardi river.
Singh Shalu	168319	Soil and vegetation along the banks of Kasardi river.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.




ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Botany – MSc Project Titles (2017-18)		
Name of Students	UIDNo.	Project Title
Chaudhari Rushabh	168301	Literature based checklist of weeds of Maharashtra and Interpretation based on seed food resources, fruit type and pollination type.
Deshmukh Aishwarya	168302	Qualitative analysis of preliminary phytochemicals and study of antioxidant activity of <i>Sphagneticola trilobata</i> in aqueous and methanolic extract.
Dhabak Maniruddin	168303	Analysis of weed distribution in Maharashtra with respect to growth form, phenology and occurrence by literature review.
Gupta Sadanand	168305	Morphological and Palynological aspects of variation in <i>Senecio belgaumensis</i> (Wight) C. B. Clarke.
Hansdah Jessica	168306	Comparative study and evaluation of antioxidant activity of <i>Bougainvillea spectabilis</i> Willd. And <i>Plumbago auriculata</i> Lam.
Maheshwari Ayushi	168311	Chromatographic analysis of the degraded Chlorophyll in <i>Ocimum sanctum</i> L. leaves due to the application of different ethylene concentrations.
Padavi Prabhakar	168313	Eradication strategies for <i>Hyptis suaveolens</i> (L.) Poit. and its mapping in Mokhada, Dist. Palghar.
Pais Merlin	168314	Seed germination of <i>Allium sativum</i> L. and <i>Cicer arietinum</i> L. in different pH of water provided for germination.
Patil Pratiksha	168315	Medicinal plants used by 'Vaidyas' for health improvement of tribal people of Alibag, Dist. Raigad, Maharashtra.
Ruetherford Ernes	168316	Aluminium toxicity, its role in inhibiting root length of <i>Cicer arietinum</i>
Shedge Siddhi	168317	Study of venation pattern in some Pteridophytes.
Diengdoh Jemyleen	168320	A study of traditional medicinal plants used by Khasi medicinal practitioners in Smit, Madanryting and Iewduh, Meghalaya.
Save Alisha	158320	Environmental factors are affecting on Stomatal Density in <i>Tabernaemontana divaricata</i> .



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Botany – MSc Project Titles (2016-17)		
Name of Student	Roll. No.	Project title
Bhandari Sanjil	001	Cluster analysis of Caesalpiniaceae members from Mumbai & nearby regions based on morphological characters
Bisht Deepa	002	Heavy metal stress : Study of germination, anatomical & biochemical response of <i>Cicer arietinum</i> to Cadmium
D'souza Ria	003	Effects of temperature & storage duration on Antioxidant status in <i>Coriandrum sativum</i> Linn.
Jadhav Janhavi	005	Cluster analysis of some members of Apocynaceae from Mumbai & nearby regions based on morphological characters
Jain Ankita	006	Nutritive analysis of <i>Citrus limon</i> peel and formulating eatable products from its peel
Karras Natasha	008	Adulterants in marketed powder of <i>Andrographis paniculata</i>
Khan Aasiya	009	Cluster analysis of Acanthaceae members from Mumbai & nearby regions based on morphological characters
Khan Saif	010	Alcohol Dehydrogenase enzyme isolation, crystallization & partial purification from <i>Saccharomyces cerevisiae</i> Meyen. ex. E.C. Hansen
Kumar Shivam	011	Role of seed priming on growth & physiological traits of <i>Triticum aestivum</i> under salinity stress conditions.
Murmu Anugrah	012	Physiochemical analysis of seed oil of <i>Annona squamosa</i> extracted by soxhlet extraction method
Sarang Dhanashree	013	Study of wood elements of some plants from sub family Caesalpiniae family Leguminosae
Serrao Gretina	014	Antimicrobial activity & phytochemical screening on leaf extracts of <i>Syzygium cumini</i> & <i>Syzygium samarangense</i>
Sinalkar Pratik	015	Numerical taxonomic study of some members of family Fabaceae from Mumbai & nearby regions based on morphological characters
Telawane Nupoor	016	Study of foliar venation in some members of Malvaceae from Mumbai & nearby regions
Unde Snehal	017	Pollen morphology of some members of Bignoniaceae
Vaity Jatin	018	Cypsel morphology of some plants of Asteraceae in & around Mumbai



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Botany – MSc Project Titles (2015-16)

Name of Students	UIDNo.	Title of Project
Dabhi Lochan	148304	Effect of ABA on antioxidant enzymes of tomato leaves subjected to pesticide stress.
D'souza Annette	148306	Determination of antifungal activity of corn cystatin.
Lapakshi R. B.	148312	Partial purification and immobilization of Alcohol Dehydrogenase from <i>Saccharomyces cerevisiae</i> .
Lotha Catherine	148313	Phytochemical screening and antioxidant activity of <i>Chromolaena odorata</i> .
Marneni Noreen	148314	Extraction and estimation of carotenoids from few fruits and vegetables.
Sarkar Sumit	148318	Immobilization of chloroplasts from spinach leaves.
Suby	148319	Antimicrobial and antioxidant activity study in <i>Chromolaena odorata</i>
Bhatt Chintan	148302	Comparative studies on plant diversity of the coastline of Vasai (Bassein).
Chang Thungdi	148303	Revising and surveying the trees of Jijamata Udyan (Rani Bagh)
Desai Jyoti	148305	Occurrence of cystolith in family Acanthaceae.
Kamble Madhavi	148307	Ethnobotanical studies of Mokhada taluka.
Kaur Inderjit	148308	Screening of poisonous plants.
Kewat Sonam	148309	Antimicrobial activity of <i>Carica papaya</i> .
Lam Bumo	148311	Post monsoon wall flora of Bassein fort and from Reay road to Cotton green.
Pandey Neeraj	148315	Tree diversity at Kalina campus at Mumbai University.
Rathore Neeta	148316	Apocynaceae and Asclepiadaceae merged according to APG- justified or not?
Sane Mansi	148317	Chemotaxonomical studies of some Monocotyledons.
ThummaKiran	148320	Study of <i>Ficus</i> sps in and around Mumbai.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

**ASSESSMENT OF ANTIBACTERIAL ACTIVITY OF
SILVER NANOPARTICLES SYNTHESIZED USING
Azadirachta indica L. AGAINST *Escherichia coli***

A dissertation submitted
to
St. Xavier's College, Autonomous
Mahapalika Marg, Mumbai

for

**M.Sc. Degree course
in Botany
(Plant Physiology and Biochemistry specialization)**

by
Varsha Giri


Under the guidance of

Prof. Alok Gude
Assistant Professor, Department of Botany

(2017-2018)



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Department of Botany,
St Xavier's College (Autonomous), Mumbai



CERTIFICATE

This is to certify that the project on "Assessment of Antibacterial Activity of Silver Nanoparticles synthesized using *Azadirachta indica* L. against *Escherichia coli*" has been successfully completed by Ms. Varsha Giri of M.Sc. Part II, UID: 168304 during the academic year 2017-2018.

Project Guide:

Mr. Alok Gude,
Associate professor,
Department of Botany.

Dr. Rajendra D. Shinde,
Head and Associate professor
Department of Botany,
Director of Blatter
Herbarium.

Date:



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

ACKNOWLEDGEMENTS

I express my deep sense of gratitude to my guide Prof. Alok Gude, Associate Professor, Department of Botany for his valuable guidance throughout the course of my project work. My work has been successfully completed due to his constant advice and effort.

I express my sincere thanks to Principal Dr. Agnelo Menezes, St. Xavier's College (Autonomous), Mumbai for providing necessary facilities.

I am also thankful to Dr. Rajendra Shinde, Head of Department, Botany and Dr. Manek Mistry, Retired Associate Professor, Department of Botany for his valuable advice and comments.

I am sincerely grateful to Dr. Vijaya Lobo and Royston Lobo for their valuable inputs in my work.

I am thankful to non-teaching staffs, Department of Botany, St. Xavier's College (Autonomous), Mumbai who helped me a lot throughout my work.

I am also grateful to my colleagues Sneha Kamale and all classmates for their help and assistance. I am also thankful to Bhupendra Singh Chauhan for his love and support.

Finally, I wish my deepest gratitude to my parents Jai Prakash Giri and Urmila Giri for their consistent and moral support.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.




ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

ABSTRACT

This dissertation investigates the antibacterial activity of colloidal silver nanoparticles synthesized by using extract of *Azadirachta indica* against *E. coli*. Importance of nanoparticles is increasing daily in the Nano world due to their wide applications and silver nanoparticles (Ag-NPs) are one of them. Their application in the field of bio-medical, antimicrobials, sensors, catalysts, electronics, optical fibers, bio-labeling, agricultural and other areas have expressed significant advances. The safe and easiest method of producing silver nanoparticles is by Green synthesis. And because of production of silver ions they are found to have antibacterial activity. In the experimental study silver nanoparticles were prepared by the reaction 0.1mM, 1mM, 3mM, 5mM concentrations of silver nitrate and extracts of *Azadirachta indica* commonly called as neem leaves. The Ag-NPs were characterized by UV-Visible spectrophotometer. Colloidal Ag-NPs obtained showed high antibacterial activity against *E. coli*.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

INDEX

Sr. No	Contents	Page No.
1.	Introduction	6-7
2.	Materials & Methods	8-10
3.	Results & Discussions	11-25
4.	Conclusion	26
5.	Future Scope	27
6.	References	28
7.	Appendix-I	29



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Diinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

INTRODUCTION

The emergence of nanotechnology has provided an extensive research in recent years by intersecting with various other branches of science and forming impact on all forms of life [1]. Metal nanoparticles synthesis is a more important research branch in nano technology.

Why silver nanoparticles?

An important area of research in nanotechnology is the synthesis of nano silver particles [2]. Silver is the one of the most commercialized nano-material with five hundred tons of silver nanoparticles production per year (Larue *et al.*, 2014) and is estimated to increase in next few years. Silver has long been used for its antimicrobial properties as its toxicity to microorganisms is greater than many other metals while maintaining low toxicity to mammalian cells (Zhao and Stevens 1998). Because of their wide applications beneficial to humans there is lots of ongoing research so as to develop more rapid and reliable protocols for synthesis of these silver nanoparticles and its applications in various fields.

Why there is a need for green synthesis of nanoparticles?

For synthesis of metallic nanoparticles chemical procedures are the most widely used methods. With the development of new chemical or physical methods, the concern for environmental contaminations are also heightened as the chemical procedures involved in the synthesis of nano materials generate a large amount of hazardous byproducts and thus, there is a need for 'green chemistry' that includes a clean, nontoxic and environment-friendly method of nanoparticles synthesis [1]. Considering the vast potentiality of plants as sources this work aims to apply a biological green technique for the synthesis of silver nanoparticles as an alternative to conventional methods [3]. The presence of phytochemicals in plant extracts are the key component in reduction and stabilization of silver ions and the phytochemicals which are responsible for reduction are terpenoids, flavonoids, ketones, aldehydes, amides, and carboxylic acids [4]. Nanoparticles produced by plants are more stable, and the rate of synthesis is faster than that in the case of other organisms and moreover, the nanoparticles are more various in shape and size in comparison with those produced by other organisms [1].



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Why prefer silver nanoparticles as medicine?

With the increase in usage of medications in any health issues, certain drugs do not fight back the disease as expected and sometimes lose its potential in drug targeting against the microbes and viruses. Nano-medicines come to rescue in such cases because of their enhanced targeted drug delivery mechanism. The microbes get resistant to certain medicines or drugs but silver nanoparticles containing a metal does not allow the microbes to become drug-resistant. It has also been reported that NSPs combined with various antibiotics have better antimicrobial effects than NSPs or antibiotics alone [7]. Li *et al.*, for example, found a greater antibacterial effect on *E. coli* when amoxicillin and silver nanoparticles were combined than when they were applied separately.

Literature review

Silver nanoparticles (SNPs) generally present at 1 to 100 nm in size in at least one dimension. SNPs offer targeted delivery of drugs, enhancing bioavailability, sustaining drug or gene effect in target tissues, and enhancing the stability. Silver nanoparticles have played a main role in the field of nanotechnology and nanomedicine.

In this regard, leaves extract of *Azadirachta indica* (commonly known as neem), a species of family Meliaceae, is used for bioconversion and bio-reduction of silver ions to nanoparticles. Neem plant is commonly available in India and each part of this tree has been used as a household remedy since ages against various human ailments from antiquity and for treatment against viral, bacterial and fungal infections (Omoja *et al.*, 2011). The biological method applied is simple, easy to perform, cost effective, and sustainable. The method does not require any toxic solvents or hazardous material from environment. It is an eco-friendly method.

The aim of this study is to assess the antibacterial activity of the synthesized silver nanoparticles using extracts of neem leaves against *E. coli*.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

MATERIALS & METHODOLOGY

MATERIALS

Plant sample: *Azadirachta indica* leaves

Bacteria culture: *E. coli*

Chemicals: Silver nitrate crystals, double distilled water, Nutrient Agar, Nutrient Broth, Sodium chloride

Glassware: Conical flasks (50mL, 100mL and 250mL), beakers (50mL, 100mL), pipettes (1.0mL, 5.0mL and 10mL), micropipettes (0-10 μ L), spreader, Petri plates, test tubes, test tube stands, glass rods, funnels, watch glass, measuring cylinder

Equipments: Weighing balance, Laminar flow cabinet, Incubator (37°C), Refrigerator, Autoclave

Other materials: tripod stand, burner, newspapers, cotton, thread, aluminum foil

METHODOLOGY

Preparation of plant extract

Collection of plant sample: *Azadirachta indica* leaves were collected from the tree in New Navy Nagar, Colaba in the month of February.


It was ensure that the plant was healthy and uninfected. The leaves were washed under running tap water to eliminate dust and other foreign particles present on the surface of leaves and to clean the leaves thoroughly. Then it was cleaned with double distilled water twice and air- dried at room temperature. About 10g leaves were finely cut and was kept in a beaker containing 100mL of double distilled water and boiled for 30 minutes. The extract was cooled down and filtered with Whatmann No1 filter paper. The extract was stored at 4°C for further use.

Green synthesis of silver nanoparticles

0.16987g of Silver nitrate crystals were weighed on a weighing balance. These crystals were added to a 250mL conical flask covered all over with aluminum foil and then slowly and gradually 100mL of double distilled water was added while continuous stirring with a glass rod. It was labeled as 'Stock'.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

From this stock, various concentrations of silver nitrate were prepared i.e. 0.1mM, 1mM, 3mM and 5mM in four different 50mL labeled conical flasks covered completely with aluminum foil. The aluminum foil prevents if any photo damage of silver ions from the sunlight around it. The stock is kept in refrigerator for further use. From each concentration of silver nitrate prepared, three different volumes i.e. 1mL, 3mL and 5ml were pipetted into test tubes. For example, from 0.1mM silver nitrate- 1mL, 3ml and 5ml of it into three different labeled test tubes. Similarly, for the rest 1mM, 3mM and 5mM it was carried out. So a set of total 12 test tubes were set up in a test tube stand and each one of them were labeled. Quickly 1mL of filtered neem leaves extract was pipetted and added to each test tube. The test tube stand was covered with aluminum foil. The set up was incubated in a dark chamber to minimize the photo- activation of silver nitrate at room temperature. The formation of colloidal silver nanoparticles was confirmed by the color change of the solution from colorless to brown. The formation and stability was also confirmed by UV-Visible spectroscopy.

Characterization of synthesized silver nanoparticles

The formation of silver nanoparticles was characterized by UV-Visible spectrophotometer. The bio reduction of silver ions in aqueous solution was monitored by spectra between 380nm- 460nm.

Antibacterial activity

In this study the antibacterial properties of Ag-NPs were investigated by growing *E. coli* colonies in nutrient agar. On the first day, all the required glassware was covered with newspaper and cotton plugs and then tied with thread. They were then autoclaved at 15psi for 20minutes to kill all the residual microbes or any contamination. Nutrient agar was prepared in a conical flask and then autoclaved. It was then poured into 20 Petri plates and 3 test tubes for slants in the laminar flow and was allowed to set for few hours. The bacteria *E. coli* was streaked onto newly prepared slants containing Agar and kept in the incubator at 37°C for 24 hours.

On the second day, 1 loopful of fresh 24 hour revived culture of *E. coli* was suspended in saline solution (0.98g in 100mL distilled water). 0.1mL of the saline solution was poured onto prepared Agar media Petri plates and then spread with the help of spreader in the laminar flow. Then on each Petri plate 4 wells were made with the help of a cork borer having 6mm diameter to carry out well diffusion assay.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Alinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

The synthesized Ag-NPs from various concentrations of AgNO₃ were then pipetted with the help of a pipette and were filled into these wells. Each Petri plate was labeled and then kept in the incubator at 37°C for 24 hours.

On the third day, observations were recorded. Diameter of zone of inhibition was noted in the observation table. The experiment was repeated two times.

Determining the MIC and MBC

For determining MIC and MBC, three controls were taken: control: Nutrient broth only; positive control - Ag-NPs synthesized from various concentrations of aqueous solutions of AgNO₃; negative control - Nutrient broth + *E. coli*.

Further for the assay, test tubes were prepared with 1mL Nutrient broth + 1 loopful *E. coli* + 1ml of Ag-NPs synthesized from various concentrations of aqueous solutions of AgNO₃ in the laminar flow. They were kept for incubation in the incubator at 37°C for 24 hours.

The next day, observations were recorded. The tubes which had no turbidity or doubtful with the growth of *E. coli* were spread onto the prepared agar media Petri plate, labeled and again incubated for 24 hours.

Finally, after 24 hours, the plates were checked to see for any growth of *E. coli*. The experiment was repeated two times.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



RESULTS AND DISCUSSIONS

Results for Antibacterial activity

Test of significance for the Diameter of zone of inhibition

Null hypothesis (H_0): There is no significant increase in the diameter of zone of inhibition as the concentration of silver nanoparticles (Ag-NPs) increases.

Alternate hypothesis (H_1): There is a significant increase in the diameter of zone of inhibition as the concentration of silver nanoparticles (Ag-NPs) increases.

The diameter of zone of inhibition was recorded as in the observation Table1 and the results were obtained using ANOVA in PSPP software.

Table 1: Diameter of zone of inhibition (in mm) for *E. coli* in the presence of synthesized silver nanoparticles using 1.0mL of neem extract and 0.1mM AgNO₃, 1mM AgNO₃, 3mM AgNO₃ and 5mM AgNO₃

Vol (mL)	SNPs synthesized from 0.1mM AgNO ₃ (mm)	SNPs synthesized from 1mM AgNO ₃ (mm)	SNPs synthesized from 3mM AgNO ₃ (mm)	SNPs synthesized from 5mM AgNO ₃ (mm)
1.0	4.0	5.0	6	7
	5.0	5.0	5	7
	5.0	5.0	5	7
	4.0	5.0	5	7
3.0	4.0	5.0	6.5	8
	4.0	5.0	6.5	7
	5.0	5.0	6.0	7.5
	5.0	5.0	6.0	8
5.0	3.0	6.0	6.0	8
	3.0	6.0	6.0	8
	3.0	5.0	7.0	7
	3.0	6.0	6.0	8

Test of Homogeneity of Variances

	Levene Statistic	df1	df2	Sig.
pointone	+Infinity	2	9	.000
one	9.00	2	9	.007
three	.50	2	9	.622
five	5.40	2	9	.029



Blinde



ANOVA		Sum of Squares	df	Mean Square	F	Sig.
pointone	Between Groups	6.00	2	3.00	13.50	.002
	Within Groups	2.00	9	.22		
	Total	8.00	11			
one	Between Groups	1.50	2	.75	9.00	.007
	Within Groups	.75	9	.08		
	Total	2.25	11			
three	Between Groups	2.67	2	1.33	6.86	.016
	Within Groups	1.75	9	.19		
	Total	4.42	11			
five	Between Groups	1.29	2	.65	4.04	.056
	Within Groups	1.44	9	.16		
	Total	2.73	11			

ANOVA in PSPP software reports that the value of $p = 0.002, 0.007, 0.016$ and 0.056 for $0.1\text{mM Ag-NPs}, 1\text{mM Ag-NPs}, 3\text{mM Ag-NPs}$ and 5mM Ag-NPs respectively. Since the value of 'p' is less than 0.05 in all the three concentrations of silver nanoparticles, i.e. $0.1\text{mM Ag-NPs}, 1\text{mM Ag-NPs}$ and 3mM Ag-NPs , which means that the data is statistically significant and there is a significant increase in the diameter of zone of inhibition as the concentration of Ag-NPs increases. Even for the fourth concentration, 5mM Ag-NPs , it is slightly greater than $p = 0.05$ (i.e. $p = 0.056$) and can be considered as a significant data. Thus, null hypothesis is rejected and alternate hypothesis is accepted.

Results for characterization of silver nanoparticles using UV-Visible spectrophotometer

Visual observation and UV Vis spectroscopy

While carrying out the synthesis of silver nanoparticles, addition of plant extract of neem into the test tubes containing different concentrations of aqueous solution of silver nitrate led to the change in color of the solution from yellowish to brown within reaction duration due to excitation of surface plasmon vibrations in silver nanoparticles (Veerasamy et al., 2011).

In order to confirm the formation of silver nanoparticles the UV Visible pattern in the figure shows the Surface Plasma Resonance SPR of colloidal silver nanoparticles range from $380\text{nm} - 460\text{nm}$.

The absorbance was taken at intervals of 5 minutes. It was observed that with the passage of time the absorption intensity was increasing indicating the enhancement of formation of SNPs (see from figure 1- 12).





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

The absorption maximum was achieved at 420nm for all concentration of synthesized Ag-NPs except 1mL (figure 4) and 3mL (figure 5) of 1mM Ag-NPs which showed the absorbance maxima at 440nm. This suggests that it could be due to the photo oxidation of silver while taking spectrophotometric readings under light or some human error while carrying out the experiment.

Results for MIC and MBC

After 24 hours of incubation under aerobic condition at 37°C, turbidity was noticed in all the test tubes ranging from 1mL of 0.1mM up to 5mL of 0.1mM Ag-NPs indicating growth of bacteria whereas in tubes ranging from 1mL of 1mM up to 5mL of 5mM, no turbidity was seen exhibiting inhibition of bacterial growth (see figure 23- 29). The suspension from the tubes of 1mL of 1mM up to 5mL of 5mM was inoculated in nutrient agar plate and incubated for 24 hours and no growth of bacteria was observed only from the plates containing 1mL of 3mM Ag-NPs to 5mL of 1mM Ag-NPs and not found in the plates containing 1mL of 3mM Ag-NPs up to 5mL of 5mM Ag-NPs hence confirming it bactericidal.

Thus, the MIC was found to be 1ml of 1mM and the MBC was found to be optimum at 1mL of 3mM Ag-NPs.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



Figure 1: absorbance v/s wavelength at different time intervals for 1mL of AgNO₃ when added to 1mL of neem extract- 0.1mM Ag-NPs

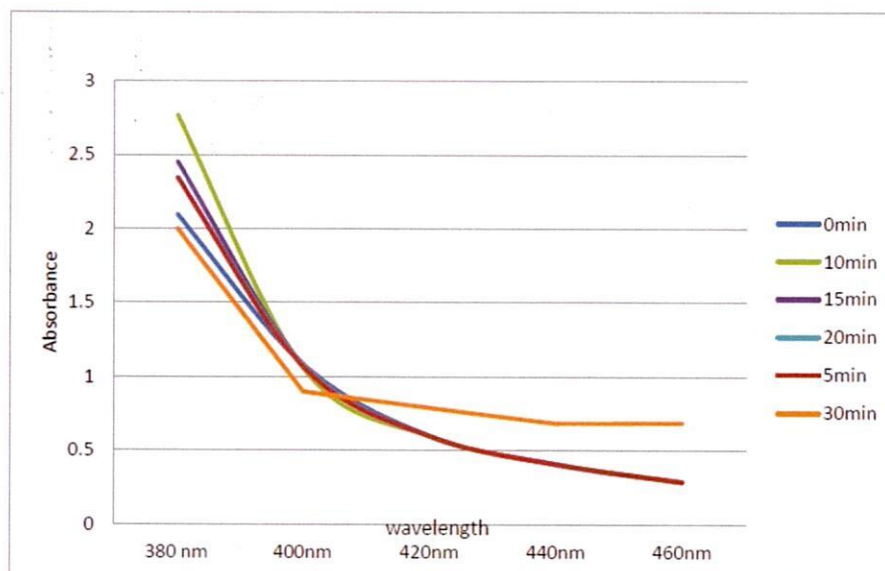
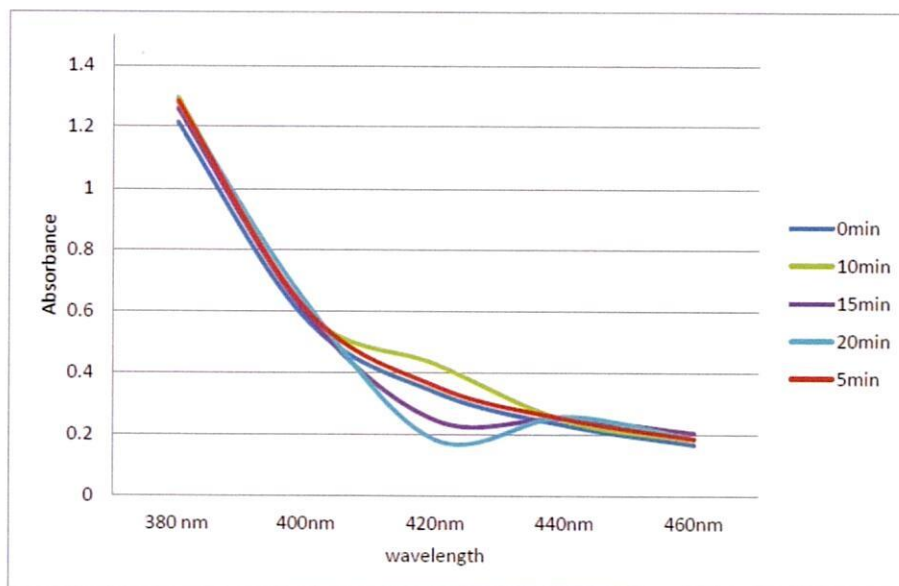


Figure 2: absorbance v/s wavelength at different time intervals for 3mL of AgNO₃ when added to 1mL of neem extract- 0.1mM Ag-NPs



Shinde



Figure 3: absorbance v/s wavelength at different time intervals for 5mL of AgNO₃ when added to 1mL of neem extract- 0.1mM Ag-NPs

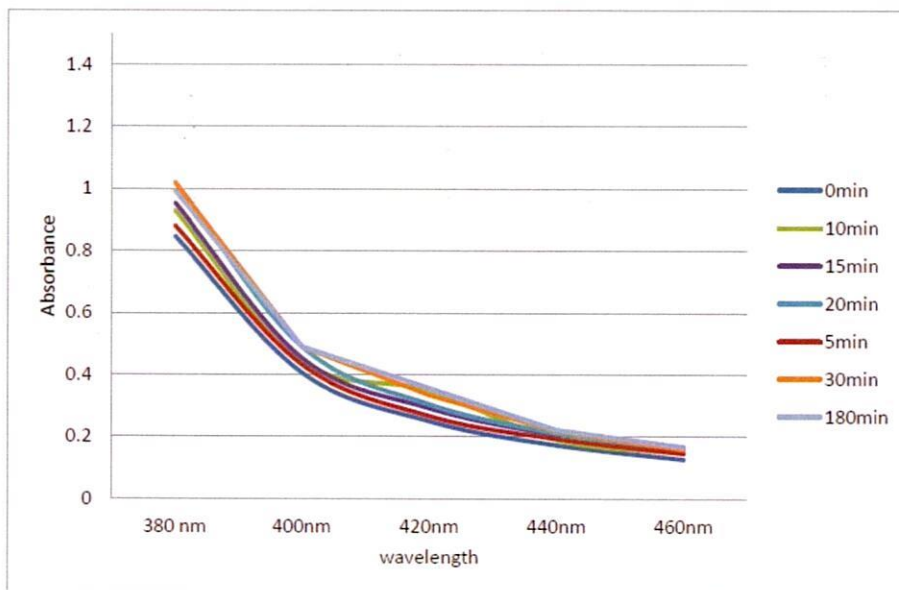


Figure 4: absorbance v/s wavelength at different time intervals for 1mL of AgNO₃ when added to 1mL of neem extract- 1mM Ag-NPs

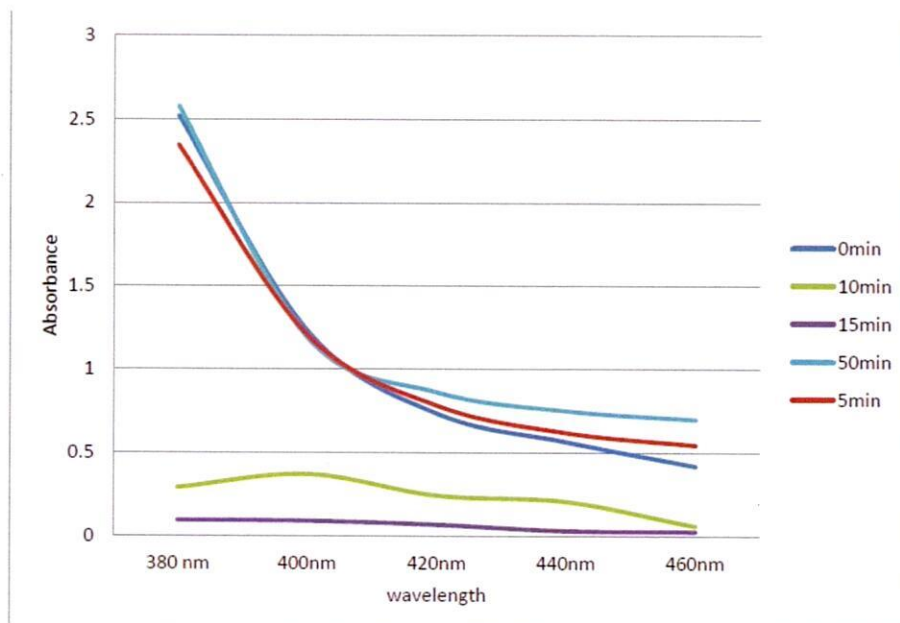




Figure 5: absorbance v/s wavelength at different time intervals for 3mL of AgNO₃ when added to 1mL of neem extract- 1mM Ag-NPs

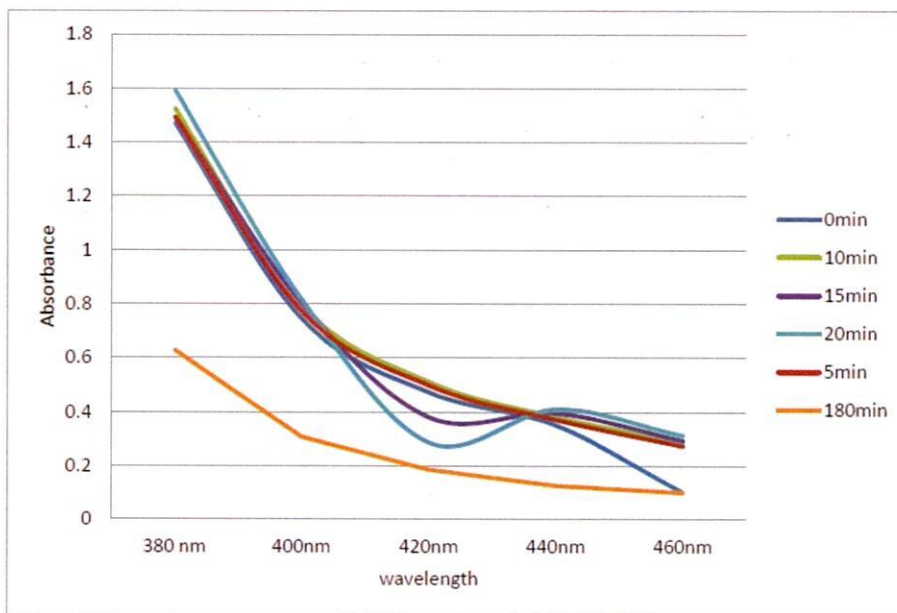
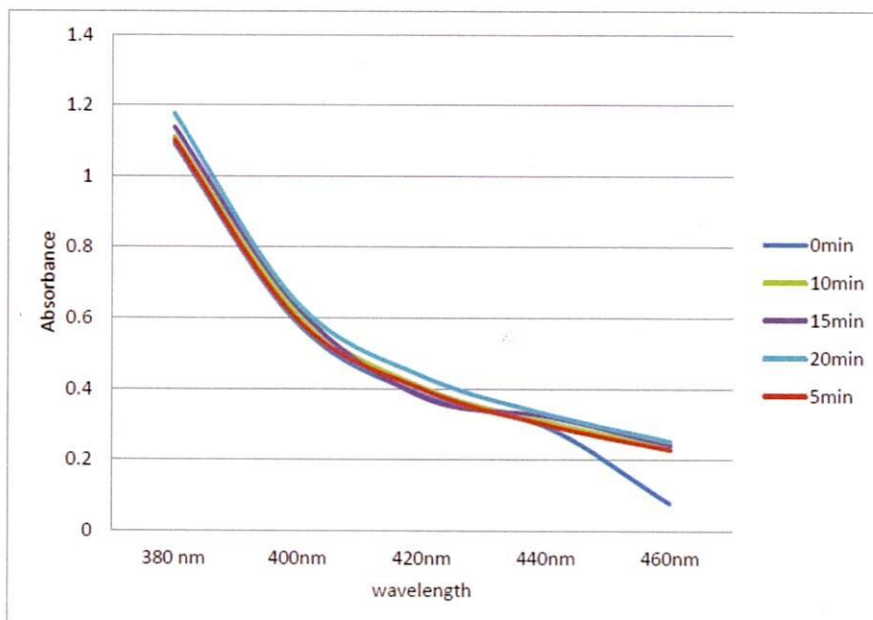


Figure 6: absorbance v/s wavelength at different time intervals for 5mL of AgNO₃ when added to 1mL of neem extract- 1mM Ag-NPs



Shink



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Figure 7: absorbance v/s wavelength at different time intervals for 1mL of AgNO₃ when added to 1mL of neem extract- 3mM Ag-NPs

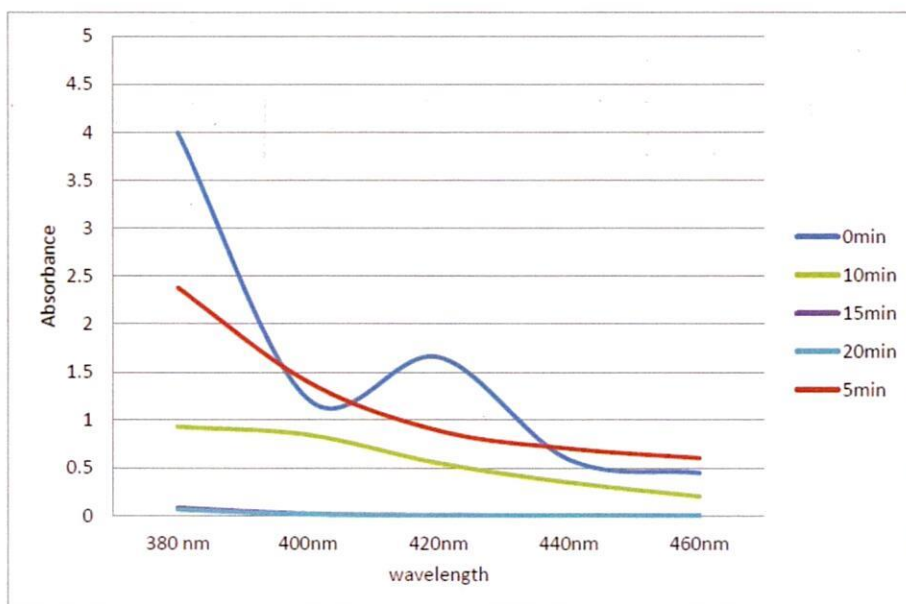
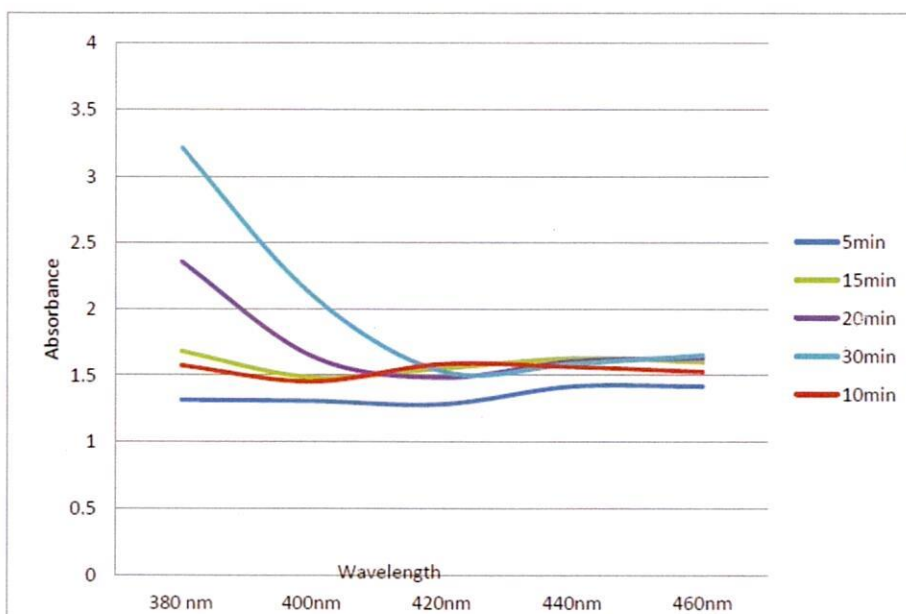


Figure 8: absorbance v/s wavelength at different time intervals for 3mL of AgNO₃ when added to 1mL of neem extract- 3mM Ag-NPs



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Alinda

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



Figure 9: absorbance v/s wavelength at different time intervals for 5mL of AgNO₃ when added to 1mL of neem extract- 3mM Ag-NPs

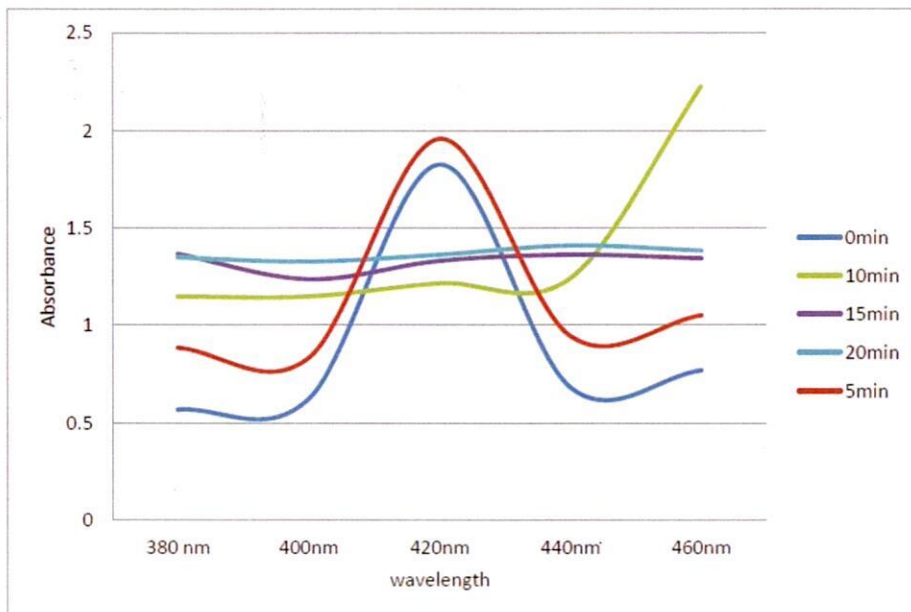
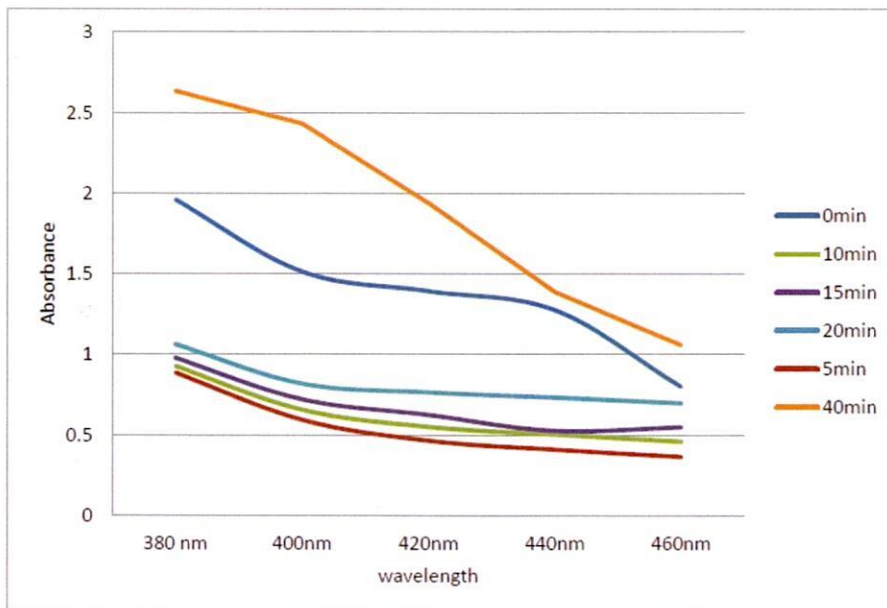


Figure 10: absorbance v/s wavelength at different time intervals for 1mL of AgNO₃ when added to 1mL of neem extract- 5mM Ag-NPs





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Figure 11: absorbance v/s wavelength at different time intervals for 3mL of AgNO₃ when added to 1mL of neem extract- 5mM Ag-NPs

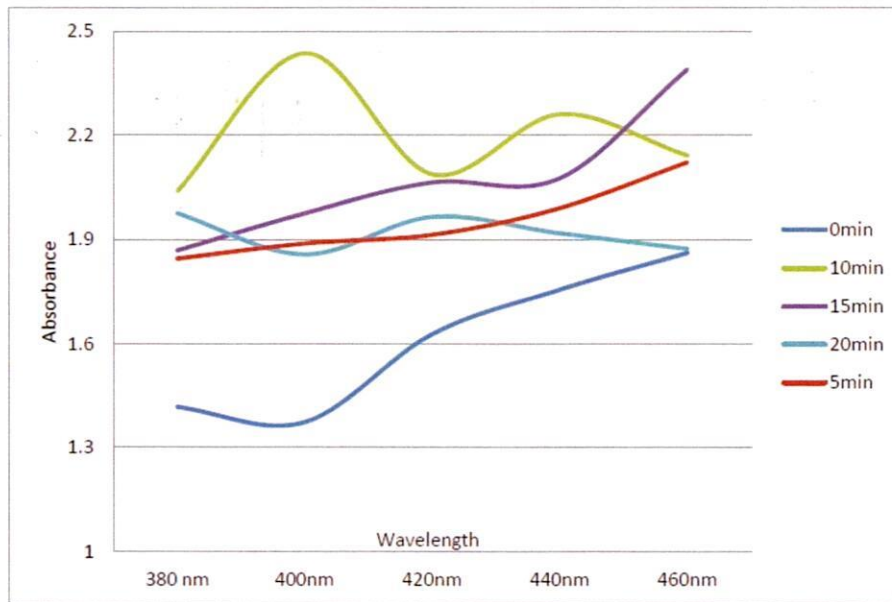
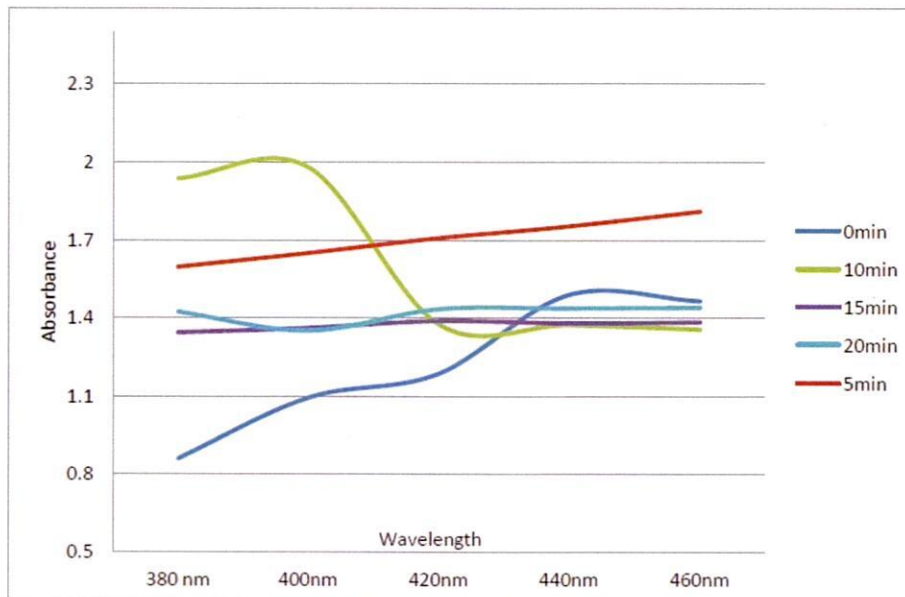


Figure 12: absorbance v/s wavelength at different time intervals for 5mL of AgNO₃ when added to 1mL of neem extract- 5mM Ag-NPs





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Figure 13: No zone of inhibition against *E. coli* (Control)

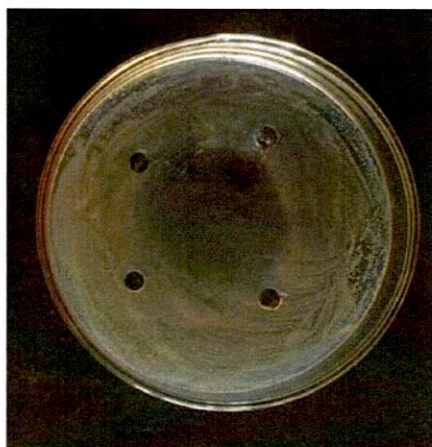


Figure 14: Zone of inhibition for 0.1mM Ag-NPs against *E. coli* (1mL of neem extract when added to 1mL of 0.1mM AgNO₃)

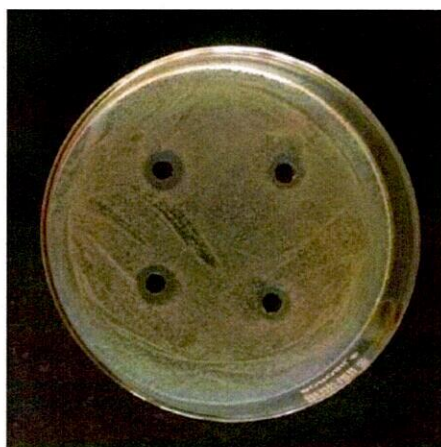


Figure 15: zone of inhibition for 0.1mM Ag-NPs against *E. coli* (1mL of neem extract when added to 3mL of 0.1mM AgNO₃)

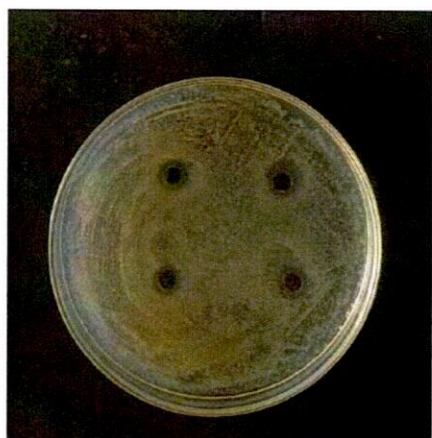
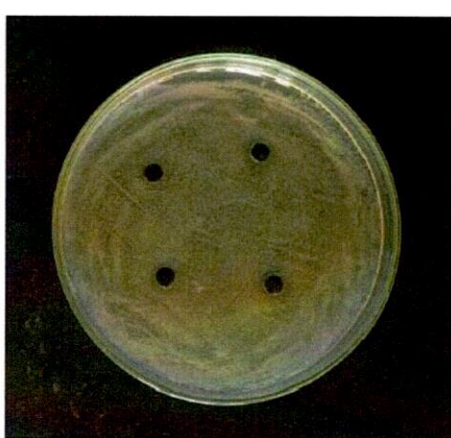


Figure 16: Zone of inhibition for 0.1mM Ag-NPs against *E. coli* (1mL of neem extract when added to 5mL of 0.1mM AgNO₃)



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



Figure 17: zone of inhibition for 1mM Ag-NPs against *E. coli* (1mL of neem extract when added to 1mL of 1mM AgNO₃)

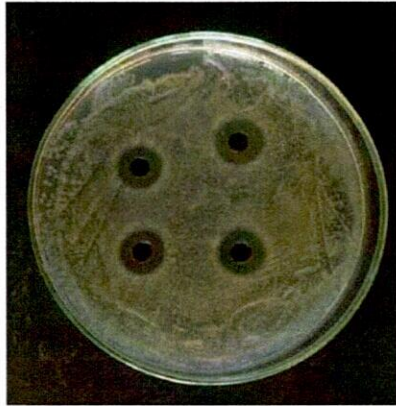


Figure 18: Zone of inhibition for 1mM Ag-NPs against *E. coli* (1mL of neem extract when added to 3mL of 1mM AgNO₃)

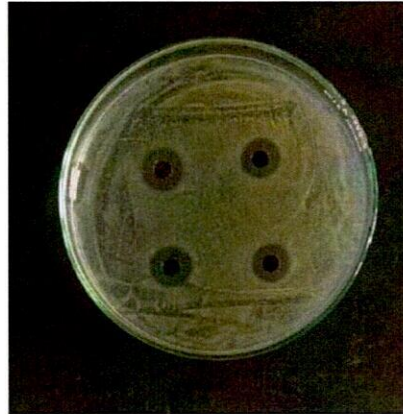


Figure 19: zone of inhibition for 1mM Ag-NPs against *E. coli* (1mL of neem extract when added to 5mL of 1mM AgNO₃)

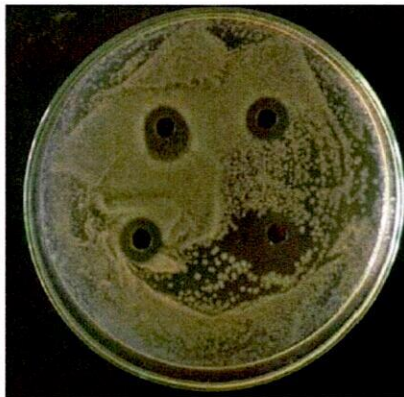
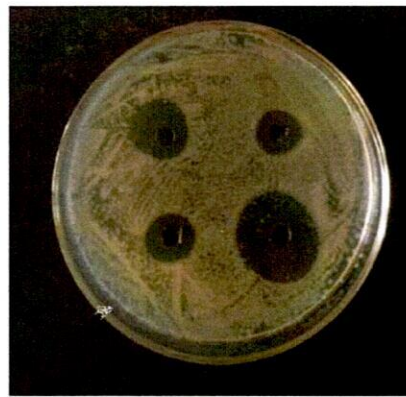


Figure 20: Zone of inhibition for 3mM Ag-NPs against *E. coli* (1mL of neem extract when added to 1mL of 3mM AgNO₃)





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Figure 21: zone of inhibition for 3mM Ag-NPs against *E. coli* (1mL of neem extract when added to 3mL of 3mM AgNO₃)

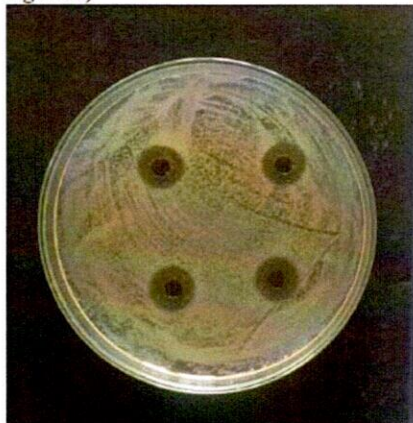


Figure 22: Zone of inhibition for 3mM Ag-NPs against *E. coli* (1mL of neem extract when added to 5mL of 3mM AgNO₃)

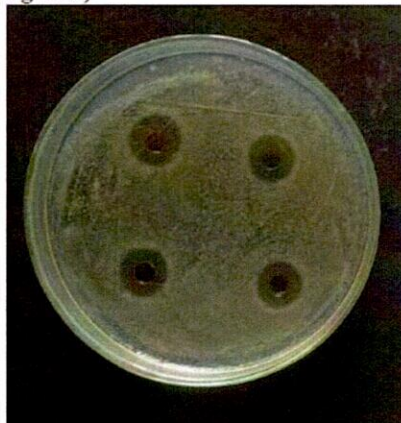


Figure 23: zone of inhibition for 5mM Ag-NPs against *E. coli* (1mL of neem extract when added to 1mL of 5mM AgNO₃)

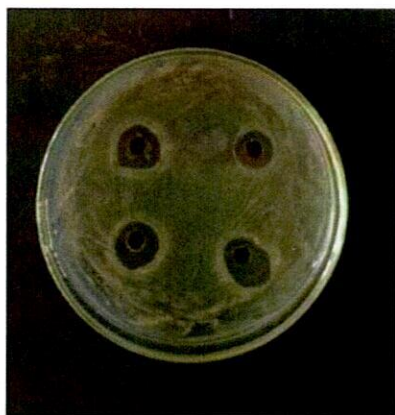


Figure 24: Zone of inhibition 5mM Ag-NPs against *E. coli* (1mL of neem extract when added to 3mL of 5mM AgNO₃)





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Figure 25: Zone of inhibition for 5mM Ag-NPs against *E. coli* (1mL of neem extract when added to 5mL of 5mM AgNO₃)



Figures for MIC and MBC assay

Figure 23: 1mL of 0.1mM up to 5mL of 0.1mM Ag-NPs

Figure 24: 1mL of 1mM to 5mL of 1mM Ag-NPs



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Figure 25: 1mL of 3mM Ag-NPs up to 5mL of 5mM Ag-NPs

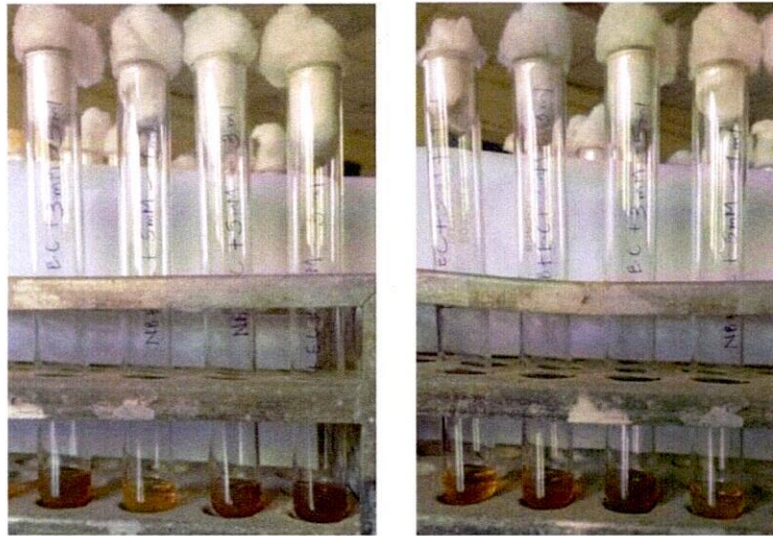
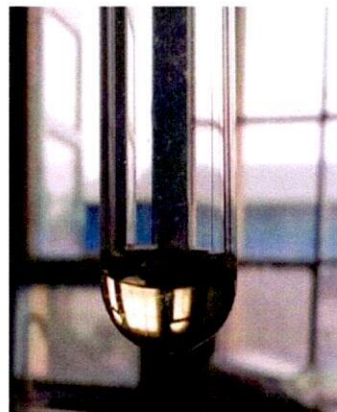


Figure 26: 5mL of 0.1mM Ag-NPs showing turbidity



Figure 27: Control containing only Nutrient broth



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Diinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Figure 28: 1ml of 1mM Ag-NPs – MIC

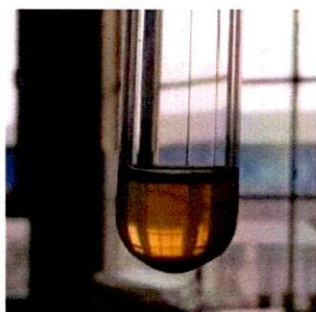


Figure 29: 1ml of 3mM Ag-NPs -
MBC

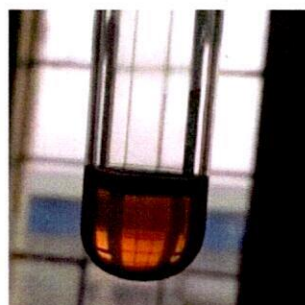
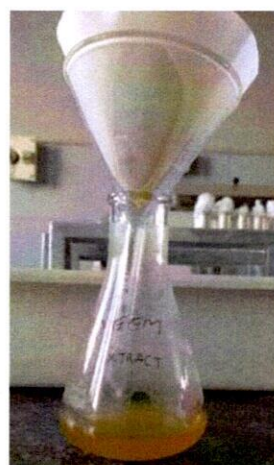


Figure 30: UV- Vis spectrophotometer



Figure 31: neem extract



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.




ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

CONCLUSIONS

Silver nanoparticles (Ag-NPs) were successfully obtained from bio-reduction of silver nitrate solutions using neem leaf extracts. The method proves to be an eco-friendly, rapid green approach for the synthesis providing a cost effective and an efficient way for the synthesis of silver nanoparticles. Ag-NPs have been appropriately characterized using UV-Vis spectroscopy. The synthesized silver nanoparticles showed efficient antibacterial activity against *E. coli*. This eco-friendly method can be a competitive alternative to the conventional physical/chemical methods used for the synthesis of silver nanoparticles and thus have a potential to use in biomedical applications and will play an important role in opto-electronics and medical devices in near future. Due to the enhanced antibacterial activity of Ag-NPs, it is effectively used in the field of medicine as well as in food and cosmetic industries.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.




ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

FUTURE SCOPES

In recent years, green synthesis of silver nanoparticles (Ag-NPs) has gained much interest from chemists and researchers. In this concern, Indian flora has yet to divulge innumerable sources of cost-effective non-hazardous reducing and stabilizing compounds utilized in green synthesis of Ag-NPs. Further detail study of phytochemicals involved in bio-reduction can be done in this field. The antibacterial property of silver nanoparticles against *E. coli* can be used clinically as alternative to various other medicaments. There are a limited number of studies on the potential toxicities of nano silver, though these studies tend to suggest that silver nanoparticles (SNPs) can induce toxicity in living beings. It should be noted that in vitro conditions are drastically different from in vivo conditions; however, longer-term studies and assessment of SNPs toxicity must be conducted so that SNP exposure does not exceed toxic levels.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.




ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

REFERENCES

1. Abbasifar, A., Irvani, M. A., Rafiee, B., Kaji, B. V., & Akbar A. (2017). Antibacterial Activity of Silver Nanoparticles Synthesized by Using Extracts of *Hedera helix*. *Zahedan Journal of Research in Medical Sciences*, 19 (1): e5920, doi: 10.17795/zjrms-5920. Retrieved from [<http://zjrms.com/en/articles/5920.html>]
2. Kaviya, S., Santhanalakshmi, J., & Viswanathan B. (2011). Green Synthesis of Silver Nanoparticles Using *Polyalthia longifolia* Leaf Extract along with D-Sorbitol: Study of Antibacterial Activity. (ID 152970), doi:10.1155/2011/152970. Retrieved from [<https://www.hindawi.com/journals/jnt/2011/152970/>]
3. Ahmed, S., Saifullah., Ahmad, M., Swami, B. L., & Ikram, S. (2016). Green synthesis of silver nanoparticles using *Azadirachta indica* aqueous leaf extract. *Journal of Radiation Research and Applied Sciences*, 9(1), doi.org/10.1016/j.jrras.2015.06.006. Retrieved from [<https://www.sciencedirect.com/science/article/pii/S1687850715000734>]
4. Khatoon, N., Mazumder, J. A., & Sardar, M. (2017). Biotechnological Applications of Green Synthesized Silver Nanoparticles. *Journal of Nanosciences: Current Research*, DOI: 10.4172/2572-0813.1000107. Retrieved from [<https://www.omicsonline.org/open-access/biotechnological-applications-of-green-synthesized-silver-nanoparticles.pdf>]
5. Krishnan, R., Arumugam, V., & Vasaviah, S. K. (2015). The MIC and MBC of Silver Nanoparticles against *Enterococcus faecalis* - A Facultative Anaerobe. *Journal of Nanomedicine & Nanotechnology*, DOI: 10.4172/2157-7439.1000285. Retrieved from [<https://www.omicsonline.org/open-access/the-mic-and-mbc-of-silver-nanoparticles-against-enterococcus-faecalis-a-facultative-anaerobe-2157-7439-1000285.pdf>]
6. Owuama, C. I. (2017). Determination of minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) using a novel dilution tube method. *African Journal of Microbiology Research*, DOI: 10.5897/AJMR2017.8545. Retrieved from [<http://academicjournals.org/journal/AJMR/article-full-text-pdf/B470EA264906>]
7. Ge, Liangpeng, et al. (2014). Nanosilver particles in medical applications: synthesis, performance, and toxicity. *International Journal of nanomedicine*, DOI: 10.2147/IJN.S55015. Retrieved from [<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4037247/>]



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

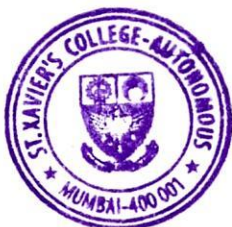

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.




ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

APPENDIX I

- UV- 1700 PharmaSpec, Shimadzu spectrophotometer
- Nutrient Agar, M001- 500G, HiMedia laboratories Pvt. Ltd.
- Nutrient Broth, M002- 500G, HiMedia laboratories Pvt. Ltd.
- Silver nitrate (double crystal) – 25gms, West Coast Laboratories



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

Study of Ficus species in and around Mumbai



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Study of *Ficus* species in and around Mumbai

Submitted by:

Kiran Thumma

Under the guidance of

Dr. Rajendra Shinde

Associate Professor

Department of Botany

St.Xavier's College (Autonomous), Mumbai

April 2016



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

St Xavier's college (Autonomous), Mumbai



Certificate

This is to certify that project titled "Study of *Ficus* species in and around Mumbai" has been successfully completed by Ms. Kiran Thumma of Msc-II, UID-148320 during the academic year 2015-2016.

Project Guide

(Dr. Rajendra Shinde)

Head of the Department

(Dr. Ujwala Bapat)

Date:



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Acknowledgement

I would sincerely like to thank Dr Rajendra Shinde and Dr Manek Mistry for their valuable guidance and support throughout the course of my project work. I would also like to thank the Head of botany Department, Dr Ujwala Bapat for providing me access to Blatter Herbarium and library. I am thankful to Mr. Raideo Singh for his advice and guidance throughout my project work and also Mr. Pravin Kale for his help in the Herbarium.

Other teachers of the Department, Mr. Alok Gude, Dr Vijaya lobo and Dr Kevin D'Cruz for their support. I am grateful to Mr. Sandeep Patil, Mr. Rajan gurav and non-teaching staff of the department for providing me with all the necessary equipments and materials. It's my pleasure to thank my friends Ms. Jyoti Desai, Ms. Madhavi Kamble, Mr. Chintan Bhatt, Mr. Bumo Lam, Mr. Thung Tea Oungh, and Mr. Jatin Vaity for collection of plant material any other friends for their constant help and support.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Index

Sr.no	Contents	Page no
1	Introduction	1
2	<i>Ficus pumila</i>	4-6
3	<i>F. benghalensis</i>	7-9
4	<i>F.benghalensis var.krishnae</i>	10-12
5	<i>F. drupacea var. pubescens</i>	13-15
6	<i>F.mollis</i>	16-18
7	<i>F.religiosa</i>	19-21
8	<i>F.arnottiana</i>	22-23
9	<i>F.benjamina</i>	24-25
10	<i>F. maclellandii</i>	26-27
11	<i>F.hispida</i>	28-30
12	<i>F.racemosa</i>	31-34
13	<i>F.auriculata</i>	35-37
14	<i>F.fraseri</i>	38-39
15	<i>F.tinctoria</i>	40-41
16	<i>F.varigata</i>	42-43
17	<i>F.virens</i>	44-46
18	<i>F.carica</i>	47-48
19	Keys	49-50
20	Result	51
21	<i>Ficus</i> FAQ	52-54
22	Reference	55-56



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Introduction

Hypothesis :Most of the Mumbai *Ficus* are Monoecious

Ficus is one of the largest genera of angiosperms, with about 750 species of terrestrial trees, shrubs, hemi-epiphytes, climbers and creepers occurring in the tropics and subtropics of the world (Berg & Corner, 2005; Ronsted et al., 2008; Frodin, 2004). *Ficus* is represented by 115 taxa (89 species and 26 infraspecific taxa); the taxa have been arranged according to the current classification among six subgenera and 12 sections. The maximum number of the species belongs to subgenera *Urostigma* (Chaudhary et al., 2012).

Vegetative characteristic feature of ficus are aerial roots, All figs possess a white to yellowish latex, some in copious quantities; the twig has paired stipules or a circular stipule scar if the stipules have fallen off; and the lateral veins at the base of the leaf are steep, forming a tighter angle with the midrib than the other lateral veins, a feature referred to as "tri-veined". Apart from this most distinguish character is its inflorescence syconium.

The fig "fruits" are actually inside-out flower clusters (inflorescences) called syconia. They are hollow, fleshy structures composed of modified stem (peduncular) tissue, lined on the inside with hundreds of minute flowers. At one end is a small opening (ostiole) lined with dense, overlapping bracts. Internally, the fig wall is best with small unisexual flowers, sometimes called "florets". So there are 3 types of florets namely Male flowers, long-style flower, short-style (gall flower). All 3 florets surrounded by calyx. Male flowers mostly found near ostiolar region with 1-3 stamens; anther 2-celled, dehiscence longitudinal. Long-style flower unusually disperse, with 1-celled ovary. Short-style flower (gall flower) abundant and disperse, sterile often pedicellate ovary. Main difference between female flower is length of style Female flowers consist of a gynoeceium. Using its threadlike ovipositor, the female fig wasp can oviposit through the short style but not the long style. Therefore, the ovaries of short-style flowers contain a wasp larva, while the ovaries of long-style flowers contain a seed.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Fig can be **monoecious** with Male, Long-style and Short style flowers in the same syconium, or they can be **dioecious** with Male and Short-style flower in one syconium and Long-style and Short style flowers in the other syconium or they can be **gynodioecious** (*f.carica*) in which Male and Short-style flower in one syconium and only Long-style flowers in the other syconium.

Pollination in *Ficus* is most interesting thing. The concealed flowers are inaccessible to most pollinator. Just one group of wasps knows how to reach them- the fig wasps. But figs are selective about which species of wasp can enter fruit. Each species has its unique wasp pollinator. Female fig wasps leaving the fig they have bred in need to fly off in search of another fig tree to continue the reproductive cycle, often a long and arduous journey, which only a few individuals out of thousands manage successfully. This remarkable feat is achieved by homing in on host tree-specific volatiles, a chemical signal released by the fig when it is receptive for pollination. Completion of this journey is the first test of endurance, as once the pollinator has located a receptive fig; she needs to circumvent the next barrier. The only link the fig cavity has to the outside world is through a tiny bract-lined opening at the apex of the fig, called the ostiole, and it is by means of this passage that the pollinating fig wasp gains access to the florets. Negotiating the ostiole is no easy task, with the female wasp having to squeeze and labour her way between the tightly closed bracts. She is, however, remarkably adapted to do so. Her body, in particular her head and thorax, is extremely flattened and elongate. She also has rows upon rows of backward pointing teeth on her mandibular appendage, situated on the underside of her head, as well as a few strong teeth on her legs. These teeth assist her progress through the ostiole and also prevent her slipping backwards. Nevertheless, the process of gaining access to the fig cavity is so difficult that her wings and antennae usually break off in the ostiole, but this fortunately does not influence her pollinating or egg-laying ability.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.




ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

The female wasp then proceeds to pollinate the stigmas and to lay eggs in the ovules of some of the florets. This she does by inserting her long ovipositor down the inside of the style. The florets that have styles longer than the wasp's ovipositor are pollinated, but no eggs are laid in the ovule and hence these florets set seed. The wasp larvae feed on the endosperm tissue in the galled ovary and larval development correlates strongly with host fig development, encompassing anything from three to twenty weeks. Once the wasps have reached maturity they chew their way out from the galls and emerge into the fig cavity within a short period of each other. The wingless males mate with the females before chewing a hole through the fig wall to the exterior to allow the females to escape – the male's only two functions in life, as he dies soon afterwards! The females either actively loads up pollen from ripe anthers into special pollen pockets, or in some species passively become covered with pollen, before exiting the fig in search of young receptive figs to complete the cycle.

Once the female fig wasps have left the fig, it ripens, changing colour and smell, and becomes attractive to seed or fruit eating birds, bats, monkeys and even lizards. Fig trees are considered to be keystone species in many tropical and subtropical ecosystems, because of the all year round production of figs, providing food in seasons when other fruiting trees are not. Fruit eating animals play an important part in the propagation of fig trees, acting as the dispersal agents of the seeds.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

***Ficus pumila* L.-Creeping fig, Climbling fig**



Juvenile foliage

Creeping fig is a vigorous, fast-growing, evergreen, climbing vine.

Stem has clusters of adventitious aerial rootlets which forms adhesive pad. Stem have a milky sap.

Leaves are of two types juvenile foliage consists of ovate, heart-shaped leaves. On fruit-bearing stems, mature foliage is oblong to elliptic, thicker, shinier and larger.

Voucher no-9, date of collection 29/12/15, Place -hanging garden, Collector kiran.thumma



Mature branch

Juvenile leaves are small heart shaped leaves, they are held closely to the surface creating a mat of foliage that extends barely 1 inch from the surface it is growing on. Once the vine reaches the top of its support it will begin to form horizontal branches on which larger adult foliage is produced. Adult leaves are more leathery than the juveniles, and are dark green.

Leaves of 2 types. Leaves on sterile branchlets subsessile; leaf blade ovate-cordate, leathery, base slightly asymmetric, apex acuminate. Leaves on fertile branchlets: leaf blade ovate-elliptic, leathery, abaxially yellow brown pubescent, adaxially glabrous.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Ficus pumila is very rapid climber able to cover vertical surfaces 3 and 4 stories tall with the aid of a powerful adhesive. This plant has developed a specialized structure; an adhesive pad that secretes a sticky substance that adheres to almost any surface, this remarkable adhesive was first described in detail by Charles Darwin in his book **The Movements and Habits of Climbing Plants** (1876). Clustered roots in *F. pumila* are sent out forming fine root hairs that emerge from internodes. These in turn secrete a substance made up of polysaccharide and protein. The roots and root hairs stick together forming the adhesive pad. Pads stick to almost any surface. If the roots do not touch a surface they usually dry up, if they touch moist soil they tend to branch and change to a typical root. Once the vine reaches the top of its support it will begin to form horizontal branches on which larger adult foliage and fruits are produced

Fig

Fig is obovoid shape, they are borne only on the horizontal stems, they are pale green in colour, and fig has a stalk with 3 basal bracts. Ostiole portion is slightly elevated with red patch with white spot.

Internal structure of fig

Male flowers near a ostiole, filament long, white in colour, anther dorsifixed, 2-celled covered with papery like thing. Anther pollen less.

Two type of female flower is seen, one is pedicellate and other is sessile; calyx lobes 3- 4, linear; style is straight in one and curved in other.

Achenes and wasp traces not seen.





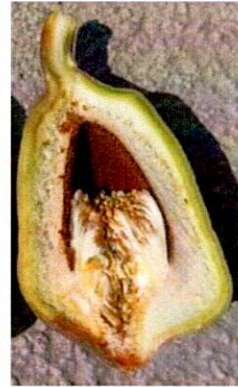
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Entire fig



T.S of fig



Valley of female flowers



2 types of female flower



Male flower



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Ficus benghalensis L.-Barh,Vad, Merri chettu



Young leaves are pink changes brown and finally green

Large spreading tree with massive horizontal branching and aerial roots, nearly evergreen

Trunk grayish bit black, young branches pale yellowish

Leaves alternate, elliptic-ovate, coriaceous, 10-17cm long with rounded base

Voucher no-3, date of collection 2/4/16,
Place -CST, Collector kiran.thumma



Gland

Leaves alternate, elliptic-ovate, 10 -20 long and 7-12cm board, coriaceous ,lateral nerves 6-8 pairs, 3-5 nerved from base, arching near a margin, intercostals transverse, glabrous above, puberulous below, leaves deep green above, paler beneath, base rounded, margin entire, apex obtuse to sub acute ;petiole 4-5cm.

Undersurface of leaves shows gland, as leaves decay even gland decay and produce white wax.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

Prop roots



Young prop root



Mature prop root

Prop roots tip which produce young roots are pink in color with yellow tip. They start thickening once they reach ground. That grows into thick woody trunks which, with age, can become indistinguishable from the main trunk.

Figs



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



Figs are sessile, nearly spherical about 2cm in diameter, growing in pair from leaf axils towards the end of twig supported at base by 3 broad greenish- yellow bract. fig and bract are covered by soft hairs.

Internal structure of fig

Figs monoecious, **Male flowers** numerous near mouth of the receptacle. Sepal 4, lanceolate. Stamens 1. Anther 2 cell oblong, unequal, connective brown partly covered by bracts.

Long style flowers sessile, ovary obovoid-globose, 3mm long, dark brown on stylar side; style erect or curved. **Short style flower** similar to Long style flowers pedicellate.

Achenes globose-ellipsoid shows remnant style.



T.S of fig



Short-style flower



Long-style flower



Male flower



Achenes





Ficus benghalensis var. krishnae-Krishna's butter cup, Makhan Katori



Young leaf shows partly cup shaped
Formation which is still attached to mid-rib

Large evergreen tree, fast growing tree
with aerial roots.

Bark grayish black, older bark is flaky,
under bark is yellow is color.

Leaves ovate, 3 nerved backside of leaf has
cup-shaped fold at base

Voucher no-4, date of collection 14/1/16,
Place - Rani baug, Collector kiran.thumma

Partly cup-shaped
formed when leaf
is young.



Front side

Arcuate vein

Cup shap



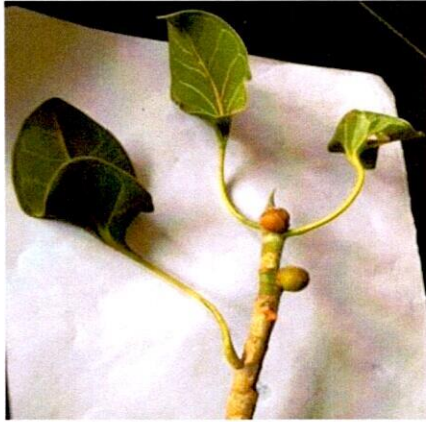
underside

Leaves alternate ovate, 3 nerved with arching near margin, entire margin, it has
long petiole 9-10 cm, and underside of leaves shows cup-shaped structure at base.
Leaves dark green above and pale below.





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Twig



Entire fig

Fig

Figs are sessile, nearly spherical about 2cm in diameter, figs grow in pair, figs changes its color from yellow, red to brown at it has base 3 broad greenish- yellow bract. fig and bract are covered by soft hairs, ostiole covered by bracts.

Internal structure of figs

Male flowers near the mouth, perianth 2-3 lobed, stamen 1, filament 1-2 mm long, anthers dorsifixed, slits medium.

Long style flower, the perianth of 3 or 4 tepals, ovary straight, long 3mm

Short style flower flowers sepals 4, 5mm long

Achenes globose-ellipsoid shows remnant style, 1mm.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



T.S of Fig



Male flower



Short style flower



long style flower



Achene



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



***F. drupacea* Thunb.- Mysore Fig, Brown woolly fig, Burali-Wad**



Young leaves with bud scale stipule

Large canopy with strangler fig, deciduous.

Trunk older one grayish, younger one pale colour, bark smooth shows lenticels

Leaves upper surface glabrous, underside cover with yellowish-brown soft hair.

Voucher no-5, date of collection 14/1/16, Place - Rani baugh, Collector kiran.thumma



Front-side



Back-side



Gland not covered by hairs

Leaves alternate obovate-elliptic, with rounded base, apex acute, margin entire, leaf bud stipules are red in colour and in young leaves both sides are covered with yellowish-brown hair, whereas in mature leaves only underside is covered with hairs, it has gland at base which is not covered by hairs even stalk has hairs. leaves 4-20cm long, 6-12 breadth.





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Arial roots embracing the stem.



Figs are in pair

Figs

Figs conic-ellipsoid, sessile growing in pair from leaf axils towards the end of twig supported at base by 3 broadly triangular blunt spreading basal bracts densely covered with brownish yellow hairs. When young figs are green in color turn yellowish-orange when ripen. Ostiole part shows red dot.

Internal structure of fig

Male flower near the apex of the receptacle, rather numerous pedicellate. Stamen 1 anther 2 celled, filament 1-2mm, dorsifixed anther.


Long style flower sepal 4, smooth flatten ovary, style elongated lateral

Short style flower broad, smooth. Style short, sub terminal.

Achenes ovoid shows remnant style, 1mm



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

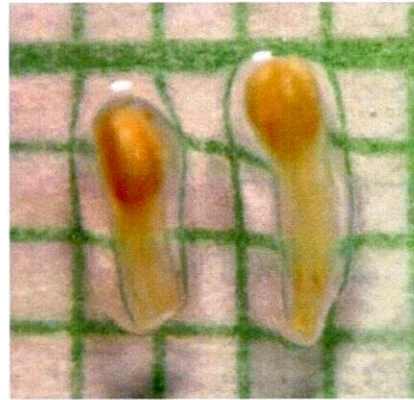

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



T.S of fruit



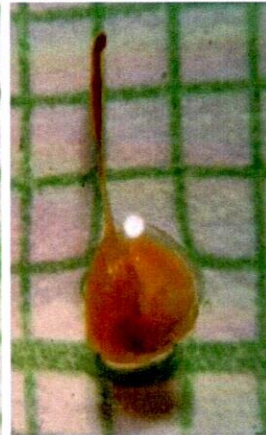
Male flower



Short style flower



Long style flower



Achene



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



Ficus mollis Vahl- Soft fig, Katbar,Chitakar



Large shady tree

Trunk large, thin aerial roots from branches; primary braches tomentose, bark white scaly.

Leaves alternate, ovate-elliptic or obovate –elliptic, glabrous above and tomentose below.

Voucher no-15, date of collection :27/2/16, Place :Mulund, Collector: Jatin Vaity

Twig



Leaf upper surface



lower surface

Leaves alternate, coriaceous, ovate-elliptic or obovate –elliptic,margin entire, apex acuminate, base rounded or cordate, basal nerves 3-5, lateral nerves 10-12,petiole 2-2.5cm long densely woolly, even rachis are woolly.





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Ostiolar region is orangish- red



Axillary pair fig

Fig

Figs conic-ellipsoid, sessile in pairs, axillary, grey-tomentose, 6-10 mm in diameter, basal bracts 3, large, spreading, pubescent, ostiolar part is orangish- red.

Internal structure of fig

Male flower few near ostiole, sepals 4, lanceolate, stamen 1, anther basifixed.

Long style flower sepals 4, lanceolate, ovary smooth, style long.

Short style flower sepals 4, shorter than ovary. Ovary smooth; style short.

Achenes not seen.

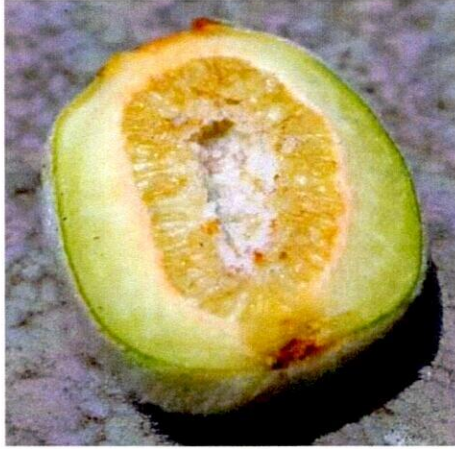


NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



T.S of fig



Male flower




Short style flower



Long style flower



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

Ficus religiosa L- Peepal, pipal, bo tree.



Large, fast growing deciduous tree

Trunk darker with reddish brown when peel off.

Leaves with wavy margin, leaf base is rounded to slightly cuneate, apex tail taller.

Voucher no-1, date of collection 2/4/16,
Place -CST, Collector Kiran.thumma

The young leaves are frequently pink change to
Copper and finally to green



Leaves alternate, broadly ovate, sub coriaceous ,3 basal nerve, lateral nerves 8-10 pairs, blade is criss-crossed by fine network of little veins, base is rounded, truncate, sometimes in young leaves cordate, petiole about 12cm, stipule ovate-lanceolate. Young leaves of plant growing as epiphytes shows slightly lobed wavy margin as compare to mature leaf of same plant.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Figs are in pairs growing in pair from leaf axils, without stalks. It has 3 bracts at base of each fig. they are slightly spherical in shape; ostiole can be clearly seen in mature fig. They are green at first, turning red, then dark purple.

Internal structure of fig


Fig monoecious; **Male flowers** small few found near bracts or mouth of receptacles, sessile, sepals 3; Stamen 1; anther single, rounded; filament short, its 1mm in size.

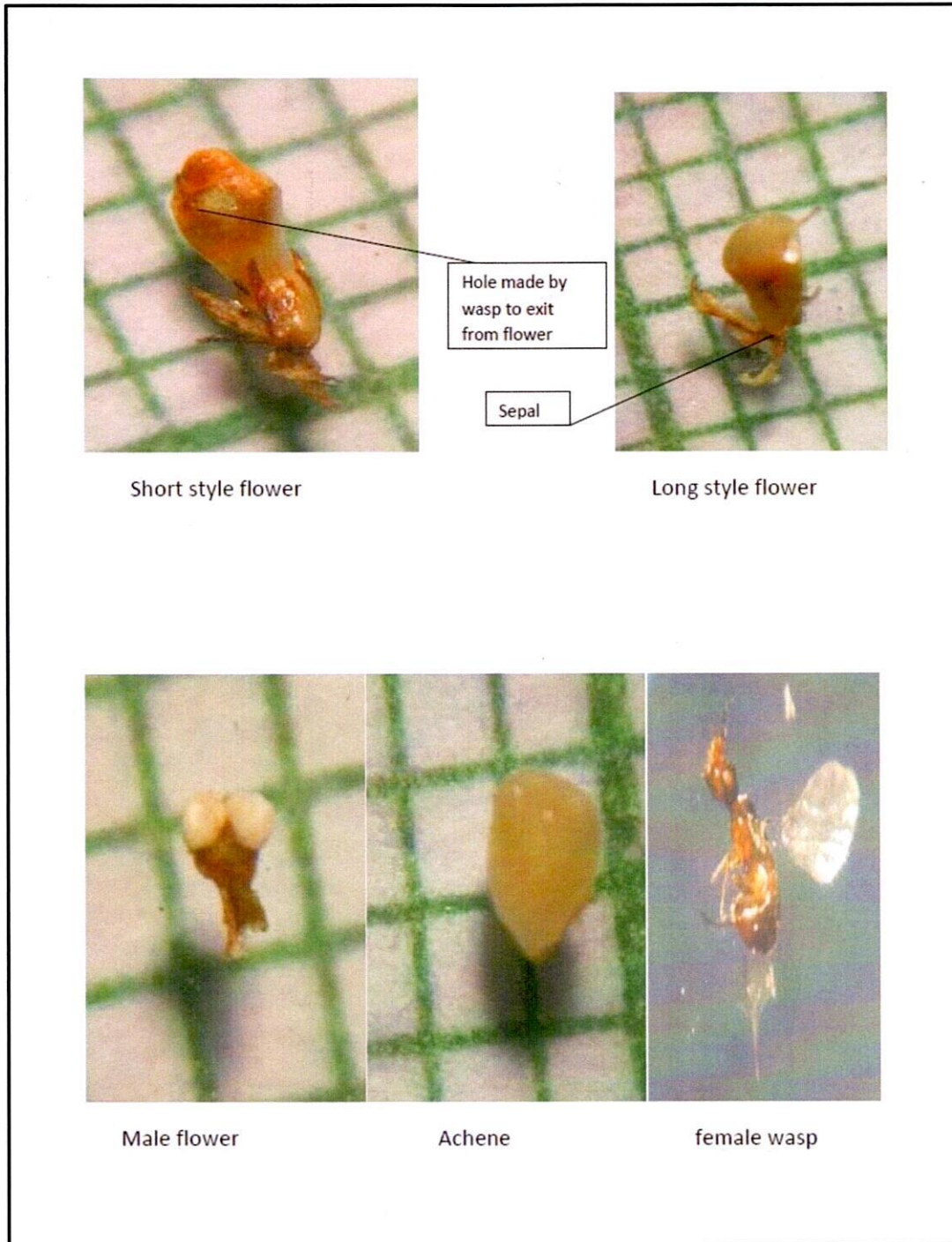
Short style and long style flowers sessile or pedicellate, the short style flowers much more numerous than long style flower, many of them without perianth . Sepal 5, style lateral, stigma rounded. Short style flower or gall flower is 3mm, it shows hole made by wasp while leaving flower. Long style flower is 2mm in size.

Achene smooth, ovate irregular in shape with 1-2 mm in size.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Ficus arnottiana (Miq.) Miq.- Indian rock fig, Pimpli, Payar



Shrub or tree, fast growing deciduous.

Trunk medium sized, bark smooth grey when young, become dark as mature.

Leaves board and cordate at base, wavy margin, veins and bright pink especially when young.

Voucher no-16, date of collection 27/2/16, Place vasai fort, Collector kiran.thumma

leaves sub-coriaceous, broadly ovate, narrowed to shortly caudate-acuminate apex, with wavy margin, base cordate, 5-7-basal nerve, 6-8 lateral pair of nerves, with minute lucid reticulate between; petioles 5-15cm long, bright pink when young.

Fig

Figs from the axils of fallen leaves, in pairs or clusters from sessile or shortly pedunculate, depressed-globose. Red with greenish dots when ripen.

Internal structures of figs

Male flowers not seen


Long-style flower sessile, sparsely scattered in the interior of syconia, cream, somewhat reddish on stylar side; ovary superior, depressed globose; style filiform; stigma flat.

Short-style flower pedicellate, short style.

Achene not seen



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

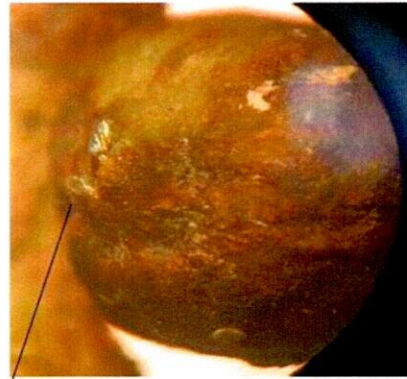

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
© 2262 0661/65



Entire fig



Female wasp lost its wing + while entering in fig

Wings



T.S of fig



Long-style flower



Short-style flower



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Ficus benjamina L.-Weeping fig, Pukar, Nandaruk



Middle –sized tree up to 20m long.

Trunk not huge, Bark gray to gray-white, smooth. branchlets gray-white
Main branches produce aerial roots.

Leaves alternate, elliptic-ovate with gracefully drooping branchlets and glossy leaves oval with pointed tip.

Voucher no-14, date of collection 18/3/16, Place –Rani baugh, Collector kiran.thumma

Leaves alternate, elliptic-ovate, subcoriaceous, not prominently nerved from base, lateral nerves raised on either sides, base rounded to broadly acute, margin entire, apex acute to shortly acuminate, Petiole 1-2 cm.

Figs

Figs monoecious, axillary, paired, sessile, globose or obovoid, figs yellowish-green in colour. fig glabrous or pubescent, base attenuate into stalk.

Internal structure of figs

Male flower few seen near ostiolar region, shortly pedicellate, stamen 1, anther oblong.


Long style flower sessile, ovary ovate, style long, stigma thick.

Short style flower similar to long style flower but pedicellate.

Achenes smooth.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
© 2262 0661/65



T.S of figs



Male flower



Short style flower



Long style flower



Achene



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
© 2262 0661/65

Ficus maclellandii King



Small semi-deciduous tree, 5 m tall.
Trunk not massive, bark grayish-brown with white spots or lenticels, prop root.
Leaves are dimorphic, oblong to ovate-elliptic, hairs on stipule.
Voucher no-12, date of collection 13/3/16, Place - Rani baug, Collector kiran.thumma

Leaves are dimorphic, leaf blade oblong to ovate-elliptic, 8-13 × 4-6 cm, leathery, glabrous but occasionally pubescent when young, base rounded to cuneate, margin entire, apex acuminate to mucronate; basal lateral veins 2, prominent, secondary veins 10-13 on each side of midvein

Fig

Figs axillary on leafy branchlets, paired, purplish red when mature, ± globose to conic, slightly flat, 6-8 mm in diam., tuberculate

Internal structure of figs

Male flowers: few to several, in ostiolar rings or dispersed, pedicellate; sepals 3, lanceolate, anther

Long style flowers: pedicellate, sepal 3, ovary globose, 2mm long


Short style flower sessile, sepals 3, ovary, with a short style, globose, 2.5mm long.

Achenes not seen.

Note: Most ornamental *Ficus longifolia* are either *Ficus binnendijkii* (stipules glabrous) or *Ficus maclellandii* (hairs on stipules)



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Entire figs



T.S of fig



Male flower



Short style flower



Long style flower



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Ficus hispida L.f-Hairy fig , kala umber, gobla



Young leaves shows prominent toothed margin

Shrub or small evergreen tree.
Trunk pale grayish-brown, slightly smooth marked by raised lines.
Leaves obovate-long, slightly thick covered with coarse hair hispid. base truncate to round.
Voucher no-7, date of collection 1/4/16, Place -CST, Collector kiran.thumma



Leaves opposite decussate, broadly oblong to elliptic-lanceolate 10-20cm long and 6-10cm broad, coriaceous, 3-nerved from base, lateral nerves 6 pairs, intercostals transverse, prominent below, leaves hispid, base truncate to rounded often unequal, margin entire to minutely toothed in mature leaves, in young leaves margin prominently toothed. Apex acute.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde.
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

© 2262 0661/65



Cauliflorous figs



Young figs

Figs

Figs dioeciously , cauliflorous on special shoots and on branchlets,depressed-globose,base narrowed, fig faintly ribbed, peduncle 0.5 cm, bracts triangular. Young figs shows prominent brownish hairs, figs shows white dots over it. Ostiole side has prominent bracts.

Internal structure of figs

Male flower stamen 1, sub sessile, anther oblong, parallel, unequal to 1mm.

Long style flower,Short style flower unable to differentiate.

Achene lenticular.

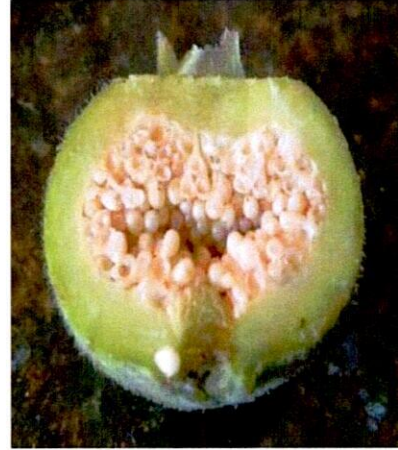




ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Entire fig



T.S of fig



Male flower



Female florets



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Ficus racemosa L.- Cluster fig, Goolar



Young leaf showing toothed margin

Middle-sized tree, deciduous

Trunk grayish-yellow smooth

Leaves alternate, oblanceolate, subcoriaceous, 3 main veins, base rounded. margin entire, when young toothed.


Voucher no-8, date of collection 5/4/16, Place - CST, Collector kiran.thumma



Leaves alternate, oblanceolate, 9-20 cm long 3-6 cm broad, subcoriaceous, 3 main nerves 8-10 lateral nerves, somewhat flattened and prominent on both sides, intercostals obscure, base rounded to acute, margin entire, in young leaves margin toothed. Apex acute, stipules lanceolate.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Cauliflorous figs



Raw fig



Ripen fig

Figs

Figs monoecious, cauliflorous, globose, 1.5-2.5cm across, fig wall thick green when ripen it become soft purplish red; peduncle to 7mm; basal bracts ovate-triangular. Young figs are covered with soft hairs.

Internal structure of fig

Male flowers near apical pore, pedicel to 3mm .3-4 stamens in closed in bracts, filaments 1mm, connate below; anthers oblong.

Long style flower ovary sessile or shortly stalked, brownish 1.5mm; style to 3mm.

Short style flower similar, long-stalked; short style.

Achenes lenticular.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
© 2262 0661/65



T.S of fig



Male flower



Gall flower



female flower



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
© 2262 0661/65



From left Male, Female pollinating, Non-pollinating wasp of *F. racemosa*



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

Ficus auriculata Lour. - Elephant ear fig, Fagoora, Phagoora



Large tree, 5-10m tall with spreading crown

Leaves alternately arranged, obovate elliptic to elliptic, length up to 50cm

Bark is grey, smooth. Young branchlets sparsely pubescent

Voucher no-2, date of collection 18/2/16,
Place - Dattaji salvi udyan, Collector
kiran.thumma

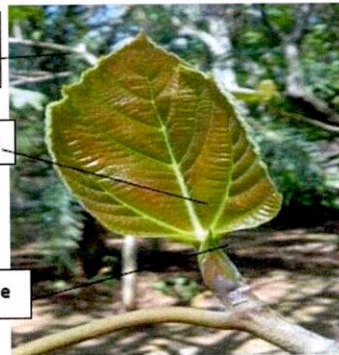
The young leaves are red and turn green as they increase in a size



Toothed margin

3 basal nerves

Bud scale stipule



Leaves alternately arranged petiole up to 4-6 cm long. Leaves obovate-elliptic to elliptic 10-50 cm long and 8-30 cm broad, glabrous above, softly pubescent beneath. 3 prominent basal nerve and 5-6 lateral nerves. Base cordate to wedge shaped young leaves have toothed margin while mature one has entire or slightly toothed margin. Apex shortly acuminate or sub-obtuse. Stipule ovate-lanceolate.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Young figs

Soft hairs

Mature fig

Figs are cauliflorous on short branchlets of old stems, figs green and turn dark brown as its mature, pear-shaped to spherical, figs has stalk and 3 bracts, mature figs shows white spots. ostiole shows prominent bracts which interlock gives spirally mosaic appearance. They are large figs 2-3.5cm across, covered with soft hairs which prominent in young figs.

Internal structure of fig

Male flowers (Not see but flora of Maharashtra do mentioned about it)

Long style flower sub-sessile or pedicellate; sepals united, 2-3 lobed, ovary with sub-terminal long hairy style. **Short style flower** similar to female flower but pedicellate.

Achenes not seen.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



"Valley" of long and short style flowers

Ostiole bracts pointing towards one direction for entry of wasp

Long style and short style flowers

Hairs

f. auriculata flowers shows these hairs on style which is not observed by me in other *ficus* sp.





Ficus fraseri Miq.-Sandpaper fig



Shrub to medium-sized tree.

Stem hard, green cylindrical, rough but not hairy.

Leaves ovate to elliptic or obovate, base often cuneate; both surfaces scabrous.

Voucher no-11, date of collection 13/3/16, Place -dattaji salvi udyan, Collector kiran.thumma

Leaves ovate to elliptic or obovate, mostly 6–12 cm long, 2.5–6.5 cm wide, margins entire, apex obtuse to slightly apex, base often cuneate; both surfaces scabrous; petiole mostly 1–2 cm long; finely hairy.

Figs

Figs ellipsoid 10–15 mm long, they are green at first, turning yellow then dark purple, stalk 5–10 mm long; paired or clustered in axils of leaves.

Internal structure of figs

Male flower and short style flower growing together with same stalk hairy and perianth, filament anther adnate; short style flower long stalked, short style, these are 2mm long.

Long style flower sessile or stalked. Ovary depressed-globosely, tip clavate, 1.5mm long

Achenes not seen.





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
© 2262 0661/65



Entire fig



T.S of fig



Male and short style flower



Long style flower



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

Ficus tinctoria G.Forst.-Dye fig, Majni, Gasti.



Small tree or shrub, often growing in rocky areas or over boulders.

Trunk not so huge, bark scaberrulous or pubescent, branchlets brown.

Leaves alternately arranged, ovate-elliptic, glossy dark green above, pale below, leaves are often asymmetrical.

Voucher no-13, date of collection 27/2/16, Place vasai fort, Collector kiran.thumma

Leaves alternate; petiole thick, 8-10 mm; leaf blade elliptic to ovate-elliptic, asymmetric, larger in juvenile plants, leathery to stiffly leathery, abaxially slightly rough, glabrous, base broadly cuneate to cordate, margin entire or toothed, apex obtuse to acute; venation abaxially conspicuous, not dark brown when dry; basal lateral veins short.

Fig

Figs when pluck yield yellow dye, figs are 5-8mm in diameter, globose in pairs, axillary or from below the leaves, peduncle is very short, fruit covered with hairs, fruits green in colour turn yellow when ripen, ostiole portion is tightly closed by bracts it has lowered than fruit.

Internal structure of figs

Unable to distinguish between florets.

Achenes ellipsoid



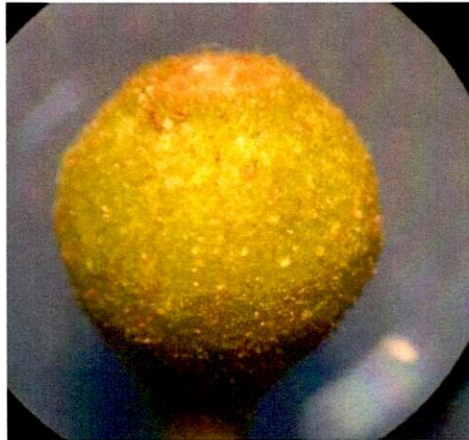
NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
© 2262 0661/65



Raw fig



Ripen fig



Ostiole portion of fig



T.S of fig



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



Ficus varigata



Woody shrub plant.

Stem woody greenish- white, nodes have ring and lenticels.

Leaves alternate, obovate, green leaves with scatter white spots.

Voucher no-10, date of collection 13/3/16, Place –dattaji salvi udyan, Collector kiran.thumma

Leaves alternate, obovate, green leaves with scatter white spots, 3 main nerves, 7-8 pairs of lateral nerves, veins are white in colour. base round, apex acute, margin entire, petiole brown in color.

Figs

Figs are growing in pair with stalks. It has 3 bracts at base of each fig. they are slightly spherical in shape; figs shows lenticels spots on it, ostiole can be clearly seen in mature fig, They are green at first, turning reddish-brown.

Internal structure of figs

Male flowers ostiolar, short stalked enclosed in a perianth, filament anther adnate.

Female flower only one type of floret is seen, ovary sessile, white short style stigma calvate brown in color, 2mm long.

Achene not seen.





ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65



Entire figs



T.S of figs



Bracts and female florets



Male flowers



female flower



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

Ficus virens Ation- White Fig Pilkhan, Pakhad



Large deciduous tree with a spreading crown.

Trunk is pale grey with lenticels

Aerial roots commonly wrap around the main stem instead of forming prop roots.

Voucher no-6, date of collection 14/3/16, Place - Rani baugh, Collector kiran.thumma

Young leaves go color transformation from Purple, red, bronze to finally green.



Distinct arching vein

Leaves alternate, oblong-ovate, coriaceous, 4-12 cm long and 3-8 cm broad, petiole up to 6 cm, 3 main nerves and 10-12 pairs of lateral nerves, it shows distinct arching or articulate vein towards margin. Base rounded to truncate, margin entire, apex abruptly acuminate.





Aerial roots wrap around the main stem



Stalked white figs

Figs

Figs monoecious, axillary, paired on short stalk, globose or spherical, 1-1.5 cm across, ripen figs are white in colour initially they are green in colour. bracts triangular-ovate.

Internal structure of figs

Male flower ostiolar, shortly stalked, enclosed in perianth. Stamen 1 ; filament anther oblong.

Long style flower sessile, ovary obovoid, 1mm, red-brown; style filiform, 2mm, tapering.

Short style flower similar, pedicellate.

Achenes smooth.





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



T.S of fig showing bracts



Male flower



Short style flower



Achene



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Ficus carica



Figs

Fig is obovoid, top-shaped or pear-shaped. It's yellowish-green with brown strips, ostiolar region it's orangish, shows large opening partly covered by bracts.

Internal structure of fig


Male flower not seen

Female flower 2 types of florets are seen but unable to distinguish.

Achenes not seen



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
© 2262 0661/65



T.S of fig



Bracts near ostiole



Two types of female florets



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



Keys to *Ficus* species

1. Plants with climbing habit, clinging roots, 2 types of leaves (juvenile short cordate and mature oblong thick, large).....*F. pumila*
1. Plant without climbing habit, clinging roots, 2 types of leaves.....2
 2. Fig sessile.....3
 3. Leaves more or less tomentose.....4
 4. Leaves obtuse, underside glabrous fig spherical, red, 2cm in diameter....5
 5. Base of the leaf not folded to form a cup*F. benghalensis*
 5. Base of the leaf folded to form a cup.....*F. benghalensis* var. *krishnae*
 4. Leaves obtuse, underside tomentose fig spherical.....6
 6. Leaves reaching 20 cm in long, shortly acuminate; receptacles oblong or obovate, fig when ripen, 2.5cm long..... *F. drupacea* var. *pubescens*
 6. Leaves reaching 12 cm in long, bluntly apiculate; receptacles pisiform, Less than 1cm in diameter, grey-tomentose.....*F. mollis*
 3. Leaves glabrous.....7
 7. Leaves cordate8
 8. Bases of leaves not narrowed to the petiole, rounded or truncate, 3-5 nerved, apical tail 1/2 as long as the main part of the blade, receptacles depressed at the apex.*F. religiosa*
 8. Bases of leaves cordate; apex shortly caudate-acuminate...*F. arnottiana*
 7. Leaves elliptical-ovate or lanceolate linear.....9
 9. Leaves elliptical-ovate, glossy leaves.....*F. benjamina*
 9. Leaves lanceolate-linear, prominent mid-rib.....*F. maclellandii*





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

2. Fig stalked.....10
10. Cauliflorous fig.....11
11. Leaves alternate decussate, leaf size 9-15 cm.....12
12. Leaves oblong to elliptic lanceolate, leaves and figs are hispid.....*F.hispida*
12. Leaves oblanceolate glabrous, figs tomentose.....*F.racemosa*
11. Leaves alternate not decussate, large leaves more than 10- 50cm.....*F.auriculata*
10. Non- Cauliflorous fig.....13
13. Fig size less than 1cm long.....14
15. Shrub, leaves hispid, figs when pluck oozes white latex.....*F.fraseri*
15. Tree, Leaves glabrous, fig when pluck oozes out latex.....*F.tinctoria*
13. Fig size more than 1cm long.....15
15. Woody shrub, leaves and fig varigated.....*F.varigata*
15. Tree leaves oblong-ovate distinct arching vein, Fig white in color.....*F.virens*



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

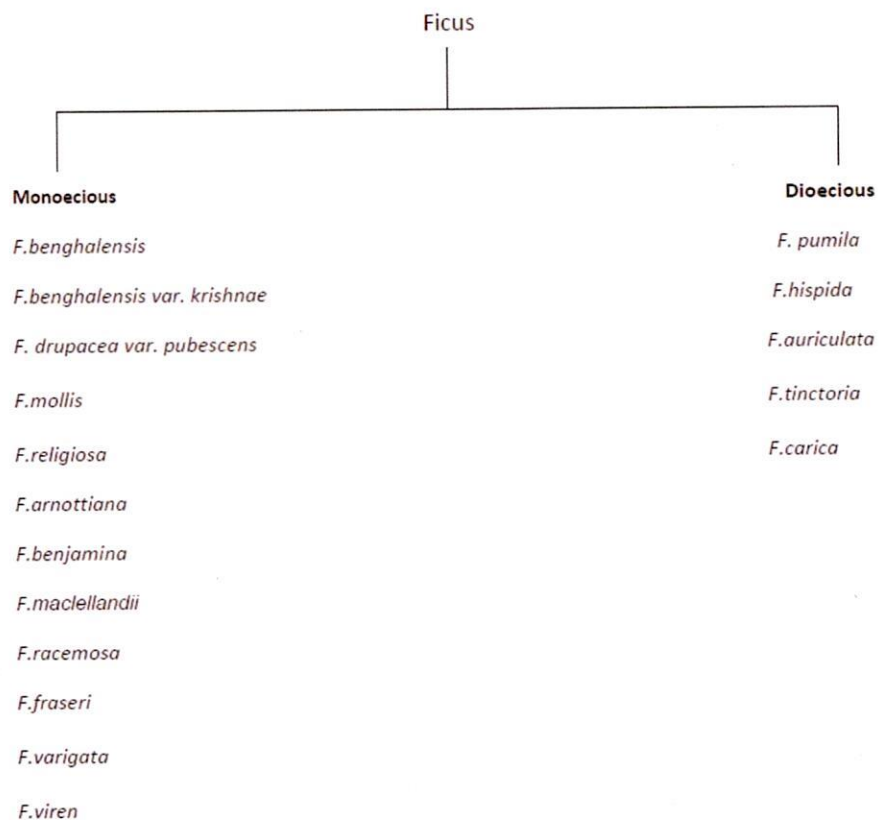
Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



Result

"Most of the Mumbai *Ficus* are Monoecious" i.e. Male flower, Long-style (Female) flower and Short style (Gall) flower in the same Syconium or fig. This hypothesis is proven **Right**, as most of the *Ficus* shows presences of all 3 florets; Some *Ficus* are **Dioecious** with Male and Short-style flower in one syconium and Long-style and Short style flowers in the other syconium. Out of 17 species, 5 species are dioecious.

Some figs mentioned as monoecious in floras, but all 3 florets are not seen specially male flower now this could be Human error or studied fig was immature (as male flower matures late).





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Ficus FAQ

- Are *Ficus* parasitic?


Parasitic plants are one which takes nutrition from host plant, *Ficus* grow as epiphytes or Hemi-epiphytes. i.e just for support, however it grows long roots and reach the ground. Then, they thicken and surround the whole tree. This eventually prevents the host tree from growth, thus "strangling" and killing it. But that doesn't mean that they are parasitic.

- Gall flowers are sterile flowers?

A tiny female wasp enters an opening (ostiole) on the syconium to pollinate the flowers and lay her eggs inside the short-style female flowers. She inserts her ovipositor down the stylar canal and deposits an egg inside the ovary of each short-style flower. According to I.J. Condit (The Fig, 1947), oviposition injures the stylar canal, thus inhibiting pollen tube growth and fertilization in short-style flowers. Because her ovipositor is too short, the fig wasp is unable to oviposit inside the long-style flowers. The latter flowers each develop a seed (with an embryo and endosperm) by normal pollination and double fertilization. Although there is considerable disagreement in the literature, many authors continue to describe the short-style flowers as "gall flowers," presumably because they are commonly occupied by a developing male or female fig wasp; however, they are fully capable of producing normal seed-bearing drupelets, and in this respect are no different from long-style flowers.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

- **Eggs are laid only in gall flower?**

Besides pollinator wasp there is another group of wasp breeds inside fig, this are non-pollinator wasp with long ovipositor. It can easily penetrate the long-style flowers which are too long for true female fig wasps. Thus bogus fig wasps can lay eggs in long-style fig flowers reserved for fig seeds. Consequently no seeds are produced in these flowers. In addition, the bogus fig wasps do not pollinate fig flowers, because they lay eggs by inserting their ovipositor through the fig wall from the outside of the fig as they cannot enter through ostiole. These wasp are know as non-pollinator or parasite wasp because they are not helping in fig pollination.

- **How *F.carica* is cultivated?**

F.carica is gynodioecious i.e male and short-style flower (gall flower) in one fig known as male tree and only long-style flower in other fig known as female tree. Edible figs are produced on female trees only if they are pollinated by fig wasps (*Blastophaga psenes*) from the syconia of male trees. The male syconia contain wasps and pollen, and are generally not eaten. male figs are collected and hook on string and hung on tree branches. Wasp enter female fig but cannot lay its egg because it has long style flower not suited to oviposition by wasp. Some *F.carica* are cultivated by parthenocarpy process which lack seeds.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

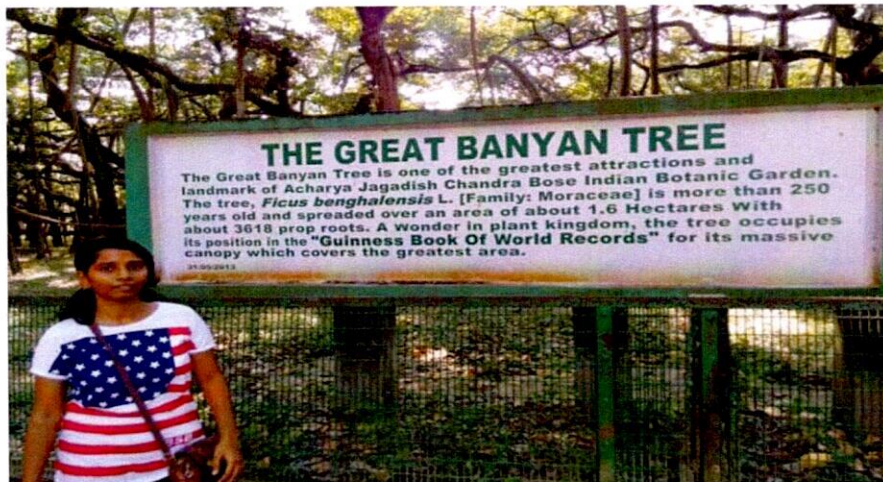
Alinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

- **World largest banyan tree?**


The banyan tree covering the largest net area is **Thimmamma Marrimanu** in the State of Andhra Pradesh. It currently covers a net canopy coverage of 19,107 m², which is approximately nine percent more than the second-ranked tree, the Kabir Vad Banyan, at 17,520 m². The third- and fourth ranked trees, with a difference of less than two percent of total area, are the Giant Banyan of Majhi and the famous Great Banyan of Calcutta. These are studied by with location information, photographic resources, and a brief description of their cultural significance. Using aerial imagery and measurement tools available via Google Earth.



According to new report Kolkata Banyan it's not a world largest tree, its ranked 5th in giant Banyan.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.




ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

References

- Cooke, T. (1958). *The Flora of the Presidency of Bombay*. Volumes 3. Calcutta: Botanical Survey of India, pp.142-150
- Almeida, M.R. (2003). *Flora of Maharashtra*. (Bischofiaceae to Ceratophyllaceae). Volume 4b. Mumbai: St. Xavier's College, pp.359-378
- Matthew, K.M. (1983). *The Flora of Tamil nadu and Carnatic*. Volume 2. Tiruchiraoalli District, Rapinat Herbarium, St Josephs College, pp.1511-1527
- Krishen Pradip, (2006) *Trees of Delhi: A Field Guide*. Dorling Kindersley (India) Pvt Ltd, New Delhi, India.
- Krishen Pradip, (2014) *Jungle Trees of Central India*. Penguin (India) Pvt Ltd, New Delhi, India.
- King, G. (1888). Ficus L. In: Hooker, J.D. *The Flora of British India*, Vol 5. L. Reeve and Co., London, UK. pp. 494-537
- Chaudhary, L.B., Sudhakar, J.V., Kumar, A., Bajpai, O., Tiwari, R. & G.V.S Murthy (2012). Synopsis of the Genus Ficus L. (Moraceae) in India. *Taiwania*, 57(2): 193-216.
- Simon van Noort, Jean-Yves Rasplus. *Iziko Museums of South Africa* (2015) *How fig tree pollinated* Available at http://www.figweb.org/Interaction/How_do_fig_wasps_pollinate/
Last accessed 2 April 2016



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.




ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

- W.P. Armstrong. Wayne sword (2016) *Sex Life Of Figs: Coevolution Of A Tree & Minute Wasp* Available at <http://waynesword.palomar.edu/arbimg10b.htm#other> Last accessed 1 April 2016
- Rohan Chakravarty .Green Humour (2014) How the Fig Wasp runs the Fig Empire Available at <http://www.greenhumour.com/search/label/fig%20tree> Last accessed 1 April 2016
- Bar-Ness, YD (March 2013). "Giant Banyans - The World's Largest Trees?" GEO (89)

Project Report: Department of Botany



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Department of Botany


Field Study Tour (2019-20): Attendance

Another field visit was organized for MSc I & II (20 students) from 1st to 4th March 2020 to Pachmari, Madhya Pradesh by train. Dr. Rajdeo Singh, Dr. Vijaya Lobo, Dr. Manek Mistry and Mr. Uddhav Patole accompanied the group and studies were done on the vegetation of places near Duchess Falls, Bison lodge, Pandav caves, Jata Shankar temple, Dhupgar, Handikho, and Pachmari lake.

Name of Students	UID No.
Anagha Santhosh	198302
Gosavi Pavan	198303
Katalkar Pooja	198304
Kesarkar Prathamesh	198305
Khan Shirin	198307
Kothari Saloni	198308
Nimbalkar Aditi	198311
Shaikh Ayesha	198316
Tare Jidnyasa	198319
Almeida Licy	188302
Anaokar Sharang	188302
Bavi Pratik	188303
Das Adya Jyoti	188306
D'Costa Clive	188307
Fernandes Valeska	188309
Kathole Ketan	188310
Longkumar Lanunchetla	188311
Panicker Tapasya	188313
Pitale Kaivalya	188314
Viana Maribelle	188320



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Field to Pachmarhi hill station, Madhya pradesh

For students of MSC 1 and MSC 2.

Accompanying teaching staff: Dr. Rajdeo singh & Dr. Vijaya lobo

Field collector: udhav patole.

Guide: Mr. Bahadur

Hotel: Raj Laxmi hotel.


- Pachmarhi, the famous hill station of central india.
- It is located in Hoshangabad district of Madhya Pradesh state.
- It is widely known as queen of satpura.

Points visited: Satpura Tiger Reserve Bison lodge, Satpura National Park, Lord Shiva, Pandvas of Ramayna..., duche's fall, Dhoopgarh, Jatashankar, Handi khoh, Ramya kund.

The forests are dominated by Teak (*Tectona grandis*). They include the westernmost groves of sal (*Shorea robusta*), which is the dominant tree of eastern India's forests. Other endemic vegetation includes wild mango, silver fern, jamun and arjun.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

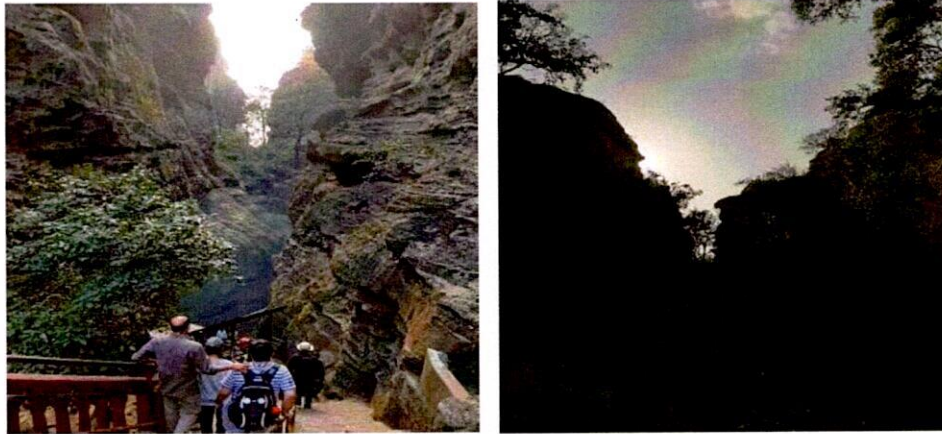
(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

1. Jatashankar

Jatashankar (also Jata Shankar) is a natural cave and Hindu shrine located north of Pachmarhi, in Hoshangabad district, Madhya Pradesh, India. Jatashankar is located in a deep ravine with enormous boulders perched above. The cave contains stalagmites which are revered as naturally formed lingams. The cave serves as a shrine to the God Shiva and is a popular destination for pilgrims. *Jata* means hair and *Shankar* is another name of Lord Shiva. There are two ponds fed by springs found in the locality, one of cold water and the other one of hot.



Jatashankar

2. Pandav caves, pachmarhi

Caves have even given the name to the town – "Panchmarhi" can be translated like "five caves" or also "five huts".

According to the local mythology Pandavas were living in these caves for 12 – 13 years while hiding away from their enemy relatives. There are several more Pandava Caves in India where reportedly have been hiding these same Pandavas – like Pandav Leni Caves in Nashik, Maharashtra. One of the brothers, Arjuna, taught music to Nagpati, he wedded the daughter of Nagraj Vasu who lived in Nagdwa



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

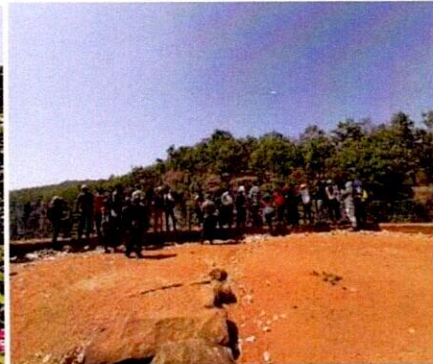
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

some 15 km from Panchmarhi. According to the legend five caves were made for each of the brothers – Yudhishtira, Arjuna, Nakul, Sahdeo, Bhima and for their wife – Draupadi.



Pandav caves



Handi khoh

2. Handi khoh

Handi Khoh is a canyon or ravine inside the Pachmarhi forest region. It falls from a height of 300 ft and has rugged rock or cliff around it. It is a lovely and lonely place where one can listen to the noise of bees and gushing water only. As per folklore there was a lake in the place called Handi Khoh earlier. But a poisonous evil serpent, which was in fact a demon, was guarding the lake. Once there was a fight between the Hindu God, Lord Shiva and the evil snake. In the fury of the war between them the lake dried and the canyon was formed. Handi got the name as it has the shape of the pot. The people of Pachmarhi used to call it Andhi Kho and later on it came to be known as Handi Khoh. Handi Khoh is famous for its marvelous natural beauty.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

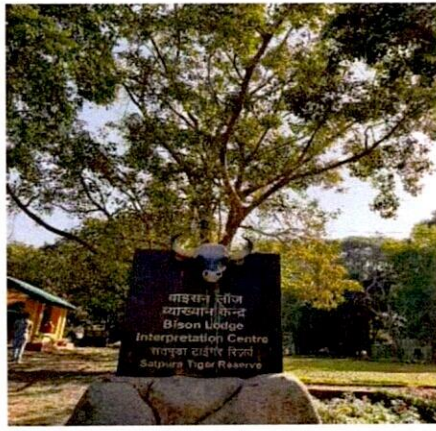
(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65



Ramya kund



Bison lodge

3. Ramya kund

Ramya kund is a shallow pond with crystal clean water. The entry to Ramya Kund is from the small passage of Reachhgarh in Pachmarhi going in the direction of Chauragarh. It is so refreshingly cool around the pond that one feels a top notch revel in. The water constantly comes out from Ramya kund. This crystal clean herbal pool situated about a kilometer ahead of Reech Garh is one of the lesser-recognized getaways in Pachmarhi. Reaching here needs a chunk of strolling

wherein you walk on a undeniable ground for around ten mins accompanied with a 300 lengthy steep trek that ends on the mouth of this spring.

4. Bison lodge

This well-maintained museum is the starting point where you pay a fee for local sightseeing excursions that includes Jeep, guides, and permits. While the inside of the lodge houses models, graphs, maps, and pictures of Pachmarhi rich flora, fauna, history and places of interest, the outside is adorned with a huge garden where you can sit and enjoy the serenity of this hill station. Stuffed animals like Crocodiles, Lions, and Tigers, etc. are also on display at this museum. Built in the year 1862. Bison Lodge is one of the oldest buildings in Pachmarhi, and used to be the former residence of Captain Forsyth.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

5. Duchees fall

The Duchess Falls is a beautiful cascade at Pachmarhi. The gorgeous waterfall creates three different cascades. One has to trek for at least 4 km to reach the base. The fall takes 100 m while falling and the water crashes down with such a beautiful gushing noise. There are many small puddles formed by the waterfalls. The visitors can safely enjoy swimming and bathing in these small puddles. The Duchess Falls is one of the most beautiful waterfalls that originates in the mighty Satpura Range. The Duchess Falls is highly recommended for people interested in photography.

6. Dhupgarh

Mount Dhupgarh or Dhoopgarh is the highest point in the Mahadeo Hills (Satpura Range), Madhya Pradesh, India. Located in Pachmarhi, it has an elevation of 1,352 metres (4,429 ft). The top of the hill is a popular area to watch sunsets. Pachmarhi Hill station is located close to the peak.



Duchees fall



Dhoopgarh



NAAC SSR Cycle 4 (2015-2020):
2_3_1 Experiential Learning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Plants of Pachmarhi.

Sr no	Botanical name	Family	Use
1	<i>Eranthemum Roseum</i>	Acanthaceae	Popular remedy of leucorrhoeo.
2	<i>Petalidium Barlerioides</i>	Acanthaceae	Ornamental.
3	<i>Justicia betonica</i>	Acanthaceae	Medicinal herb.
4	<i>Clematis species</i>	Ranunculaceae	Medicinal use.
5	<i>Diospyros melanoxylon</i>	Ebenaceae	Relief of stomach disorder.
6	<i>Cascuta Reflexa</i>	Convolvulaceae	Blood purifier.
7	<i>Pimpinella Hyeneana</i>	Apiaceae	Medicinal.
8	<i>Carvia Callosa</i>	Acanthaceae	Traditional medicine.
9	<i>Abutilon Persicum</i>	Malvaceae	Medicinal use.
10	<i>Ficus Hispida</i>	Moraceae	Treatment of ulcer.
11	<i>Blumeria Microphylla</i>	Urticaceae	Medicinal .
12	<i>Oplismenus Compositus</i>	Poaceae	Edible to livestock.
13	<i>Buchanania lanzan</i>	Anacardiaceae	Seeds edible to human.[chironji]
14	<i>Drosera Burmannii</i>	Droseraceae	To treat Ailments .
15	<i>Utricularia Australis</i>	Lentibulariaceae	For treating urinary disorder.
16	<i>Thunbergia Grandiflora</i>	Acanthaceae	Antifungal , Antibacterial .
17	<i>Pogostemon benghalensis</i>	Lamiaceae	Aromatic uses.
18	<i>Osmunda Regalis</i>	Osmundaceae	Medicinal uses.
19	<i>Lycopodium spp.</i>	Lycopodiaceae	For digestive disorder .
20	<i>Trichodesma Indica</i>	Boraginaceae	To cure fever.
21	<i>Sophora Interrupta</i>	Fabaceae	Medicinal uses.
22	<i>Dianthus L.</i>	Caryophyllaceae	Medicinal
23	<i>Thuja Orientalis</i>	Cupressaceae	Respiratory tracts infections.
24	<i>Michellia champaca</i>	Magnoliaceae	Used in perfumes.
25	<i>Mallotus Philippensis</i>	Euphorbiaceae	Medicinal .
26	<i>Shorea Robusta</i>	Dipterocarpaceae	Astringent in Ayurveda .
27	<i>Syzygium Cumini</i>	Myrtaceae	Medicinal use.
28	<i>Tectona Grandis</i>	Verbenaceae	Traditional medicinal uses.
29	<i>Pinus Roxburghii</i>	Pinaceae	Medicinal uses.
30	<i>Murraya spp.</i>	Rutaceae	Ornamental and traditional uses.
31	<i>Anogeissus Latifolia</i>	Combretaceae	Medicinal uses.
32	<i>Terminalia bellirica</i>	Combretaceae	Used in Ayurveda.
33	<i>Opium poppy</i>	Papvarenaceae	Morphine is prepared.
34	<i>Nicotiana spp</i>	Solanaceae	Dried leaves is used for smoke.
35	<i>Campanula</i>	Campanulaceae	cure for hydrophobia
36	<i>Gardenia Latifolia</i>	Rubiaceae	Medicinal uses.
37	<i>Cheilanthes</i>	Pteridaceae	Ornamental .
38	<i>Scrophularia</i>	Scrophulariaceae	Used to make medicine.
39	<i>Lavandula Bipinnata</i>	Lamiaceae	To prevent hair loss.
40	<i>Micromeria spp.</i>	Lamiaceae	Medicinal use.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Alinda
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Department of Botany M.Sc. Excursion: Madhya Pradesh



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Department of Botany, St. Xavier's College, Mumbai


Twenty students of MSc I went to Khandala, Pune for botanical field study tour from 27th to 29th August 2019. Dr. Rajdeo Singh and Mr. Alok Gude accompanied them. The places visited were Bhoma hill, old St. Xavier's Villa, Kune plateau and the area beside the St. Mary's Villa where the students were staying.

Names of Students

Name of Students	UID No.
Afkham Farzan	198301
Anagha Santhosh	198302
Gosavi Pavan	198303
Katakar Pooja	198304
Kesarkar Prathamesh	198305
Kache Omkar	198306
Khan Shirin	198307
Kothari Saloni	198308
Lalmingsangi	198309
More Riddhi	198310
Nimbalkar Aditi	198311
Palekar Vaishnavi	198312
Pant Harsh	198313
Salunke Aishwarya	198314
Sayed Nawazish	198315
Shaikh Ayesha	198316
Shyamsundar Shyla	198317
Singh Namrata	198318
Tare Jidnyasa	198319
Yadav Dinesh	198320



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



EXCURSION TO KHANDALA

DATE:- 27th AUGUST 2019 - 29th AUGUST 2019.

Khandala is a small village and railway station on the Bombay-Pune railway route, situated near the western edge of the Deccan plateau. It is at a distance of 116 kms by road from Mumbai and 66 kms from Pune. The Mumbai-Bangalore highway passes from middle of the village.

The place is situated at an altitude of about 650m, above the sea level. Due to its position on the edge of the Ghats, Khandala is exposed to strong wind & full blast of monsoon. They set in the first half of June and continues until the beginning of August - October, onwards upto the end of May of the following year, there is no rain on it is very rare. The average annual rainfall of the year is about 120 to 120 mm.

The hottest months of the year are March & April. Noon temperature in shades often reaches 37°C to 38°C. The minimum temperature may be 8°C to 9°C. Owing to the position, Khandala receives breeze from the sea which is only about 60 kms away. Therefore, the atmosphere is never dry.

We visited at the end of the August month, to see the onset of flowering and some species already blooming. We were guided by Dr. Rajdeo Singh and Mr. Atok Gude. There were around 60-70 species were observed and studied. We stayed at St. Marys Villa. The species we observed and studied are listed in this report.

SCIENTIFIC NAME	COMMON NAME	FAMILY	DESCRIPTION
1) <i>Boehmeria macrophylla</i>	Morrom (stinging nettle)	Urticaceae	stinging hairs, spike like inflorescence, fruiting perianth with round base
2) <i>Mallotus philippensis</i>	Kumkum or Tamala tree	Euphorbiaceae	yellow-brown flowers from rounded red dye suited to cloth of silk & wool.
3) <i>Phoenix sylvestris</i>	Indian date palm	Arecaceae	Used in making of wine and jelly used to make palm jaggery, tarsi is extracted
4) <i>Adelocaryum lambertianum</i>	Lambert's Brage (Nixi Nisudi)	Boraginaceae	scorpid cyme inf., no persistent calyx, fruits hidden in calyx
5) <i>Justicia prostrata</i>	Water willow (Karambal)	Acanthaceae	Bracts and bracteoles both present, leaves squeezed in eyes for ophthalmia
6) <i>Murdannia semiteres</i>	Munshi, Murdanali	Commelinaceae	flowers open only during morning, 7.50 leaf would be semiteres
7) <i>Rhamphixpa longiflora</i>	Tutari	Scrophulariaceae	fruit is beaked, flowers open only during early morning and late evening
8) <i>Amerophallus commutatus</i>	Jungli suvan	Araaceae	spadix inflorescence, flowering occurs in May, spathe present





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

SCIENTIFIC NAME	COMMON NAME	FAMILY	DESCRIPTION
9) <u>Euphorbia ligularia</u>	Milk bush	Euphorbiaceae	succulent, cyathium inflorescence, latex or milky juice present
10) <u>Ficus amathiana</u>	Indian rock fig	Moraceae	leaf stalk and veins are bright pink to red in colour
11) <u>Colocasia esculenta</u>	Alonchi paane, elephant ear	Araceae	spadix inflorescence, dark green above and light green beneath.
12) <u>Impatiens balsamina</u>	garden balsam	Balsaminaceae	spike present, spike has rectae, male reproductive organ like hood
13) <u>Pongamia pinnata</u>	Pongon oil tree, Karanj	Papilionaceae	fruit is karanj shaped, indehiscent pods, Karanj oil extracted used in runstems
14) <u>Alstonia scholaris</u>	Devil's tree, blackboard tree, Saptaparni.	Apocynaceae	releases more amount of CO ₂ , lenticels present
15) <u>Terminalia belitica</u>	Scheda	Combretaceae	used for medicinal purposes, twigs are used.
16) <u>Murraya paniculata</u>	Kumri, Kamini	Rutaceae	oil glands are seen, flowers are like jasmine.

SCIENTIFIC NAME	COMMON NAME	FAMILY	DESCRIPTION
1) <u>Boehmeria macrophylla</u>	Hemem (stinging nettle)	Urticaceae	stinging hairs, spike like inflorescence, fruiting perianth with round base
2) <u>Mallotus philippensis</u>	Kumkum or kamala tree	Euphorbiaceae	yellow-brown flowers form racemes, red dye suited to color of silk & wool.
3) <u>Phoenix sylvestris</u>	Indian date palm	Araceae	Used in making of wine and jelly, used to make palm jaggery, sadi is extracted
4) <u>Adeloxayum lambertianum</u>	Lambert's Borage (Mirri Nisuedi)	Boraginaceae	scorpid cyme Infl., no persistent calyx, fruit hidden in calyx
5) <u>Justicia prostrata</u>	Water willow (Karambai)	Acanthaceae	Bracts and bracteoles both present, leaves squeezed in eyes for ophthalmia
6) <u>Murdannia semiteres</u>	Munshi, Murdanali	Commelinaceae	flowers open only during morning, T.S of leaf would be semiteres
7) <u>Rhamphixpa longiflora</u>	Titazi	Scrophulariaceae	fruit is beaked, flowers open only during early morning and late evening
8) <u>Amorphophallus commutatus</u>	Jungli suwan	Araceae	spadix inflorescence, flowering occurs in may, spathe present





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

SCIENTIFIC NAME	COMMON NAME	FAMILY	DESCRIPTION
25) <u><i>Senecio bombayensis</i></u>	Sonki	Asteraceae	golden yellow flower heads central floret is bisexual.
26) <u><i>Cucurbita pseudomontana</i></u>	Kaam halad	Zingiberaceae	flower are bright yellow, seeds ovoid or oblong, covered with oils
27) <u><i>Vitex negundo</i></u>	Nirgundi, chaste tree	Verbenaceae	Aromatic shrub with quadrangular, densely whitish, tomentose branchlets
28) <u><i>Alloesia oxypa</i></u> <u><i>Zingiber diwataxidrum</i></u>	Diwata's ginger	Zingiberaceae	Flowers are borne in spikes, found in wetter parts
29) <u><i>Begonia crenata</i></u>	Ambati, Rock begonia	Begoniaceae	Flowers only in monsoon, leaf base unequally heart-shaped
30) <u><i>Impatiens minor</i></u>	Lessee balsam	Balsaminaceae	Smallest balsam flower in India
31) <u><i>Caryota urens</i></u>	Fishtail palm	Arecaceae	stinging hairs, toddy is extracted from the inflorescence
32) <u><i>Adelocaryum</i></u> <u><i>coelestinum</i></u>		Boraginaceae	scorpid inflorescence

SCIENTIFIC NAME	COMMON NAME	FAMILY	DESCRIPTION
33) <u><i>Cria microchilus</i></u>	Tiny-lip-eria	Orchidaceae	Epiphytic orchid with pseudobulbs compressed, flowers borne in zigzag racemes
34) <u><i>Dendrobium barbatulum</i></u>	small-bearded dendrobium	Orchidaceae	no leaf and flower occur at same time, flowering in winter.
35) <u><i>Cyperus brevifolius</i></u>		Cyperaceae	Fruit notiny nut, in flower is spikelet (flower head) is green and egg-shaped.
36) <u><i>Pogostemon</i></u> <u><i>decanensis</i></u>	Jambhi manjiri	Lamiaceae	small erect aquatic herb, narrow stalkless leaves occur in whorls
37) <u><i>Dopatrium junceum</i></u>	Fush-like dopatrium	Scrophulariaceae	annual herb, roots are fibrous, stem fleshy and much branched
38) <u><i>Polygonum chinensis</i></u>	creeping smartweed	Polygonaceae	obovate stipules, stipules cover the internode.
39) <u><i>Asystasia dalzelliana</i></u>	Neelkanth	Acanthaceae	Bracts and bracteoles are present, seeds placed on top of ejaculators
40) <u><i>Trichosanthes</i></u> <u><i>cucumerina</i></u>	snake gourd, Kundal	Cucurbitaceae	round fruit which at maturity turns red. extrafloral nectary present



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Alinda.
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

SCIENTIFIC NAME	COMMON NAME	FAMILY	DESCRIPTION
41) <u>Argyroxiphys nervosa</u>	elephant-ear	Convolvulaceae	plant is a climber, funnel shaped corolla present.
42) <u>Carallia brachiata</u>		Euphorbiaceae	It is exception, not being mangrove still placed in family Euphorbiaceae. Lenticels are present.
43) <u>Cyanotis cristata</u>	Nabhali	Commelinaceae	Creeper herb found in sandy or grassy spots.
44) <u>Zingiber cernuum</u>	Kan-ala	Zingiberaceae	Flowers are borne in spike, stamen is one with short filament.
45) <u>Terminalia chebula</u>	Hirda	Combretaceae	leaves are alternate to subopposite. The dull white to yellow flowers are monocious.
46) <u>Cissus pentaphylla</u>		Vitaceae	
47) <u>Clerodendrum serratum</u>	Bharangi	Verbenaceae	Plant has quadrangular, glabrous branches, flowers are large pinkish.
48) <u>Agave americana</u>	Century plant	Asparagaceae	Agave has tallest inflorescence, fibres used in thread or weave.

SCIENTIFIC NAME	COMMON NAME	FAMILY	DESCRIPTION
49) <u>Mabenaria digitata</u>	Green orchid	Orchidaceae	Green Mabenaria is a terrestrial herb, Green spur is present.
50) <u>Catumaregam spinosa</u>	mountain pomegranate	Rubiaceae	Flowers solitary or paired at the ends of axillary branchlets.
51) <u>Peristylus stockii</u>	Ground orchid	Orchidaceae	minute flower, non-colored, pollinated mostly by moths.
52) <u>Utricularia praeterita</u>	Tiny bladderwort	Lentibulariaceae	roots have sac like, small annual carnivorous.
53) <u>Nemotis foetida</u>	foetid star-violet	Rubiaceae	foetid star-violet, flowers are borne in leaf-axils, found in western ghats.
54) <u>Sweetia minor</u>	Lesser sweetia, Lesser sweetia	Gentianaceae	flowers are borne in leafy panicle-like cyme.
55) <u>Mabenaria variflora</u>	spreading flowered Mabenaria	Orchidaceae	flowers arise on long peduncles, greenish white, curved spur.
56) <u>Ceropegia sahyadrica</u>	Landini Karuludi	Asparagusaceae	Greenish-white flower. Flowers are purple on inside. Endemic to Sahyadri hills.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Attitude

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

SCIENTIFIC NAME	COMMON NAME	FAMILY	DESCRIPTION
57) <u>Neuwamanthus spharostachys</u>	Pin-cushion plant	Acanthaceae	hairy inflorescence, flowers occur in rounded clusters
58) <u>Nabeana keyniana</u>	Toothbrush-orchid	Orchidaceae	Inflorescence with 2-8 flowers arranged all on one side of an upright stalk.
59) <u>Erinocarpus nimmonii</u>	Jungali Bhendi	Tiliaceae	Big yellow flowers, fruit is eaten and is important famine food.
60) <u>Utricularia striatula</u>	striped-bladderwort	Lentibulariaceae	small carnivorous plant, grows as a lithophyte or epiphyte on wet rocks or tree trunks.
61) <u>Alea asiatica</u>	Bancharita	Vitaceae	gregarious shrub with angular stem swollen above the nodes and internodes.
62) <u>Asparagus raumerus</u>	Shatavari	Asperagaceae	Species common throughout India, small pine-needle like phyllocladus
63) <u>Impatiens oppositifolia</u>	Lal-tada, opposit-leaved balsam	Balsaminaceae	Upper leaves are stalkless, while lower one have stalks.
64) <u>Myrioxpus spp</u>	moneywort	Fabaceae	

SCIENTIFIC NAME	COMMON NAME	FAMILY	DESCRIPTION
65) <u>Eragrostis minor</u>	Caregrass	Poaceae	commonly used as livestock fodder. It is planted to prevent soil erosion.
66) <u>Murdannia spirata</u>	Asiatic-dew flower	Commelinaceae	It is a perennial herb with narrowly ovate to lanceolate clasping leaves and pale blue flowers.
67) <u>Ceropegia evansii</u>	Evans' ceropegia	Apoynaceae	twining climber, petals are white in their lower half and pale yellow in their upper.
68) <u>Musa balbisiana</u>	Wild banana	Musaceae	grows with leaves in clumps with a more upright habit, flowers grow in infl. contained seed to maroon.
69)			
70)			



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.




ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Department of Botany M.Sc. Excursion : Khandala



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65


A botanical study tour of 15 MSc-II and 15 TYBSc students was taken to Matheran, Neral by train on 11th January 2020 by Dr. Rajdeo Singh and Mr. Alok Gude.

St. Xavier's College (Autonomous), Mumbai-1; Botany M.Sc Part II

Name of Student	UID No
Almeida Licy	188301
Anaokar Sharang	188302
Bavi Pratik	188303
Chavan Aishwarya	188304
Damle Niharika	188305
Das Adya Jyoti	188306
D'Costa Clive	188307
Fargose Siona Justin	188308
Fernandes Valeska	188309
Kathole Ketan	188310
Longkumar Lanunchetla	188311
Nikalje Poonam	188312
Panicker Tapasya	188313
Pitale Kaivalya	188314
S Sanjay Sasidharan	188317
Shaikh Ena	188318
Shedage Vaibhav	188319
Viana Maribelle	188320



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Names of the Students present (TYBSc)

St. Xavier's College - Autonomous		T.Y.B.Sc. 2019 - 2020		BOTANY																
				3 UNITS																
Professor : _____		Month : _____		No. of Lectures engaged : _____																
SUBJECT : BOTANY - BIOCHEM (BOT. - BIO.)				PAPER : _____																
NAME OF STUDENTS	Date / UIDNO	Roll No.																		TOTAL PRESENT
Lobo Zeenal Sebastian	172175	001																		
		002																		
SUBJECT : BOTANY - ZOOLOGY (BOT. - ZOO.)				PAPER : _____																
NAME OF STUDENTS	Date / UIDNO	Roll No.																		TOTAL PRESENT
Almeida Gynelle Mary Ewon	172149	004																		
Bandgar Vaibhavi Shrikant	162421	005																		
Carvalho Jewel Mariano	172155	006																		
Chavan Mayuri Samikumar	162109	007																		
Colaco Anciya Gregory	172157	008																		
Dsouza Rohan Leo	172164	009																		
Gonsalves James Glenn	162135	010																		
Jacob Noah John	172167	011																		
Jemima Joseph	162097	012																		
Kittykal Clarissa Anthony	172173	013																		
Kumari Pooja	172174	014																		
Mascarenhas Premal Praveen	172177	015																		
Misra Gayatri Gaurav	172178	016																		
Patrao Simrin Stevan	172181	017																		
Peje Abhishek Gopichand	172182	018																		
Rawat Aayushi Shashi	172184	019																		
Tambe Akhilesh Pramod	172193	020																		
Yadav Shreya K K	172196	021																		
		022																		



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

FIELD REPORT
VID : 188318
Msc II- SBOT 1002



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

INDEX

PARTICULARS OF THE EXPERIMENTS PERFORMED

Expt. No.	Name of Experiment	Page No.	Date of Experiment	Date of Submission	Remarks
MATHERAN FIELD VISIT					
1	Introduction	1-2	31-01-2020	10-02-2020	
2	Checklist of the Plants	3-7	31-01-2020	10-02-2020	
3	References.	8	31-01-2020	10-02-2020	
CHECKLIST OF HORNIMAN CIRCLE GARDEN, FORT					
1.	Introduction	9	09-03-2020		
2.	Checklist of the Plants	10-15	09-03-2020		
3.	References.	16	09-03-2020		



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

EXPERIMENT: No. <input type="text"/>	Field Report	Page No. <input type="text"/>
Date: <input type="text"/>		
Field Visit Location: Matheran		
Date: 11 January, 2020		
<u>Introduction</u>		
<p>Matheran is a hill station and municipal council in Karjat Taluk in the Raigad district in the Indian state of Maharashtra. Matheran is part of the Mumbai Metropolitan Region. Matheran is one of the smallest hill stations of India. It is located on the Western Ghats range at an elevation of around 800 m (2625 ft) above sea-level. It is about 90 km from Mumbai.</p>		
<p>Matheran, which means "forest on the forehead" (of the mountains) is an eco-sensitive region, declared by the Ministry of Environment, Forest and Climate Change, Government of India. It is Asia's only auto-mobile free hill-station.</p>		
<p>The forest type of Matheran is semi evergreen forests. The trees are evergreen; making the plateau forest very dense and even congested in places. The laterite, porous soil along with very heavy rainfall mixed with dense fog resulted in unique flora rich in diversity on the plateau. The forest show vegetation in top, middle and storey on the ground. The trees form a cover over a variety of shade loving herbs, climbers, ferns and mosses. The forests of Matheran have attracted many botanists who have studied the flora of Matheran: Smith J.Y (1891), Birdwood H.M (1886) and (1896), Cooke T (1887-1901). A good collection of the dried plants is deposited in Blatter Herbarium, St Xavier's College, Bombay (Mumbai).</p>		
Teacher's Sign: _____		



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

EXPERIMENT:

No.

Page No.

2

Date

Matheran has a huge number of medicinal plants and herbs. Inside the forest animals like barking deer, Malabar giant squirrel, fox, wild boar, mongoose may be found. But these animals are rare in numbers compared to monkeys.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Hinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

EXPERIMENT: No		Page No	3
		Date	
2. Checklist of the plants.			
Sl. no	Botanical Name	Family	Remarks
1	<u>Memecylon umbellatum</u>	Melastomataceae	- Large shrub with cluster of attractive blue-purple flowers. - Dominant tree in this region - Small transparent margin of leaf against sunlight. - Iron wood tree - timber use.
2	<u>Piper trichostachyon</u>	Piperaceae	stout Climbers
3	<u>Gnetum ula</u>	Gnetaceae	- Only climbing gymnosperm - Dioecious. - Evolutionary connecting link between angiosperms and gymnosperms.
4	<u>Eranthemum roseum</u>	ACONTHACEAE	- used in the preparation of medicine "Dashmularisht"
5	<u>Strabilarthes integrifolia</u>	ACONTHACEAE	- Flowers once in 7 years.
6	<u>Triumfetta rhomboides</u>	Tiliaceae	- woody shrub, Fruit is subglobose with hooked hair for seed dispersal

Teacher's Sign: _____



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



EXPERIMENT: No. <input type="text"/>		Page No. <input type="text" value="4"/>	Date <input type="text"/>
Sr. No.	Botanical Name	Family	Remarks
7.	<u>Strobilanthes callosa</u>	Acanthaceae	- Grows wild along slopes - Flowers once in 9 years
8	<u>Flamingo bracteata</u>	Fabaceae	- Flowers enclosed in large leaf like bracts. - Bracts are papery, persistent, heart shaped - Standard petals, large and circular.
9	<u>Lepidagathis cuspidata</u>	Acanthaceae	- Erect spiny shrub. - Upper leaves are stalkless, smaller, spiny tips
10	<u>Glochidion zeylanicum</u>	Euphorbiaceae	- Triangular persistent stipule - Male flower at upper branch and female part at lower branchlet.
11	<u>Ziziphus rugosus</u>	Rhamnaceae	- Straggling shrub
12	<u>Prospitman benghalensis</u>	Lamiaceae	- large herb, quadrangular stem - Strong odour. - Flowers in dense spikes.

Teacher's Sign: _____





ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

EXPERIMENT		No.	Page No. 5	Date
Sl. No.	Botanical Name	Family	Remarks	
13.	<i>Syzygium cumini</i>	Myrtaceae	- Tall tree with oblong opposite leaves.	
14.	<i>Striga gesnerioides</i>	Orbanchaceae	- Root hemiparasite - Erect fleshy stems are reddish purple, tapering	
15.	<i>Leucas stelligera</i>	Lamiaceae	- erect branched herb. - Flower occurs in dense axillary / terminal whorls.	
16.	<i>Blumea lanuginosa</i>	Asteraceae	- Stout herb, strongly aromatic, tap roots. - Flowers are densely woolly	
17.	<i>Ageratum conyzoides</i>	Asteraceae	- Herbaceous weed - Unpleasant odour.	
18.	<i>Justicia pertinax</i>	Acanthaceae	- Small annual herb, rock surface - Flowers bilipped, narrow tube	
19.	<i>Carissa carandus</i>	Apocynaceae	- semi-vine shrub - Milky sap is seen.	

Teacher's Sign. : _____



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)


5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

Sl. No.	Botanical Name	Family	Remarks
20.	<u>Terminalia bellirica.</u>	combretaceae	- used in preparation of 'Triphala churn'
21.	<u>Calliandra tomentosa</u>	Lamiaceae	- Quadrangular branchlets - leaves are leathery, tomentose
22	<u>Xantalis tomentosa</u>	Sapotaceae	Elliptic leaves with velvety hairs
23	<u>Blumea membranacea</u>	Asteraceae	Florets yellow, Female florets threadlike Receptacle is flat, slightly convex.
24.	<u>Actinodaphne angustifolia</u>	Lauraceae	- Trees with hairy verticillate leaves - Branchlets silky tomentose.
25	<u>Solanum howei</u>	solanaceae	- Bushy, erect spiny plant
26.	<u>Crossandra viridi.</u>	Acanthaceae	- Flowers with asymmetrical petals - seed pods found after flowers dried up



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

EXPERIMENT: No. <input type="text"/>		Page No. <input type="text" value="7"/>	
		Date <input type="text"/>	
Sr. No.	Botanical Name	Family	Remarks.
27.	<i>Tylophora dalzellii</i>	Apocynaceae	- Climber with round slender, twinning stem. - it exudes milky juice when bruised.
28.	<i>Propstemon parviflorus</i>	Lamiaceae	- Purple flower with bearded stamens are crowded therein. - Strong odour
29.	<i>Cynarospermum asperinum</i>	Acanthaceae	- Annual prostrate herb - Rooting at nodes - Bilipped blue flowers Upper lip almost absent.
30.	<i>Gymnosporia rothiana</i>	Celastraceae	- Unarmed erect shrub. - Stamens alternating with petals.
31.	<i>Terminalia chebula</i>	Combretaceae	- Tall tree - One of the ingredient of 'Triphala Churna'
32.	<i>Acacia concinna</i>	Fabaceae	- Flower buds are purple / dark red. - Thorny spreading shrub - Bark is light grey



Teacher's Sign: _____



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

EXPERIMENT:	No. <input type="text"/>	Page No. <input type="text" value="8"/>
		Date <input type="text"/>

3. References.

- www.eflora.org
- Kothari, M.J.; Moorthy, S (30 October 1993) "Flora of Raigad District, Maharashtra State". Botanical Survey of India.

Teacher's Sign : _____



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

EXPERIMENT:	No. <input type="text"/>	Stage No. <input type="text"/>
	Field Report - 2	Date <input type="text"/>
Location: Horniman Circles Garden, Fort, Mumbai		
Date : 09/03/2020		
1. Introduction		
<p>The horniman gardens located right in front of the famous Asiatic Library; encompassing an area of 2 and half acres. Situated in fort, this area is known as "Bombay green" back in the history i.e in 18th century. In 1947, After independence; it was renamed as horniman Gardens in the honour of Benjamin Horniman; editor of 'The Bombay Chronicle' newspaper; who supported Indian Independence.</p> <p>The Garden was planned in 1869 and completed in 1872 with laid out walkways and trees along with ornamentals planted in 4 quadrants of the garden.</p>		
		Teacher's Sign. : _____



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.


© 2262 0661/65

EXPERIMENT: No. <input type="text"/>		2. Checklist of Plants.		Page No. <input type="text"/>
				Date <input type="text"/>
S.No.	Name	Family	Notes	
1	<u>Ixora coccinea</u>	Rubiaceae	- Bright red flowers in corymb rose cyme - Interpetiolar stipules present	
2	<u>Ixora chinensis</u>	Rubiaceae	- Leaves with short petioles - Oblong, shiny, waxy leaves	
3	<u>Ficus benghalensis</u>	Moraceae	- Tree with large prop roots	
4	<u>Peltophorum pterocarpum</u>	Caesalpiniaceae	- Copper pods seen, - leaves pinnately compound	
5	<u>Ficus religiosa</u>	Moraceae	- Huge tree, caudate apex of leaves	
6	<u>Hibiscus schizopetalus</u>	Malvaceae	- Petals are feathery - Rec, droopy flowers.	
7	<u>Couroupita guianensis</u>	Lecythidaceae	- Fruits are hard-shelled - They are spherical, hanging	
8	<u>Roystonea regia</u>	Arecaceae	- Big attractive palm trunk swollen at base	
9	<u>Plumeria rubra</u>	Apocynaceae	- Pink flowers, thick petals with citrusy smell and yellow centre	

Teacher's Sign: _____



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

EXPERIMENT: No. <input type="text"/>		Page No. <input type="text"/>	
		Date <input type="text"/>	
NO.	NAME	FAMILY	NOTES
10.	<i>Polyalthia longifolia</i>	Annonaceae	- false ashoka, straight trunk, droopy leaves.
11.	<i>Cocos nucifera</i>	Areaceae	- Huge pinnate leaves - Prominent leaf scars seen
12.	<i>Tabebuia aurea</i>	Bignoniaceae	- Trumpet shaped, bright yellow flowers.
13.	<i>Tusticia gendarussa</i>	Acanthaceae	- Bilipped, white small flower, lower lip with purple dots.
14.	<i>Borassus flabellifer</i>	Areaceae	- Fan-shaped palm leaves - Spiny ends of leaves.
15.	<i>Sterculia fetida</i>	Sterculiaceae	- Fruit, is aggregate of follicle, scarlet, boatshape
16.	<i>Mangifera indica</i>	Anacardiaceae	- Huge canopy, leaves arranged in whorls.
17.	<i>Senna siamea</i>	Caesalpiniaceae	- Dense racemes, - Brown, slightly curved pods.

Teacher's Sign. : _____



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Alinda
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

EXPERIMENT: No. <input type="text"/>		Page No. <input type="text"/> 12	
Date <input type="text"/>			
NO	NAME	FAMILY	NOTES
18	<u>Lantana camara</u>	Verbenaceae	- Flowers arranged in umbels - leaves aromatic
19	<u>Plumeria alba</u>	Apocynaceae	- Yellow centred aromatic white flowers.
20	<u>Jatropha podagrica</u>	Euphorbiaceae	- lobed leaves. - Entire inflorescence is bright red.
21	<u>Penias lanceolata</u>	Rubiaceae	- Buds purple, flowers white arranged in cymes
22	<u>Petunia violacea</u>	Solanaceae	- lax sprawling habit - Violet coloured flowers.
23	<u>Malvaviscus arboreus</u>	Malvaceae	- Pendulous flower, closed hibiscus like appearance, scarlet in colour
24	<u>Latania lontaroides</u>	Arecaceae	- Ornamental short fan - palms.
25	<u>Tabernaemontana diversicata</u>	Apocynaceae	- Leaves are waxy - Pinwheeled flower due to twisted destination.

Teacher's Sign. : _____



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Alinda

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

EXPERIMENT: No. <input type="text"/>		Page No. <input type="text" value="3"/> Date <input type="text"/>	
No.	Name	Family	Notes
27	<i>Carica papaya</i>	Caricaceae	- Trunk is softwood - Branchlets with prominent leaf scars.
28	<i>Cordia africana</i>	Boraginaceae	- Flowers in terminal cyme, red, attractive.
29	<i>Elephantopus scaber</i>	Asteraceae	- Leaves are stiff and rough stem heavy.
30	<i>Wedelia chinensis</i>	Asteraceae	- Yellow inflorescence - Aromatic leaves.
31	<i>Annona squamosa</i>	Annonaceae	- Fruits are green, aggregate, small tree.
32	<i>Bougainvillea spectabilis</i>	Nyctaginaceae	- Flowers on leaf axils, surrounded by colourful papery bracts.
33	<i>Meliconia bijai</i>	Meliconiaceae	- Inflorescence enclosed in bright red boat shaped bracts.
34	<i>Hamelia patens</i>	Rubiaceae	- Flowers are red, showy, corymb. - Tubular flower.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Alinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.


© 2262 0661/65

EXPERIMENT: No. <input type="text"/>		Page No. <input type="text"/>	
		Date <input type="text"/>	
NO.	Names	Family	Notes
35	<i>Mimobilis jalapa</i>	Nyctaginaceae	- Cordate leaves - Pink trumpet flowers
36	<i>Crossandra infundibuliformis</i>	Acanthaceae	- Bilipped, orange - Flowers crowded at ends.
37	<i>Artocarpus heterophyllus</i>	Moraceae	- Large, fruits borne directly on the stem.
38	<i>Hymenocallis littoralis</i>	Amaryllidaceae	- Long leathery leaves - Fragrant white flowers with versatile anthers.
39	<i>Russelia equisetiformis</i>	Scrophulariaceae	- Leaves like equisetum. - Tubular flowers.
40	<i>Combretum indicum</i>	Combretaceae	- Buds white, flowers pink.
41	<i>Bauhinia purpurea</i>	Caesalpiniaceae	- 2-lobed leaves.
42	<i>Putterlickia roxburghii</i>	Putterlickiaceae	- Dark grey bark, lenticels.
43	<i>Ficus elastica</i>	Moraceae	- Milky white latex - Leaves develop inside reddish sheath at the tip of branches, attractive

Teacher's Sign: _____



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
 (AUTONOMOUS)
 5, Mahapalika Marg, Mumbai - 400 001,
 INDIA.
 © 2262 0661/65

EXPERIMENT: No.		Page No. 15	Date
NO.	Name	Family	Notes -
44.	<u>Tectona grandis</u>	Verbenaceae	- Huge ovate leaves. - Wood used for timber
45	<u>samanea saman</u>	Fabaceae	- leaves pinnately compound, huge tree - Flowers look like pink puffs due to number of petalloid stamens.



Blind
 PRINCIPAL
 ST. XAVIER'S COLLEGE
 (AUTONOMOUS)
 MUMBAI - 400 001.

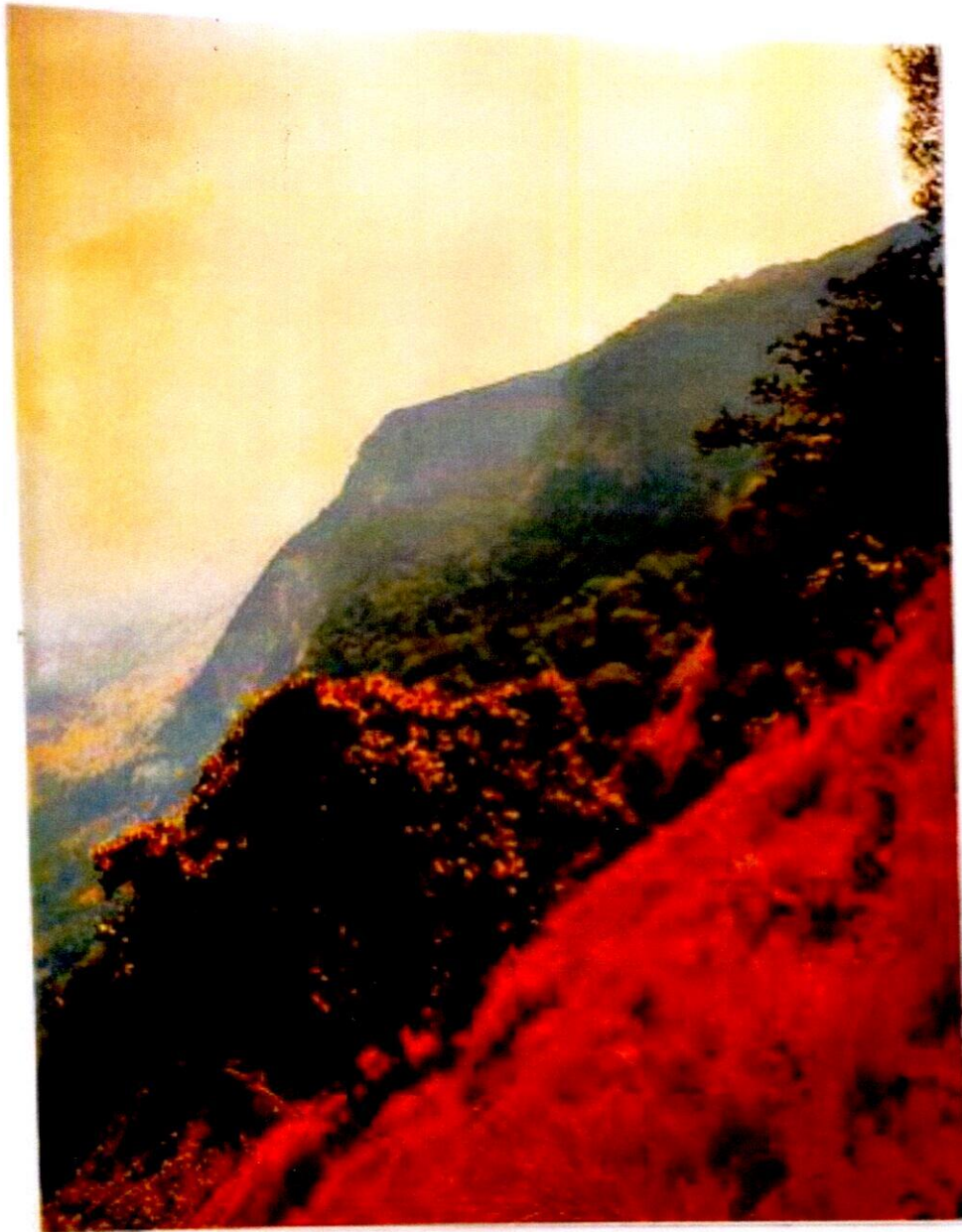


ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65



Matheran



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

© 2262 0661/65



Memecylon umbellatum



Gnetum uia



Piper trichostachyon



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

© 2262 0661/65



Eranthemum roseum



Xantholis tomentosa



Male and female cone of
Gnetum ula



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65



Striga gesnerioides



Blumea membranacea



Flamingia bracteata



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
© 2262 0661/65



Glochidion zeylanicum



Lepidagathus cuspidata



Crossandra viridi



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Acacia coarctata



Acacia coarctata



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.

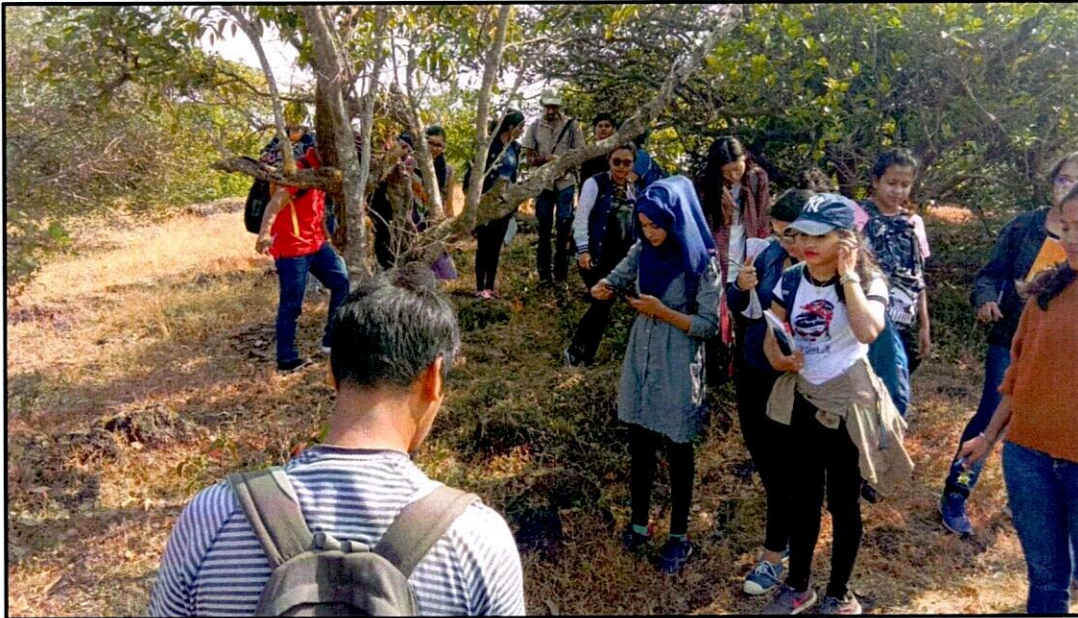


ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65



Department of Botany M.Sc. & TYBSc Excursion : Matheran (2019-20)



NAAC SSR Cycle 4 (2015-2020):
2_3_1 *Experiential Learning*

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

Forty students of SYBSc visited BPT Garden, Colaba, in the morning to see and study the vegetation growing there under the supervision of Dr. Rajdeo Singh on 17th January 2020.

Names of students present

Course Code: _____			Department: _____																			
Month: _____			Total no. of lectures: _____																			
Sr.	Name	UID																				
1	Bio-Chem																					
2	Aqsa Majgaonkar	182065																				
3	Aurelius Alex	182075																				
4	Laeticia Rodgrives	182233																				
5	Chelsea Rumab	182273																				
6	Sana D'souza	182286																				
7	Riya Biju	182336																				
8	Richa Lopes	182340																				
9	Astrial D'mello	182411																				
10	Eliza Raj	182415																				
11	Melroy Sequeria	182417																				
12	Ziphion Pereira	182441																				
13	Renisha Pinto	182445																				
14	Cyrus Ramvarma	182488																				
15	Carlton Dass	182497																				
16	Christopher Alapatt	182559																				
	Bot-Zoo																					
1	Anushka Kajwal	182005																				
2	Tanaya Rele	182033																				
3	Saloni Sawant	182049																				
4	Atira Ann Zacharian	182050																				
5	Afreen Motiwala	182061																				
6	Lydea Rodrigues	182068																				
7	Anushka Agarwal	182079																				
8	Benisha Fernandes	182100																				
9	Shalabh Goyal	182125																				
10	Ruthvik S. P.	182161																				
11	Liza Bora	182192																				
12	Jyotsna Nag	182222																				
13	Kaithyn Vaz	182305																				
14	Achasa Anna Biju	182450																				
15	Mary Anthony	182452																				
16	Calida Fernandes	182453																				
17	Hannah Juin	182461																				
18	Athul Augustine																					
19	Kallumkal	182469																				
20	Aleen Makasare	182472																				
21	Melvina Lasar	182478																				
22	Sheba Sonar Kandan	182479																				
23	Pavithra Sundar	182524																				
	Prajwal Arote	182560																				



NAAC SSR Cycle 4 (2015-2020):
2 3 1 Experiential Learning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



A LAYMAN'S GUIDE TO A LOCAL BOTANICAL GARDEN

-BY ANUSHKA AGARWAL

Located at Colaba, South Mumbai's 'Sagar Upvan' / 'Bombay /Mumbai Port Trust (BPT / MPT)', is a famous botanical garden. The refreshing greenery is known to have been rejuvenating the hectic lives of people for the last 20 years.

The Sagar Upvan was merely a garbage dumping yard in the year 2000 (21 Years ago as of 2021).

It is a wonderful garden that is connected to the sea and is right next to an urban area with over 1500 plants and birds. It is fascinating because the moment you step into the garden you are literally standing at the border of wildlife and urbanization.

Spread over 12 acres of land with around 150 species of trees alone, including shrubs the number totals up to 450.

During the visit, many trees were seen and given below is a list of all the trees seen there, but only a few have been explained in detail.

List of species of plants and birds seen,

- *Common Barbet*
- *Asian Koel*
- *Common Myna*
- *Common Tailorbird*
- *Brahminy Kite*
- *White-throated kingfisher*
- *Little egret*
- *Red-whiskered bulbul*
- *Cochlospermum religiosum*
- *Justicia adhatoda*
- *Asparagus racemosus*
- *Ivora*
- *Caesalpinia pulcherrima*
- *Livistona Chinensis*

53



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Blonde.

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



- Asian paradise flycatcher
- Purple-rumped sunbird
- Indian Pond Heron
- Rose-ringed parakeet
- Black kite
- Oriental magpie-robin
- Cattle egret
- Indian golden oriole
- Samanea saman
- Money plant
- Mammillaria plumosa
- Dolichotheca sphaerica
- Oreocereus celsianus
- Gymnocalycium mihanovichii 'Friedrichi-Variated'
- Lagerstroemia speciosa
- Magnolia champaca
- Ravenala
- Saraca asoca
- Roystonea regia
- Ficus
- Hibiscus
- Cestrum nocturnum
- Barringtonia asiatica
- Millingtonia hortensis
- Bougainvillea
- Allamanda
- Bombax ceiba
- Couroupita guianensis
- Delonix regia
- Almond
- Eucalyptus
- Tabernaemontana
- Jasminum sambac
- Hedyscpe canterburyana
- Gaillardina bonduc
- Murraya paniculata
- Firmiana simplex
- Banana tree
- Manihara zapota
- Ananas comorus
- Artocarpus heterophyllus
- Gardenia jasminoides
- Azadirachta indica
- Jasmine
- Okra
- Gliricidia sepium
- Arancaria columnaris
- Hecet brasiliensis
- Delonix regia
- Pterocarpus santalinus
- Arcca nut
- Dicksonia fibrosa
- Rose
- Lily
- Duranta erecta
- Caterpillars
- Earthworms
- Butterflies

54



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Blind
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
© 2262 0661/65



Interesting facts of a few plants.

Kingdom: Plantae
Clade: Tracheophytes
Clade: Angiosperms
Clade: Monocots
Order: Alismatales
Family: Araceae
Genus: *Epipremnum*
Species: *E. aureum*

The Climber money plant has a flowering that is so rare that it flowers only a few times. Only 4 herbarium sheets in the world have these flowers. A tale says that a king wanted the flower so desperately that he was ready to pay for it and hence, it got its name- Money Plant. The scientific name is *Pothos aureum*. They show yellow flowers. In this Family Araceae, boat-shaped bracts enclosing the flower in bud state are seen, and the plants show the spadix type of inflorescence.

Kingdom: Plantae
Clade: Tracheophytes
Clade: Angiosperms
Clade: Monocots
Clade: Commelinids
Order: Poales
Family: Poaceae
Genus: *Bambusa*
Species: *B. vulgaris*

Bambusa vulgaris, commonly known as bamboo, is an open-clump type bamboo species. It flowers only once in its lifetime, after 50 years, and hence is a monocarpic species.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Alinda
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

© 2262 0661/65

Kingdom: Plantae
Clade: Tracheophytes
Clade: Angiosperms
Clade: Eudicots
Clade: Rosids
Order: Fabales
Family: Fabaceae
Clade: Mimosoideae
Genus: *Samanea*
Species: *S. saman*

It is commonly known as the Rain tree. It is native to the the South American region. During cloudy weather, the tree will close its leaves which indicates that it is going to rain. Insects like Cicadas are found on the tree and their secretions look like droplets of rain.

Kingdom: Plantae
Clade: Tracheophytes
Clade: Angiosperms
Clade: Monocots
Clade: Commelinids
Order: Arecales
Family: Arecaceae
Genus: *Roystonea*
Species: *R. regia*

It gets its name as the Bottle palm because its trunk is like a bottle.

It gets its Scientific name- *Roystonea regia* because it was named after the civil war hero Royston, while *Regia* means royal. The Family *Arecaceae* (earlier named *Palmae*) has unipinnate compound leaves but two rows of leaves.

Extra information- Sapariplant (type genus of *Arecaceae*) *Areca nut* has bipinnately compound leaves and is called the fishtail palm.

Kingdom: Plantae
Clade: Tracheophytes
Clade: Angiosperms
Clade: Eudicots
Clade: Asterids
Order: Lamiales
Family: *Bignoniaceae*
Genus: *Millingtonia*
Species: *M. hortensis*

Commonly called the Cork tree because cork originates from this tree. It has long, beautiful, white flowers in the winter. *Millingtonia* derives the name of its genus from Sir Thomas Millington, who was honoured by Carl Linnaeus, who first described the genus, for being an inspiration to him. The specific epithet 'hortensia' derives from 'hortensis' and 'hortus', which in Latin is related to the garden. In its synonym, *Bignonia suberosa*, 'suberosa' derived from 'suberos' which means 'corky' in Latin. It is a Monotypic plant which means that it is the only species in the entire genus.

Kingdom: Plantae
(unranked): Angiosperms
(unranked): Eudicots
(unranked): Rosids
Order: Fabales
Family: Fabaceae
Genus: *Brownlea*
Species: *B. coccinea*

Scientific name- *Brownlea coccinea* has red flowers that are found inside the canopy to hide from other pollinators.

Kingdom: Plantae
Clade: Tracheophytes
Clade: Angiosperms
Clade: Eudicots
Clade: Asterids
Order: Ericales
Family: *Lecythidaceae*
Genus: *Couroupita*

The Cannonball tree has flowers where the stamens look like the hood of a snake and hence, also called Shiv Lingam in India, which is why they have a religious significance. It is native to French Guiana. *Couroupita guianensis* have fruits only on the main trunk. It bears up to 150 fruits on each tree which take up to a year to mature in most areas, sometimes as long as 18 months. The white fruit flesh gets oxidized to a blue colour.

Kingdom: Plantae
Clade: Tracheophytes
Clade: Angiosperms
Clade: Eudicots
Clade: Asterids
Order: Solanales
Family: *Solanaceae*
Genus: *Solanum*
Species: *S. diphyllum*

56



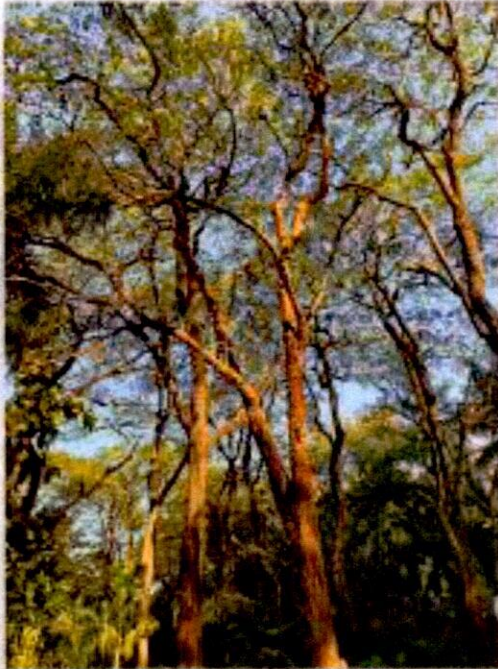


ST. XAVIER'S COLLEGE

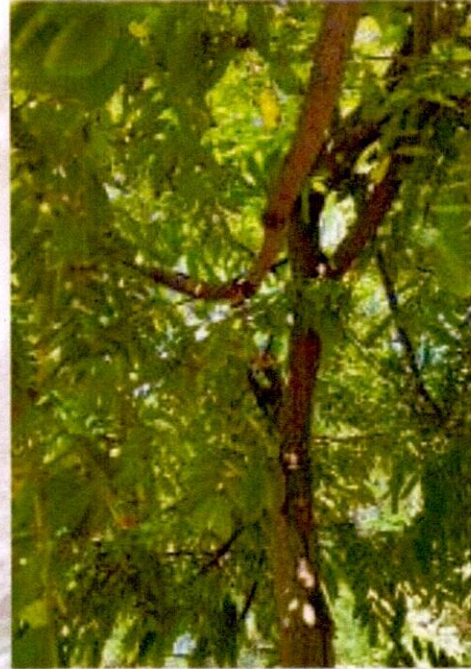
(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

© 2262 0661/65



Millingtonia hortensis



Brownea coccinea



Couroupita guianensis



57



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Hinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



This is a group of plants that have a persistent calyx. *Solanum dipetalum* gets its name because of the two leaf arrangement. It is commonly known as the two-leaf nightshade. Native to America, it is a species of nightshade that bears clusters of round, green fruits. These turn yellow as they ripen. The plant is cultivated as an ornamental plant for its fruits.

Kingdom: Plantae
Clade: Tracheophytes
Clade: Angiosperms
Clade: Eudicots
Clade: Rosids
Order: Myrtales
Family: Combretaceae
Genus: *Terminalia*
Species: *T. catappa*

Terminalia catappa gets its name because its leaves are crowded at the terminal end. Native to Asian, Australian and African countries, the large tropical tree belongs to the lead-wood tree family, scientifically referred to as Combretaceae.

Kingdom: Plantae
Clade: Tracheophytes
Clade: Angiosperms
Clade: Eudicots
Clade: Rosids
Order: Fabales
Family: Fabaceae
Subfamily: Detarioideae
Genus: *Saraca*
Species: *S. asoca*

Saraka Ashoka has other names such as the True Ashoka tree or Sita Ashoka because of Indian mythology where they say that Ravan used

parts of the plant to make tonic Ashokarishta. The Family Caesalpiniaceae shows a rounded canopy. Belonging to the subfamily Detarioideae. *Saraca asoca* is an important legume, with values in cultural traditions of India and the adjacent areas. It is sometimes incorrectly identified as *Saraca indica*.

Kingdom: Plantae
(unranked): Angiosperms
(unranked): Eudicots
(unranked): Rosids
Order: Rosales
Family: Moraceae
Genus: *Ficus*
Subgenus: *Urostigma*
Species: *Ficus benghalensis*

The Banyan tree gets its name *Ficus benghalensis* because it is a fig bearing tree from the Bengal presidency. The biggest one is in Andhra Pradesh, spanning about 47 acres. All the flowers are enclosed in a hypanthodium inflorescence and have wasps as their primary pollinator. It gets its common name because it is said that local Banyas (merchants) did their trades under the tree.

Kingdom: Plantae
Clade: Tracheophytes
Clade: Angiosperms
Clade: Eudicots
Clade: Rosids
Order: Rosales
Family: Moraceae
Genus: *Ficus*
Species: *F. religiosa*

Ficus religiosa, commonly known as the peepal tree or the sacred fig, is considered to be religiously important in three of the major religions of India, Buddhism, Jainism and Hinduism. It is considered sacred by Hindu and Jain ascetics, who often meditate under it. This is the tree under which Gautama Buddha is believed to have attained enlightenment.

Kingdom: Plantae
Clade: Tracheophytes
Clade: Angiosperms
Clade: Eudicots
Clade: Rosids
Order: Sapindales
Family: Rutaceae
Genus: *Aegle*
Species: *A. marmelos*

In this family of Rutaceae, oil glands are seen in the leaves. When one crushes a leaf, oil from the glands come out. *Aegle marmelos* L., commonly known as bael (or bill or bilbel), also Bengal quince, golden apple, Japanese bitter orange, stone apple or wood apple, is a species of tree native to the Indian subcontinent and Southeast Asia. It is present in Sri Lanka, Tamilnadu, Thailand, and Malaysia as a naturalized species. The tree is considered to be sacred to Hindus.





ST. XAVIER'S COLLEGE

(AUTONOMOUS)

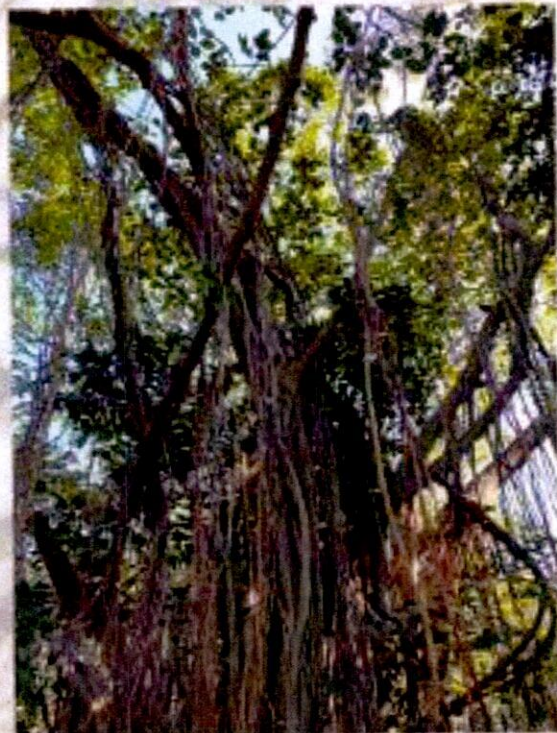
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

© 2262 0661/65



Terminalia cattapa

Ficus benghalensis



59



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Hinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



Kingdom: Plantae
Clade: Tracheophytes
Clade: Angiosperms
Clade: Eudicots
Clade: Rosids
Order: Rosales
Family: Moraceae
Genus: Ficus
Subgenus: Sycomorus
Species: *F. racemosa*

Ficus racemosa is a plant species found in the family Moraceae. It is popularly called the cluster fig tree, Indian fig tree or goolar (gular) fig. This is a native tree to the continent of Australia, Malaysia, Indo-China and the Indian subcontinent.

The figs grow on, or near the tree trunk. This phenomenon is called cauliflory. In India, the tree and its fruit are called gular in the North and atti in the South. The fruits are a favourite staple. It serves as food for caterpillars of the two-brand crow butterfly (*Euploea sylvester*) of Northern Australia.

Kingdom: Plantae
Clade: Tracheophytes
Clade: Angiosperms
Clade: Monocots

Clade: Commelinids
Order: Arecales
Family: Arecaceae
Subfamily: Arecnideae
Tribe: Cocoseae
Genus: Cocos
Species: *C. nucifera*

Cocos nucifera (coconut) is unipinnately compound and found mostly only in coastal regions and not on mainland and is a water dispersal fruit. The fruit can stay in seawater till about 110 days and will grow once it is planted. The term 'coco' was coined by the 16th-century Portuguese and Spanish. It means 'head' or 'skull'. The coconut was named after the three indentations on the coconut shell that resemble facial features.

Kingdom: Plantae
Clade: Tracheophytes
Clade: Angiosperms
Clade: Eudicots
Clade: Asterids
Order: Gentianales
Family: Loganiaceae
Genus: Strychnos
Species: *S. nux-vomica*

Strychnos nux-vomica, the strychnine tree, a deciduous tree native to Southeast Asia and India, is also known as nux vomica or poison nut, semen strychnos, and quaker buttons. It contains strychnine which indicates that the plant is poisonous and the term vomica indicates that the seeds induce vomiting.

Strychnine and brucine are derived from the round, orange to green fruits that the tree bears. These are highly poisonous and severely bitter alkaloids. The seeds contain approximately 1.5% strychnine, and the dried blossoms contain 1.0%. The tree's bark also contains brucine and other poisonous compounds. This is a medium-sized tree in the family Loganiaceae. It grows in open habitats. Their leaves are ovate and 1-1.5 inches in size.

Kingdom: Plantae
Clade: Tracheophytes
Clade: Angiosperms
Clade: Eudicots
Clade: Rosids
Order: Myrtales
Family: Myrtaceae
Genus: Syzygium
Species: *S. aromaticum*

Commonly known as Clove, it gets its name syzygium which means paired or opposite and aromaticum (aroma). Cloves are beautiful, aromatic flower buds found on a tree, in the family Myrtaceae. *Syzygium aromaticum*. They are commonly used as a spice and are native to the Maluku Islands (or Moluccas) in Indonesia. Cloves are common as they are available throughout the year due to different harvest seasons in different countries.





Kingdom: Plantae
Clade: Tracheophytes
Clade: Angiosperms
Clade: Eudicots
Clade: Rosids
Order: Fabales
Family: Fabaceae
Clade: Mimosoideae
Genus: *Calliandra*

The genus comprises herbaceous perennial plants, shrubs, and rarely small trees, growing 0.7-6 m tall, with bipinnate leaves. The flowers are produced in cylindrical or globose inflorescences and have numerous long slender stamens which give rise to the common names powder-puff, powder puff plant, and fairy duster. These plants flower all year round, but the best blooming is in spring and summer. They can be easily pruned. This plant has a small green calyx at the end, but also the Powder puff tree has a calyx and corolla that are not showy but the stamens are showy.

Kingdom: Plantae
Clade: Tracheophytes
Clade: Angiosperms
Clade: Eudicots
Clade: Rosids
Order: Malvales
Family: Malvaceae
Subfamily: Bombacoideae
Genus: *Adansonia*

Native to the arid regions of Madagascar, mainland Africa, Arabia, and Australia, this genus of deciduous trees is also known as baobabs. The generic name honours Michel Adanson, the French naturalist and explorer who described *Adansonia digitata*. The species is 'digitata' because of digitate leaves. The baobab is surrounded by ancient myths, like thieves hide inside the big bark. They are also called 'upside-down trees' which can again be tied to the myths. The oldest angiosperm was a 2450-year-old tree (died in 2011). They have large, white, night-blooming flowers that are pollinated by bats in the summer.

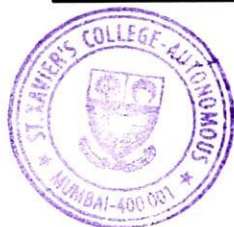
Kingdom: Plantae
Clade: Tracheophytes
Clade: Angiosperms
Clade: Eudicots
Clade: Asterids
Order: Gentianales
Family: Apocynaceae
Genus: *Plumeria*

Species: *P. alba*
Plumeria alba has white, deciduous white flowers with stamens hidden in the corolla. This deciduous shrub has narrow, elongated leaves, 2-8 m in length in addition to large vase-shaped flowers with a yellow-centre and a significantly strong perfume.

They are native to Central America and the Caribbean but now common in southern and southeastern Asia. It is the national flower of Laos, known as Dok Champi and considered as a symbol of luck.

Parkia biglandulosa from the family Mimosaceae has two glands at the base together to secrete nectar, mostly present in flowers. There is a symbiotic relationship between ants and this tree. African locust tree is a tall tree native of W. Africa. These trees are frequently found in old Mahomedan gardens in the city of Hyderabad. The farinaceous pulp surrounding the seeds is edible. Their edible seeds taste like garlic. They are often confused with *Delonix* or *Acacias* species. The distinguishing feature would be their tennis-ball shaped fluffy flower heads which bloom during December-January.

Kingdom: Plantae
(unranked): Angiosperms
(unranked): Eudicots
(unranked): Rosids
Order: Fabales
Family: Fabaceae
Genus: *Adenanthera*
Species: *A. parouina*



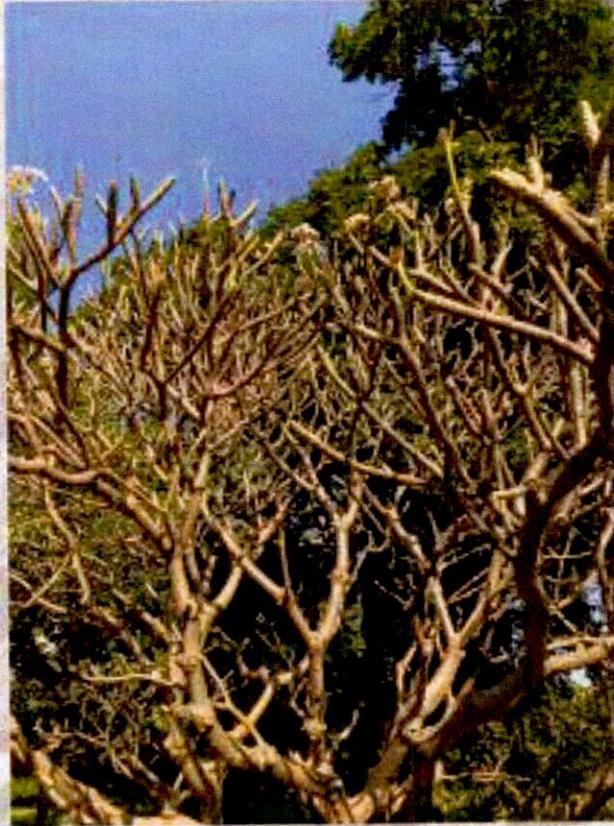


ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65



Plumeria alba

62



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

A. K. K. K.
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.

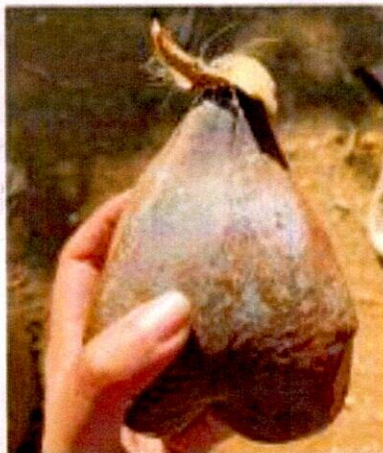


Batanguni *Adenanthera pavonina* is a perennial and non-climbing species belonging to the legume family. It finds its uses as food, drink, traditional medicine, and timber.

Kingdom: Plantae
(unranked): Angiosperms
(unranked): Eudicots
(unranked): Asterids
Order: Ericales
Family: Lecythidaceae
Genus: *Barringtonia*
Species: *B. asiatica*

Barringtonia asiatica is commonly called the fish poison tree. They are also called the sea poison tree because it contains Saponin. Their fruits are box-shaped and hence, they are also called the box fruit.

They are native to mangrove habitats from islands of the Indian Ocean to tropical Asia and islands of the Western Pacific Ocean. They are grown as windbreaks along the coasts. They are also grown along streets for aesthetic and shade purposes in certain parts of India. It shows multiple stamens united at a ring. Their flowers get dispersed by water. Their fibrous fruits can stay in seawater for 15 years.



Fruit of *Barringtonia asiatica*

Kingdom: Plantae
Clade: Tracheophytes
Clade: Angiosperms
Clade: Eudicots
Clade: Rosids
Order: Fagales
Family: Casuarinaceae
Genus: *Casuarina*
Species: *C. equisetifolia*

Casuarina equisetifolia is an angiospermic tree (and not a pine even though it may look like it). In Malayalam, it means 'feather-like' or 'tail-like', called so because of its hanging equisetum like flower. They are planted on the shores as a windbreakers to minimise the velocity of the wind. Casuarinas are commonly used as a bonsai trees, particularly in South-east Asia and parts of the Caribbean. The bonsais cultivated in Indonesia and Taiwan are regarded among the best in the world. Their wood is used for shingles, fencing, and is said to make excellent hot-burning firewood. They are grown for erosion prevention in the islands of Hawaii.



Cassurina equisetifolia

All the photographs in this article have been captured by the author.

63






ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

A field study tour was arranged by Dr. Rajdeo Singh and Mr. Alok Gude for FYBSc (80 students) and MSc-I (12 students) to Veer Jijamata Udyan, Byculla to see the different varieties of plant species growing there on 13th and 14th January 2020. It was also a place to see many animals and birds and students became aware of varied flora and fauna.

Names of students present (Names and UID No)



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

236
263

NAME	UID NO	ROLL NO
<u>LSC/CHE/BOT</u>		
Affonso Deborah Annie David	192056	071
Ananya Pandey	192536	072
Archana	192561	073
Astha Sharma	192267	074
Bharmal Rashida Huzaiifa	192060	075
Shoukha Ratil	192160	076
Chrissie Rose Promod	192054	077
Cleena Clectus	192417	078
Cherish Rose Dicoch	192588	079
Doryl Infanta	192376	080
Dsouza Swedel Marshall	192379	081
Gaonkar Pallavi Pradeep	192042	082
Hall Britney Grenville	192436	083
Jonathan Jake Fernandes	192383	084
Joshua Jacob	192421	085
Kevin Abraham	192456	086
Konve Priyansh Singh Karwar	192342	087
Lobo Ashton Peter	192431	088
Mariya Antony	192360	089
Mascarenhas Alicia Anil	192420	090
Meghna Vinodan	192211	091
Menessa Sereng Mundu	192368	092
Officewala Maria Halim	192036	093
Puthuparampil Christy Moncy	192472	094
Ranjan Anil Vinay	192499	095
Rege Devika Vivek	192082	096
Reynolds Niall Nathan	192430	097
Rodriguez Priyanka Merline	192465	098
Rodrigues Riona Rony	192083	099
Rumao Kerensa Vijay	192387	100
Salve Rhea Adele Abhay	192371	101
Sampreeti Gupta	192529	102
Sanskriti Agarwal	192248	103
Sequeira Wilinta Wilfred	192041	104
Shinia	192424	105
Singh Gloria Francis	192069	106
Sonia Varghese	192533	107
Ujrekar <i>Diya</i>	192050	108
Vas Elton Valerian	192422	109
Yash Rajesh Bhandare	192495	110
		115



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

NAME	UID NO	ON TION
<u>BOT/CHE/ZOO</u>		
Aaron Edric Trnidade	192509	207
Ancy George	192009	208
Gonsalves Aaron Cosmos	192094	209
Ansari Anam Mod Sajid	192031	210
Arakal Aaron Sebastian	192101	211
Arthi Manohar	192245	212
Arya Kaul	192549	213
Barreto Elain Pascuela Rudolf	192075	214
Bhagwat Rudram Sudesh	192706	215
Dalmet Sonal Jerome	192582	216
Danielle Dsouza	192395	217
Dion Calvin Dsouza	192703	218
Divreena Talwar	192505	219
Dongarkar Grace Gilbert	192427	220
Dsouza Steffe Joseph	192365	221
D'Souza Suzan Marian	192394	222
Emmanuel Massey	192389	223
Falcao Leonl George	192482	224
Gajbhiv Anushka Raju	192077	225
Heli K Vora	192454	226
Isheeta Singha	192187	227
Jane Jesline Tryphosa Raj	192423	228
Jossop Nilu Anthony	192426	229
Karan Mayappa Shenusa	192707	230
Karthik K K	192702	231
Keswanl Omika Rajesh	192631	232
Lewis Glancia Gracian	192442	233
Lobo Sharel Anusha Albert	192416	234
Mahabale Deepankar Vinod	192604	235
Maria Sharon Francis	192441	236
Mathew Jose	192372	237
Mathew Medwin Sunny	192409	238
Mazarello Luke James	192045	239
Mote Aishwarya Bhaurao	192048	240
Muskan Agarwal	192570	241
Nadar Felshia Packiadurai	192366	242
Palash Sukhdeve	192158	243
Paras Modha	192542	244
Patil Ankur Vijay	192161	245
Prajapati Marmik Shailesh	192189	246
Pratibha Kumari	192520	247



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

© 2262 0661/65

F.Y.E

Professor : _____

No. of Lectures engaged : _____

M

NAME	UID NO	ROLL NO	
Rene Mary Zachariah	192285	248	
Reon Andrews	192433	249	
Rittika Ghosh	192497	250	
Sanya Resita Richard	192268	251	
Satvik Patriak	192522	252	
Shaikh Sana Masood Ahmed	192070	253	
Shailee Shah	192628	254	
Shameen Saud Siddiqui	192071	255	
Soumya Jacob	192255	256	
Surve Gauri Sunil	192086	257	P
Tuscano Lyeen Ulhas	192390	258	
Vadhel Yagnit Kanti	192262	259	P
Aishwarya Bhandari	192789	262	
Sakshi Chaphe	192104	261	
Nirmaan Desai	192102	262	
Supriya	182026	263	P
		2	



Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

A GREEN WALK

13th January,

The Botany Department of St Xavier's College, Mumbai organized a field trip to Veermata Jijabai Udyan, Byculla on 13th and 14th of January this year. The trip was batch wise which means that one batch went on 13th and the other one on 14th. The main purpose of this field trip was to study and observe the plants in the botanical garden which is technically a part of the zoo. We studied and observed almost 13 species of unique plants in the garden.

How did we go there?

Most of us went there by Train which almost everyone of us boarded from Mumbai CSMT. Some of the students came by Bus. This field trip happened after our lectures in the botany practicals time. So me and a friend of mine boarded a Kalyan Train and both of us deboarded it at Byculla. From the station we walked for approx. 10 mins and finally reached the place.

What did we do there?

On arrival at the garden all of us as per the rules took a ticket worth 50 Rs. We had Alok Sir and XYZ Sir with us as our guides and we also had MSc Students as well. XYZ Sir explained us about the history of the gardens and gave a lot of information on the trees which we studied. The following is what we got to know.

1) History of Jeejamata Udyan:

The Garden (Udyan) was founded in the year 1861 under the name of Victoria gardens by the British. This park consists of around 280 species of trees which are found all over the world.

2) The Species Studied:

The following are the species of trees which we observed and studied.



Alinda

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

a) Baobab Tree

- Scientific Name: *Adansonia digitata*
- Also known as Gorakh Chinch
- Native to Mainland Africa this unique tree is a deciduous type
- Its trunk is large bottle shaped and stores a lot of water.
- Average Life Span: 2500 years



Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.




ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

b) Ghost Tree:

- Scientific Name: *Sterculia urens*
- Also known as Karayagum
- In summers the tree completely turns white
- Belongs to the Family Combritaceae
- Has Unicellular hairs consisting of Chemicals



NAAC SSR Cycle 4 (2015-2020):
2_3_1 Experiential Learning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

c) Harda Tree:

- Scientific Name: *Terminalia chebula*
- Found in the Western Ghats
- Has Medicinal Value
- Also known as Tilapa Chur



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

d) Cajeput Tree:

- Scientific Name: *Melaleuca leucadendra*
- Native to Southeast Asia
- Consists of Oil Glands on Leaves
- Belongs to the Eucalyptus Group



Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

e) Barringtonia:

- Scientific Name: *Barringtonia asiatica*
- Found in Coastal Regions
- Also known as Samudrafool
- Pollinates with the help of Air Pollination



Barringtonia Flower



NAAC SSR Cycle 4 (2015-2020):
2_3_1 Experiential Learning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

f) Cocoa Tree:

- Scientific Name: *Theobroma cocoa*
- Belongs to the earlier discussed ghost tree family
- It is a Caducifolious Plant
- Its fruit is the main ingredient of modern-day Chocolates.



NAAC SSR Cycle 4 (2015-2020):
2_3_1 *Experiential Learning*

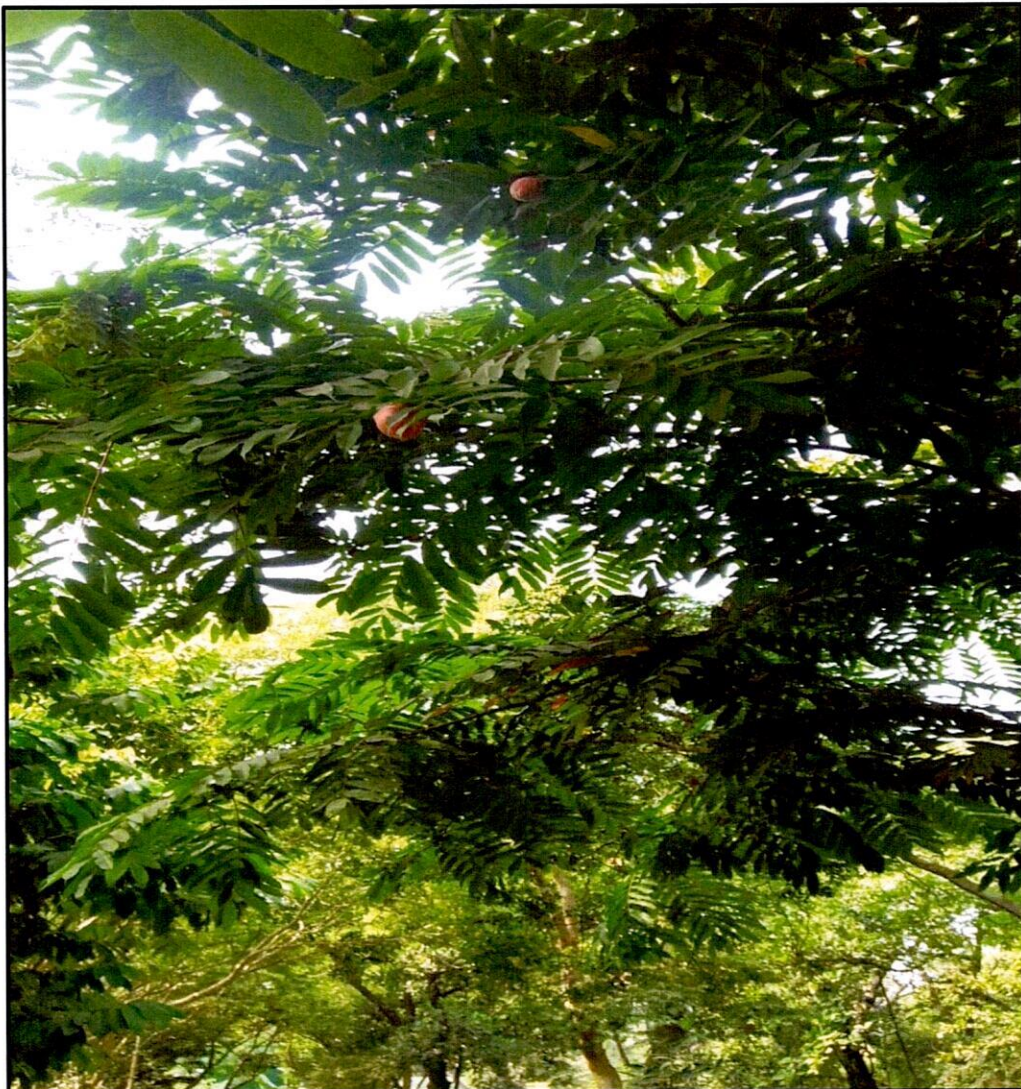
Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

g) Rose of Venezuela:

- Scientific Name: *Brownea coccinea*
- As the name suggests it is endemic to Venezuela and Latin America.
- Its leaves are unipinnately compound
- Belongs to the Gulmohar Family



NAAC SSR Cycle 4 (2015-2020):
2_3_1 *Experiential Learning*


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

h) Star Apple Tree:

- Scientific Name: *Chrysophyllum cainito*
- Ornamental Plant and found in many Gardens
- Native to The West Indies
- Belongs to Chickoo Family (Sapotaceae)



NAAC SSR Cycle 4 (2015-2020):
2_3_1 *Experiential Learning*

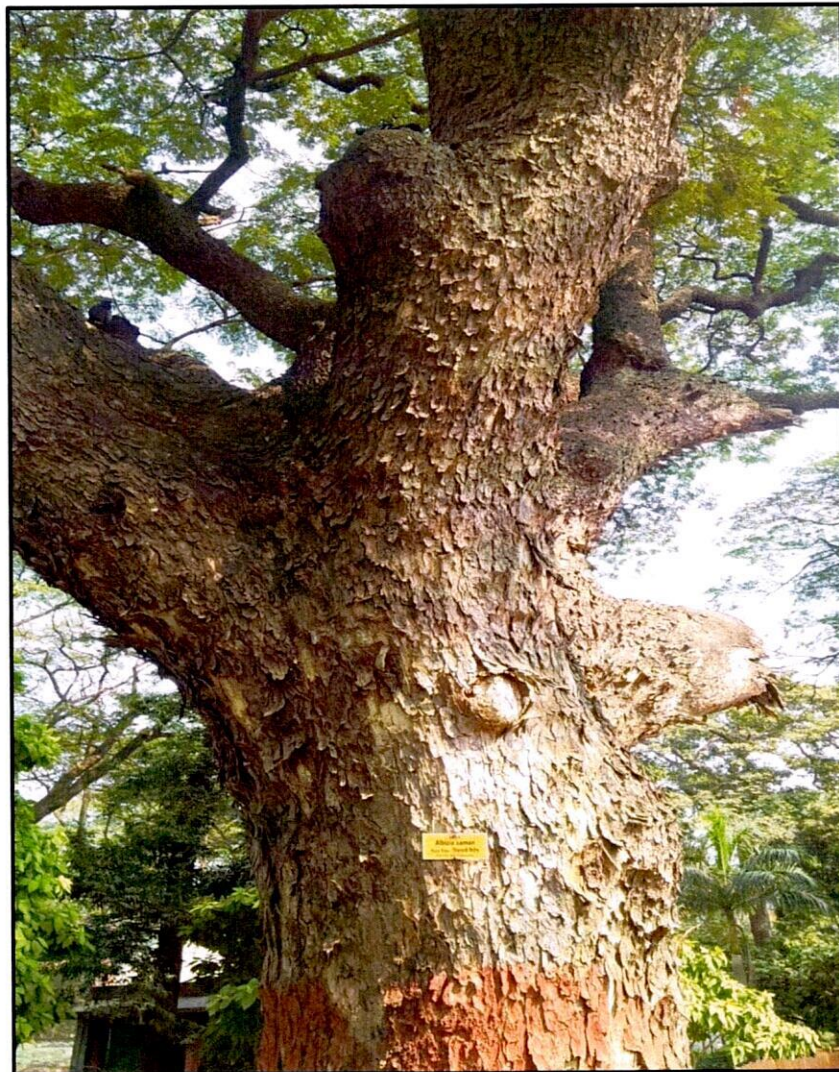

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

i) Rain Tree:

- Scientific Name: *Albizia saman*
- Native to Central and South America
- Wide Canopiod tree with a large umbrella shaped crown
- It has Pinkish Flowers



Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

j) Ashoka Tree:

- Scientific Name: *Saraca asoca*
- Belongs to Fabaceae Family (Gulmohar)
- Native to the Western Ghats
- A Rainforest Tree



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Hinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

k) Noni Tree:

- Scientific Name: *Morinda citrifolia*
- Belongs to the Coffee Family (Rubiaceae)
- Grows in Shady Forests as well as on open rocky or sandy shores.
- Reaches maturity in about 18 months
- A type of Fruit Fly feeds on the Fruit of this plant



Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

1) Aakash Neem:

- Scientific Tree: *Millingtonia hortensis*
- Known as Cork Tree
- Found by Micheal Milling
- Important Plant in Horticulture



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde.
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

m) Badminton Ball Tree:

- Scientific Name: *Parkia biglandulosa*
- Also known as African Locust Bean
- Perennial Deciduous Tree
- Its inflorescence is long and pendulous



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

n) Cannon Ball Tree:

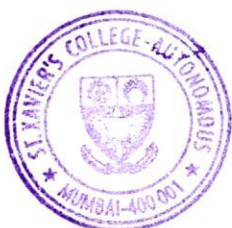
- Scientific Name: *Couroupita guianensis*
- Deciduous Tree in the family Lecythidaceae
- Native to Tropical Forests of Central and South America
- Fruits are spherical and woody shaped and hence the tree gets its name



In the end we also saw some animals which included Elephants, Jackals, Deers, Hippos, Penguins, etc.

Conclusion:

The Trip to Jijamata Udyan was very Eye Opening and we got to know a lot about different kinds of Plants.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Diade
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Department of Botany M.Sc. & FYBSc Field trip: Jijamata Udyan



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Alinda
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Department of Botany

Field Study Tour (2018-19):

The MSc students also visited Gorai on 9th March 2019 to study the mangrove flora. Dr. Rajdeo Singh explained about the peculiarities of plants found there.

Name of Students	UID No.
Aishwarya D. Mehendale	178301
Vekuduto	178302
Raveena Biswas	178303
Anwesa Dutta	178304
Kajal Babu	178305
Aroma A. Barla	178306
Shahid Nawaz Landge	178307
Patrisia Lobo	178308
Prakriti Tigga	178309
Priya Roy	178310
Athira Rajan	178312
Husain Bee Shaikh	178313
Sharayu Dalvi	178314
Bushra Shaikh	178315
Arati Dhanawade	178316
Pranay Juwartkar	178317
Kanchi Harchekar	178318
Kiran Sharma	178319
Ritu Raut	178320
Trupti Tiwari	178321



Shinde
PRINCIPAL

ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Department of Botany M.Sc. Field trip: Gorai



NAAC SSR Cycle 4 (2015-2020):
2_3_1 *Experiential Learning*

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65


Field Study Tour (2018-19):

The MSc- II students were also taken to Rice Research Station, Karjat, by Mr. Alok Gude on 18th August 2018 to study the rice cultivation methods and diseases of plants.

Name of Students	UID No.
Aishwarya D. Mehendale	178301
Vekuduto	178302
Raveena Biswas	178303
Anwesa Dutta	178304
Kajal Babu	178305
Aroma A. Barla	178306
Shahid Nawaz Landge	178307
Patrisia Lobo	178308
Prakriti Tigga	178309
Priya Roy	178310
Athira Rajan	178312
Husain Bee Shaikh	178313
Sharayu Dalvi	178314
Bushra Shaikh	178315
Arati Dhanawade	178316
Pranay Juwartkar	178317
Kanchi Harchekar	178318
Kiran Sharma	178319
Ritu Raut	178320
Trupti Tiwari	178321



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Ahinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Field Study Tour (2018-19): Attendance

Another field visit was organized for MSc I & II students from 18th - 22nd January 2019 to Birmani village, Mahabaleshwar, Panchgani and nearby forest areas. Dr. Rajdeo Singh (BNHS Scientist) and Dr. Manek Mistry (Retd Staff) were the resource persons. They were also accompanied by Mr. Uddhav Patole and Mr. Alok Gude. Exams were held every night after dinner on what was studied during the day time. The marks were given for CIA.

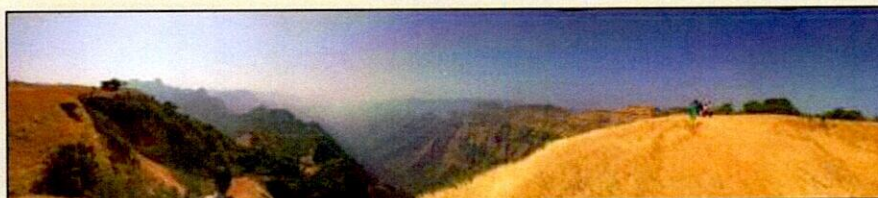
Name of Students	UID No.
Aishwarya D. Mehendale	178301
Vekuduto	178302
Raveena Biswas	178303
Anwesa Dutta	178304
Kajal Babu	178305
Aroma A. Barla	178306
Shahid Nawaz Landge	178307
Husain Bee Shaikh	178313
Pranay Juwartkar	178317
Kiran Sharma	178319
Ritu Raut	178320
Trupti Tiwari	178321
Almeida Licy	188302
Anaokar Sharang	188302
Bavi Pratik	188303
Das Adya Jyoti	188306
D'Costa Clive	188307
Fernandes Valeska	188309
Kathole Ketan	188310
Longkumar Lanunchetla	188311
Panicker Tapasya	188313
Pitale Kaivalya	188314
Viana Maribelle	188320





MAHABALESHWAR SURVEY REPORT (19TH -22ND JANUARY)

Mahabaleshwar is a hill station in India's forested Western Ghats range. It is located in the Satara district at an altitude of approximately 1400 meters, and is nestled in the Sahyadri range of Maharashtra. Due to its high altitude and cool temperatures varying vegetation from evergreen trees, shrubs, epiphytic orchids, ferns and mosses are found in the area.



SR.NO	BOTANICAL NAME	COMMON NAME	FAMILY	CHARACTERISTICS
1	<i>Tectaria</i>	Fern	Tectariaceae	Gregarious fern
2	<i>Leucas aspera</i>	Common leucas	Lamiaceae	Calyx round with many teeth, flowers white
3	<i>Arundinella leptochloa</i>	Red sprangletop	Poaceae	Common grass, spikelet elliptic lanceolate
4	<i>Themeda</i>	Kangaroo grass	Poaceae	Awned grass
5	<i>Dichanthium</i>	Bluestem	Poaceae	Spikelet with long awn
6	<i>Ischaemum</i>	Murainagrass	Poaceae	Ribs on spikelet
7	<i>Oberonia</i>	Fairy orchids	Orchidaceae	Epiphytic orchid, two thin flat leaves
8	<i>Butea monosperma</i>	Palash	Papilionaceae	Trifoliate corolla, state tree of Jharkhand
9	<i>Pimpinella heyneana</i>	Heyne burnet	Apiaceae	Compound umbel, fruit cremocarp
10	<i>Vernonia cinerea</i>	Bitter leaf, little ironweed	Asteraceae	Homogamous head
11	<i>Senecio</i>	Ragworts	Asteraceae	Heterogamous head
12	<i>Elephantopus scaber</i>	Elephant foot	Asteraceae	Homogamous head, three involucre bracts, scabrate leaves
13	<i>Hemigraphis latebrosa</i>	Shade loving hemigraphis	Acanthaceae	Large bracts, blue flower
14	<i>Gnidia glauca</i>	Fish poison bush	Thymelaeaceae	Yellow flowers surrounded by large





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

				hairy bracts
15	<i>Rungia pectinata</i>	Comb rungia	Acanthaceae	Comb like flower spike
16	<i>Buchnera hispida</i>	Hairy buchnera	Orobanchaceae	Root parasite on grasses
17	<i>Linum mysorensense</i>	Mysore flax	Linaceae	Yellow flowers, leaves sessile
18	<i>Eranthemum roseum</i>	Blue eranthemum	Acanthaceae	Prominent bracts, flowers purple, when dried rose coloured
19	<i>Justicia sp.</i>	Small flowered justicia	Acanthaceae	Spikes with narrow linear bracts, small pink flowers
20	<i>Cynarospermum asperimum</i>	Hill blepharis	Acanthaceae	Bilabiate corolla with no upper lip and lower lip fusion of 3 lips, purple flowers
21	<i>Crotalaria juncea</i>	Sunn hemp, Indian hemp	Papillionaceae	Yellow flowers, simple oblanceolate leaves, pod swollen
22	<i>Cajanus lineatus</i>	Wild toor	Papillionaceae	Yellow flower, compound leaves, prominent veins below, suffruticose
23	<i>Crotalaria filipes</i>	Creeping hemp	Papillionaceae	Narrow hair like peduncle
24	<i>Arundinella pumila</i>	Dwarf Reedgrass	Poaceae	Diffused panicle
25	<i>Cheliantes farinosa</i>	Lip fern, silver fern	Pteridaceae	Sorus on margin
26	<i>Clematis vitalba</i>	Old man's beard	Ranunculaceae	Climber, apocarpous, trifoliate leaves
27	<i>Terminalia paniculata</i>	Kindal tree, Kinjal	Combretaceae	Three winged fruit
28	<i>Colebrookea oppositifolia</i>	Indian squirrel tree	Lamiaceae	Finger like spike inflorescence
29	<i>Hygrophila serphyllum</i>	Marsh carpet	Acanthaceae	Prostrate herb
30	<i>Ziziphus rugosa</i>	Wild Jujube	Rhamnaceae	Triveined leaf, toothed margin, two spines-hooked and erect
31	<i>Leea indica</i>	Bandicoot berry	Vitaceae	Compound tripinnate toothed leaves
32	<i>Piper trichostachyon</i>	Wild/forest black pepper	Piperaceae	Triveined lanceolate leaves
33	<i>Gentianella griffithiana</i>	Dwarf gentians	Gentianaceae	Perennial herbs
34	<i>Vernonia divergens</i>	Bandar	Asteraceae	Homogamous disc florets, purple flowers



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

35	<i>Mappia foetida</i>	Ghanera	Icacinaceae	Contains camptotocine-anticancerous
36	<i>Symplocos racemosa</i>	Lodhra	Symplocaceae	Crenate margin, panicle inflorescence, white flowers, many stamens
37	<i>Thunbergia mysorensis</i>	Mysore trumpet vine	Thunbergiaceae	Exotic species, bearded, stamens, yellow flowers
38	<i>Pogostemon benghalensis</i>	Bengal pogostemon	Lamiaceae	Purple flowers, bearded stamen
39	<i>Pisa angustifolia</i>	Pisa	Lauraceae	Tomentose leaves, aromatic smell
40	<i>Leucas ciliata</i>	Tufted leucas	Lamiaceae	Golden yellow hairs
41	<i>Litsea sp.</i>	Meda	Lauraceae	Under side of leaf silvery
42	<i>Ligustrum</i>	Privet	Oleaceae	Small tree or shrub found on crest of ghats
43	<i>Crotalaria retusa</i>	Rattleweed	Fabaceae	Stems are ridged, velvety with short appressed hair
44	<i>Girardinia diversifolia</i>	Indian stinging nettle	Urticaceae	Stinging hair
45	<i>Canscora diffusa</i>	Kilwar	Gentianaceae	Stalkless leaves, four petals two of which merge to form single notched petal
46	<i>Scutia myrtina</i>	Cat thorn	Rhamnaceae	Strangling herb, hooked spine
47	<i>Persicaria</i>	Knotweed	Polygonaceae	Ochreate stipule, terminal inflorescence
48	<i>Blumea malcolmii</i>	Bhumea	Asteraceae	Homogamous head
49	<i>Memeceylon umbellatum</i>	Ironwood tree	Melastomataceae	Pink buds, purple stamens
50	<i>Glochidion zeylanicum</i>	Umbrella cheese tree	Euphorbiaceae	Male flower - bottom stalk, female - sessile
51	<i>Cissus pentaphylla</i>	Veldt grape	Vitaceae	Symphodial growth, climber with tendrils, palmately compound
52	<i>Lepidagathis cuspidata</i>	Pointed leaf lepidagathis	Acanthaceae	Flattened tuft plant, woody undershrub, spiny leaves
53	<i>Catunaregum spinosa</i>	Mountain pomegranate	Rubiaceae	Inferior ovary, interpetiolar stipules
54	<i>Aerides crispa</i>	Curled aerides	Orchidaceae	Flower stalk branched
55	<i>Striga gesnerioidis</i>	Purple witchweed	Orobanchaceae	Root parasite





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

56	<i>Ageratina adenophora</i>	Crofton weed	Compositae	Triangular leaf, stem dark purple
57	<i>Rubia cordifolia</i>	Indian madder	Rubiaceae	Square stem, rigose spines, type genus
58	<i>Elaeagnus conferta</i>	Wild olive	Elaeagnaceae	Leaves silvery below
59	<i>Lantana camara</i>	West indian lantana, wild sage	Verbenaceae	Inflorescence axillary corymb, flower surrounded by involucre of bracts narrowly ovate
60	<i>Mucuna pruriens</i>	Velvet bean	Fabaceae	Leaves trifoliolate, diadelphous stamens (9+1), S shape fruit
61	<i>Flemingia strobilifera</i>	Wild hops, luck plant	Fabaceae	Flowers enclosed in leaf like bracts
62	<i>Cassia fistula</i>	Golden shower tree, indian laburnum	Caesalpiniaceae	Long grape bunch like yellow flowers, state flower of kerala
63	<i>Elaeocarpus ganistrus</i>	Rudraksha	Elaeocarpaceae	Evergreen tree, fruit bluish purple drupe
64	<i>Balanophora</i>	Fungus root	Balanophoraceae	Mushroom like root parasite, male and female separate
65	<i>Indigofera cassioides</i>	Cassia indigo	Fabaceae	Erect shrub, lanceolate stipule
66	<i>Haplanthodes verticillatus</i>	Spiny bottle brush	Acanthaceae	Bract modified into spine like structure, presence of ejaculators below seed
67	<i>Garcinia talboti</i>	Talbot garcinia	Clusiaceae	Bark yellowish brown, branchlets angular and hairless
68	<i>Conyza stricta</i>	Erect horseweed	Asteraceae	Calyx modified into hair like structure- pappus
69	<i>Pentanema cernuum</i>	Nodding pentanema, sonsari	Asteraceae	Heterogamous, sessile leaves
70	<i>Spermadictyon suaveolens</i>	Forest champa	Rubiaceae	Interpetiolar stipules, corymbose
71	<i>Rauwolfia densiflora</i>	Devil peppers	Apocynaceae	Whorled leaves arise from one point
72	<i>Euphorbia</i>	Spurge	Euphorbiaceae	Tricarpellary, female flower on thalamus surrounded by male flower, latex leaves, cyathium inflorescence
73	<i>Olea dioica</i>	Rose sandalwood	Oleaceae	Distinct teeth on margin



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

74	<i>Leucas stelligera</i>	Starry leucas	Lamiaceae	Sepal throat villous with erect hair
75	<i>Nicandra physalodes</i>	Shoo fly plant	Solanaceae	Fruit dry berry, monotypic genus
76	<i>Cyathula prostrata</i>	Prostrate pastureweed	Amaranthaceae	Prostrate or erect stem, stem hairy, flowers pale pink, rooting at nodes
77	<i>Bidens pinnata</i>	Beggar's ticks, spanish needle	Asteraceae	Each black stalk spike represents a fruit
78	<i>Artemisia nilagirica</i>	Indian wormwood	Asteraceae	Aromatic shrub
79	<i>Atalantia monophylla</i>	Indian atalantia	Rutaceae	Woody climbers
80	<i>Murraya paniculata</i>	Orange jasmine	Rutaceae	Evergreen plant, small white scented flowers
81	<i>Casuarina equisetifolia</i>	Whistling pine	Casuarinaceae	Male- bract, stamen, female- bract, ovary
82	<i>Cleodendrum chinense</i>	Chinese glory bower	Verbenaceae	White colour flowers in clusters
83	<i>Ipomoea palmata</i>	Railway creeper	Convolvulaceae	Corolla funnel shape, 5 unequal stamens, twiner
84	<i>Acacia mangium</i>	Black wattle, forest mangrove	Fabaceae	Petiole modified into phyllode
85	<i>Poinsettia</i>	Christmas flower	Euphorbiaceae	Large coloured bracts
86	<i>Xanthoxylon resta</i>	Prickly ash bark	Rutaceae	Seeds used as spice
87	<i>Moullava spicata</i>	Candy corn plant	Caesalpiniaceae	Lower branch-hooked spines, paripinnate leaves
88	<i>Terminalia bellerica</i>	Baheda	Combretaceae	Obovate leaves
89	<i>Ixora nigricans</i>	Black ixora	Rubiaceae	Leaves that dry dark, polychasial cyme
90	<i>Holigarna grahamii</i>	Blistering varnish tree	Anacardiaceae	Stipules on pulvinous leaf base





ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65



Flemingia strobilifera



Aerides crispa



Thunbergia mysorensis



Acacia mangium



Mappia foetida



Butea monosperma



Indigofera cassiodes



Buchnera hispida



Clematis vitalba



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Clerodendrum chinense



Hemigraphis latebrosa



Crotalaria filipes



Cheilanthes farinosa



Leea indica



Girardinia diversifolia



Canscora diffusa



Moullava spicata



Rungia pectinata



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65



Bidens pinnata



Holigarna grahamii



Lantana camara



Lepidagathis cuspidata



Leucas ciliata



Memecylon umbellatum



Pentanema cernuum



Ipomoea palmata



Spermadictyon suaveolens



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
© 2262 0661/65



Gnidia glauca



Conyza stricta



Cynarospermum asperrimum



Striga gesnerioides



Mucuna pruriens



Cassia fistula



Balanophora




Rauwolfia densiflora



Nicandra physalodes



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Ageratina adenophora



Linum mysorense



Pogostemon benghalensis



Haplanthodes verticillatus



Colebrookea oppositifolia



Casuarina equisetifolia



Hygrophila serpyllum



Eranthemum roseum



Caianus lineatus



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Persicaria amplexicaulis



Poinsettia



Symplocos racemosa



Vernonia divergens



Vernonia cinerea



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Alinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Field Study Tour (2018-19): MSc 1 &2, Attendance

Name of Students	UID No.
Almeida Licy	188302
Anaokar Sharang	188302
Bavi Pratik	188303
Das Adya Jyoti	188306
D'Costa Clive	188307
Fernandes Valeska	188309
Kathole Ketan	188310
Longkumar Lanunchetla	188311
Panicker Tapasya	188313
Pitale Kaivalya	188314
Viana Maribelle	188320
Aishwarya D. Mehendale	178301
Vekuduto	178302
Raveena Biswas	178303
Anwesa Dutta	178304
Kajal Babu	178305
Aroma A. Barla	178306
Shahid Nawaz Landge	178307
Patrisia Lobo	178308
Prakriti Tigga	178309
Priya Roy	178310
Athira Rajan	178312
Husain Bee Shaikh	178313
Arati Dhanawade	178316
Pranay Juwartkar	178317
Kanchi Harchekar	178318
Kiran Sharma	178319
Ritu Raut	178320
Trupti Tiwari	178321



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Field Study Tour (2018-19):

Khandala Field Trip Report (27th July -29 July 2018).

The Department of Botany arranged a field trip to Khandala for the TY students.

Total number of students: TY BSc = 21

Total staff members: Mr. Kevin D'cruz and Dr. Vijaya Lobo = 03

Resource Persons: Dr. Manek Mistry and Mr. Rushab Chaudhary = 02

Field Collector: Mr. Udhave Patole = 01

Day 1 (27th July Friday): Everyone assembled at the College gate at 1.30 pm and headed towards the CST station. Boarded the 2.20 pm Sinhadgad Express, reaching Khandala at 4.30 pm. The whole group marched to the St Xavier's Villa and reached around 6.00 pm; rooms were allotted in Villa 3 and everyone settled in their rooms. After dinner everyone assembled in hall at 9.00 pm to see a documentary on "History of plant classification" followed by a presentation by Mr. Rushab Chaudhary on the common monsoon plants of Khandala. The presentation briefed the students about the plants they were likely to see in the field and their location.

Day 2 (28th July Saturday): After breakfast at 8.00am, the field visit started at 9.00am.

The trail started from the Villa, went via the Tata power point uphill to the Bhooma Hill plateau.

Permission for visiting TATA POWER Forbey was in place and Mr. Gangdhar, Manager, TATA POWER from Lonavala Branch, guided us round the 103-year unit which provides clean hydroelectricity to Mumbai. The group then went botanising up to the plateau, where after a short break in pleasant surroundings and weather, we returned to the Villa at 2.00 pm for lunch. Post lunch and an hour's rest, the groups visited the plateau behind the Villa.

The whole group was inspired with the visit to the old St Xavier's Villa, at the edge of the plateau, where late Rev.Fr. Santapau had stayed while working on his iconic "Flora of Khandala".

The troop returned to the villa around 7 pm. After dinner everyone gathered in the hall at 9.00pm for a presentation on the plants seen during the day plus a short documentary on bladderworts.

Day 3 (29th July Sunday): Post the morning 8 o'clock breakfast the students went to St. Mary's Villa. There the group spent some time at the grave of John Graham, the first botanist who studied the plants of Khandala, and then visited the plateau behind the Villa.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Everyone returned around 12.30 pm. After lunch we started the return journey at 2.00 pm. The group boarded the Deccan Express at Lonavala station at 4.30pm and reached CST at 7.50.

We ensured that all the students had reached their homes by 9.00pm.

Note: The facilities for stay in the St. Xavier's Villa, Kandala were very unpleasant. The rooms were not cleaned and the ceiling of two rooms was leaking directly on the bed; students had to shift the bed in middle of the night to avoid the water falling on them. The rooms were moist and chilly, yet blankets were not provided. On insisting about the same the administrator provided only 6 blankets for a group of 26 people; these blankets moreover had been in storage for long and were smelly. Washrooms latches are broken and so is one toilet. The food was decent; however the bread provided was stale and was smelling bad.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Alinda
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Field Study Tour (2017-18):

Department of Botany, St. Xavier's College, Mumbai

Two Local field trips for 40 students of SYBSc were conducted by Dr. Rajendra Shinde, one to BPT Garden, Colaba, Mumbai on 12th January 2018, and another to Hanging garden and Kamala Nehru Park, Mumbai on 16th February 2018 to show the different types of plants growing there and to emphasize the importance of these gardens in keeping the greenery alive in the cities.

Names of students present

Professor : <u>KEVIN DORAZ</u>		
No. of Lectures engaged : <u>12</u>		
NAME	UID NO	
BOTANY-CHEMISTRY		
/ Almeida Sanskriti	162010	P
/ Castelino Sweeny	162035	P
/ Malean James	162086	A
/ Purohit Vishal	162137	A
/ Samantha	162278	P
/ Bhargava Ameesha	162325	P
/ Ranjan Mimansha	162340	A
/ Dsouza Melissa	162382	
/ Nunes Sanida	162411	P
/ Swamy Reetika	162426	P
ZOOLOGY - BOTANY		
Gonsalves Trish	152013	A
Mayekar Ruchira	152030	A
/ Naikare Yashashree	152118	P
/ Dsilva Magdalene	162031	P
/ Anthony Anushia	162033	P
/ Menezes Victoria	162044	A
/ Noronha Lizanne	162060	A
/ Fernandes Sheena	162082	
/ Jemima	162097	A
Gonsalves James	162135	P
Dsouza Ambrose	162152	P
/ Bansal Vidisha	162204	P
Kalita Sudipta	162226	A
Nikhil	162251	P
/ Jana M Daphisa	162264	P
/ Nair Radhika	162285	A
/ Rodrigues Clarissa	162302	A
/ Cellini Swetlena	162349	P
/ Reshell	162378	P
/ Chettiar Alina	162396	A
/ Dsilva Kim	162413	A
/ Moraes Theresa	162423	A
/ Deolalkar Mrunal	162531	A
KWRISHI	177029	P





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Field Study Tour (2017-18):

The F.Y.B.Sc. were taken to the College garden and the nearby area in batches of 10, once a week, as a part of the curriculum.

Dr. Manek Mistry a senior faculty member of Botany took initiative of carrying short field visits of the above mentioned students. He made small groups of about 10 and every week twice during their free lectures took these students and explained about plant morphology. The students used to inform Dr Manek about their availability, and accordingly he used to manage time for these students. Many times he took them even during their break time and explained basics of field botany.

In FYBSc, the students need to know only the basics of plant morphology, ie what is the variation between leaves, branches, stem, bark, pattern, overall look of a plant; how to identify common trees and plants, basic knowledge of plants, how to identify different kinds of leaves, what are the variation between leaves, what are compound and simple leaves, how to observe and notice the variation between plants, how to identify plants, basics of palms, aroids, garden plants, grass, flowering plant, fruiting plants, and foliage plants.

The field visit was taken in college campus only and students were familiarized with the plants. He gave information on common name, scientific name, family, basic identification characters, their peculiarities, their economic importance, where the plant is useful, basics of plant propagation, a story related to that specific plant and interesting information related to a plant.

Overall these field visits were very useful to these students who needed basic knowledge of plants and also inspired the young minds.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.




ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Names of students present

Professor : <u>KEVIN DURUJ</u>		F.
No. of Lectures engaged : _____		
NAME	UID NO	403
<u>LSC/CHE/BOT</u>		
/ Arora Riyansha Anil	172039	P
/ Bency Jose	172041	P
/ Bharadwaj Riny Prabhat	172042	P
Castelino Kenneth Brian Boniface	172043	P
/ Dsouza Annet Francis	172046	P
/ Dsouza Siena Ivan	172047	P
Gonsalves Noel Quintiano Savio F	172050	P
/ Handique Prapti Priyam Rana	172051	P
/ Maliakkal Annmariya Johnson M C	172056	P
/ Maliakkal Jissmariya Johnson M C	172057	P
/ Misquitta Josette Deanne Mckenzi	172058	P
/ Nachanolkar Neha Sanjay	172059	P
/ Nimisha Thomas	172060	P
/ Pereira Shania Dominic	172061	P
Rajyaguru Soham Nipuibhai	172064	P
/ Shah Upasana Paresh	172065	P
/ Singh Samant Kshirabdi Taneya B	172067	P
Tandon Parth Pradeep	172068	P
/ Trivedi Ira Prabodh	172069	P
<u>BOT/CHE/ZOO</u>		
/ Agnes Thomas	172147	P
Alapatt Christopher David	172148	P
/ Almeida Glynelle Mary Elwyn	172149	P
Arote Prajwal Dinesh	172150	P
/ Bommera Achshah Thirupati	172151	P
/ Braganza Anoushka Darlene Vern	172153	P
/ Carvalho Gracia Marcel	172154	P
/ Carvalho Jewel Mariano	172155	P
/ Carvalho Marissa Pradeep	172156	P
/ Colaco Anciya Gregory	172157	P
/ Dabre Rose Rajesh	172158	P
Dave Shail Samir	172159	P
Dsilva Melcom Robert	172162	P
/ Dsouza Jovita Joseph	172163	P
Dsouza Rohan Leo	172164	P
/ Iype Aashra Hannah	172166	P
Jacob Noah John	172167	P
/ Jisha Joseph	172170	P
Kalita Saurav Kumar Kamala	172171	P
/ Kittykal Clarissa Anthony	172173	P
/ Kumari Pooja	172174	P



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)


5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

	NAME	UID NO	
/	Lobo Zeena! Sebastian	172175	P
/	Mascarenhas Premal Praveen	172177	P
/	Misra Gayatri Gaurav	172178	P
/	Nair Tanaya Manoj	172180	P
/	Patrao Simrin Stevan	172181	P
	Peje Abhishek Gopichand	172182	P
/	Rawat Aayushi Shashi	172184	P
/	Rodrigues Kelsey Danielle Kin	172185	P
/	Rose Mary Babu	172186	P
/	Singh Alka Nihal	172189	P
/	Sneha Bince	172190	P
/	Sophiya John	172191	P
	Tambe Akhilesh Pramod	172193	P
	Verma Aman Deepak	172194	P
	Vira Bhavya Navin	172195	P
/	Yadav Shreya K K	172196	P
	Mhatre Gandhar Yatin	172240	A
/	Dsouza Vanessa Ronald	172277	P
/	Chati Nidhi Nitin	172425	P



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Field Trip: College campus (2017-18)

Report

Dr. Manek Mistry conducted short field visits every week in and around college campus to familiarize the FYBSc and SYBA Garden Art students with the Flora.

Dr. Manek Mistry a senior faculty member of Botany took initiative of carrying short field visits of the above mentioned students. He made small groups of about 10 and every week twice during their free lectures took these students and explained about plant morphology. The students used to inform Dr Manek about their availability, and accordingly he used to manage time for these students. Many times he took them even during their break time and explained basics of field botany.

In FYBSc, the students need to know only the basics of plant morphology, ie what is the variation between leaves, branches, stem, bark, pattern, overall look of a plant; how to identify common trees and plants, basic knowledge of plants, how to identify different kinds of leaves, what are the variation between leaves, what are compound and simple leaves, how to observe and notice the variation between plants, how to identify plants, basics of palms, aroids, garden plants, grass, flowering plant, fruiting plants, and foliage plants.

The field visit was taken in college campus only and students were familiarized with the plants. He gave information on common name, scientific name, family, basic identification characters, their peculiarities, their economic importance, where the plant is useful, basics of plant propagation, a story related to that specific plant and interesting information related to a plant.

In a similar way Dr Mistry took field visit in college campus for the SY- BA/BMM/BMS cross faculty students who do garden art course in botany. These students show interest about plants and these field visits were very important to create awareness among these students and to clear their doubts and answers their questions and queries.

Overall these field visits were very useful to these students who needed basic knowledge of plants and also inspired the young minds.



NAAC SSR Cycle 4 (2015-2020):
2_3_1 *Experiential Learning*


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

No. of Lectures engaged: _____

NAME	Roll No
LIFE SC / CHEM / BOT - (03)	
/ Bhasin Surpreet Kaur Karamjeet	064
/ Castelino Sweeny Sandra Lawrence	065
/ Deoliveira Christabell Paul	066
/ Devasia Linta KJ Devasia	067
/ Dsouza Rochelle Carol Patrick	068
/ Fernandes Assumpta Robert	069
/ Fernandes Premie Pascal	070
/ Fernandes Raizel Joaquim	071
/ Fernando Judith Snowfer	072
/ Gite Spandan Nitin	073
/ Jose Alidatresa Roy	074
/ Lewis Andrea Prakash	077
/ Lopes Saloni John	079
/ Malam Priyanka Deepak	080
/ Mendonca Shania Sabatini John	081
/ Modak Sanchita Prakash	082
/ Monteiro Naomi Nirmal	083
/ Rajda Kriti Nitin	085
/ Roy Ankita Amit	086
/ Shaikh Zubia Abdul Haseeb	087
/ Shana Jasmin Abdul Azeez	088
/ Silpa Zacharias	090
/ Udaipurwala Umm E Salama Yus	091
BOT / CHEM / ZOO - (06)	
/ Agarwal Himrekha Hanuman	194
/ Almeida Sanskriti Olivia Stanley	195
/ Anthony Anushia Maria Siluval	196
/ Bandgar Vaibhavi Shrikant	197
/ Bansal Vidisha Tarun	198
/ Bhargava Ameesha Govind	200
/ Cellini Swetlana Sagayaraj	202
/ Chavan Mayuri Sarojkumar	204
/ Chettiar Alina Johnsimon	205
/ Christopher Moris Samantha Chri	206
/ Deolalkar Mrunal Milind	208
/ Deshpande Tanvi Sanjeev	209
/ Dsilva Kim Harold	212
/ Dsilva Magdalene Michael	213
/ Dsilva Melcom Robert	214
/ Dsouza Ambrose Augustine	215
/ Dsouza Ashwyn Leo	216

NAME	Roll No
/ Dsouza Eden Kevin	217
/ Dsouza Malaika Annabelle Arun	218
/ Dsouza Melissa Jose	219
/ Fernandes Felicia Leonard	223
/ Fernandes Sheena Rose Carl	224
/ Gavande Asawari Pramod	225
/ Ghosals Elvina Robert	226
/ Gonsalves James Glenn Gonsalv	228
/ Gonsalves Sharon George	229
/ Greeshma Chacko	230
/ Gupta Shimontika Prosenjit	231
/ Jana M Daphisa Mohendro	232
/ Jemima Joseph	233
/ Kalita Sudipta Dipak	234
/ Khemnar Pranjali Bajirao	235
/ Malean James Arociassamy Swa	237
/ Mendes Clarita Iona Charles	238
/ Menezes Victoria Kareena Favorir	239
/ Mitra Amartya Tashi Debashis	240
/ Moraes Theresa Marcelino	241
/ Mukherjee Avignan Avijit	242
/ Naikare Yashashree Dilip	243
/ Nair Radhika Sunil	244
/ Nikhil Thomas	245
/ Noronha Lizanne Brenelle Brian	246
/ Nunes Sanida Hillary	247
/ Porwal Neelam Jitendra	248
/ Purohit Vishal Mohanlal	249
/ Ranjan Mimansha Mrigank	251
/ Raphael Arnold Arulappan	252
/ Reshamwala Nida Javed Akhtar	255
/ Reshell George	256
/ Risamol Babu	257
/ Rodrigues Clarissa Timothy	258
/ Rodrigues Ryshele Felicia Raymo	259
/ Swamy Reetika Peter	265
/ Vieira Alike Tandon Anson	267
/ Wankhade Anisha Vinod	268
/ Pollayil Anupa	269
/ Nawarey Vaibhavi Vijay	270



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

S.Y.B. CROSS FA
Professor: Kevin O'Grady, Alok Cruz, I
No. of Lectures engaged : _____

NAME	Roll No	UID NO.	
Manasvini Abhyankar	001	151409	4
Sunandan Banerjee	011	151437	3
Ruha Cherian	021	151346	4
Soham Daruwala	023	151323	3
Nikita Fernandes	032	151148	4
Zahabiya Halela	039	151445	4
Juhi Jain	042	151458	4
Ujjayee Lunkar	051	151453	4
Jasmine Minhas	057	151430	3
Khanjana Mistry	058	151188	4
Serah Paul	066	151302	2
Shikhar Shah	082	151438	2
Shweta Shirodkar	084	151034	3
Tanvi Singh	086	151314	4
Sneha Sebastian	087	151368	4
Aditi Surve	089	151162	4
Angika Dewri	118	151304	3
Tanvi Kaur Gandhi	125	151059	4
Tanaya Jagtiani	134	151023	-
Mohini Jha	136	151397	3
Jai Mendonsa	149	151225	3
Sunaina Menezes	150	151079	4
Michele Mary Bernadine	152	151107	4
Veena Nair	154	151165	4
Sania Rafiq	163	151391	2
Saloni Rao	166	151466	4
Rhea Anthony	170	151083	4
Tasya Maria Afonso	201	151087	4
Tanya Dias	218	151196	3
Madlin D'Silva	222	151100	3
Riea Enok	227	151161	4
Maitry Gandhi	234	151321	4
Yashi Gandhi	235	151025	3
Arukshita Kaushal	243	151426	2
Pooja Kulkarni	246	151125	4
Pranjali Kishor Magar	249	151272	4
Chaitali Mendon	253	151068	3
Indrayani Mundada	259	151398	4
P. Samantha Shaji	264	151077	4
Eleanor Pinto	272	151267	3
Tamara Rasquinha	279	151036	3
Shah Dhruv	288	151416	4

S.Y. CROSS F
Professor: KD/RG/MM
No. of Lectures engaged : _____

NAME	Roll No	UID NO.
Jeni Thakkar	301	151242
Dhruv Shah	302	151416
Hetvi Dhimar	329	151324
Minella Fernandes	340	151223
Mammootil Meryl Mathew	362	151022
Ayesha Marfatia	363	151149
Elizabeth Mary Mathew K.	364	151287
Rayna Pinto	380	151084
Rebecca Shibu	384	151401
Andrea Rodrigues	385	151115
Sakshi Kulthe	388	151320
Pearl Shroff	394	151167
	164	
	368	
	375	
	389	
Shilpa Giri	024	153045
Jeremiah Andrew	004	154021
Merlin George	018	154003





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Field trip: (2016-17)

Dr. Vijaya Lobo along with Mr. Rajdeo Singh conducted a botanical excursion to Phansad Wildlife sanctuary, Murud, Raigad from 19th to 21st January 2016 for the M.Sc. Botany students.


This field trips develop interest of students in field botany, environment, nature and help them to learn the technique of identifying plants in the wild. They also learnt the method of plant collection, basics of herbarium preparation, local ecology, conservation strategies, importance of endemic plants their and also the knowledge of local people there about plants.

Attendance

Name of Students	UID No.	Name of Students	UID No.
Chaudhari Rushabh	168301	Mulakkal Joel	168312
Deshmukh Aishwarya	168302	Padavi Prabhakar	168313
Dhabak Maniruddin	168303	Pais Merlin	168314
Giri Varsha	168304	Patil Pratiksha	168315
Gupta Sadanand	168305	Ruetherford Ernes	168316
Hansdah Jessica	168306	Shedge Siddhi	168317
Harge Madhuri	168307	Shukla Alka	168318
Kamale Sneha	168308	Singh Shalu	168319
Khawaja Faahmida	168310	Maheshwari Ayushi	168311



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

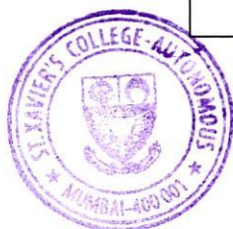

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Department of Botany: Excursion 2016-17 - Phansad Wildlife Sanctuary



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Dr. R.D. Shinde and Dr. Manek Mistry organized local excursions for TYBSc students to Sanjay Gandhi National Park, Borivali and to BPT Garden, Colaba for studying the seasonal flora during January 2016.

Professor : <u>Manek K. D.</u>		
SUBJECT : BOTANY - BIOCHEMISTRY		
NAME OF STUDENTS	Date	UIDNO
	Roll No.	
M Surve Siddhesh Anil	002	132146
F Verella Chiselle Lian Socorro	004	142120

SUBJECT : BOTANY - ZOOLOGY		
NAME OF STUDENTS	Date	UIDNO
	Roll No.	
F Carvalho Sweta Francis	009	142325
M Dhodi Kristan Anil	010	142394
M Dsilva Prinson William	011	142440
M Dsouza Brandon Paul	012	142080
F Jhala Harshini Yadvendradev	013	142399
F K. Athira Rajan	014	157291
M Nair Udit Madhusudan	015	142468
F Rodrigues Marishia Alria M Mario	016	142429
F Shaikh Husainbee Farooq	017	142037
F Shukla Shivira Arvind	018	142609
M Singh Harshit Narendra	019	142191
F Tade Komal Vasanta	020	132587
F Vaidokaran Rochelle Varghese	021	142430 110628
D'Souza Sean	022	



R.D. Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Department of Botany: TYBSc Field trip 2015-16 - SGNP



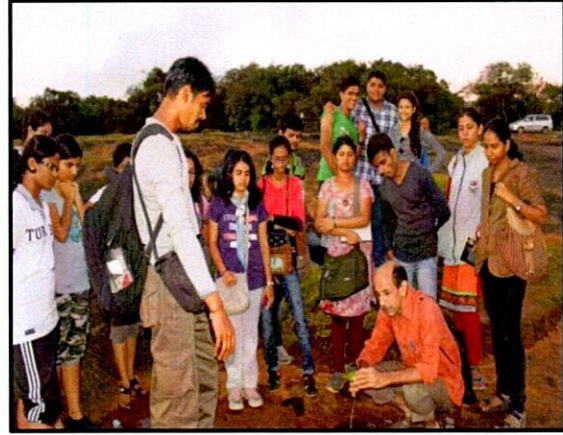
NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Alinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Botany Excursion: KAAS (2015-16)



Department of Botany Excursion 2015-16: KAAS



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

H. Kurde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

**5, Mahapalika Marg, Mumbai - 400 001,
INDIA.**

☎ 2262 0661/65

DEPARTMENT OF VOCATION STUDIES PROJECTS



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

TYBVoc - List of Projects 2019-20

NAME OF STUDENTS	UID NO.	ROLL NO.	6
D'Costa Vineesha William	169214	002	Not submitted - No communication
Jebisow Dimitry	159221	001	Dimitry-Acknowledgement on ISREAL.pdf Dimitry-Certificate page.pdf Dimitry-DECLARATION page.pdf Dimitry-INDEX.pdf Dimitry-ISREAL.docx Dimitry-Thesis cover page with logo.pdf
Dsouza Pratheek Paul	169215	003	Not Submitted - No communication
/ Agashe Kalyani Sudhir	179201	004	Y Kalyani Agashe_179201_Germany Project.pdf
Carassco Richie Eugenio	179203	005	Y carasscorichie_26924635_99362713_BRAZIL BB.pdf
Danthi Derek Aldrin	179204	006	Y danthiderekaldrin_26923886_99359480_179204 Dere...




PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.




ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

/ Deshpande Aadya Shailesh	179206	007	Y 179206- Aadya Deshpande.pdf
/ D'Mello Elrica	179207	008	Y dmelloelrica_26898164_99266432_179207- Elrica D...
/ Dongarkar Crizel Renne	179208	009	Y dongarkarcrizel_26918908_99293459_Crizel Dongar... dongarkarcrizel_26918908_99293463_DECLARATION ... dongarkarcrizel_26918908_99293471_Certificate p...
/ D'Souza Anisha Anthony	179210	010	Y attached below
/ D'Souza Carol William	179211	011	Y dsouzacarol_26891588_99343623_179211- Croatia.pdf
/ Fernandes Alinda Xavier	179212	012	Y fernandesalinda_26922161_99345134_179212 Alinda...
Fernandes Chris Joseph	179213	013	Y PHILIPPINES -179213.pdf
/ Fernandes Drisya Remy	179214	014	Y fernandesdrisya_26911560_99222667_179214- Drisy...
Fernandes Renferd Joseph	179215	015	Y fernandesrenferdjoseph_26910993_99346479_179215...
Fernandes Sherwin Alfred	179216	016	Y fernandessherwin_26922561_99349044_179216 - She...
/ Gautam Jyothi Keshav	179217	017	Y gautamjyothi_26922293_99346481_179217 - Jyothi ...
/ Hublikar Madhura Vishnu	179218	018	Y hublikarmadhuravishnu_26898224_99104214_179218 ...
Kate Kunal Ravindra	179219	019	Y ravindrakatekunal_26927354_99389713_179219-KATE...
/ Khanna Shivangi	179220	020	C khannashivangi_26891795_99344821_Netherlands_17...



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

/ Kulkarni Sanika Srihari	179221	021	Y kulkarnisanika_26891672_99212757_Sanika Kulkarn...
/ Kunnuthottiyil Nikitha Sunil	179222	022	Y sunilkunnuthottiyilnikitha_26923628_99359126_1.... sunilkunnuthottiyilnikitha_26923628_99359130_Ch... sunilkunnuthottiyilnikitha_26923628_99359131_Ch... sunilkunnuthottiyilnikitha_26923628_99359133_Ch... sunilkunnuthottiyilnikitha_26923628_99359183_Ch... sunilkunnuthottiyilnikitha_26923628_99359188_Ch... sunilkunnuthottiyilnikitha_26923628_99359190_Ch... sunilkunnuthottiyilnikitha_26923628_99359192_Ch... sunilkunnuthottiyilnikitha_26923628_99359193_Ch... sunilkunnuthottiyilnikitha_26923628_99359196_Ch... sunilkunnuthottiyilnikitha_26923628_99359200_Ch... sunilkunnuthottiyilnikitha_26923628_99359207_Ce... sunilkunnuthottiyilnikitha_26923628_99359210_Co... sunilkunnuthottiyilnikitha_26923628_99359216_DE... sunilkunnuthottiyilnikitha_26923628_99359227_Pr... sunilkunnuthottiyilnikitha_26923628_99359234_z....
/ Mathias Vinisha Glanet	179223	023	Y FINLAND PROJECT -179223.pdf
/ Mendes Sheley Kemmy	179224	024	No softcopy
/ Mendes Simran Kemmy	179225	025	No softcopy
Moncy Kurian	179227	026	Y moncykurian_26923620_99354583_MALDIVES (1)-con...
/ Naikade Simran Sachin	179228	027	Y Simran N-coverpage for thesis.docx Simran N-Mexico Brochure.pdf Simran N-THESIS FINAL DOCUMENT.pdf
Nakhwa Dhaval Jeevan	179229	028	Y 179229 Dhaval-Chapter 1 thesis.docx





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Pal Vinayak	179231	029	Not submitted- No Communication
Patil Allson Vincent	179233	030	Y allson -ITALY project.pdf
/ Rodricks Rhea Maria	179235	031	Y rodricksrhea_26916451_99275894_179235- Rhea Rod...
Rosario Joy Leonardo	179236	032	Y Joy-Thesis.docx
Saluja Chirag	179237	033	Y chirag-Georgia Thesis Final-converted.pdf
/ Sharma Jahnvi	179238	034	Y Jahnvi -Certificate page (2).docx Jahnvi -DECLARATION page.docx Jahnvi -INDONESIA final-converted.pdf Jahnvi -Thesis cover page with logo.docx
/ Sharma Shruti Milind	179239	035	Y sharmashruti_26924143_99359867_179239-ShrutiSha...
/ Shinde Gargi Avinash	179240	036	Y shindegargi_26891527_99026332_179240 - Gargi Sh...
/ Shirke Isha Ravindra	179241	037	Y shirkeisha_26900179_99118873_179241 - Isha Shir...
/ Srivastava Aashna Bhanu	179242	038	Y srivastavaaashna_26922392_99347844_AASHNA SRI...
/ Singh Astuti	179243	039	Y Astuti- Fiji Final Submission.pdf
/ Sinha Priyaanka Manish	179244	040	Y sinhapriyaankamanish_26891549_99191129_179244- ...
Sonawane Rutwik Pankaj	179245	041	Y sonawanerutwikpankaj_26924655_99362505_179245- ...
/ Survase Minal Gopal	179246	042	Y 179246-MINAL GOPAL SURVASE-(South Korea).pdf

Sutar Jayesh Manohar	179247	043	Y Thesis 179247.docx
/ Tandel Yuganti Mahendra	179248	044	Y tandelyuganti_26903532_99139823_179248 Yuganti ...
/ Park Hey Jeong	179251	045	No softcopy
/ Parekh Jeenal Haresh	179232	046	Y parekhjeenal_26891686_99279111_JEENAL Russia.pdf



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65



ST. XAVIER'S COLLEGE (AUTONOMOUS)

MUMBAI

Department of Vocation

Bachelor of Vocation in Tourism

Final Year Thematic Project on

JAPAN

By

Aadya Deshpande

179206

TYBA

2019-2020

1|JAPAN. ENDLESS DISCOVERY.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



PROJECT CERTIFICATE

This is to certify that the Thematic Project titled JAPAN is undertaken at St. Xavier's College (Autonomous), Mumbai by **AADYA DESHPANDE**, 179206 in partial fulfilment of Bachelor of Vocation degree in Tourism. This work has not been submitted for any other examination and does not form part of any other course undergone by the student. It is further certified that the student has completed all required phases of the project.

Signature
(Guide)

Signature
(Examiner)

Signature
(HOD)

College Seal

2 | JAPAN. ENDLESS DISCOVERY.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shikha
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

DECLARATION

I, **AADYA DESHPANDE**, UID NUMBER- 179206, hereby declare that this thematic project on **JAPAN**, which is being submitted in partial fulfilment of the Bachelor of Vocation in Tourism, final examination conducted by St. Xavier's College (Autonomous), Mumbai is the result of work carried out by me under the supervision of Ms. Uma Ranade, visiting faculty, B.Voc Department, St. Xavier's College (Autonomous).

This work has not been previously submitted to any other University or college for any examination. Wherever references are made to previous work by others, it has been clearly indicated as such and included in the bibliography.

Signature of Student

Date: 04/02/2020

Place: Mumbai

3 | JAPAN. ENDLESS DISCOVERY.



NAAC SSR Cycle 4 (2015-2020):
2_3_1 Experiential Learning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

ACKNOWLEDGEMENT

I would like to express my special thanks of gratitude to my mentor for the Thematic Project Ms. Uma Ranade for guidance and support to complete my project.

I would also like to extend my gratitude to my Japanese friends- Kotono Mizutani, Riho Harada, Reina Hida, Yuji Kobayashi, Kazutaka Suzuki, Yuichi Suzuki for helping me out to finish the task and providing core information about Japan for my project.

This project would not have completed without the support of my parents, friends and guardians. I would like to thank them for their valuable suggestions and guidance.

Date- 04/02/2020


AADYA DESHPANDE

TY Bachelor in Vocational, Travel and Tourism.

4 | JAPAN. ENDLESS DISCOVERY.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



INDEX

Chapter Number	Topics and Sub-topics	Page Number
Chapter 1	Introduction 1.01 Synopsis 1.02 Fact File 1.03 Political Map 1.04 Physical Map 1.05 Tourism Map	7
Chapter 2	Country Profile 2.01 Geographical Features 2.02 History 2.03 Culture 2.04 Current Political Scenario	13
Chapter 3	Tourism in Japan 3.01 Current Tourism Scenario – Statistics, Position in World 3.02 Tourism Potential – Types, Heritage Sites 3.03 Tourism Policy 3.04 Relations with India	38
Chapter 4	6 As 4.01 Overview 4.02 Accessibility 4.03 Attractions 4.04 Activities 4.05 Accommodation 4.06 Amenities 4.07 Affordability	46
Chapter 5	Documentation 5.01 Overview 5.02 Consulate locations in India 5.03 Visa – Form & Process 5.04 Documents Required 5.05 Health Requirements 5.06 Foreign Exchange 5.07 FAQs	61
Chapter 6	Itineraries & Tour Packages 6.01 Analysis of existing itineraries 6.02 Popular Tourist Circuits 6.03 Proposed Tour Itineraries 6.04 USP of proposed tour itinerary	64
Chapter 7	Market Research & Analysis 7.01 Target Customer Profile 7.02 Survey Questionnaire	73

5 | JAPAN. ENDLESS DISCOVERY.





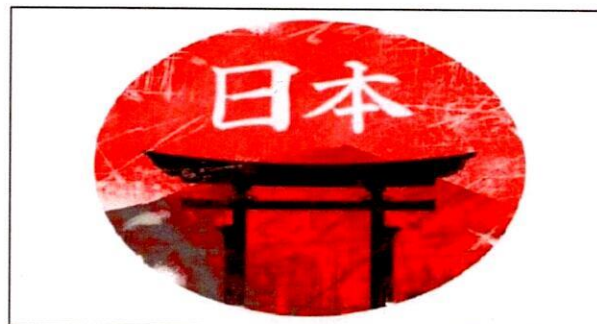
ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

	7.03 Analysis of Survey 7.04 Findings & Challenges	
Chapter 8	Challenges 8.01 Environmental Sustainability 8.02 Economic Issues 8.03 Socio- Political Issues	84
Chapter 9	Marketing & Publicity 9.01 SWOT analysis of Destination 9.02 Marketing Features & Publicity Strategy	91
	Conclusion	95
	References	96



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

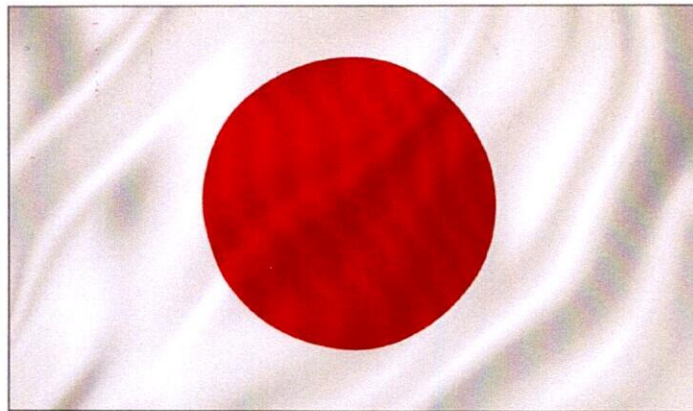
Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

CHAPTER 1- INTRODUCTION



Flag of Japan

1.01: SYNOPSIS

"Japan is truly timeless, a place where ancient traditions are fused with modern life as if it were the most natural thing in the world." On the surface Japan appears exceedingly modern, but travelling around it offers numerous opportunities to connect with the country's traditional culture. Japan is a long and slender, highly volcanic archipelago. It's over two-third of Mountains, with bubbling hot springs at every turn. In the warmer months there is excellent hiking, through cedar groves and fields of wildflowers, up to soaring peaks and ancient shrines. In the winter, all this is covered with snow and the skiing is world class. And if you've never paired hiking or skiing with soaking in onsen, you don't know what you've been missing. Meanwhile in the southern reaches, there are tropical beaches for sunning, snorkelling and diving. Meditate with monks or learn how to whisk bitter matcha (powdered green tea) into a froth. From the splendour of a Kyoto geisha dance to the spare beauty of a Zen rock garden, Japan has the power to enthral even the most jaded traveller. As you will discover, Japanese cuisine has great regional variations. The hearty hotpots of the mountains are, for example, dramatically different from the delicate sushi for which the coast is famous. It's also intensely seasonal, meaning you can visit at a different time of year and experience totally new tastes. Wherever you are in Japan, it seems, you're never far from a great meal. Restaurants often specialise in just one dish perhaps having spent generations perfecting it and pay close attention to every stage, from sourcing the freshest, local ingredients to assembling the dish attractively. Japan is incredibly easy to get around. You can do a whole trip using nothing but its immaculate, efficient public transport. The Shinkansen network now runs all the way from the southern tip of Kyushu (the southernmost of Japan's major islands) up to Hokkaido (its northernmost), and reasonably priced rail passes make it affordable. Major cities have subway networks that are signposted in English and these days we're seeing and hearing more English all over. But if getting off the beaten track and outside your comfort zone is what you're after, you can have that experience, too. From castles to amusement parks to beautiful gardens, Japan is truly magical and travellers heaven!



7 | JAPAN. ENDLESS DISCOVERY.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

1.02: FACT FILE

Official Name- Nihon/Nippon

Continent- Asia

GPS Coordinates- 36.2048°N, 138.2529°E

Bordering Water Bodies- Pacific Ocean (E), Sea of Japan (W), East China Sea (S), Philippine Sea (SE) and Sea of Okhotsk (N)

Capital- Tokyo

Currency- Yen (¥)

Symbol- Rising Sun Flag

National Anthem- Kimigayo

Time Zone- GMT/UTC +9 Hours (No daylight saving time)

Phone Pin/Extension- +81

Latest Population- Around 124.41 Million in 2020

Religion(s) - Shintoism (79.2%), Buddhism (66.8%), Others (7.1%) and Christianity (1.5%)

Sects/Tribes/Communities- Ainu, Bonin Islanders, Yamato, Ryukyuan are native Japanese

Official Language- Japanese (With many dialects)

Languages Spoken- English, French, Portuguese, etc.

Public Holiday- New Year (Genjitsu), Sejin-no hi, Kenkoku kinembi, Shunbun no hi, Showa no hi, O bon, Golden week, Shogatsu, Ten no tanjyoubi, Midori no hi, Umi no hi, etc

Address of Indian Embassy in Japan- 2 Chome-2-11 Kudan Minami, Chiyoda City, Tokyo 102-0074, Japan

Current Regime in Power- Reiwa Period (of Emperor)/Shinzo Abe (Prime Minister)

Emergency Contact- Ambulance/Fire- 119, Police-110 and local directory-104

Weights and Measure System- Uses international metric system

Electric Supply- Universal Charge (100V- Tokyo & Eastern Japan are 50Hz & Nagoya, Kyoto and Osaka are 60Hz)

8 | JAPAN. ENDLESS DISCOVERY.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Alinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



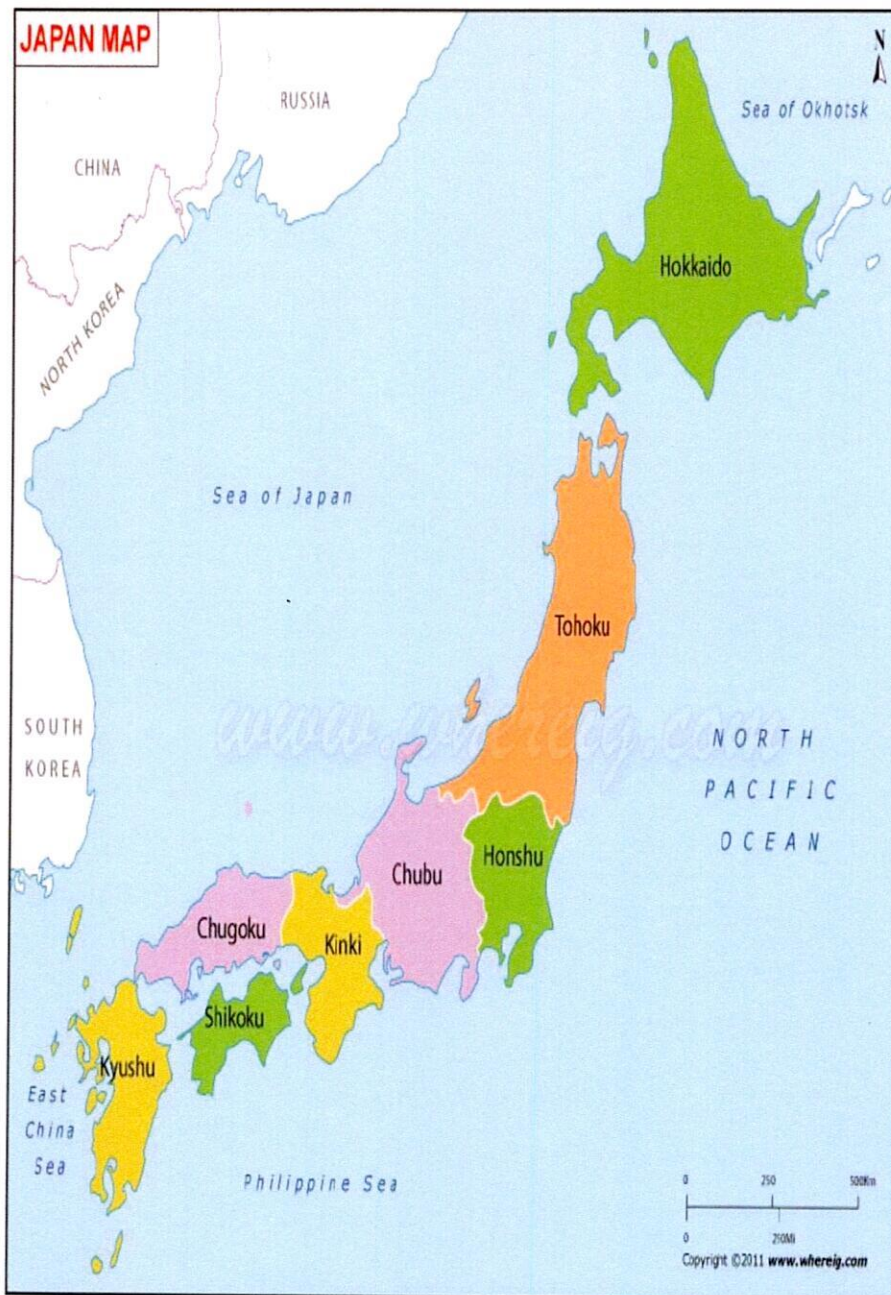
ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

1.03: POLITICAL MAP



9 | JAPAN. ENDLESS DISCOVERY.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Alinda

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.

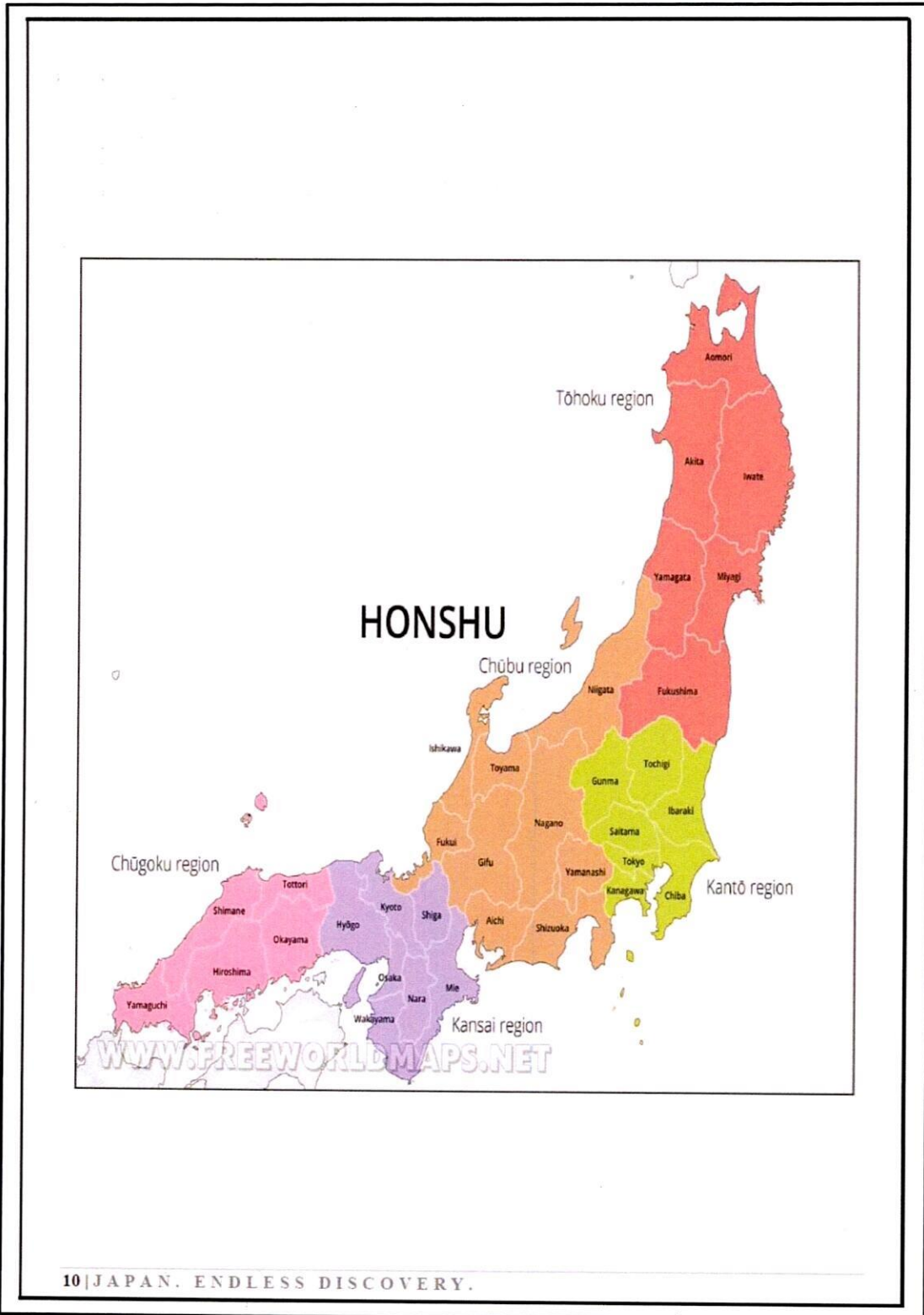


ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

1.04: PHYSICAL MAP



11 | JAPAN. ENDLESS DISCOVERY.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

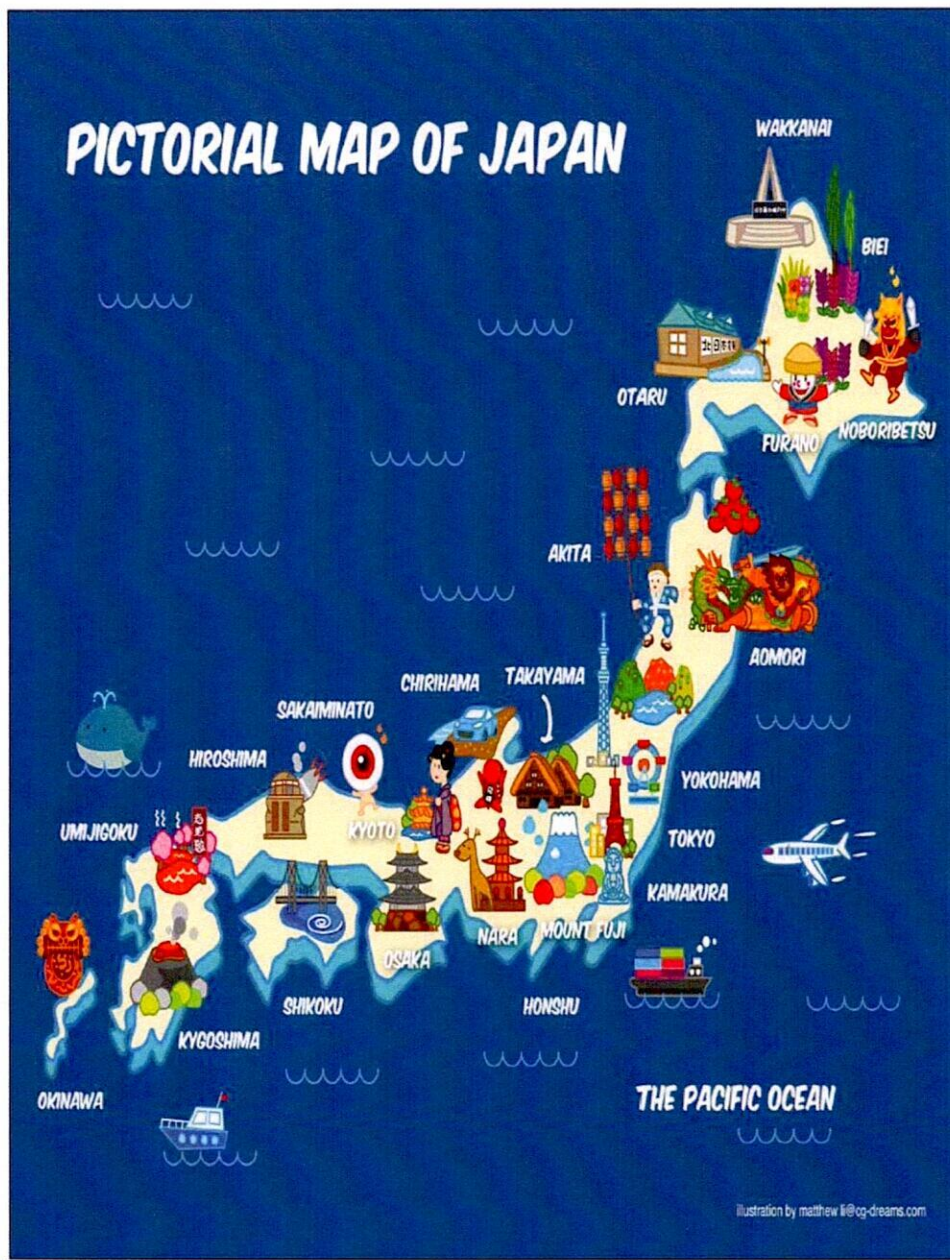
Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

1.05: TOURISM/ TOURIST MAP



12 | JAPAN. ENDLESS DISCOVERY.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Alinda

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



CHAPTER 2- COUNTRY PROFILE

2.01: GEOGRAPHICAL FEATURES

Japan is an island country. It consists of a string of many islands that stretches approximately 2,400 kilometres. Nearly the entire land area is taken up by the country's four main islands. These are Hokkaido, Honshu, Shikoku and Kyushu (from northwest to southeast). Honshu is the largest of the four followed in size by Hokkaido, Kyushu and Shikoku. Also, there are numerous smaller islands, the major groups of which are Ryukyu (Nansei) islands which include the popular island of Okinawa, Izu, Bonin (Ogasawara) and Kazan Islands. Japan is divided into state-like 47 prefectures. Japan's capital city is Tokyo and it is one of the most populous cities in the world. It is said that Japan was not an island country. But, 10,000 years ago, due to rise in the level of the sea and floods a land bridge which connected Japan to the Asian countries drowned.

DID YOU KNOW?

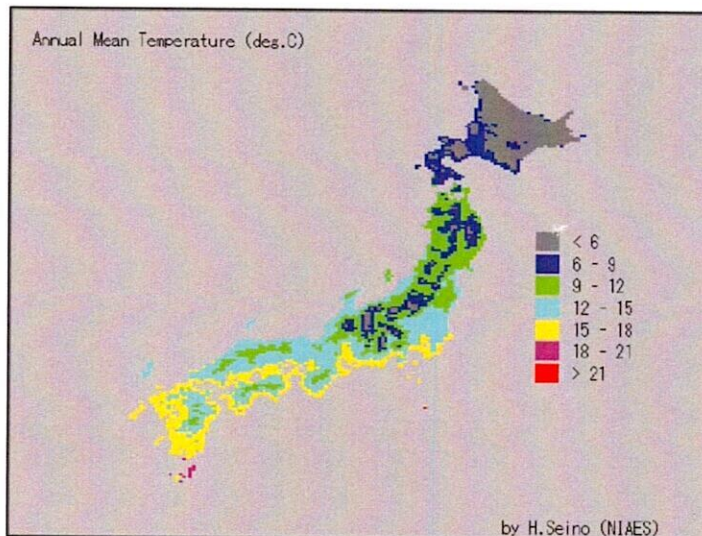
Japan consists of over 6, 800 islands!!

Location-

Japan lies off the eastern coast of Asia. Japan is surrounded by the Pacific Ocean to the east, the Sea of Japan to the west, the East China Sea to the south, Philippine Sea to the southeast and Sea of Okhotsk in the north. The neighbouring countries of North Korea, South Korea, China and Russia are located to the west of Japan. Its co-ordinates on the world map are 35°41'N139°46'E.

Climate-

Japan has four distinct seasons- winter, spring, summer and autumn with a climate ranging from subarctic in the north to subtropical in the south. Conditions are different between the Pacific side and the Sea of Japan side. Winter is from December to February, spring is from March to May, summer is from June to August and autumn is from September to November. In June, the country experiences a three to four-week rainy season during which the farmers plant their rice. Northern Japan has warm summers and very cold winters with heavy snow on the Sea of Japan side and in mountainous areas. Eastern Japan has hot and humid summers and cold winters with very heavy snow on the Sea of Japan side and in mountainous areas. Western Japan has very hot and humid summers (with temperatures sometimes reaching 35 degree celsius or above) and moderate cold winters. Southern Japan i.e. Okinawa and Amami have a subtropical oceanic climate. These areas have hot and humid summers (with temperatures rarely reaching 35 degree celsius or above) and mild winters.





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Landscape-

DID YOU KNOW?

**There are 108
active volcanoes in
Japan!**

Japanese landscape is rugged, with more than four-fifth of the land surface consisting of mountains. Mount Fuji (Fuji-san) is the highest mountain in Japan. It is an active volcanic mountain located Yamanashi-Ken and Shizuoka-Ken (Prefecture) of central Honshu. It was formed because of an earthquake and erupted on 16th December 1707 the last time. There are many other active volcanoes around the country. Shinano (Shinano-gawa) is the longest and the widest river in Japan. It is also known as Chikuma River (Chikuma-gawa). It is located in north-eastern Honshu, rising in the Japanese Alps at the foot of Mount Kobushi and flowing northeast through Nagano and Niigata prefectures.



Flora and Fauna-

Japan's archipelago is fantastically varied. Due to the latitudinal spread of Japan's islands there is a wide diversity of flora and fauna. In Japan, one can experience variety of climates and ecosystems-right from coral-reefs to islands to snow capped mountains. But, unfortunately, it is one of the most crowded country's in the world. Almost 70% of Japan's land area is forested. Of this area, almost 40% is planted. Most of it is with uniform rows of conifers (Sugi). The Nansei and Ogasawara islands in the far south are sub tropical, and flora and fauna in this regions are related to those found on the Malay Peninsula. Mainland Japan Honshu, Kyushu and Shikoku, on the other hand, show more similarities with Korea and China. While, Hokkaido shares some features with Sakhalin Island in Russia.

Flora

The flora of Japan today is not what the Japanese saw hundreds of years ago. It is not just because Japan's landscape has exposed to the urban culture but also a lot of Japan's flora is imported. Almost 200-500 plant species were introduced to the Japanese mainly from Europe and also North America. But, The Flora of Japan comprises a large assemblage of plant species which can be found in Japan, such as sakura, katsura, momiji and azalea. There are many species which are endemic to Japan. Roughly, the forests are dominated by sugi in Hokkaido, buna in Eastern Japan and shirakashi in Western Japan.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.

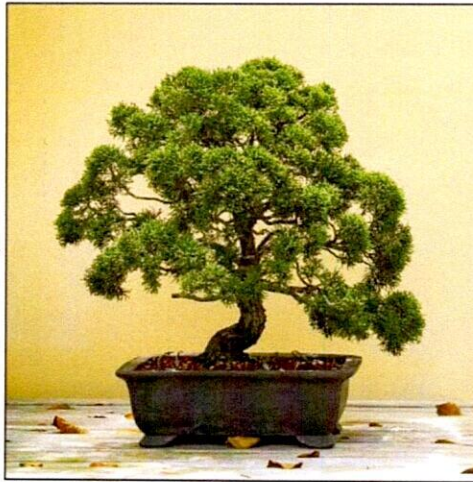


ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65



Bonsai are trees and plants grown in small containers

Fauna

Japan being very close to some of the other Asian country's it allows the migration of animals and birds from Korea and China. There are species that are unique to Japan: some of them are Japanese salamander and Japanese macaque. Nansei Island has few unique examples of fauna that are classified by experts as 'living fossils' such as Iriomote Cat. Japan's largest carnivorous mammals are its bears. There are 2 species of bears found in Japan- Higuma (brown bear) found on the island of Hokkaido and Tsukinowaguma (Asiatic brown bear) found on the islands of Kyushu, Honshu and Shikoku. According to IUCN 2009 report, there are 312 endangered animal species in Japan. They include the Iriomote cat, Tsushima cat, Blakinston fish owl and Japanese river otter.



Higuma (Brown bear)



Iriomote cat

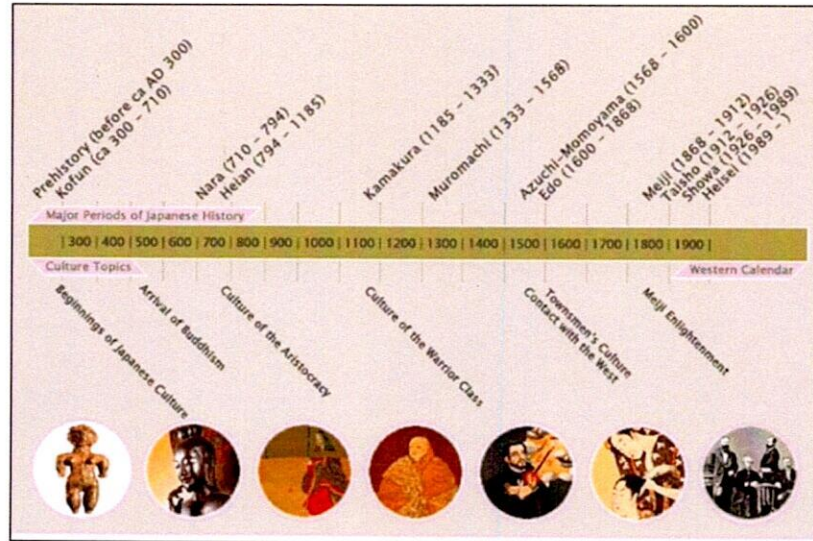
2.02: HISTORY



Shinde



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Early Japan (Until 710)-

During the Jomon Period (13000 BC to 300 BC), the inhabitants of the Japanese islands were gatherers, fishers and hunters. Jomon is the name of the era's pottery. In Yayoi Period (300 BC to 250 AD), the rice culture was imported into Japan around 100 BC. With the introduction of agriculture, social classes started to evolve, and parts of the country began to unite under powerful land owners. Chinese travellers during the Han and Wei dynasties reigned over Japan at that time. The Yayoi period brought also the introduction of iron and other modern ideas from Korea into Japan. Again, its pottery gave the period its name. By the beginning of the Kofun Period (250 - 538), a centre of power had developed in the fertile Kinai plain, and by about 400 AD the country was united as Yamato Japan with its political centre in and around the province of Yamato (about today's Nara Prefecture). The period's name comes from the large kofun (tombs) that were built for the political leaders of that era. The Soga clan soon took over the actual political power, resulting in a system in which most of the emperors only acted as the symbol of the state and performed Shinto rituals. During the Asuka Period (538-710), the influence from the mainland increased strongly thanks to friendly relations to the kingdom of Kudara on the Korean peninsula. Buddhism was introduced to Japan and was promoted by the ruling class. Prince Shotoku is said to have played an especially important role in promoting Chinese ideas. He also wrote the Constitution of Seventeen Articles about moral and political principles. In 645, era of the Fujiwara clan was started that was to last until the rise of the military class (samurai) in the 11th century. In the same year, the Taika reforms were realized: A new government and administrative system was established after the Chinese model. All land was bought by the state and redistributed equally among the farmers in a large land reform in order to introduce the new tax system that was also adopted from China.

Nara and Heian Period (710-1185)-

In the year 710, the first permanent Japanese capital was established in Nara, a city modelled after the Chinese capital. Large Buddhist monasteries were built in the new capital. The monasteries quickly gained such strong political influence that, in order to protect the position of the emperor and central government, the capital was moved to Nagaoka, and finally to Heian (Kyoto) where it remained for over one thousand years. One characteristic of the Nara and Heian periods is a gradual decline of Chinese influence which, nevertheless, remained strong. Many of the imported ideas were gradually "Japanized". In the arts too, native Japanese movements became increasingly popular. The development of the Kana syllables made the creation of actual Japanese literature possible. Several new Buddhist sects that were imported from China during the Heian period, were also "Japanized". The Fujiwara family controlled the political scene of the Heian period over several centuries through

16 | JAPAN. ENDLESS DISCOVERY.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Ali Sa.
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

strategic intermarriages with the imperial family and by occupying all the important political offices in Kyoto and the major provinces. The power of the clan reached its peak with Fujiwara Michinaga in the year 1016. After Michinaga, however, the ability of the Fujiwara leaders began to decline, and public order could not be maintained. Many land owners hired samurai for the protection of their properties. That is how the military class became more and more influential, especially in Eastern Japan. The Fujiwara supremacy came to an end in 1068 when the new emperor Go-Sanjo was determined to rule the country by himself, and the Fujiwara failed to control him. In the year 1086 Go-Sanjo abdicated but continued to rule from behind the political stage. This new form of government was called Insei government. Insei emperors exerted political power from 1086 until 1156 when Taira Kiyomori became the new leader of Japan. Later, the Taira and Minamoto clans fought a deciding war for supremacy, the Gempei War, which lasted from 1180 to 1185. By the end of the war, the Minamoto were able to put an end to Taira supremacy, and Minamoto Yoritomo succeeded as the leader of Japan. After eliminating all of his potential and acute enemies, including close family members, he was appointed Shogun (highest military officer) and established a new government in his home city Kamakura.



Clothing during Nara and Heian Period

Kamakura Period (1192-1333)-

Minamoto Yoritomo established a new military government, the Kamakura Bakufu, in Kamakura and was appointed shogun in the year 1192. Chinese influence continued to be relatively strong during the Kamakura period. New Buddhist sects were introduced: the Zen sect (introduced 1191) found large numbers of followers among the samurai, which were now the leading social class. The shogun stayed in Kamakura without much power while deputies of him were located in Kyoto and Western Japan. Stewards and constables controlled the provinces tightly and loyally. The Hojo regents were able to bring several decades of peace and economic expansion to the country until an external power began to threaten Japan. By 1259, the Mongols had conquered China and became also interested in Japan. Several threatening messages of the powerful Mongols were ignored by Kamakura. This resulted in the first Mongol invasion attempt in 1274 on the island of Kyushu. After only a few hours of fighting, however, the large naval invasion fleet was forced to pull back because of bad weather conditions. Due to good preparations, the Japanese were able to maintain a strong defence for several weeks during a second invasion attempt which occurred in 1281. Kyushu remained in alert for a possible third invasion attempt, but the Mongols soon had too many problems on the mainland in order to care about Japan. The consequences of the many years of war preparations against the Mongols were fatal to the Kamakura government since they resulted only in expenditures and no profits. Many of the loyal men, who were fighting for Kamakura, were now waiting for rewards that the government could not pay. Hence, financial problems and decreasing loyalty among the powerful lords were some of the reasons for the fall of the Kamakura government. By 1333 the power of the Hojo regents had declined to such a degree that the emperor Go-Daigo was able to restore imperial power and overthrow the Kamakura Bakufu.

17 | JAPAN. ENDLESS DISCOVERY.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65



Shogunate Kamakura Bafuku

Moromachi Period (1333-1573)-

Ashikaga Takauji, once fighting for the emperor, now challenged the imperial court and succeeded in capturing Kyoto in 1336. In 1338 Takauji appointed himself shogun and established his government in Kyoto. Two imperial courts existed in Japan for over 50 years: the Southern and Northern courts. They fought many battles against each other. The Northern court usually was in a more advantageous position; nevertheless, the South succeeded in capturing Kyoto several times for short time periods resulting in the destruction of the capital on a regular basis. The Southern court finally gave in in 1392, and the country became emperor-wise reunited again. During the era of Shogun Ashikaga Yoshimitsu (1368-1408), the Muromachi Bakufu was able to control the central provinces, but gradually lost its influence over outer regions. Domestic production also increased through improvements in agriculture and the consequences of a new inheritance system. These economic changes resulted in the development of markets, several kinds of towns and new social classes. During the 15th and 16th centuries, the influence of the Ashikaga shoguns and the government in Kyoto declined to practically nothing. In 1542 the first Portuguese traders and Jesuit missionaries arrived in Kyushu, and introduced firearms and Christianity to Japan. The Jesuit Francis Xavier undertook a mission to Kyoto in 1549-50. Despite Buddhist opposition, most of the Western warlords welcomed Christianity because they were keen in trade with overseas nations mainly for military reasons. By the middle of the 16th century, several of the most powerful warlords were competing for control over the whole country. One of them was Oda Nobunaga. He made the first big steps towards unification of Japan by capturing Kyoto in 1568 and overthrowing the Muromachi bakufu in 1573.

18 | JAPAN. ENDLESS DISCOVERY.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65



Ashikaga Takauji

Azuchi-Momoyama Period (1573-1603)-

Oda Nobunaga achieved control over the province of Owari (around the modern city of Nagoya) in 1559. After establishing himself in Kyoto, Nobunaga continued to eliminate his enemies. Among them were some militant Buddhist sects, especially the Ikko sect which had become very powerful in several provinces. In 1582, general Akechi murdered Nobunaga and captured his Azuchi castle. Toyotomi Hideyoshi, a general fighting for Nobunaga, reacted very quickly, defeated Akechi, and took over control. In order to bring the country under absolute control, Hideyoshi destroyed many castles that were built throughout the country during the era of civil wars. In 1588 he confiscated the weapons of all the farmers and religious institutions in the "Sword Hunt". He forbade the samurai to be active as farmers and forced them to move into the castle towns. In 1590, Hideyoshi's large castle, the Osaka Castle, was completed. In 1587, Hideyoshi issued an edict expelling Christian missionaries. Nevertheless, Franciscans were able to enter the country in 1593, and the Jesuits remained active in Western Japan. In 1597 Hideyoshi intensified the persecution of Christian missionaries, forbade further conversions, and executed 26 Franciscans as a warning. Foreign traders and missionaries had acted aggressively and intolerant towards native Japanese institutions in an era when their fellow countrymen were conquering and colonizing other parts of the world in the name of Christianity. After uniting the country, Hideyoshi attempted to realize his dream of conquering China. In 1592, his armies invaded Korea and captured Seoul within a few weeks; however, they were pushed back again by Chinese and Korean forces in the following year. Hideyoshi stubbornly didn't give in until the final evacuation from Korea in 1598, the same year in which he died. Tokugawa Ieyasu, who had been an intelligent partner of Hideyoshi and Nobunaga, succeeded Hideyoshi as the most powerful man of Japan.

19 | JAPAN. ENDLESS DISCOVERY.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Azuchi Castle

Edo Period (1603-1868)-

Tokugawa Ieyasu, who had been an intelligent partner of Hideyoshi and Nobunaga, succeeded Hideyoshi as the most powerful man of Japan. In the battle of Sekigahara in 1600, Ieyasu defeated the western rivals. Hence, he achieved almost unlimited power and wealth. In 1603, Ieyasu was appointed Shogun by the emperor and established his government in Edo (Tokyo). The Tokugawa shoguns continued to rule Japan for a remarkable 250 years. Ieyasu brought the whole country under tight control. Ieyasu continued to promote foreign trade. He established relations with the English and the Dutch. On the other hand, he enforced the suppression and persecution of Christianity from 1614 on. After the destruction of the Toyotomi clan in 1615 when Ieyasu captured Osaka Castle, he and his successors had practically no rivals anymore, and peace prevailed throughout the Edo period. Therefore, the samurai (warrior) were educating themselves not only in the martial arts but also in literature, philosophy and the arts. In 1633, shogun Iemitsu forbade travelling abroad and almost completely isolated Japan in 1639 by reducing the contacts to the outside world to strongly regulated trade relations with China and the Netherlands in the port of Nagasaki. In addition, all foreign books were banned. Even though the Tokugawa government remained quite stable over several centuries, its position was steadily declining for several reasons: A steady worsening of the financial situation of the government led to higher taxes and riots among the farm population. In addition, Japan regularly experienced natural disasters and years of famine that caused riots and further financial problems for the central government. All factors combined, the anti-government feelings were growing and caused other movements such as the demand for the restoration of imperial power and anti western feelings, especially among ultra-conservative samurai in increased. In 1867-68, the Tokugawa government fell because of heavy political pressure, and the power of Emperor Meiji was restored.



Edo period Samurai (Warriors)

20 | JAPAN. ENDLESS DISCOVERY.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

Meiji Period (1868-1912)-

In 1867/68, the Tokugawa era found an end in the Meiji Restoration. The emperor Meiji was moved from Kyoto to Tokyo which became the new capital; his imperial power was restored. The actual political power was transferred from the Tokugawa Bakufu into the hands of a small group of nobles and former samurai. Like other Asian nations, the Japanese were forced to sign unequal treaties with Western powers. These treaties granted the Westerners one-sided economical and legal advantages in Japan. In order to regain independence from the Europeans and Americans and establish herself as a respected nation in the world, Meiji Japan was determined to close the gap to the Western powers economically and militarily. After about one to two decades of intensive westernization, a revival of conservative and nationalistic feelings took place: principles of Confucianism and Shinto including the worship of the emperor were increasingly emphasized and taught at educational institutions. The large expenditures led to a financial crisis in the middle of the 1880's which was followed by a reform of the currency system and the establishment of the Bank of Japan. The textile industry grew fastest and remained the largest Japanese industry until WW2. Work conditions in the early factories were very bad. Conflicts of interests in Korea between China and Japan led to the Sino-Japanese War in 1894-95. Japan defeated China, received Taiwan, but was forced by Russia, France and Germany to return other territories. New conflicts of interests in Korea and Manchuria, this time between Russia and Japan, led to the Russo-Japanese War in 1904-05. The Japanese army also won this war gaining territory and finally some international respect. Japan further increased her influence on Korea and annexed her completely in 1910. In 1912 emperor Meiji died, and the era of the ruling clique of elder statesmen (genro) was about to end.

DID YOU KNOW?

**THE SALARIES OF
FOREIGN SPECIALISTS
INVITED TO JAPAN
DURING MEIJI PERIOD
ARE BELIEVED TO HAVE
AMOUNTED TO 5% OF
ALL GOVERNMENT
EXPENDITURE DURING
THE PERIOD!**



Russo-Japanese War Painting

Taisho and Early Showa Period (1912-1945)-



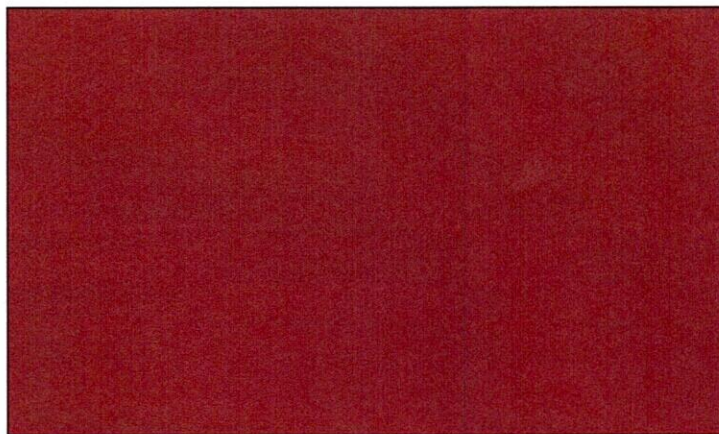
NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

In the First World War, Japan joined the Allied powers, but played only a minor role in fighting German colonial forces in East Asia. At the following Paris Peace Conference of 1919, Japan's proposal of amending a "racial equality clause" to the covenant of the League of Nations was rejected by the United States, Britain and Australia. Arrogance and racial discrimination towards the Japanese had plagued Japanese-Western relations since the forced opening of the country in the 1800s, and were again a major factor for the deterioration of relations in the decades preceding World War 2. In 1924, for example, the US Congress passed the Exclusion Act that prohibited further immigration from Japan. After WW1, Japan's economical situation worsened. The Great Kanto Earthquake of 1923 and the world wide depression of 1929 intensified the crisis. During the 1930s, the military established almost complete control over the government. Many political enemies were assassinated, and communists persecuted. Indoctrination and censorship in education and media were further intensified. Navy and army officers soon occupied most of the important offices, including the one of the prime minister. Japan followed the example of Western nations and forced China into unequal economical and political treaties. Furthermore, Japan's influence over Manchuria had been steadily growing since the end of the Russo-Japanese war of 1904-05. Japanese air force bombarded Shanghai in order to protect Japanese residents from anti Japanese movements in China. In July 1937, the second Sino-Japanese War broke out. The Japanese forces succeeded in occupying almost the whole coast of China and committed severe war atrocities on the Chinese population, especially during the fall of the capital Nanking. However, the Chinese government never surrendered completely, and the war continued on a lower scale until 1945. In 1940, Japan occupied Vietnam upon agreement with the French Vichy government, and joined the Axis powers Germany and Italy. These actions intensified Japan's conflict with the United States and Great Britain which reacted with an oil boycott. The resulting oil shortage and failures to solve the conflict diplomatically made Japan decide to capture the oil rich Dutch East Indies (Indonesia) and to start a war with the US and Great Britain. In December 1941, Japan attacked the Allied powers at Pearl Harbour and several other points throughout the Pacific. Japan was able to expand her control over a large territory that expanded to the border of India in the West and New Guinea in the South within the following six months. On July 27, 1945, the Allied powers requested Japan in the Potsdam Declaration to surrender unconditionally, or destruction would continue. However, the military did not consider surrendering under such terms, partially even after US military forces dropped two atomic bombs on Hiroshima and Nagasaki on August 6 and 9, and the Soviet Union entered the war against Japan on August 8. On August 14, however, Emperor Showa finally decided to surrender.



Taisho-Showa period shopping street. (Which shows that Japan was developing)

Post-war Period (Since 1945)-

After World War II had ended, Japan was devastated. All the large cities (with the exception of Kyoto), the industries and the

22 | JAPAN. ENDLESS DISCOVERY.



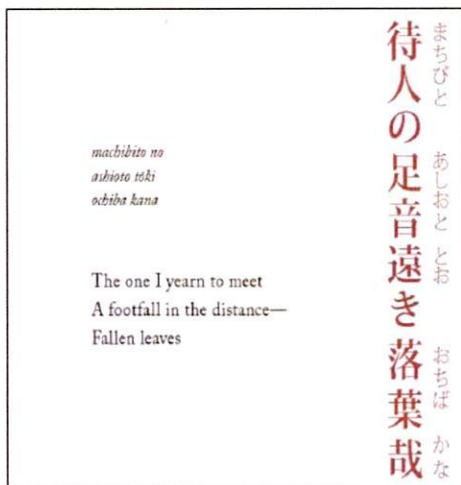
NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



4) Haiku- Poems

Japanese poetry includes various styles, such as haiku, waka, kanshi and tanka, and is one of the most widely known forms of Japanese literature. The first compilation of Japanese poems, the Manyoshu, dates back to the Nara Period in the 8th century. It contains about 4500 poems written by royalty and commoners alike.



Japanese Haiku poem

Festivals-

There are countless local festivals (Matsuri) in Japan because almost every shrine celebrates one of its own. Most festivals are held annually and celebrate the shrine's deity or a seasonal or historical event. Some festivals are held over several days. An important element of Japanese festivals is processions, in which the local shrine's o kami sama (Shinto deity) is carried through the town in palanquins. It is the only time of the year when the o kami sama leaves the shrine to be carried around town. Many festivals also feature decorated floats, which are paraded through the town, accompanied by drum and flute music by the people sitting on the floats. Every festival has its own characteristics. While some festivals are calm and meditative, many are energetic and noisy. Few common festivals of Japan are-

- 1) **Takayama Matsuri**- The Takayama Festival is ranked as one of Japan's three most beautiful festivals alongside Kyoto's Gion Matsuri and the Chichibu Yomatsuri. It is held twice a year in spring and autumn in the old town of Takayama and attracts large numbers of spectators. It is held on two days of spring and autumn.



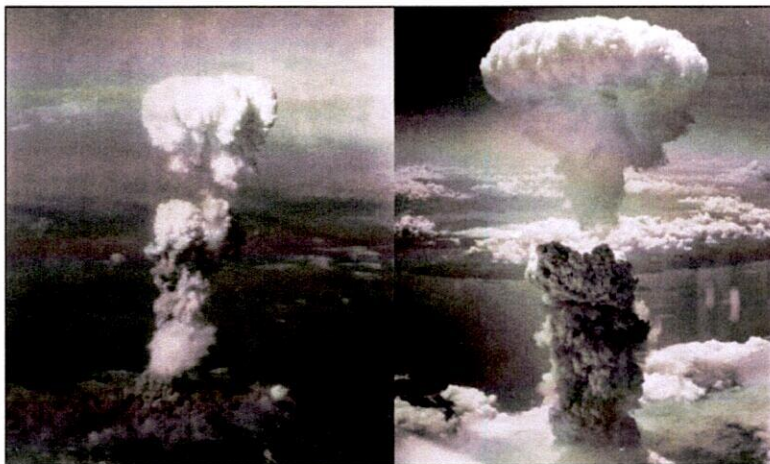


ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

DID YOU KNOW?

**AFTER 1945 NUCLEAR
BOMBING, USA CANNOT
EVEN SELL A NEEDLE IN
JAPAN TILL THE DATE,
DUE TO PATRIOTISM OF
JAPANESE PEOPLE!**

transportation networks were severely damaged. A severe shortage of food continued for several years. The occupation of Japan by the Allied Powers started in August 1945 and ended in April 1952. General MacArthur was its first Supreme Commander. The whole operation was mainly carried out by the United States. Japan basically lost all the territory acquired after 1894. In addition, the Kurile Islands were occupied by the Soviet Union, and the Ryukyu Islands, including Okinawa, were controlled by the USA. Okinawa was returned to Japan in 1972, however a territorial dispute with Russia concerning the Kurile Islands has not been resolved yet. A new constitution went into effect in 1947: The emperor lost all political and military power, and was solely made the symbol of the state. Universal suffrage was introduced and human rights were guaranteed. Japan was also forbidden to ever lead a war again or to maintain an army. Furthermore, Shinto and the state were clearly separated. The co-operation between the Japanese and the Allied powers worked relatively smooth. Critics started to grow when the United States acted increasingly according to interests in the Cold War, reintroduced the persecution of communists, stationed more troops in Japan, and wanted Japan to establish an own self defence force despite the anti-war article in the constitution. With the peace treaty that went into effect in 1952, the occupation ended. Japan's Self Defence Force was established in 1954, accompanied by large public demonstrations. Great public unrest was also caused by the renewal of the US-Japan Security Treaty of 1960. After the Korean War, and accelerated by it, the recovery of Japan's economy flourished. The economic growth resulted in a quick rise of the living standards and changes in society. Japan's relations to the Soviet Union were normalized in 1956, the ones to China in 1972. The 1973 oil crisis shocked the Japanese economy which was heavily depended on oil. The reaction was a shift to high technology industries.



Atomic bombing at Nagasaki and Hiroshima



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



2. 03: CULTURE

Religion-

For centuries Japan is operating as a combination of two different belief systems- Shinto and Buddhist rituals which co-exist side-by-side with increasing influence of other religions. Unlike in the West, religion in Japan is rarely preached, nor is it a doctrine.

Instead it is a moral code, a way of living, almost indistinguishable from Japanese social and cultural values. Japanese religion is also a private, family affair. It is separate from the state; there are no religious prayers or symbols in a school graduation ceremony, for example. Religion is rarely discussed in everyday life and the majority of Japanese do not worship regularly or claim to be religious. Until World War 2, Japanese religion focused around the figure of the Emperor as a living God. Japanese people saw themselves as part of a huge family of which all Japanese people were members.

Today, religions define Japanese identity more than spirituality, and at helps strengthen family and community ties. Shintoism is Japan's indigenous spirituality. It is believed that every living thing in nature (e.g. trees, rocks, flowers and animals - even sounds) contains O kami sama (gods). Consequently Shinto principles can be seen throughout Japanese culture, where nature and the turning of the seasons are cherished. This is reflected in arts such as Ikebana (flower arranging) and bonsai (small Japanese plants) and the annual celebration of Sakura (cherry blossom). Shintoism is the spirituality of this world and this life, whereas Buddhism is concerned with the soul and the afterlife. That's why for the Japanese the two religions exist so successfully together, without contradiction. Japan grants full religious freedom, allowing minority religions such as Christianity, Islam, Hinduism and Sikhism to be practiced. These religions account for roughly 5-10% of Japan's population.

DID YOU KNOW?

THE JAPANESE RELIGION OF SHINTO IS ONE OF THE FEW RELIGIONS WITH A FEMALE SOLAR DEITY!

Many people get confused between Japanese temples and shrines. But, shrines are Shinto and temples are Buddhist. Shrines can be identified by the huge Torii (gate) often painted vermilion red. Luck, fate and superstition are important to the Japanese. Japanese Matsuri (festivals) connected to shrines. In a tradition stretching back centuries Matsuri parades and rituals relate to the cultivation of rice and the spiritual wellbeing of the local community. The most important times of year in the Japanese calendar are New Year, celebrated from the 1st to the 3rd of January, and O-Bon held in the month of August. Here are some etiquette one should follow while entering a shrine:

1. Bow slightly.
2. Gently toss a coin into the box in front of you. Many Japanese people believe that using a 5-yen coin increases their chances of finding a significant other, since go-en is homophonous to the Japanese word meaning "relationship." However, this is nothing more than an urban legend; gods existed before the yen currency did.
3. Ring the bell (if there is one) 2 or 3 times to signal to the gods that you have arrived.
4. Deeply bow twice (until you reach a 90 degree angle).
5. Clap twice, with your left hand slightly in front.
6. Pay your respects, remembering to thank the gods as well.
7. Deeply bow once.

24 | JAPAN. ENDLESS DISCOVERY.

DID YOU KNOW?

FOND OF CATS? THERE IS NYAN NYAN-JI TEMPLE- A SHRINE DEDICATED TO CATS WITH CAT MONKS IN KYOTO!!





ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65



Shinto shrine



O Bon Festival

People-

Japan has a fascinating and multifaceted culture: on the one hand it is steeped in the deepest of traditions dating back thousands of years; on the other it is a society in a continual state of rapid flux, with continually shifting fads and fashions and technological development that constantly pushes back the boundaries of the possible.

DID YOU KNOW?

**SHINTOISM IS THE
MAIN RELIGION OF
JAPAN.**

DID YOU KNOW?

**ONE OF THE OLDEST
TEMPLES IN JAPAN
FOUNDED IN 606 IS
HYAKUSAIJI TEMPLE.
ALSO KNOWN AS
"TEMPLE OF A HUNDRED
COLOURS" FOR ITS
GREENERY AND FALL IN
SPRING!**

Though Japan is still a place of strong tradition, Japanese society is changing and diversifying constantly. Social roles are adapting under the demands of modern life, westernisation and rapidly advancing technology- future Japan will have much more challenges. Also, to cope up with the problems with ageing population is one of the main challenges Japan is facing now. They have to hire young population from other countries for the jobs which can change the culture of Japan. Thus, younger generations are facing a dramatically different working culture in which a job for life is no longer guaranteed. In a highly competitive job market where learning fluent English is seen as one of the keys to success, more and more young Japanese people are studying abroad - mainly in the United States. This means that some are developing more stereotypically western individualist outlooks in their formative years. Apart from foreign immigration, Japanese people and their descendants have moved freely since the borders were opened. Although the census does not recognise them, there are now an estimated 750,000 Japanese citizens with mixed heritage, as well as 1.5 million permanent foreign residents in a total population of around 126 million.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Food and Drinks-

When it comes to food, the Japanese are among the most enthusiastic and passionate of any race. Careful preparation and meticulous presentation are crucial elements of Japanese cuisine. Food is an art form and even the simplest dishes are often prepared by chefs who have trained for many years. Rice has been a staple food for the Japanese for over 2,000 years and still accompanies or forms the base of many meals. Fish is also an integral part of Japanese cuisine. Japan has a huge variety of fruit and vegetables, a whole host of noodle dishes and some of the best patisseries outside of France. If you are a vegetarian, there are various options. Eating meat was prohibited in Japan for more than a thousand years prior to 1868! From a country that survived on a diet of mainly fish and vegetables just over a century ago, Japan has reached the stage where there are now a number of well known fast-food restaurant chains available to choose from. Japanese-style Famiresu (family restaurants) often based on the concept of western chains are also worth a look.

DID YOU KNOW?
MORE THAN 25 BILLION
DISPOSABLE
CHOPSTICKS ARE USED
IN JAPAN ANNUALLY!

DID YOU KNOW?

JOMON POTTERY
VESSELS DATING BACK
SOME 15,000 YEARS ARE
THE OLDEST KNOWN
POTTERY VESSELS IN
THE WORLD!

From Matcha green tea to Sake rice wine- there are many drinks to quench your thirst in Japan. Sake (rice wine) is the national drink of Japan and Beeru (lager-beer) is the most popular drink. Japan is a nation obsessed with vending machines, and you will find one on almost every street corner. Whisky is very popular amongst Japanese men - scotch is considered the best and is highly sought-after. Many Japanese whiskies are now gaining popularity in the west. Sado (Japanese green tea ceremony) is an ancient tradition with roots traced back to Zen Buddhism. Literally translated as "the way of the tea", the ceremony involves the preparation and drinking of tea. It is widely taught in schools across Japan and still remains a popular hobby today. The strict etiquette, graceful movement and elegance in which the way the tea is prepared, poured and consumed is quite a sight.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Alinda
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65



Sushi and Sake



Sashimi

Clothing-

There are typically two types of clothing that the Japanese wear: the Japanese clothing, such as kimonos and Western clothing. The most well known form of Japanese traditional fashion is the kimono (literally means "something to wear"), but other types include the yukata and the hakama. Hakama was traditionally men clothing. It was either worn for martial arts or formal wear. Yukata is an inexpensive, informal summer robe that's popular for cherry blossom viewing parties, festivals and fireworks. Obi is an ornate wide sash that is wrapped around the waist of Kimono. They are very expensive. Happi is a robe-like cotton vest used as a uniform for teams at festivals. It usually comes with a matching headband. Furisode is a kimono with extremely long sleeves in the forearm only worn by adult single women. It is most commonly worn to Coming of Age Day Ceremony (It is a ceremony for a girl who turn 20 years old). Zori is a type of wooden sandal which is considered to be formal.

Sports-

Sports play a significant part in the fabric of modern day Japanese life. From a very young age Japanese children join school teams, installing the sense of pride, hard work and dedication. Some of the other important sports played in Japan are skating, pro-wrestling, rugby, shogi (Japanese chess), horse racing, golf, etc.



Typical Japanese shogi (chess)

1) Sumo

Deeply rooted in Japan's culture, sumo has a history of over 1,500 years. Legend has it that the very survival of the Japanese people balanced on the outcome of a sumo match between the gods, and indeed sumo originated as a form of Shinto ritual. Though it has developed into a professional sport, elements of these rituals are still apparent, from the use of salt to purify the ring, to the shrine-like roof hanging above. But, it is not an official sport of Japan. The pre-bout antics are strict and formalised.

27 | JAPAN. ENDLESS DISCOVERY.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde.

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



the fights are a spectacular blur of flesh, noise and power as the two Man Mountains attempt to push, pull or slap each other out of the ring, or onto any part of their body other than the soles of their suppersize feet.



Huge sumo wrestlers

2) Kendo

Kendo could be described loosely as "Japanese fencing", though the "swords" are today crafted from four substantial bamboo slats, usually held together by leather straps. Its origins lie in the Kamakura period (1185-1333) with the samurai, who needed to practice their swordsmanship. They established "kenjutsu" schools for this purpose, and, with the influence of Zen Buddhism, it took on a rather spiritual as well as physical essence. Over time the swords were replaced with the bamboo staves, and thick, protective body armour was introduced. Today kendo is practiced all over Japan and is a sport for all ages of participants.



Kendo game

3) Judo

Of all of Japan's martial arts, Judo is perhaps the one that has spread most successfully around the world. The essence lies in the speed, subtlety and skill of using the size and strength of the opponent against themselves. The inspiration for judo was born out of the bullying that Jigoro witnessed at the English medium boarding school he attended in Tokyo, when he was just fourteen years old.





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Traditional judo game

4) Yakyuu

The undisputed king of team sports in Japan is baseball, introduced by an American at the end of the nineteenth century. Although happy to take on a foreign sport, the Japanese were keen that it should have a distinctly Japanese name, so whilst most other global sports are known by an approximation of their English name, but, baseball is known as yakyuu.



Simulation of Yakyuu

Sakura- Cherry Blossom

Spring in Japan can only mean one thing: cherry blossom. Sandwiched between the long, bitter winter months and the sweltering humidity of summer, spring is by far the most popular time for tourism in Japan - both domestic and international. The cherry blossom "front" sweeps along the length of the country each year, beginning with Okinawa in the far south in February and working its way along Japan to northern Hokkaido in May. Typical hanami (enjoy cherry blossom) spots include city parks, landscape gardens, castle grounds and along riverbanks, and you'll find all of these areas buzzing with people throughout the sakura season. The blossom usually only hangs around for a couple of weeks - sometimes less if there is heavy rain on the cards - so you only have a brief window in which to enjoy the trees in full bloom. So popular are these parties that some companies will pay a member of staff to sit in the park all day, saving a spot for the office hanami in the evening! If you're in Japan during hanami season, it can seem as though the country has gone a little sakura-mad. Not only are there blossom-themed events and festivals going on up and down the country, but even the products in the supermarkets reflect the coming season - with limited edition, sakura-flavoured foods and drinks on the menu.





ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65



Sakura, Japanese castle and a river.

Art-

1) Ikebana- Flower arrangement art

Ikebana is the Japanese art of flower arrangement. It is more than simply putting flowers in a container. It is a disciplined art form in which the arrangement is a living thing where nature and humanity are brought together. It is steeped in the philosophy of developing closeness with nature. As is true of all other arts, ikebana is creative expression within certain rules of construction. Its materials are living branches, leaves, grasses, and blossoms. Its heart is the beauty resulting from color combinations, natural shapes, graceful lines, and the meaning latent in the total form of the arrangement. Ikebana is, therefore, much more than mere floral decoration.



Ikebana art

2) Origami- Paper folding art

Origami from ori meaning "folding" and kami meaning "paper" (kami changes to gami) is the art of paper folding, which is often associated with Japanese culture. In modern usage, the word "origami" is used as an inclusive term for all folding practices, regardless of their culture of origin. The goal is to

30 | JAPAN. ENDLESS DISCOVERY.



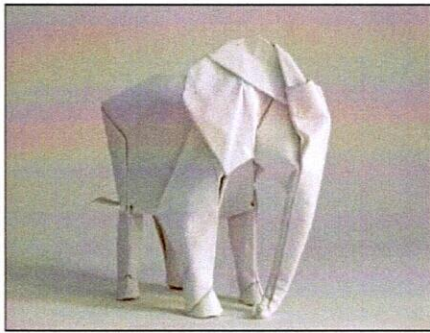
NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Blinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



transform a flat square sheet of paper into a finished sculpture through folding and sculpting techniques. Modern origami practitioners generally discourage the use of cuts, glue, or markings on the paper. Origami folders often use the Japanese word kirigami to refer to designs which use cuts.



Origami Bird

3) Geisha and Maiko- The artist perform various traditional arts of Japan

Like most nations, Japan has always had some manner of pleasure quarter offering various forms of entertainment. As Japan cut off all contact with the outside world during the Edo era, the rich merchants of the cities continued to develop the arts of the country in the major urban areas. With the many courtesans of the time providing one area of fulfilment, the merchants looked for other types of entertainment, including music, dance and poetry. From these early stages, the world of the geisha developed, providing a service to entertain and charm, working alongside the very desirable, and for most people unobtainable, courtesan. As this form of entertainment progressed, the first geisha on the scene were actually men, appearing around the early eighteenth century. Women soon caught on, and the geisha as we know her today emerged with strict rules. Nowadays if you long to experience geisha culture, you must head to the cultural capital of Kyoto. Under a hundred geisha remain in the city, living and working in the traditional teahouses as they always have done. The inevitable declining numbers due to the strict and secular world make this profession as elite and enigmatic as it always has been. If you wish to meet and drink with a maiko or geiko (the performers of Geisha), it's all about who you know - and they don't come cheap. Most only work at licensed ochaya (teahouses) in the geisha districts, often veiled behind anonymous wooden doors, with small discreet signs that most passersby wouldn't detect. Due to the demanding lifestyle of the geisha and the pressures of the modern world, numbers are declining. The image of Japan is one constantly pushing forward into the future, and whilst some may say the geisha world is outmoded and losing its dignity, the links to the past and tradition in Japan are astoundingly enduring. As long as Japan continues to hold its rich and respected culture paramount, the world of the geisha as we know it will continue to survive.



Geisha artists





- 2) **Aoi Matsuri**- The Aoi Matsuri is one of Kyoto's three most famous festivals (along with the Gion Matsuri and Jidai Matsuri) and takes place every May 15. The festival's main attraction is a large parade in Kyoto: in which over 500 people dressed in the aristocratic style of the Heian Period (794-1185) walk from the Imperial Palace to the Kamo Shrines.



- 3) **Gion Matsuri**- Gion Matsuri is the festival of Yasaka Shrine, is the most famous festival in Japan. It takes place over the entire month of July. There are many different events, but the grand procession of floats (Yamaboko Junko) on July 17 is particularly spectacular. Very enjoyable are also the festive evenings preceding the procession (Yoiyama). From 2014, a second procession of floats was reintroduced on July 24 after a hiatus of 48 years.



- 4) **Sapporo Snow Festival**- The Sapporo Snow Festival (Sapporo Yuki Matsuri) is held during a week every February in Hokkaido's capital Sapporo. It is one of Japan's most popular winter events. The Sapporo Snow Festival was started in 1950, when high school students built a few snow statues in Odori Park. It has since developed into a large, commercialized event, featuring spectacular snow and ice sculptures and attracting more than two million visitors from Japan and across the world. The snow festival is staged on three sites: the Odori Site, Susukino Site and Tsu Dome Site.





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



- 5) **Tanabata Matsuri**- Tanabata Matsuri takes place from the 6th to the 8th of August in Sendai City, Miyagi. It is a festival based on the Chinese legend about two stars, Altair and Vega. You will find thousands of huge colourful paper decorations hanging in the streets.



Language-

Japanese is the national language of Japan. It is 2nd toughest language in the world after Chinese. It has 3 different scripts- Hiragana, Katakana and Kanji. Japanese has no genetic relationship with Chinese, but it makes extensive use of Chinese characters, or kanji in its writing system, and a large portion of its vocabulary is borrowed from Chinese. Traditional Japanese is written from right to left and vertically. But now, western style (Horizontal and left to right) is used to write. Although Japanese is spoken almost exclusively in Japan, it has been spoken outside. Before and during World War II, through Japanese annexation of Taiwan and Korea, as well as partial occupation of China, the Philippines, and various Pacific islands, locals in those countries learned Japanese as the language of the empire. As a result, many elderly people in these countries can still speak Japanese. But, Japanese is one of the least learned languages in the world. Dozens of dialects are spoken in

DID YOU KNOW?

**JAPANESE LANGUAGE
HAS 3 SCRIPTS-
HIRAGANA,
KATAKANA & KANJI**



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Alvika
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400.001.



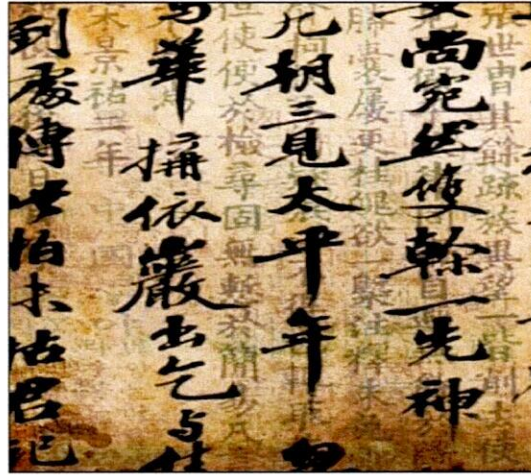
ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

Japan. Dialects typically differ in terms of pitch accent, vocabulary, and particle usage.



Architecture-

Japanese architecture has been typified by wooden structures, elevated slightly off the ground, with tiled or thatched roofs. Sliding doors were used in place of walls, allowing the internal configuration of a space to be customized for different occasions. Since the 19th century, however, Japan has incorporated much of Western, modern, and post-modern architecture into construction and design, and is today a leader in cutting-edge architectural design and technology. In Japanese traditional architecture, there are various styles, features and techniques unique to Japan in each period and use, such as residence, castle, Buddhist temple and Shinto shrine. On the other hand, especially in ancient times, it was strongly influenced by Chinese culture like other Asian countries, so it has characteristics common to architecture in Asian countries.

In Japan, earthquakes are regular events. Japanese have managed to build earthquake proof buildings using the best technology in modern times. Thanks in part to materials that are flexible and shock-absorbent as well as modern tools to test and analyze the performance of a building, the architecture and engineering seen in Japan is among the most resilient in the world, with even some older buildings retrofitted to make them more earthquake-resistant. There are huge rubber pads under the sky scrapers which stop the base from shaking due to earthquake. Earlier, there used to be huge pillars buried deep inside the ground till the top and the shrine or temple used to be constructed taking support of the pillar. It made them earthquake resistant.

35 | JAPAN. ENDLESS DISCOVERY.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

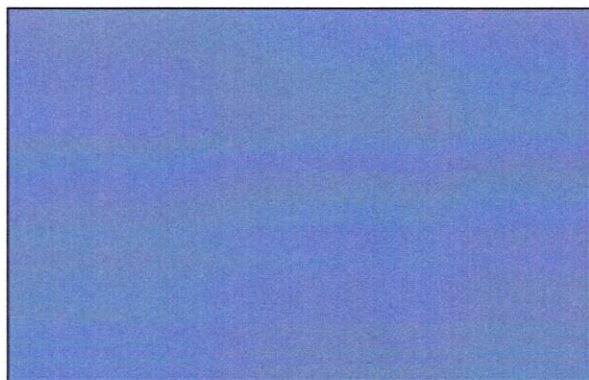
Alunde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Japanese traditional shrine and temple



Tokyo skyline

2.04: CURRENT POLITICAL SCENARIO

The politics of Japan are conducted in a framework of a multi-party bicameral parliamentary representative democratic constitutional monarchy whereby the Emperor is the ceremonial head of state and the Prime Minister is the head of government and the head of the Cabinet, which directs the executive branch. Legislative power consists of the House of Representatives and the House of Councillors. Judicial power is under the Supreme Court and lower courts, and sovereignty is under in the Japanese people by the Constitution. Japan is considered a constitutional monarchy with a system of civil law. The Constitution of Japan defines the Emperor to be "the symbol of the State and of the unity of the people". He performs ceremonial duties but holds no real power. Political power is held mainly by the Prime Minister and other elected members. The Imperial Throne is succeeded by a member of the Imperial House as designated by the Imperial Household Law. The chief of the executive branch, the Prime Minister, is appointed by the Emperor. He is a member of either house of the political parties and must be a civilian. The current Prime Minister is Mr. Shizo Abe and recently from 1st of May, there was change in the era of Japanese emperor. The new era is named as 'Reiwa' and the emperor is Naruhiro.

Recently on 1st of December, India-Japan held an inaugural security talks. India said that ties with Japan is a key to stability in the Indo-Pacific region as the two countries held their inaugural foreign and defence ministerial dialogue in New Delhi with an aim to further bolster strategic partnership. Defence Minister Rajnath Singh and External Affairs Minister S. Jaishankar headed the Indian

36 | JAPAN. ENDLESS DISCOVERY.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde
PRINCIPAL

ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

delegation, while the Japanese side was led by Foreign Minister Toshimitsu Motegi and Defence Minister Taro Kono. They took place following a decision by Indian Prime Minister Narendra Modi and his Japanese counterpart, Shinzo Abe, during a summit between the leaders last year. Singh held talks with Kono on a range of issues. The Press Trust of India news agency reported that the two ministers discussed deepening ties in the development of weapons and military hardware. Shuri-ji castle is to be restored by the designs led by resurrection. Work to rebuild Okinawa Prefecture's treasured Shuri-jo castle, including its Seiden main hall, will be based on designs used to reconstruct it after it was destroyed in the 1945 Battle of Okinawa. Reconstruction of the castle using those designs was completed in 1992, but further work carried on up until the day before the Oct. 31 fire this year that again reduced large areas of the site to ashes. The decision to use the designs was made at a ministerial meeting on restoring the UNESCO World Heritage site in Naha on Dec. 2. The castle, which served as a centre of politics and culture for the Ryukyu Kingdom (1429-1879), burned down in a fire believed to have been caused by an electrical short. The government said it will finalize its basic policy on the work before year-end. It is also officially decided to establish an expert panel in the Okinawa General Bureau of Cabinet Office to facilitate assembling building materials and craftsmen for the project. Okinawa Governor Denny Tamaki participated in the meeting. A representative from the Okinawa prefectural government will take part in the expert panel.



Mr. Toshimitsu Motegi, Mr. Taro Kono, Mr. Rajnath Singh and Mr. Jaishankar S



Government Seal of Japan



Emperor Naruhito and his family



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

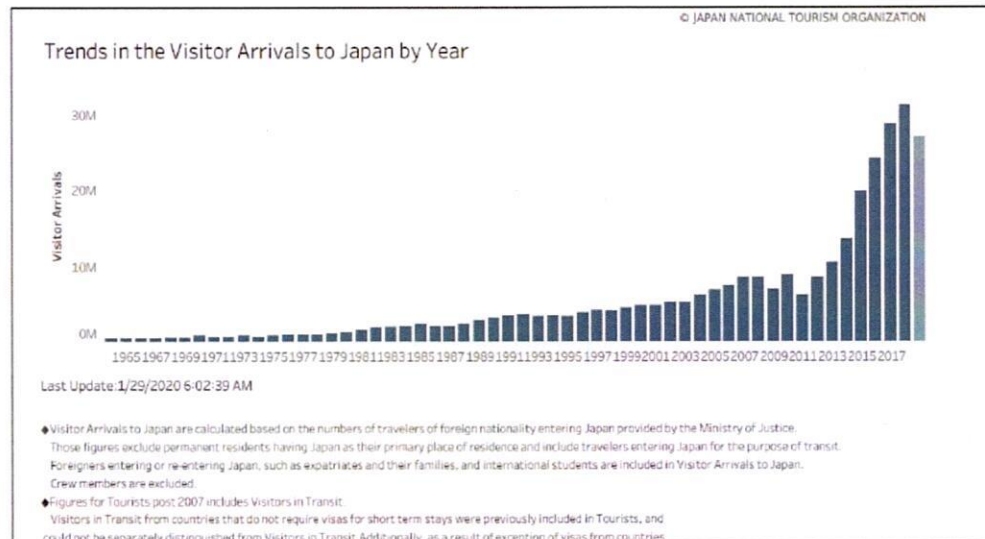
Shunde.
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.

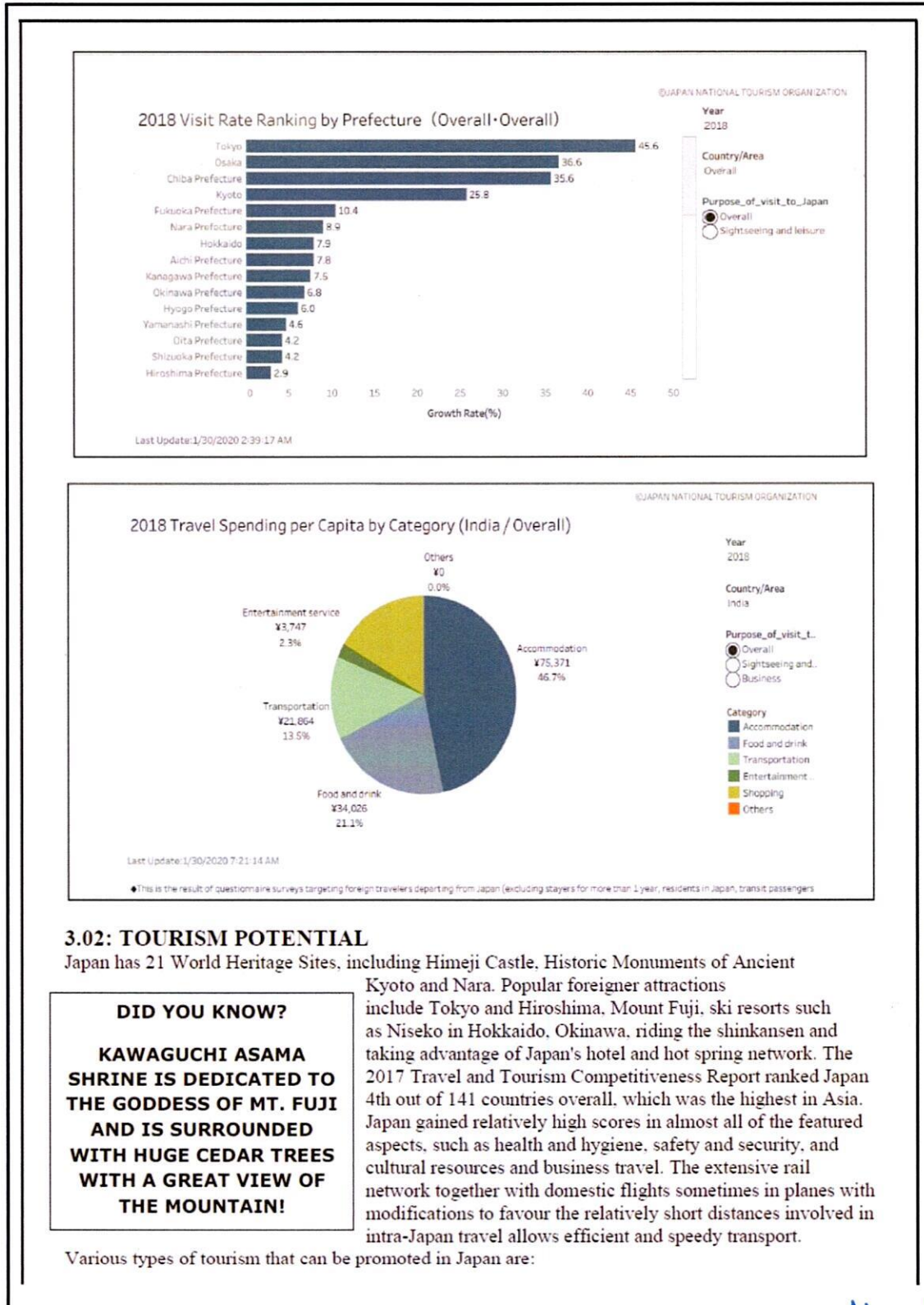


CHAPTER 3- TOURISM IN JAPAN

3.01: CURRENT TOURISM SCENARIO

In contrast to the rapid development of outbound tourism since the 1980s, inbound tourism has played a minor role in Japan until 2002, when the Japanese government embarked on a policy of active enticement of foreign tourists. Through active promotion and pushed by economic development in neighbouring countries, visitor numbers almost doubled from 4,771,555 in 2001 to 8,350,835 in 2008; since then, worldwide economic downturn, disaster, and a soaring yen have taken their toll. Being able to attract tourists from overseas leads to greater international understanding of Japan and more exchanges with people from abroad. The depreciation of the yen since 2012 made travel to Japan more affordable, and the government took steps such as easing visa requirements for tourists from Southeast Asia as well as increasing the number of duty-free shops, while more flights to Japan by low-cost carriers also shored up inbound tourism. In the first 10 months of 2018, travellers from four East Asian economies China, South Korea, Taiwan and Hong Kong accounted for 74 percent of the total, while the share of tourists from Europe, North America and Australia came to around 12 percent a regional breakdown that has remained roughly the same for the past few years. Because the growth in the number of tourists from East Asia is expected to slow down, one of the challenges is to attract more travellers from Western countries and Southeast Asia to diversify the sources of inbound tourists. Following are the three statistics which includes the data of 1- Trends in the visitor arrival to Japan each year, 2- Prefecture-wise arrival of the tourists and 3- consumption of Indian tourists in Japan





3.02: TOURISM POTENTIAL

Japan has 21 World Heritage Sites, including Himeji Castle, Historic Monuments of Ancient

Kyoto and Nara. Popular foreigner attractions include Tokyo and Hiroshima, Mount Fuji, ski resorts such as Niseko in Hokkaido, Okinawa, riding the shinkansen and taking advantage of Japan's hotel and hot spring network. The 2017 Travel and Tourism Competitiveness Report ranked Japan 4th out of 141 countries overall, which was the highest in Asia. Japan gained relatively high scores in almost all of the featured aspects, such as health and hygiene, safety and security, and cultural resources and business travel. The extensive rail network together with domestic flights sometimes in planes with modifications to favour the relatively short distances involved in intra-Japan travel allows efficient and speedy transport.

DID YOU KNOW?

KAWAGUCHI ASAMA SHRINE IS DEDICATED TO THE GODDESS OF MT. FUJI AND IS SURROUNDED WITH HUGE CEDAR TREES WITH A GREAT VIEW OF THE MOUNTAIN!

Various types of tourism that can be promoted in Japan are:





Cultural Tourism-

Experiencing geisha and other theatre arts like kabuki, etc can promote tourism in Japan. It is a typically authentic Japanese culture one can experience when in Japan. Many other cultural aspects like hanami, tea ceremony, etc can be experienced. Uchiko is a charming retro town located in Ehime prefecture, on the island of Shikoku. Yokaichi old town is a street lined with 90 Meiji period houses, which sport the areas trademark yellow plaster and white detailing. They have been beautifully preserved, so the townscape still looks as it did when this was a huge centre for wax and paper-making.

Leisure Tourism-

One can visit Japan just for leisure and the tourists won't be disappointed.

Religious Tourism-

The main religions of Japan are Shinto and Buddhism. There are many Buddhist temples and Shinto shrines throughout the country. They can be major tourist attractions in Japan. There are many ancient pilgrimage routes in western Japan.

Adventure Tourism-

One can hike on Mt. Fuji and Japanese Alps. Japan experiences snowfall from the month of December to March. Hence, snow skiing can be the major adventure sport in Japan. Japanese tourism board has developed many snow resorts.

MICE/Business Tourism-

Japan is known for its IT and automobile industry. Hence there are many people who come to Japan just for business purpose.

Educational Tourism-

Government of Japan is coming up with various exchange programs and courses in English language for foreigners. They are providing with many scholarships to young and enthusiastic students.

Health Tourism-

Onsen (Hot water spring) are very famous in Japan. They are not just rejuvenating and relaxing but also healthy. Spas are developed in famous resort chains and ryokans.

Dark Tourism-

There are sites like Hiroshima and Nagasaki which were affected by the World War. Many people suffered during that period. Now there are museums created for people to know the history.

Wildlife Tourism-

Nara is famous for its deer. There are many other Japanese species of animals which tourists can experience.

Sustainable Tourism-

Japan is very famous for its sustainability. They follow the 3 'R' systems. Thus if you want to experience sustainable tourism, Japan can be the best place.

Sport and Recreational Tourism-

A very great example is upcoming Tokyo 2020 olympics. There are many sports in Japan which tourists can experience. For eg. Judo, karate, yakyuu, etc

Historic Tourism-

There are many castles and palaces which portraits the rich history and culture of the country.

Agro Tourism-

Japan is not really promoting agro tourism but the countryside of Japanese prefectures has many small gardens which are owned by the locals. They spend almost whole day in taking care of the plants in the garden. If you opt for home stays in the countryside, you can experience the agricultural practices in Japan. Yamakoshi is a small farming village in Niigata prefecture. Niigata is top rice-producing region

40 | JAPAN. ENDLESS DISCOVERY.

DID YOU KNOW?

**JAPAN HAS A FAMOUS
DUNE AREA IN
TOTTORI PREFECTURE-
TOTTORI SAND
DUNES.IT IS THE
LARGEST OF THEIR
KIND IN JAPAN.**

DID YOU KNOW?

**AMAMI ARCHIPELAGO
IN KAGOSIHMA
PREFECTURE IS KNOWN
FOR ITS WORLD CLASS
SCUBA DIVING, WHITE
SANDY BEACHES AND
CORAL REEFS!**



Alinda



in Japan and Yamakoshi has amazing views of terraced rice paddy fields. Village maintains its original Japanese landscape from olden times which makes it a must visit place when in Japan.

3. 03: TOURISM POLICY

Over the past three years, the Abe administration has implemented a number of reforms in the tourist industry, including the strategic relaxation of visa requirements, a significant increase in duty-free stores, and an increase in flights to Japan. As a result, international visitors increased to 20 million people in 2015, more than doubling from three years ago. Spending by international visitors increased to 3.5 trillion yen, more than triple the figure for three years ago and nearly as much as earned by the exportation of automobile parts. International visitors have been steadily increasing, with every month bringing a new record in visitors for that month. There are a limited number of countries that excel in all of the four fundamental pillars required for a strong tourist industry: a diverse natural environment, a rich history and culture, seasonal diversity and world-class cuisine. By leveraging these to-date undeveloped tourism resources, Japan should be able to expand its tourism industry significantly to the benefit of the whole nation. Tourism development is one of the main components of the regional revitalization strategy, and the pillar of the administration's economic growth strategy that aims to increase GDP to 600 trillion yen. A firm commitment must be made by the whole country to create a world-class tourist industry in Japan, in line with that in other major developed countries. The administration has set a new set of much more aggressive targets for the tourist industry:

- International visitors to Japan: 2020: 40 million tourists & 2030: 60 million tourists
- Spending on travel by international visitors to Japan 2020: Yen 8 trillion & 2030: Yen 15 trillion
- Guest nights spent by international visitors outside three major metropolitan areas 2020: 70 million guest nights
- International repeat visitors 2020: 24 million & 2030: 36 million
- Spending on travel by domestic Japanese tourists 2020: Yen 21 trillion & 2030: Yen 22 trillion

The objective being the world-class tourist industry! Japan is ready to welcome international visitors throughout the country. The government wishes to develop dynamic multicultural exchange so that Japan can truly open to the world, rapidly develop new services and innovations in the tourism sector and thereby create a positive cycle which enhances regional economies and industry. There is a need to create jobs in the regional economies through tourism, to develop human resources and to reform the tourism industry to improve its international competitiveness and productivity. Prompt improvement of the visitor environment is required i.e. hotels and other accommodations, telecommunications, transportation and payment systems. At the same time, there is the need to create the infrastructure to allow every traveller, including the elderly and people with disabilities, to experience 'the joy of travelling' in Japan.

The Tourism Vision of Japan tourism proposes the following 'three basic visions' recognizing the fact that 'tourism is a major pillar of Japan's strategy for economic growth and regional revitalization'. All levels of government, all ministries, and the public and private sectors will work together to improve Japan tourism and make all the services world-class.

- **Vision 1:** Maximizing the attractiveness of tourism resources in order to make tourism the base of regional revitalization
- **Vision 2:** Foster innovation in the tourism industry to boost its international competitiveness and develop it into a core industry
- **Vision 3:** Ensure all visitors may enjoy a satisfying, comfortable and stress-free sightseeing experience

For the 2020 Tokyo Olympic and Paralympics Games, it is necessary to incorporate higher-level comprehensive design at individual tourist destinations and transportation facilities, while implementing barrier-free awareness development projects throughout the country. Implementation of city planning and barrier-free mindset development projects throughout the country based on the "Tokyo 2020 Accessibility Guidelines," thereby satisfying possible demand and increasing consumption. To improve the domestic tourism industry, work/holiday reforms to encourage workers to take more

41 | JAPAN. ENDLESS DISCOVERY.

DID YOU KNOW?

VISIT

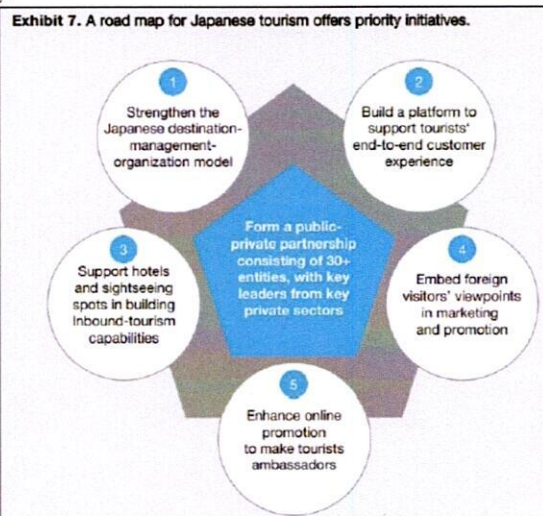
<https://www.japan.travel/en/in/> FOR THE BEST
INFORMATION ABOUT
JAPAN TOURISM





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

annual paid holidays are being promoted. To achieve innovation in the public transportation environment online reservation (made in overseas countries) for the main public transportation forms including shinkansen bullet trains and express buses is accepted. Frequency of LCC's is improved to enhance internal travel. The use traditional Japanese culture and modern attractions as the foundation for marketing to Western countries and leveraging the 2020 Tokyo Olympics wave of publicity to raise the perception of Japan in the eyes of foreign tourists. If this is executed well, Japan tourism could flourish for another decade. Japan is reaching out to western movie or music celebrities or key opinion leaders to promote Japan to western countries using their social media influence or blogs is another speedy way to reach a target audience. In India, every year in January, Japanese Film Festival (JFF) is held in 6 cities of various states. So that people in Indian can get an idea of what Japan is, what Japanese culture is and they will visit Japan at least once. This festival is held in many other countries as well. Japan's official tourism website is an important portal through which the government can enhance awareness of Japan's assets and paint a vivid picture of what travellers can experience during a visit to the country. Japan is forming a public-private partnership (PPP) for tackling the largest underlying obstacle to growing Japan's inbound tourism that is a lack of leadership and coordination across the industry. It will require a sustained effort to influence potential visitors across the customer decision journey. No one entity has the scale and reach to make an impact on its own. The pool of potential visitors is simply too large and the channels of engagement too varied. Implementing an effective, comprehensive strategy, therefore, calls for a broad-based effort that seeks to harness the resources and energy of all stakeholders, including both government agencies and private-sector organizations that directly or indirectly benefit from increased tourism. Today, government agencies and private-sector businesses interact with travellers on a regular basis, but they typically do not coordinate their actions or share information with other organizations across the network sufficiently. While some airlines, travel companies, and other stakeholders have begun forming collaborative partnerships, these relationships have not yet taken root in industries and entities where inbound demand is a low priority or where capabilities are lacking. In many cases, government agency staff and budgets are allocated on a yearly basis, so maintaining the focus and resources to implement ongoing measures has proved difficult. Due to the potential tourists, coordination, transparency, collaboration are needed. Therefore, the formation of a PPP whose sole mission is to increase Japan's inbound tourism is an enabling factor for the five levers. Stakeholders that stand to benefit such as airlines, airports, travel agents, hotels, infrastructure businesses, ryokans (Japanese Inns) and other peripheral industries should be tapped to join this mission, make connections with other players, and create platforms that strengthen Japan's inbound tourism industry.



42 | JAPAN. ENDLESS DISCOVERY.



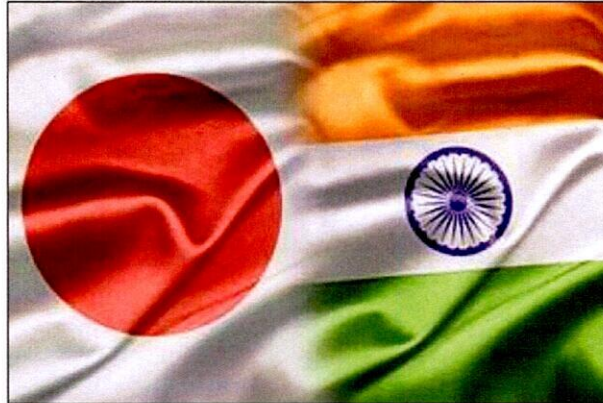
NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

3.04: INDIA-JAPAN RELATIONS



DID YOU KNOW?

**JAPAN AND INDIA HAVE
VERY STRONG
RELATIONS FROM MANY
CENTURIES!!**

India-Japan relations have traditionally been strong. Exchange between Japan and India is said to have begun in the 6th century when Buddhism was introduced to Japan. Indian culture, filtered through Buddhism, has had a great impact on Japanese culture, and this is the source of the Japanese people's sense of closeness to India. India's earliest documented direct contact with Japan was with the Todaiji Temple in Nara, where the consecration or eye-opening of the towering statue of Lord Buddha was performed by an Indian monk, Bodhisena, in 752 AD.

After World War II, in 1949, Indian Prime Minister Jawaharlal Nehru donated an Indian elephant to the Ueno Zoo in Tokyo. This brought a ray of light into the lives of the Japanese people who still had not recovered from defeat in the war. Japan and India signed a peace treaty and established diplomatic relations in 1952. This treaty was one of the first peace treaties Japan signed after World War II. In the post World War II period, India's iron ore helped a great deal Japan's recovery from the devastation. Japanese Prime Minister Nobusuke Kishi's visit to India in 1957. Japan started providing yen loans to India in 1958. Prime Minister Yoshiro Mori's visit to India in August 2000 provided the momentum to strengthen the Japan-India relationship. The visit of their Highnesses, the then Japanese Crown Prince Akihito and Crown Princess Michiko in 1960 elevated the relations to a new level. A test of the reliability of Japan as a friend was witnessed in 1991, when Japan was among the few countries that bailed India out of the balance of payment crisis. Mr. Mori and Prime Minister Atal Bihari Vajpayee decided the establishment of "Global Partnership between Japan and India". The transformation of our ties with Japan were provided further fillip by the decision to have annual summits between the Prime Ministers commencing 2006. In contemporary times, among prominent Indians associated with Japan were Swami Vivekananda, Rabindranath Tagore, JRD Tata, Netaji Subhash Chandra Bose and Judge Radha Binod Pal. The sole dissenting voice of Judge Radha Binod Pal at the War Crimes Tribunal struck a deep chord among the Japanese public that continues to reverberate to this day. The Japan-India Association was set up in 1903, and is today the oldest international friendship body in Japan. When Prime Minister Manmohan Singh visited Japan in December 2006, Japan-India relationship was elevated to the "Global and Strategic Partnership". Japan is regarded as a key partner in India's economic transformation. In the recent past, the India Japan relationship has transformed to a partnership of great substance and purpose because of India's rapidly growing economy and the new economic opportunities created have caught the attention of the Japanese corporate sector, which is a driving force behind closer bilateral relations. PM Abe pledged to realize public and private investments worth JPY 3.5 trillion and doubling of the number of Japanese companies in India over the next five years (Till 2019). A Comprehensive Economic Partnership Agreement (CEPA) between Japan and India was concluded in 2011. Prime Minister Narendra Modi paid an official visit to Japan



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

and had a summit meeting with Prime Minister Shinzo Abe. They agreed that Japan-India relationship was upgraded to "Special Strategic and Global Partnership." In December 2015, Prime Minister Abe paid an official visit to India and had a summit meeting with Prime Minister Narendra Modi. The two Prime Ministers resolved to transform the Japan-India Special Strategic and Global Partnership into a deep, broad-based and action-oriented partnership, which reflects a broad convergence of their long-term political, economic and strategic goals. They announced "Japan and India Vision 2025 Special Strategic and Global Partnership Working Together for Peace and Prosperity of the Indo-Pacific Region and the World" a joint statement that would serve as a guide post for the "new era in Japan-India relations." Prime Minister Abe intended to make an effort to realize 3.5 trillion yen of public and private investment and financing, including Official Development Assistance (ODA), to India over the coming five years. The Ahmedabad-Mumbai High Speed Rail, the Western Dedicated Freight Corridor (DFC), the Delhi-Mumbai Industrial Corridor with twelve new industrial townships, the Chennai-Bengaluru Industrial Corridor (CBIC) is these entire mega projects which were declared in 2015 will transform India in the next decade. Delhi Metro Project has also been realized with Japanese assistance. The railway's operation of Ahmedabad-Mumbai Shinkansen would commence in 2023. It will help boosting tourism sector in India. Japan expects India for improving the business environment, including the easing of regulations and the stabilization of the system. India and Japan concluded 15 MoUs or agreements in panoply of areas ranging from connectivity, investments, civil aviation, Japanese language training, disaster risk management, science and technology and sports. In 2018, Prime Minister Narendra Modi was hosted by Prime Minister Shinzo Abe for a private dinner at his ancestral home in Yamanashi, the first such reception to be extended to a foreign leader. A cultural agreement was signed between India and Japan on 29 October 1956, which came into effect on 24 May 1957. In 1951, India established a scholarship system for young Japanese scholars to study in India. Prime Minister Rajiv Gandhi attended the April 1988 opening ceremony of the Festival of India. The Vivekananda Cultural Centre in Tokyo opened in September 2009. The Centre offers classes on Yoga, Tabla, Bharatanatyam, Odissi, Sambalpuri, Bollywood dances and Hindi and Bengali languages. In recent years, there has been a change in the composition of the Indian community with the arrival of a large number of professionals, including IT professionals and engineers working for Indian and Japanese firms as well as professionals in management, finance, education, and S&T research. Approximately 38,423 Indians live in Japan as of 2019. India-Japan Defence and Security partnership has evolved over the years and today forms an integral pillar of the bilateral ties. India-Japan exchanges have strengthened due to growing convergence on strategic matters; and its significance is growing from the common outlook on issues of peace, security and stability of the Indo-Pacific Region. Coast Guards have regular annual exchanges since 2006. Under the MoC signed in 2016 to train 30,000 shop floor leaders, Japanese companies have established 12 Japan India Institute of Manufacturing (JIM) in India and 4 Japanese Endowed Courses (JEC) in Indian Engineering Colleges. Following the signing of MoC on Technical Intern Training Programme (TITP), NSDC completed the first round of accreditation of 23 Sending Organizations in March 2018 that are recognized by Japan for accepting interns under TITP. As of March 2019, 31 TITP interns arrived in Japan including the first batch of Indian nurses as elderly care-workers to Japan. Following the 2017 MoC in the field of Disaster Risk Reduction, the Cabinet Office of Japan and Ministry of Home Affairs of India jointly organized a series of workshops to exchange information on policy and measures on disaster risk reduction, and to enhance cooperation between Japan and India. The first workshop was held in March 2018 in New Delhi; the second in October 2018 in Tokyo and the third workshop on 18 March 2019 in New Delhi. In view of synergies and complementarities between the two nations, "India-Japan Digital Partnership" (I-JDP) was launched during the visit of PM Modi to Japan in October 2018 furthering existing areas of cooperation as well as new initiatives within the scope of cooperation in S&T/ICT, focusing more on Digital IC Technologies. During Minister Seko's visit to India in May 2018, both sides signed Joint Statement on Japan-India start-up initiative setting up the first start-up hub in Bangalore by JETRO to identify selected Indian start-ups for Japanese market and for potential Japanese investors.

44 | JAPAN. ENDLESS DISCOVERY.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65



PM Shinzo Abe and PM Narendra Modi

45 | JAPAN. ENDLESS DISCOVERY.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Alinda
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

CHAPTER 4- 6 A's OF TOURISM

4.01: OVERVIEW

Japan is well accessible by air from all major Indian cities. The fare ranges from INR 30,000- INR 45,000 depending upon the season and when you book your tickets. Accessibility within Japan is the best. Shinkansen is used for long distance travel; highways are used to travel within the same prefectures. You can reach anywhere in Japan in not more than 5 hours because of ultra developed and comfortable transport system. China, Taiwan and Russia being very close to Japan, they are well-connected by water.

For attractions, I've selected the same cities as my itinerary as they are most loved by the tourists and the main cities of Japan. There is a lot to see in these cities namely Tokyo, Osaka, Kyoto, Hiroshima and Miyajima. People from all age groups can enjoy here. I have included parts of cultural Japan as well as modern Japan.

Most of the activities are common in any part of Japan. So there was nothing specific to segregate them as per the cities I have selected. There are so many activities that even 1 month will be less to experience them all.

There are various types of accommodation right from beautiful resorts or 5* properties to ryokans and hostels and cheap BnB with great facilities. Tourists have many options varying according to the budget.

If you go to Japan through a travel agency, it can be bit expensive. You can also do backpacking in Japan as all the facilities in Japan are the best and you can rely on them.

4.02: ACCESSIBILITY

To Japan-

Japan being an island country, one cannot travel to Japan by surface route like rail and road. Only air or sea can be used to travel to Japan. From India, Japan is well connected by direct flights from Delhi to Narita Airport or Haneda Airport (Tokyo) and Kansai Airport (Osaka). Whereas other cities like Mumbai, Chennai, Bengaluru, Kolkata, Hyderabad, etc have connecting flights to Tokyo and Osaka as they are the main cities of Japan. Cathay Pacific, Air Asia, Japan Airlines, All Nippon Airlines, Thai Airways, Singapore Airlines, Vistara Airlines, VietJet, Malaysian Airlines, etc operate regular flights to Japan from India. International ferry services to Japan are available, from Korea, China, Taiwan and Russia. Busan-Osaka, Shanghai-Osaka/Kobe, Keelung-Ishigaki/Naha and Russia to Japan via Sakhalin are some of the major ferries.



In Japan-

Transportation in Japan is modern and highly developed. Japan's transport sector stands out for its energy efficiency: it uses less energy per person compared to other countries. Transport in Japan is also very expensive in international comparison.

46 | JAPAN. ENDLESS DISCOVERY.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



DID YOU KNOW?

THE RICKSHAW WAS NOT DEVELOPED UNTIL 1869, AFTER THE TOKUGAWA BAN ON WHEELED TRANSPORT WAS LIFTED.

reflecting high tolls and taxes, particularly on automobile transport. Japan's spending on roads has been large. The 1.2 million kilometres of paved road are the main means of transport. A single network of high-speed, divided, limited-access toll roads connects major cities, which are operated by toll-collecting enterprises. Japan, as we know it today, is home to one of the world's most developed transport networks. Mass transport is well developed in Japan, but the road system lags behind and is inadequate for the number of cars owned in Japan. This is often attributed to the fact that road construction is difficult in Japan because of its uniquely high population density, and the limited amount of available usable land for road construction. Dozens of Japanese railway companies compete in regional and local passenger transport markets. For instance—seven JR Group companies, Kintetsu Railway, Seibu Railway and Keio Corporation. Some 250 high-speed Shinkansen trains connect major cities. All trains are known for punctuality. There are 176 airports and the largest domestic airport is Haneda Airport. It is Asia's one of the busiest airports. The largest international gateways are Narita International Airport (Tokyo area), Kansai International Airport (Osaka/Kobe/Kyoto area), and Chubu Centrair International Airport (Nagoya area). The largest port is Nagoya Port.

1) Railway

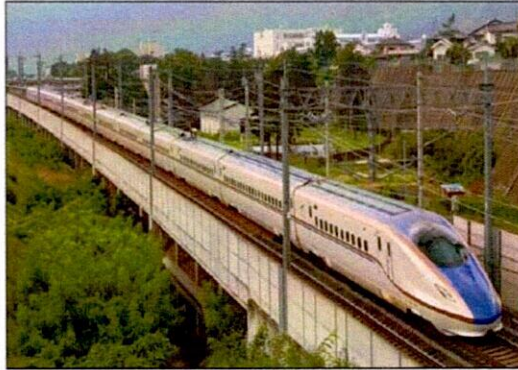
In Japan, railways are a major means of passenger transport, especially for mass and high-speed transport between major cities and for commuter transport in metropolitan areas. There also are railway services operated by private rail companies, regional governments, and companies funded by both regional governments and private companies. Japanese railways cover the distance of 27,182 km in total. Shinkansen take up a large portion of the long distance travel in Japan, with the whole system carrying over 10 billion passengers in its lifetime. Shinkansen operates at the maximum speed of 320 km/h. Shinkansen trains are known to be very safe, with no accident-related deaths or injuries from passengers in its 50-plus year history. The average delay of these trains is 6 seconds. The first Shinkansen line opened between Tokyo and Osaka in 1964, and trains can now make the journey in 2 hours and 25 minutes. Japan has been developing maglev technology trains, and broke the world maglev speed record in April 2015 with a train travelling at the speed of 603 km/h (375 mph). Here is little etiquette one must follow while taking a train in Japan:

1. Let passengers first disembark before you board the train
2. Not being noisy on the train is an iron rule
3. Set your smartphone to silent mode and avoid talking on it when on the train
4. Do not look at your smartphone when you are walking in the station or on the train platform!
5. Eating or drinking on the trains is taboo
6. Be careful how you sit on the train
7. Be careful that any large bags or luggage do not inconvenience other passengers

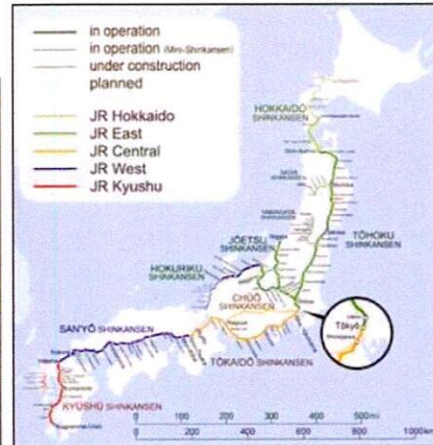




ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



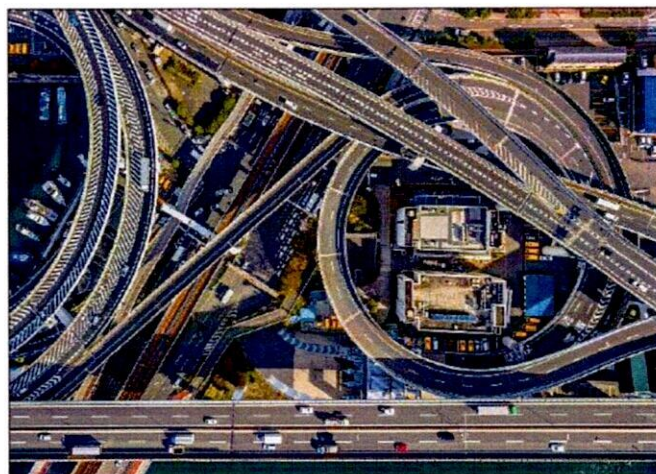
Japanese Shinkansen



Shinkansen route

2) Road

A single network of high-speed, divided, limited-access toll roads connects major cities on Honshu, Shikoku and Kyushu. Hokkaido has a separate network, and Okinawa Island has a highway of this type. Road passenger and freight transport expanded considerably during the 1980s as private ownership of motor vehicles greatly increased along with the quality and extent of the nation's roads. Bus companies including the JR Bus companies operate long-distance bus services on the nation's expanding expressway network. In addition to relatively low fares and deluxe seating, the buses are well utilised because they continue service during the night, when air and train services are limited.

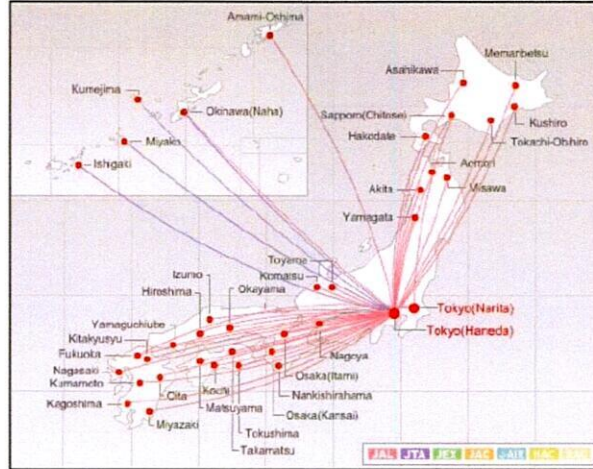


Japan Highways

3) Air

Domestic air travel in Japan has historically been highly regulated. From 1972, the three major domestic airlines (JAL, ANA, and JAS) were allocated certain routes, with JAL and ANA sharing trunk routes, and ANA and JAS sharing local feeder routes. JAL and JAS have since been merged to help compete with ANA. JAL also had a flag-carrier monopoly on international routes until 1986.





Connectivity by air

4) Water

There are 1770 km of waterways in Japan; seagoing craft ply all coastal inland seas. There are more than 994 ports in Japan as of April 2014. There are overlapping classifications of these ports, some of which are multi-purpose, e.g. cargo, passenger, naval, and fishery. The five designated "super" container ports are- Yokkaichi, Yokohama, Nagoya, Kobe and Osaka. 23 are designated major/international, 125 designated as important, while there are also purely fisherman ports. Ferries connect Hokkaido to Honshu, and Okinawa Island to Kyushu and Honshu. They also connect other smaller islands and the main islands. The scheduled international passenger routes are to China, Russia, South Korea and Taiwan.



Water transport in Japan

4.03: ATTRACTIONS

The attractions in my selected destinations- Tokyo, Osaka, Kyoto, Hiroshima and Miyajima are-

- 1) **Imperial Palace, Tokyo-** It is Tokyo's most famous landmarks. The Imperial Palace is surrounded by walls and a moat with its beautiful 17th-century parks is a must-see when visiting the nation's capital. Even if majority of palace is closed to the public because it's still in use by Imperial family, there is still enough to see simply by strolling the grounds. There are numerous points in the surrounding parkland including the famous Nijubashi (Double bridge) named for its watery





ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

reflection. Higashi-Gyoen (East garden) and other areas that are opened to the public as part of an organized tour.



Imperial Palace, Tokyo

- 2) **Disneyland, Tokyo**- Tokyo Disneyland is a theme park in Disneyland resort. It is the first Disneyland built outside the USA. The park has seven themed areas- the World Bazaar and the four traditional Disney lands- Adventureland, Westernland, Fantasyland and Tomorrowland and two minis-lands- Critter Country and Mickey's Toontown. Many of these areas mirror those in the original Disneyland as they are based on American Disney films and fantasies. Not only kids but even adults can bring kids inside them out and enjoy in this theme park.



Tokyo Disneyland

- 3) **Osaka Castle, Osaka**- Osaka castle was the largest castle in Japan in 16th century. It was ordered to build by Japanese warrior and politician Toyotomi Hideyoshi. After Hideyoshi's defeat in 1615, the castle was destroyed, only to be rebuilt by the Tokugawa shoguns for reasons of prestige. Again destroyed after the fall of the Shogunate, the castle was reconstructed in its present form in 1931. Highlights include the five-story main tower containing a great museum with exhibits related to the history of the castle and the city. It also offers superb views of Osaka from its upper floors. Osaka Castle Park is the Hokoku Shrine dedicated to Hideyoshi and his family.

DID YOU KNOW?

TSUKIJI FISH MARKET IN TOKYO IS THE LARGEST FISH MARKET IN THE WORLD. IT HANDLES MORE THAN 2246 TONNES OF MARINE PRODUCTS A DAY!



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Alinda
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

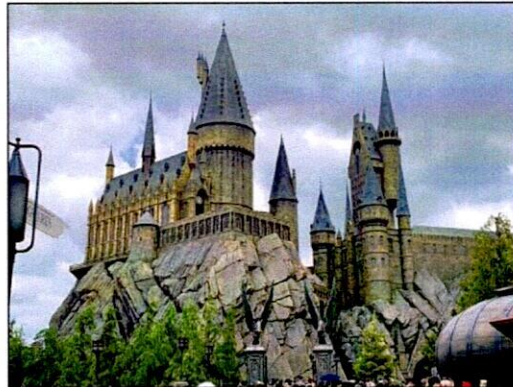
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65



Osaka Castle

- 4) **Universal Studios, Osaka**- Universal Studios is the city's newest attractions and is becoming one of the top attractions in Osaka. Universal Studios Japan is also one of the city's busiest sites, attracting around 10 million visitors each year. It is one of only four Universal theme parks worldwide.



Universal Studios, Osaka

- 5) **Kinkaku-Ji, Kyoto**- It is also known as a Golden Pavilion. It was originally built in the 14th century as a retirement villa for Shogun Ashikaga Yoshimitsu and it is now a Zen Buddhist temple. It is one of Kyoto's most picturesque attractions. It is built over a large pond; the site is also famous for its beautiful grounds, as well as its old stone pagoda and the Sekkatei Teahouse with its traditionally served beverages.

51 | JAPAN. ENDLESS DISCOVERY.



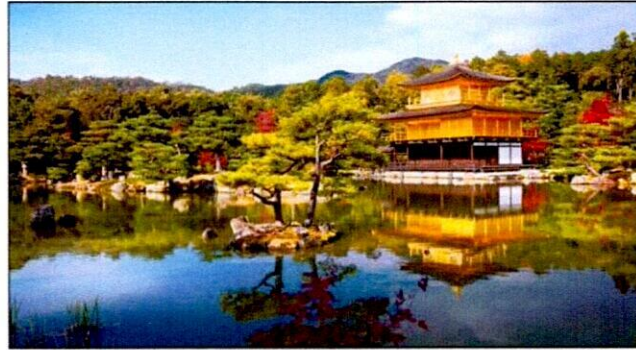
NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



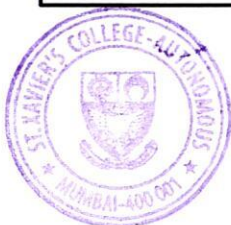
Kinkaku-ji, Kyoto

- 6) **Daitoku-ji, Kyoto**- The Daitoku-ji Temple is the Zen Temple of Great Virtue is one of the principal temples of the Rinzaï sect and was founded in 1324, with the present structures dating from the 16th and 17th centuries. Of the 22 buildings on-site, seven are open to the public. The temple is notable for its many fine ceiling paintings and statues.



Daitoku-ji, Kyoto

- 7) **Hiroshima Peace Memorial Park, Hiroshima**- It was created to symbolize the need for everlasting peace. Hiroshima Peace Memorial Park (Hiroshima Heiwa Kinen Kōen) commemorates the many victims of the world's first nuclear attack in August 1945. The park includes a variety of important monuments, memorials, and museums relating to the events of that fateful day and its aftermath, and attracts more than a million visitors each year. Highlights at the park include the Peace Memorial Museum, the Memorial Cenotaph, and the Flame of Peace, the Atom Bomb Dome comprising the ruins of the old Chamber of Industry and Commerce, which lay at the epicentre of the explosion.





ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65



Hiroshima Peace Memorial Park

- 8) **Shukkei-en, Hiroshima**- Shukkei-en is a garden situated on the banks of the river Ota. It was once the home of Emperor Meiji but the gardens opened to the public after being donated to the city in 1940. It was heavily damaged by the nuclear attack of 1945 but the gardens reopened in all their former glory in 1951. A highlight of the garden is simply walking its many garden trails and traversing its bridges while enjoying the abundance of pools and streams, which draw their water from the Ota River. You can also join in one of the authentic tea ceremonies offered at on-site teahouses.



Shukkei-en Garden, Hiroshima

- 9) **Itsukushima Jinja, Miyajima**- Miyajima is also known as a shrine island and it is Japan's one of the most visited and most important tourist site. The island is famous for the spectacular Itsukushima shrine, dedicated to the Princesses Ichikishimahime, Tagorihime and Tagitsu-hime, daughters of the Shinto wind god Susanoo. The shrine's buildings rise out of the waters of a small bay supported on piles and, at high tide, appears to float on water - a particularly attractive sight at night time. That is why the shrine gates are known popularly as 'Floating Torii' (Gate).

53 | JAPAN. ENDLESS DISCOVERY.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Floating Torii, Itsukushima shrine, Miyajima

- 10) **Fuji Yama-** Mt. Fuji is the highest mountain in Japan. It is an active volcano which most recently erupted in 1707. It stands on the border between Yamanashi and Shizuoka prefectures and can be seen from Tokyo and Yokohama on clear days. It has been worshiped as a sacred mountain and experienced big popularity among artists and common people throughout the centuries. Mount Fuji can be enjoyed at a more leisurely pace and from nice natural surroundings from Fujigoko (Fuji five lakes) region at the northern foot of the mountain or to Hakone- a nearby hot spring resort. Mount Fuji is officially open for climbing during July and August via several routes.



Mt. Fuji

4.04: ACTIVITIES

Japan is culturally rich and offers many interesting activities with respect to architecture, art, music, food, lifestyle, and nature. It is the perfect amalgamation of modernization and tradition. From ancient temples to huge skyscrapers, traditional tea ceremonies to over-the-top arcades, relaxing hot springs to thrilling go-kart rides; Japan has so much to offer everyone. There are so many amazing things to do in Japan that one trip is never enough. Japan can attract people of every age group and various interests. Following are some of things you should not miss when you go to Japan:

- 1) **Visit Shrines and Gardens-** Kyoto in Honshu is very famous for its shrines and green and well maintained gardens. All of the main ancient pilgrimage routes like Koya-San and Kumano-Kodo and other major temples and gardens are located in and around Kyoto. It has more than 1000 temples and shrines. Almost all shrines are surrounded by typical beautiful Japanese gardens most known examples are Ginkaku-ji, Ryoan-ji and Tofuku-ji.
- 2) **Eat mouth-watering Japanese Cuisine-** Japan is food lover's paradise. There are many varieties in Japanese cuisine right from simple soba noodles (buckwheat noodles) to kaiseki banquets (modern cuisine). It is said that in cities like Tokyo and Kyoto you could eat different Japanese cuisine without repeating for a month. Japanese food can be eaten only by the non-vegetarians. It is difficult

54 | JAPAN. ENDLESS DISCOVERY.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

to get pure vegetarian food in Japan. Sushi- traditional Japanese dish has become very popular all round the world.

- 3) **Soak into Onsen-** Onsen are natural hot water springs. Japan is famous for its onsen and it is must do activity when in Japan. you just can't miss it. You can literally feel your muscles relaxing after a hectic day. In many places, the onsen is outside in an open space and there is nice stream running by and greenery around you. Wakayama prefecture in Kyushu is famous for its traditional Onsens.

DID YOU KNOW?

DON'T FORGET TO TAKE OFF YOUR JEWELLERY BEFORE ENTERING AN ONSEN. SOME MINERALS CAN DISCOLOUR YOUR JEWELLERY.



Japanese Onsen

DID YOU KNOW?

THERE ARE MORE THAN 80,000 RYOKANS IN JAPAN BUT THE NUMBER DECREASED AFTER MODERN HOTELS WERE INTRODUCED.

- 4) **Stay in Japanese Ryokan-** Ryokan means typical Japanese inn. Ryokan gives you taste of how Japanese used to live years before. You can literally spend your whole day relaxing, lounging in traditional robe, bathing while looking at the beautiful garden, eat traditional food, etc. There are no beds in Ryokan, instead, they use 'Futon' a Japanese bedding style which can be spread on the floor while sleeping and roll it when you don't require. There is a typical Japanese table for dining where you have to sit down on the floor and have your food. If you want the best experience of traditional Japanese ryokan, you should live in the countryside.



- 5) **Sakura Hanami-** Sakura is cherry blossom and Hanami is viewing. Japanese are most happy-go-lucky people under a cherry tree when it is fully blossomed. They drench themselves in sake (Japanese wine) and beer with tasty snacks and sing their heart out with the karaoke and dance. You can witness sakura hanami in the springtime which is from mid-march to April 1st week. It differs



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



from region to region and island to island. Best places to join in the fun are Ueno-koen (Garden) in Tokyo and Maruyama-koen (Kyoto). Japan is a happy place when it's the season of cherry blossom and Japanese are the most welcoming people if you want to join the party.

- 6) **Skiing and hiking**- Japanese Alps are the best kept secret of Japan. From Japanese alps from Honshu to Hokkaido, one can experience greatest activities skiing and snowboard activities. There are well-priced equipment rental shops on the slopes of Alps so you need not even worry about that. The best part is you can soak in onsen for a unique experience after ski. You can go for hiking on clear days in Alps and even on Mt. Fuji which is the highest peak of Japan. Hundreds and thousands of people climb sacred volcanic Mt. Fuji every year as it is an old tradition going on for centuries.



Skiing at Hakuba



Yoshida trail, Mt. Fuji

- 7) **Shop till you drop**- If you want to see some incredible shops, you have to go to Japan. It is said that if it is available to humanity, you can buy it in Japan. Whether it is Yen 10, 000 melon or Yen 100 shops you will be amazed at the sheer variety of goods offered in Tokyo. Ginza is famous for boutiques. No trip to Tokyo will be complete without a visit to Tsukiji fish market. Shibuya and Shinjuku shopping hubs. Huge variety of shops can be seen in these areas.



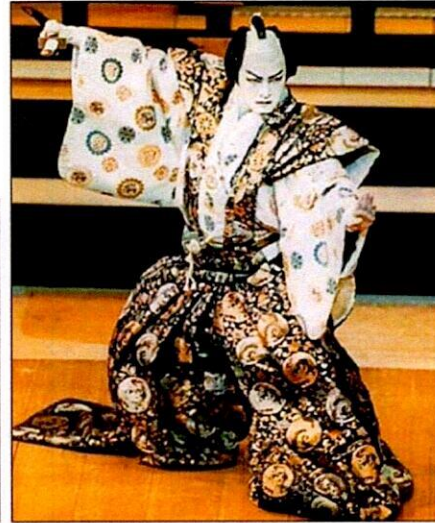
Shinjuku Shopping Street

- 8) **Spectacular Kabuki**- Kabuki means a stylised Japanese theatre. It doesn't matter even if you don't understand the words. The most entertaining art is the alien like beings who come down to earth and perform for us. The two best places to see Kabuki are Minami-za Theatre (Kyoto) and Kabuki-za Theatre (Tokyo).





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



- 9) **Sumo Wrestling**- Watching Sumo wrestling is like sitting along a ringside and watch two Yokozuna (Grand champions) clash as if two mountains are clashing. You can just about feel the earth shake. Catching a sumo match is highlight of any Japans trip. It is different from any other sport.



Huge Sumo Wrestlers

- 10) **Castles**- Castles of Japan gracefully tells us the stories of military realities behind their construction. Towering above the plains, they seem to be designed more to please the eye than to protect their lords. If you have an interest in the world of Samurai, Shogun or the Military, you will love Japanese castles. The look more spectacular in the season of cherry blossom.

4.05: ACCOMMODATION

Japan offers a wide range of accommodation types in both Japanese and Western styles, including some unconventional forms such as capsule hotels and temple lodgings. Most of Japanese accommodation offers free WiFi, basic/modern bedding facilities, television, etc. Rates range from less than 2,000 yen per person in a dormitory to over 50,000 yen per person in a first class hotel or ryokan. Following are some of the options of accommodation in Japan- Washitsu (Japanese style room) (1st two options) or Western style rooms:

57 | JAPAN. ENDLESS DISCOVERY.



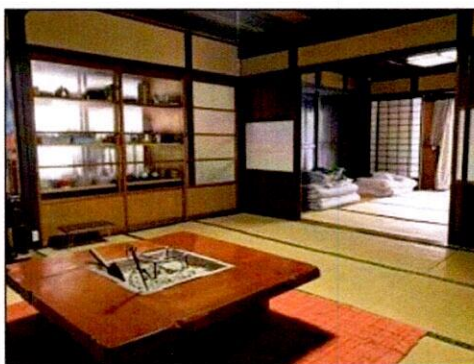
NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

- 1) **Ryokan**- Ryokan is a traditional Japanese-style inn with Japanese-style rooms. A stay at a ryokan typically includes dinner and breakfast and is recommended to all travellers to Japan as it gives you the opportunity to experience a traditional Japanese lifestyle.
- 2) **Minshuku**- Minshuku is Japanese-style bed and breakfast lodgings. They are usually family run, offer Japanese-style rooms, and often include one or two meals in the price. In simple words, it is a home stay.



Minshuku

- 3) **Business Hotels**- Business hotels offer small, simple Western-style rooms with snacks and drinks provided by vending machines. Some business hotel chains, such as Route Inn, APA Hotel, Super Hotel and Toyoko Inn, operate dozens of hotels across Japan.
- 4) **Pensions**- Pensions are comparable to Minshuku, except that they offer rooms in Western-style rather than in Japanese-style. They are typically found in mountainous resort towns and in the countryside.
- 5) **Hostels and Dormitories**- Hostels in Japan offer lodging and meals at the lowest budget level. Japan Youth Hostels, a member of the International Youth Hostel Federation, operates more than 300 hostels across Japan. These hostels provide a comfortable and safe stay.
- 6) **Vacation Rentals**- Air BnB and other vacation rental services are popular in Japan. They offer apartments and rooms with traditional or modern interior, as well as restored historic houses.
- 7) **Capsule Hotels**- Capsule hotels mainly target male clients in need of nothing but a bed; capsule hotels accommodate their guests in small capsules. A television, a shared bathroom and coin lockers are usually provided. It was first started in Osaka for working class men who miss the last train of the day and can't afford staying in a hotel.



Capsule Hotel

58 | JAPAN. ENDLESS DISCOVERY.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

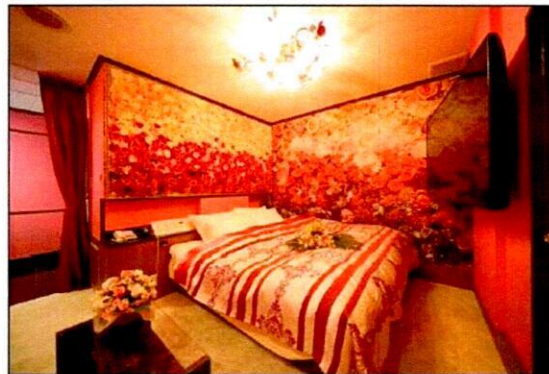
☎ 2262 0661/65

- 8) **Temple Lodging-** It is possible for tourists to spend the night at some Buddhist Shukubo (Temple lodging). A stay often includes two vegetarian meals and the opportunity to join the morning prayers. One of the best places to experience a night at a temple is Mount Koya.



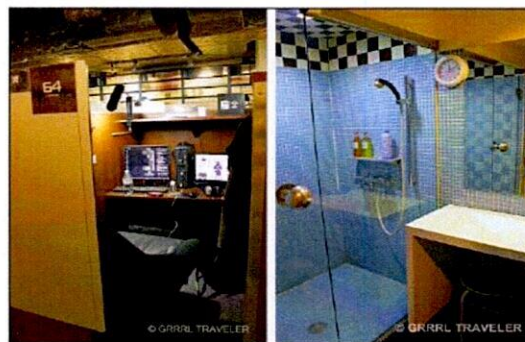
Temple stay at Mt. Koya

- 9) **Love Hotels-** Love hotels are not meant as tourist lodgings. they are visited by couples who wish to enjoy some undisturbed time together. Rooms at love hotels can be rented for 2-3 hours during the day or for an overnight stay.



Love Hotel

- 10) **Manga Kissaten-** Manga cafes are establishments that provide their customers with seats or booth to read manga (Japanese comics) and surf the internet. They are open 24 hours and provide various amenities that make them an option for low-budget overnight stays. They also have shower rooms and private booths where you can sleep in good rates.



Private booth and shower at Manga Kissaten

59 | JAPAN. ENDLESS DISCOVERY.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



4.06: AMENITIES

Japan is a tourist friendly country as there are good facilities and amenities provided everywhere in the country. At the famous attractions, there are guides for the tourists everywhere. Toilets and Restrooms are everywhere in Japan. One of the main goals of Japan is to create 'Barrier-free' facilities while travelling. This is not only useful for the residents but also for the tourists coming in. The government looks after every small problem which people may face. Right from navigation by wheelchairs to non-step buses, wide elevators, etc. to all problems tourists can face are looked after.

4.07: AFFORDABILITY

Japan is one of the most expensive countries to live in the World. Tokyo which is the capital of Japan is the most expensive city. Japan is 166% more expensive than India. All the tour packages of Japan are not less than Rs. 2,15,000. The cost of living in Japan is very high. Tourist cannot afford to spend hefty amount on food or accommodation. If you make train reservations in advance through the travel agents who handle JR Pass, they will charge you a fairly hefty amount.

On other hand, backpackers can explore Japan on a budget. It is still expensive than backpacking in other countries but cheaper than the tour packages provided by the tourism companies. Japan is losing out to peer destinations on the perception of affordability. The fact that it is possible to visit Japan for a reasonable price is not being communicated effectively, partly because the reservation and purchase process is inefficient and partly because online promotion of low-cost options is insufficient. For transportation, budget travellers can use Japan Rail Pass. It is the best way to see Japan without going broke. It is one of the greatest travel bargains in the World like Eurail pass. It allows unlimited travel nationwide rail system including the Shinkansen (Bullet train). If you don't have Japan Rail Pass, Seishun Juhachi Kippu (Youth 18 Ticket) can be the best option. Here you get 5 one day tickets for JPY 11,500. You can travel anywhere to Japan on Japan Railway (JR) line. The drawback being, you cannot travel by Shinkansen or Express trains and each ticket must be used within 24 hours. If you don't want all 5 tickets, separate tickets are available in the shops near the station in cheaper rates than a normal ticket. These 5 day tickets are only available seasonally. If in case you hire a car, try staying on the local roads instead of expressway to save highway tolls. Always check for special transport passes in the areas you explore at the tourist information centre.

Most of the Shrines and temples are free in Japan. So tourists can save their money in attractions. All the major museums and galleries in Japan are free. While others are free few days each month. Tourists can get these days in tourist information centre nearby. Most of parks and gardens of Japan are free to enter.



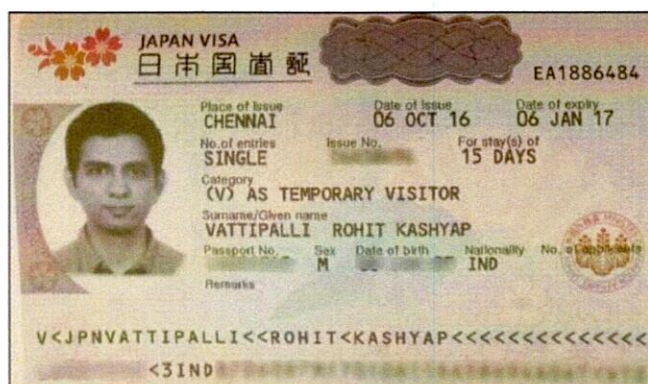


ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

CHAPTER 5- DOCUMENTATION

5.01: OVERVIEW

Japanese visa is one of the easiest visas for Indians. It is also one of the cheapest. You can get a Japanese visa in just Rs. 510 for single as well as multiple entries. Its embassy is in Delhi and consulates are in Mumbai, Kolkata, Chennai and Bengaluru. No vaccinations are required for Indian travellers. Currency of Japan is Japanese Yen. The current rate of JPY against INR is. The current rate of JPY against USD is. You can get JPY in India but it is advisable to exchange the currency at the airport.



Japanese Visa for Indians

5.02: EMBASSY AND CONSULATE LOCATIONS IN INDIA

Embassy of Japan is in the capital of India, Delhi. People from Andaman & Nicobar Islands, Arunachal Pradesh, Assam, Chandigarh, Delhi, Haryana, Himachal Pradesh, Jammu & Kashmir, Lakshadweep, Manipur, Meghalaya, Mizoram, Nagaland, Punjab, Rajasthan, Sikkim, Tripura, Uttaranchal and Uttar Pradesh have to apply in Delhi for Japanese visa. In Consulate General of Japan in Mumbai people from Maharashtra, Goa, Gujarat, Madhya Pradesh, Chhattisgarh, Daman, Diu, Dadra and Nagar Haveli have to apply for visa. In Consulate General of Japan in Kolkata people from nearby states like West Bengal, Bihar, Jharkhand and Odisha have to apply. In Consulate General of Japan in Chennai, people under jurisdiction of Tamil Nadu, Andhra Pradesh, Telangana, Kerala and Pondicherry can apply for visa. In Consulate General of Japan in Bengaluru only people from Karnataka state can apply for visa.

DID YOU KNOW?

Embassy: Delhi

**Consulates: Mumbai,
Kolkata, Chennai,
Bengaluru**

5.03: VISA TYPES, FEE AND PROCESS

There are many types of Japanese visa offered to Indian tourists. They are tourist visa (Single/Multiple entry), business visa (Single/Multiple entry), transit visa, medical visa, long term visa, student visa with single entry (Up to 90 days), etc.

Tourist/Business visa fee for Japan is Rs. 510 for single or multiple entries and transit visa for Rs. 50 only for Indian nationals. But if you apply through VFS (Visa Facilitating Service), it will include the service charge thus it will be Rs. 650. Some travel agencies charge hefty service charges and the fees can go up to Rs. 4000 or even more. It is always recommended to apply for Japan visa through VFS as all the process will be followed properly and there will be less chances of your visa getting rejected. If there are any problems in the visa application form or required documents, they can help you out





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

DID YOU KNOW?

**Indian nationals
can get Japanese
visa just at Rs.
510!!**

before you submit it to the consulate. Minimum processing time for visa is 4 days once it is accepted by the Consulate General of Japan. You will get a refund if your visa is rejected for any reason.

The application process for visa is not very lengthy for Indian nationals. Following are the steps to apply for visa- (Visa form attached in appendix)

Step 1: Obtain required information. Know your proper visa type.

Step 2: Take a photograph for visa according to the requirement of the country. (45mmx45mm/2inchx2inch with white background)

Step 3: Complete the application form thoroughly without any mistakes.

Step 4: Prepare supporting documents (Given below)

Step 5: Submit your application at Japan Visa application centre. Pay visa fee and service charge if you are applying through VFS. You can track your application by entering your reference number and your date of birth.

Step 6: Collect your passport.

5.04: DOCUMENTS REQUIRED

1. Application form (With photo)
2. Passport valid for at least 6 months after arrival in home country and old passport that shows Japanese temporary visitor visa and entry stamps in the last three years (If any)
3. Spouse/parent passport if he/she has the multiple entry visa as applicant with sufficient financial capacity.
4. Income tax return of 3 years to prove the sufficient financial capacity.
5. Documents such as certificate of 6 month bank statement and pension/retirement allowance/inheritance/lease agreement/ real estate register/deed of property, etc.
6. Day to day travel itinerary and hotel bookings.
7. Confirm flight tickets.
8. Covering letter stating purpose of visit.
9. Proof of student status (Only for students)
10. Invitation letter for events, meetings, etc (For MICE/ Business travel)

5.05: HEALTH/ VACCINATION REQUIREMENTS

No compulsory vaccinations are required to enter Japan. But some vaccinations like Hepatitis A are recommended for most travellers. The disease is spread by food and water. Vaccination for Japanese Encephalitis is a threat to travellers travelling to Japan, which is spread by mosquitoes, is recommended for the travellers who travel to Japan in the months of July to October.

5.06: FOREIGN EXCHANGE

Currency of Japan is Japanese Yen (JPY). The current rate of JPY against INR is 1.52. The current rate of JPY against 108.34 USD is (As of 3rd February 2020). It is advisable to exchange currency at the airport. The rates are the same as at the banks, and you want to have Japanese yen once you leave the airport. It is possible to exchange money at major hotels, but the rates are usually not as good. It is beneficial to exchange money before arriving in Japan if you are travelling from India. Credit card usage is not much common in Japan. You have to carry cash everywhere because credit/debit cards are not accepted in restaurant, hotels, shopping, etc.

The everyday expense may vary depending up on the level of luxury and number of people. Average amount spent by the tourist everyday is around USD 40- USD 50. Japanese Yen is easily available in India. Companies like Thomas Cook, Weizmann currency exchange, book my forex, etc.

DID YOU KNOW?

1 INR= 1.52 JPY

1 USD= 108.34 JPY

5.07: FREQUENTLY ASKED QUESTIONS

62 | JAPAN. ENDLESS DISCOVERY.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

1) Who needs a visa for Japan?

All Indian nationals require a visa to enter Japan. People of some countries do not need a visa if their period of stay in Japan is 90 days or less and they are not going to be engaged in income-earning activities.

2) When should I apply for visa?

Applicants should apply as early as possible keeping in mind the average processing times and their intended date of travel. However they should also not apply before 45 days from intended date of travel.

3) Who decides if I will get a visa?

The Embassy of Japan assesses and decides all visa applications.

4) Do I need appointment to submit my application?

Applicants do not require any prior appointment to submit visa application.

5) What is the processing time for visa?

Under normal circumstances, the visa applications will take a minimum of 3 working days to process including the date of submission at Japan Visa Application Centre. This may vary for certain applications and it is at the sole discretion of the Embassy of Japan, New Delhi.

6) If I do not have any document for particular reason, what should I do?

In case applicants do not have any required document and are also unable to obtain it prior to their schedule travel to Japan, they shall mention in a Covering Letter. The Covering Letter should be in original and signed by the applicant and also shall cover the reason for inability in obtaining the document.

7) Will I be asked to submit additional documents after submission of my application?

Sometimes additional information will be required for the assessment process by the Embassy of Japan, and in the process they may request applicants to submit extra documents in addition to the documents indicated in Requirement List. Each applicant has different conditions and circumstances, and sometimes the Embassy of Japan do not become aware of these until the application has been accepted, therefore there are some documents that are not requested to everyone to submit in the beginning.

8) Will I be called for a personal Interview?

Sometimes applicants could be requested by the Embassy of Japan for a personal interview. These interviews shall take place only at Embassy of Japan and not at any VFS centre if you have applied through VFS.

9) How can I withdraw my application?

In case applicants wish to withdraw the visa application, they can do so by providing a request letter, mentioning the reason for withdrawal. The letter should be in original and signed by the applicant. Scanned copies or email confirmation will not be accepted as request letter.

10) How will I know the reason in case my visa is refused?

The reason for the rejection is that your application did not meet the criteria of visa issuance. The Embassy of Japan does not give you the specific reason of the rejection.

11) Can I apply again if my visa is refused?

The Embassy of Japan does not accept your visa application if your previous application was rejected and you will apply for the same purpose of visit after six months from the rejection.





CHAPTER 6- ITINERARIES AND TOUR PACKAGES

6.01: ANALYSIS OF EXISTING ITINERARIES:

According to my analysis of existing Japan itineraries of more than 20-25 companies, the most popular tourist circuit I found was Tokyo-Hiroshima-Osaka-Nara-Kyoto. In these cities, you can get a glance of Japanese lifestyle, both, modern (Tokyo and Osaka) and traditional (Nara and Kyoto) and most of the tourist destinations are in this circuit. Travelling to these cities is much easier because of the World famous Shinkansen (Japanese bullet train) or even by road as Japan has very good road network connectivity and great highways. In most of the itineraries: Tokyo, Osaka and Kyoto had equal number of nights i.e. 2 nights or three nights while Hiroshima and Nara had mostly one or maximum two nights. Hakone is getting popular in Japanese tourist circuits. Many itineraries of Kesari Tours had 2 nights in Hakone. Mt. Fuji is very close from Hakone so it is a better option to stay in Hakone and then have one day return tour to Mt. Fuji. Most popular tourist circuits are on the islands of Honshu and Kyushu. No companies from India take tours to Hokkaido and Shikoku islands of Japan.

6.02: POPULAR TOURIST CIRCUITS

Most popular tourist circuit of Japan is Tokyo-Hiroshima-Osaka-Nara-Kyoto. Most of the attractions covered in the circuit are City Tour in Tokyo and Osaka, Atomic Bomb Dome in Hiroshima, Nara (which is a one day return trip from Kyoto/Osaka), etc.

DID YOU KNOW?

Most popular tourist circuit of Japan amongst Indians is Tokyo-Hiroshima-Osaka-Nara-Kyoto



6.03: PROPOSED TOUR ITINERARIES

In the following itineraries, I have tried to include common tourist circuit but offbeat attractions in which you will be able to explore Japan in completely a different way.

Itinerary 1- Mesmerising Japan

Tour Overview- 1 Country | 6 Cities | 9 Days

Osaka-Kyoto-Nara-Koyasan-Hiroshima-Miyajima-Osaka

- 9 Days/8 Nights
- Customisation available
- Enjoy traditional and modern Japanese life



Shinde



- Live like a local
- Tour Highlights-**
- Enjoy superfast ride on the World famous Shinkansen (Japanese bullet train)
 - View all picturesque landmarks of Japan
 - Enjoy the best view of Osaka from Tempozan Ferris Wheel
 - Bring out the kid in you at the Universal Studios
 - Meet and greet Geisha and Maiko
 - Pay homage at Hiroshima Peace Memorial Park
 - Enjoy the great wonder of floating torii gates at Miyajima

Itinerary-

Day 1- Arrive at Osaka	Arrive at Itami International Airport a.k.a Osaka International Airport early in the morning. Early check-in to the hotel. After breakfast leave for sightseeing tour of Osaka city. Visit famous Osaka Castle . In its original construction back in the 16th century, it was the largest and best constructed castle in Japan. The castle contains thirteen structures that have been designated as important cultural assets of Japan. We go for lunch after that. Post-lunch transfer to Kamigata Ukiyoe Museum . There you can see traditional Japanese woodblock prints of popular Kabuki actors from late Edo period. From there we go to Tempozan Ferris Wheel to experience the best view of Osaka city from the top. It was the tallest ferris wheel in the world few years back. After that, drop to Dotonbori Street for dinner. This street is famous for traditional Japanese food and sake (Japanese rice wine). Also, there are many bars and cafes. Overnight stay in Osaka. Meals included: Breakfast
Day 2- Osaka-Universal Studios	Breakfast at hotel. Leave for Universal Studios , Osaka. It is one of the 5 Universal Studios in the world. Enjoy full day inside. You can try out rides inside the park. Pick up from there at 1800 hours. Evening free at leisure. Overnight stay in Osaka. Meals included: Breakfast
Day 3- Osaka	Breakfast at hotel. After breakfast leave for Hozon-ji Temple . It attracts Indian tourists as it is a temple of Kangiten- Japanese version of Lord Ganesha. Evening at leisure. Overnight at Osaka. Meals included: Breakfast
Day 4- Osaka-Kyoto	Leave for Kyoto early in the morning. Early check-in at Ryokan- A traditional Japanese Inn to experience life like a local. Breakfast at Ryokan. After breakfast leave for Kyoto city tour. Visit Kinkaku-ji (Golden Pavilion) . It is officially named as Rokuon-ji. It is a Zen Buddhist Temple in Kyoto. It is a world heritage site and one of the historic monuments of ancient Kyoto. It has a beautiful lake. Then we go to famous Hokan-ji Temple (Yasaka Pagoda) . It is the best photo spot and one of the most attractive areas of Kyoto. It is an amazing place to walk around and explore among the narrow lanes with traditional old houses. Have lunch. Post lunch drop at Arashiyama Bamboo Grove . It is the most famous and picturesque spot of Kyoto. Many magazines use it as a cover picture while depicting Kyoto. Also visit Tenryu-ji Temple and Okouchi Sanso Garden which is in the same campus. Leave for Gion district for Maiko and Geisha Show . Meet and greet them, know more about their art, culture and history. Have dinner with the artist. Overnight stay in Kyoto. Meals included: Breakfast and Dinner
Day 5- Kyoto-Nara	Breakfast in the ryokan. After breakfast leave for Nara- former capital of Japan. There we visit Nara Deer Park . It is home to hundreds of freely roaming deers. Nara's nearly 1200 deer have been designated as a natural

65 | JAPAN. ENDLESS DISCOVERY.





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

	treasure. Later visit Todai-ji Temple (Giant Buddha) . It is a UNESCO World Heritage site and also one of Japan's most famous and historically significant temples and a landmark of Nara. Have lunch. Post lunch visit famous Chaya Ocha (Tea) House to taste typical Japanese tea, learn the process to make it, understand do's and don'ts. Leave for Kyoto. Evening free at leisure in Kyoto. Overnight stay in Kyoto. Meals included: Breakfast
Day 6- Kyoto-Koyasan	Breakfast in the ryokan. After breakfast leave for Koyasan. It is a trip to mountain top Buddhist Retreat . It is a perfect way to delve into the quiet mysticism of Japanese Buddhism. Lunch in the temple (Vegetarian is available). Leave for Kyoto after lunch. Evening free at leisure in Kyoto. Suggestion- Onsen. Overnight stay in Kyoto. Meals included: Breakfast
Day 7- Kyoto-Hiroshima	Leave for Hiroshima early in the morning. Have breakfast enroute Hiroshima. Check- in into the hotel. Leave for guided city tour on SIC basis sharp at 1100 hours. Visit Hiroshima Peace Memorial Park and Museum . Visit Atomic Bomb Dome . On 6th August 1945, first atomic bomb ever in human history was dropped on Hiroshima. The Atomic Bomb Dome was located almost directly underneath the explosion, it somehow avoided complete destruction and the remains of the building still stand today. Have lunch. Post lunch go to Shukkei-en . Have a walk in the typical Japanese garden. Learn more about them. Evening free at leisure. Overnight stay at Hiroshima. Meals included: Breakfast
Day 8- Hiroshima-Miyajima	Leave for Miyajima early in the morning. Breakfast enroute Miyajima. Visit Itsukushima Shrine (Floating Torii Gate) . After that visit Momijidani-koen . It is one of the most picturesque gardens in Japan. Have lunch. Post lunch go to Mt. Misen . It is the highest mountain on the island. Go to the top of the mountain by ropeway for the best view. Leisure time at the top. Leave for Hiroshima. Evening free at leisure. Overnight at Hiroshima.
Day 9- Hiroshima-Osaka	Transfer to Osaka. Depart with sweet memories!!

Inclusions-

- Return airfare by All Nippon Airlines
- Visa Fees
- Insurance
- Hotel with breakfast
- Transfers and sightseeing by Shinkansen and AC coach as mentioned in the itinerary
- Entertainment mentioned in the itinerary

Exclusions-

- Lunch and dinner
- GST and other taxes
- Any increase in airfare, visa fees, airport taxes, government taxes, fuel or any new taxes from government
- Any upgradation in airline class or hotel category
- Laundry, telephone charges, shopping, wines & alcoholic beverages, mineral water, items of personal nature, etc
- Any extra cost incurred on behalf of an individual due to illness, accident, hospitalisation, or any personal emergency
- Anything specifically not mentioned in the 'Includes' column

Route Map-

66 | JAPAN. ENDLESS DISCOVERY.

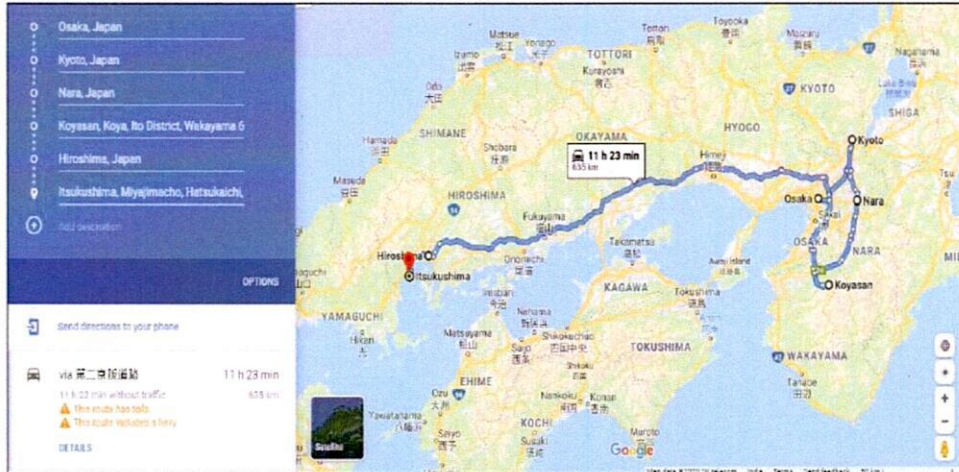


NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Tour Cost- INR 1,75,000 Per Pax

Itinerary 2- Yokoso Nihon! (Welcome to Japan)

Tour Overview- 1 Country | 8 Cities | 13 Days

Tokyo-Mt.Fuji-Osaka-Kyoto-Nara-Koyasan-Hiroshima-Miyajima-Osaka

- 13 Days/12 Nights
- Customisation available
- Enjoy traditional and modern Japanese life
- Live like a local

Tour Highlights-

- Enjoy superfast ride on the World famous Shinkansen (Japanese bullet train)
- Visit the highest mountain of Japan- Mt. Fuji
- View all picturesque landmarks of Japan
- Enjoy the best view of Osaka from Tempozan Ferris Wheel
- Bring out the kid in you at the Universal Studios
- Meet and greet Geisha and Maiko
- Pay homage at Hiroshima Peace Memorial Park
- Enjoy the great wonder of floating torii gates at Miyajima

Itinerary-

Day 1- Tokyo	Arrive in Tokyo early in the morning. Early check-in to the hotel. After breakfast leave for Tokyo Imperial Palace . It is the site of old Edo castle. Visit beautiful gardens there. After that, leave for Tokyo Skytree . You can see Mt. Fuji on clear days as it is Japans tallest structure. Have lunch in a local restaurant. Post lunch, leave for Tokyo National Museum . It is considered the oldest national museum in Japan, is the largest art museum in Japan, and is one of the largest art museums in the world. Evening free at leisure. Overnight stay at Tokyo Meals Included- Breakfast
-----------------	--

67 | JAPAN. ENDLESS DISCOVERY.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Day 2- Tokyo	Breakfast at hotel. After breakfast, leave for Senso-ji Temple . It is Tokyo's oldest temple, and one of its most significant. Formerly associated with the Tendai sect of Buddhism, it became independent after World War II. Then we proceed to Meiji Shrine . It is a shrine dedicated to 19 th century emperor. Have lunch. Post lunch, go to Harajuku for shopping. Then leave for Tokyo Tower which is also known as an Eiffel Tower of Japan. Visit a Guinness World Record museum, aquarium and wax museum. In the evening after becoming dark, go to the observation deck and have look at the twinkling city of Tokyo. Overnight stay at Tokyo. Meals Included- Breakfast
Day 3- Tokyo	Early in the morning, leave for Tsukiji Fish Market . Here you can find fresh and processed seafood and produce alongside food-related goods such as knives. It is a must visit place when in Tokyo. Sushi lovers can try best sushis in the market for breakfast or have breakfast in the nearby restaurant. Pick up for Tokyo Disneyland . Spend whole day in Disneyland. Pick up at 1800 hours from there. Evening free at leisure. Overnight stay at Tokyo. Meals Included- Breakfast
Day 4- Tokyo-Mt. Fuji	Leave for Mt. Fuji and Lake Kawaguchi at 0730 hours on Seat In Coach Basis. Take packed breakfast with you. Visit Arakurayama Sengen Park . You can get the best views of Mt. Fuji from there. In case of bad weather, we will visit Shiraito Waterfalls . Then we visit Lake Kawaguchi. We will have lunch there. There you have various options. You can go for painting, pilgrimage of 7 lucky gods or learn to make mochi rice cake. Then we visit Oishi Park . You can capture sights of Japanese naturescapes. Then we leave for Sai Iyashi and Sato Gamba Village . Leave for Tokyo at 1800 hours. Overnight at Tokyo. Meals Included- Breakfast
Day 5- Tokyo-Osaka	Check out from hotel early in the morning. Today, we will experience an unforgettable ride in a superfast Japanese Shinkansen to Osaka. Early check-in to the hotel. After breakfast leave for sightseeing tour of Osaka city. Visit famous Osaka Castle . In its original construction back in the 16th century, it was the largest and best constructed castle in Japan. The castle contains thirteen structures that have been designated as important cultural assets of Japan. We go for lunch after that. Post-lunch transfer to Kamigata Ukiyoe Museum . There you can see traditional Japanese woodblock prints of popular Kabuki actors from late Edo period. From there we go to Tempozan Ferris Wheel to experience the best view of Osaka city from the top. It was the tallest ferris wheel in the world few years back. After that, drop to Dotonbori Street for dinner. This street is famous for traditional Japanese food and sake (Japanese rice wine). Also, there are many bars and cafes. Overnight stay in Osaka. Meals included: Breakfast
Day 6- Osaka-Universal Studios	Breakfast at hotel. Leave for Universal Studios , Osaka. It is one of the 5 Universal Studios in the world. Enjoy full day inside. You can try out rides inside the park. Pick up from there at 1800 hours. Evening free at leisure. Overnight stay in Osaka. Meals included: Breakfast
Day 7- Osaka	Breakfast at hotel. After breakfast leave for Hozon-ji Temple . It attracts Indian tourists as it is a temple of Kangiten- Japanese version of Lord Ganesha. Evening at leisure. Overnight at Osaka. Meals included: Breakfast
Day 8- Osaka-Kyoto	Leave for Kyoto early in the morning. Early check-in at Ryokan- A traditional Japanese Inn to experience life like a local. Breakfast at Ryokan. After breakfast leave for Kyoto city tour. Visit Kinkaku-ji (Golden

68 | JAPAN. ENDLESS DISCOVERY.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

	<p>Pavilion). It is officially named as Rokuon-ji. It is a Zen Buddhist Temple in Kyoto. It is a world heritage site and one of the historic monuments of ancient Kyoto. It has a beautiful lake. Then we go to famous Hokan-ji Temple (Yasaka Pagoda). It is the best photo spot and one of the most attractive areas of Kyoto. It is an amazing place to walk around and explore among the narrow lanes with traditional old houses. Have lunch. Post lunch drop at Arashiyama Bamboo Grove. It is the most famous and picturesque spot of Kyoto. Many magazines use it as a cover picture while depicting Kyoto. Also visit Tenryu-ji Temple and Okouchi Sanso Garden which is in the same campus. Leave for Gion district for Maiko and Geisha show. Meet and greet them, know more about their art, culture and history. Have dinner with the artist. Overnight stay in Kyoto. Meals included: Breakfast and Dinner</p>
Day 9- Kyoto-Nara	<p>Breakfast in the ryokan. After breakfast leave for Nara- former capital of Japan. There we visit Nara Deer Park. It is home to hundreds of freely roaming deers. Nara's nearly 1200 deer have been designated as a natural treasure. Later visit Todai-ji Temple (Giant Buddha). It is a UNESCO World Heritage site and also one of Japan's most famous and historically significant temples and a landmark of Nara. Have lunch. Post lunch visit famous Chaya Ocha (Tea) House to taste typical Japanese tea, learn the process to make it, understand do's and don'ts. Leave for Kyoto. Evening free at leisure in Kyoto. Overnight stay in Kyoto. Meals included: Breakfast</p>
Day 10- Kyoto-Koyasan	<p>Breakfast in the ryokan. After breakfast leave for Koyasan. It is a trip to mountain top Buddhist Retreat. It is a perfect way to delve into the quiet mysticism of Japanese Buddhism. Lunch in the temple (Vegetarian is available). Leave for Kyoto after lunch. Evening free at leisure in Kyoto. Suggestion- Onsen. Overnight stay in Kyoto. Meals included: Breakfast</p>
Day 11- Kyoto-Hiroshima	<p>Leave for Hiroshima early in the morning. Have breakfast enroute Hiroshima. Check- in into the hotel. Leave for guided city tour on SIC basis sharp at 1100 hours. Visit Hiroshima Peace Memorial Park and Museum. Visit Atomic Bomb Dome. On 6th August 1945, first atomic bomb ever in human history was dropped on Hiroshima. The Atomic Bomb Dome was located almost directly underneath the explosion, it somehow avoided complete destruction and the remains of the building still stand today. Have lunch. Post lunch go to Shukkei-en. Have a walk in the typical Japanese garden. Learn more about them. Evening free at leisure. Overnight stay at Hiroshima. Meals included: Breakfast</p>
Day 12- Hiroshima-Miyajima	<p>Leave for Miyajima early in the morning. Breakfast enroute Miyajima. Visit Itsukushima Shrine (Floating Torii Gate). After that visit Momijidani-koen. It is one of the most picturesque gardens in Japan. Have lunch. Post lunch go to Mt. Misen. It is the highest mountain on the island. Go to the top of the mountain by ropeway for the best view. Leisure time at the top. Leave for Hiroshima. Evening free at leisure. Overnight at Hiroshima.</p>
Day 13- Hiroshima-Osaka	<p>Transfer to Osaka. Depart with sweet memories!!</p>

Inclusions-

- Return airfare by All Nippon Airlines
- Visa Fees

69 | JAPAN. ENDLESS DISCOVERY.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde.
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

- Insurance
- Hotel with breakfast
- Transfers and sightseeing by Shinkansen and AC coach as mentioned in the itinerary
- Entertainment mentioned in the itinerary

Exclusions-

- Lunch and dinner
- GST and other taxes
- Any increase in airfare, visa fees, airport taxes, government taxes, fuel or any new taxes from government
- Any upgradation in airline class or hotel category
- Laundry, telephone charges, shopping, wines & alcoholic beverages, mineral water, items of personal nature, etc
- Any extra cost incurred on behalf of an individual due to illness, accident, hospitalisation, or any personal emergency
- Anything specifically not mentioned in the 'Includes' column

Tour Cost- INR 1,90,000 Per Pax

Itinerary 3- Olympics Tour

Tour Overview- 1 Country | 3 Cities | 8 Days

Tokyo-Yokohama-Shizuoka

- 8 Days/7 Nights
- Customisation available as per budget and sports interest
- Enjoy traditional and modern Japanese life
- Live like a local

Tour Highlights-

- View all picturesque landmarks of Tokyo
- Enjoy the best view of Osaka from Tempozan Ferris Wheel
- Learn about Japanese culture at Tokyo city tour
- Cheer your favourite teams in the Olympics event

Itinerary-

Day 1- 24 th July 2020 Tokyo	Arrive in Tokyo early in the morning. Early check-in to the hotel. After breakfast leave for Tokyo Imperial Palace . It is the site of old Edo castle. Visit beautiful gardens there. After that, leave for Tokyo Skytree . You can see Mt. Fuji on clear days as it is Japans tallest structure. Have lunch in a local restaurant. Post lunch, leave for Tokyo National Museum . It is considered the oldest national museum in Japan, is the largest art museum in Japan, and is one of the largest art museums in the world. At 1730 hours, leave Olympic Stadium for grand opening of Olympics and Paralympics Games 2020. Overnight stay at Tokyo Meals Included- Breakfast
Day 2- 25 th July 2020 Tokyo	Breakfast at hotel. After breakfast, leave for Yumenoshima Park where Archery matches would be held. Enjoy the live match till afternoon. Then we have lunch and proceed to Senso-ji Temple . It is Tokyo's oldest temple, and one of its most significant. Formerly associated with the Tendai sect of Buddhism, it became independent after World War II. Then we proceed to Meiji Shrine . It is a shrine dedicated to 19 th century emperor. Have lunch. Post lunch, go to Harajuku for shopping. Then leave for Tokyo Tower which is also known as an Eiffel Tower of Japan. Visit a Guinness World Record museum, aquarium and wax museum. In the evening after becoming dark, go to the observation deck and have look at the twinkling

70 | JAPAN. ENDLESS DISCOVERY.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

	city of Tokyo. Overnight stay at Tokyo. Meals Included- Breakfast
Day 3- 26 th July 2020 Tokyo	Early in the morning, leave for Tsukiji Fish Market . Here you can find fresh and processed seafood and produce alongside food-related goods such as knives. It is a must visit place when in Tokyo. Sushi lovers can try best sushis in the market for breakfast or have breakfast in the nearby restaurant. Then we go for swimming event at Tokyo Aquatics Centre . After that we will have lunch and enjoy diving event at the same place. Evening free at leisure. Meals Included- Breakfast
Day 4- 27 th July 2020 Tokyo	Breakfast in the hotel. After breakfast leave for Musashino Forest Sport Plaza for badminton match. Afternoon free at leisure. In the evening we go to Tatsumi Water Polo Centre to enjoy water polo event. Overnight at Tokyo. Meals Included- Breakfast
Day 5- 28 th July 2020 Tokyo-Yokohama- Tokyo	Breakfast in the hotel. After breakfast, leisure time. Then leave for Yokohama in the afternoon for baseball (Softball) event. It will be held at Yokohama Baseball Stadium . Enjoy the event and return back to Tokyo. Overnight stay at Tokyo. Meals Included- Breakfast
Day 6- 29 th July 2020 Tokyo-Shizuoka- Tokyo	Breakfast at hotel. Leave for Fuji International Speedway for cycling event (on road). Osaka. Enjoy till evening and return back to Tokyo. Evening free at leisure. Overnight stay at Tokyo. Meals included: Breakfast
Day 7- 30 th July 2020 Tokyo	Breakfast at hotel. After breakfast leave for Kasai Canoe Slalom Centre for canoeing event. Evening free at leisure. After dinner, leave for Saitama Super Arena for badminton match. Overnight stay at Tokyo. Meals included: Breakfast
Day 8- 31 st July 2020 Tokyo-Mumbai	Transfer to Narita International Airport. Depart with sweet memories!! (Stay can be extended till the closing ceremony according to the interest and budget of the guests)

Inclusions-

- Return airfare by All Nippon Airlines
- Visa Fees
- Insurance
- Hotel with breakfast
- Transfers and sightseeing by AC coach as mentioned in the itinerary
- Olympics games tickets

Exclusions-

- Lunch and dinner
- GST and other taxes
- Any increase in airfare, visa fees, airport taxes, government taxes, fuel or any new taxes from government
- Any upgradation in airline class or hotel category
- Laundry, telephone charges, shopping, wines & alcoholic beverages, mineral water, items of personal nature, etc

71 | JAPAN. ENDLESS DISCOVERY.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



- Any extra cost incurred on behalf of an individual due to illness, accident, hospitalisation, or any personal emergency
- Anything specifically not mentioned in the 'Includes' column

Tour Cost- Depends upon the customization

6.04: USP OF PROPOSED TOUR ITINERARY

Usually in the itineraries by other travel agencies, they try to cover everything in 8 or 9 days. Therefore, visitors don't get time to experience and explore the place, the country and interact with the locals. In the above itineraries, I have kept most of the evenings for leisure so that tourists can explore nook and corners of the city they are in. In all the itineraries, I have included all touristy places as well as off-beat places that no travel company offers. For e.g. - Hozon-ji temple, tempozan ferris wheel, etc. No company gives an opportunity to meet and greet with Geisha and Maiko artists. This is exclusively for the above itineraries. I have also included tea house which teaches tourists how to drink tea in Japanese manner which is very different from the Indian style. In Kyoto, guests will stay in a ryokan which is an experience no one can miss in Japan. There they will be able to experience Japanese lifestyle.

Cherry blossom tours in Japan have become very common these days. Therefore, for Special Interest Tours, I have planned an itinerary for Tokyo Olympics 2020 which is going to attract millions of tourists to Japan. Olympics games happen once in 4 years in different countries every time and this year it is luckily happening in Japan, so experiencing the games in a country like Japan is definitely a unique experience.

• SOUVENIRS TO GET FROM JAPAN:

- 1) **Lucky charms-** Shinto and Buddhists believe in driving away evil spirits. You can get Maneki Neko which is a lucky cat or small bells to hang or even silk bags with prayers inside.
- 2) **Chopsticks-** Chopsticks is an obvious choice. You get beautiful and colourful chopsticks at reasonable rates. It can be the best choice to gift your close ones!
- 3) **Ceramics-** Pottery in Japan has evidence from 10,000BC. You can get sake sets, bowls, dishes, cups, teapots, etc from Japan to use in your house.
- 4) **Sensu (Folding Fans) -** Folding fans are meaningful souvenir from Japan. They are made from bamboo or Japanese Cypress and connected by washi paper.
- 5) **Daruma Dolls-** Daruma dolls appear to be fearsome bearded men. Their grumpy-looking demeanour actually has a positive message behind it. They are meant to be scary, but encouraging!
- 6) **Kitkats-** You get plenty of flavours of Kitkat in Japan. You have to get Matcha flavoured Kitkat because you can't get it anywhere else in the world, but only in Japan!





CHAPTER 7- MARKET RESEARCH AND ANALYSIS

7.01: TARGET CUSTOMER PROFILE

As we discussed earlier, Japan has a lot to offer to all the age groups and all kind of tourists. So there everyone can be targeted for tourism in Japan. But only drawback being, Japan is a very expensive country if you don't plan your trip well. If you stay in BnB or hostels your trip will be a budgeted one. Average budget for Japan ranges from 1 lakhs to 2.5 lakhs. Therefore, mostly middle class or higher middle class can be targeted. Starting from kids to senior citizens, everyone can enjoy to the fullest in Japan. People who love culture will love Kyoto and nearby areas. Whereas, people who love modern life or night life will enjoy in Tokyo or Osaka. Fit and healthy people can travel to Japan as there is a lot to walk and sometimes, there's too much of travelling. Though they have developed moving walkways, elevators and escalators everywhere, you may feel tired after some point.

7.02: SURVEY QUESTIONNAIRE

(Attached in the Appendix)

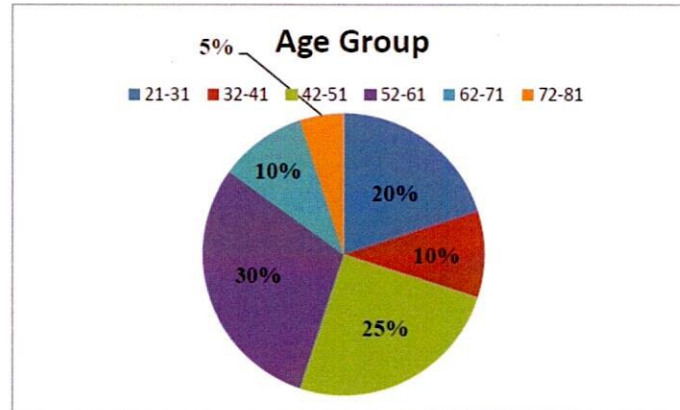
7.03: ANALYSIS OF SURVEY

(Forms attached in the appendix)

Overview

Q1. Age

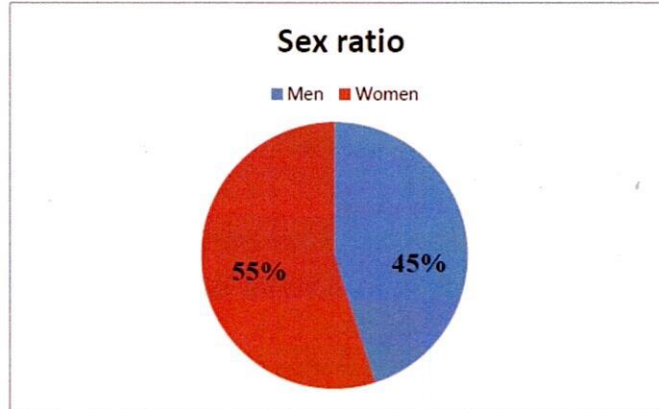
Ans- I included people from age 21 years to 79 years as I have included attractions where people from all age groups can enjoy.



Q2. Sex

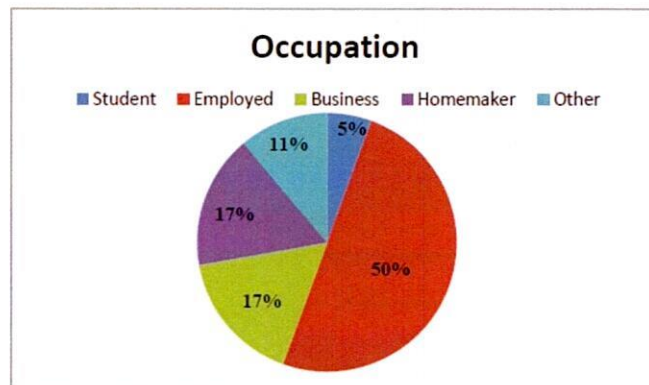
Ans- My survey form was filled by eleven women and nine men.





Q3. Occupation

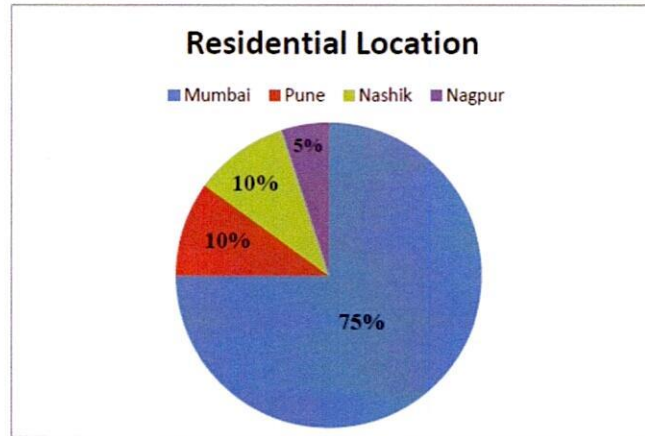
Ans- Only one person out of twenty from the data is a student. While most of the people are employed or working in some firm/company (9/20). Only three women out of twenty are homemaker. And three people out of twenty have their own business. Two people have retired from their jobs.



Q4. Residential Location

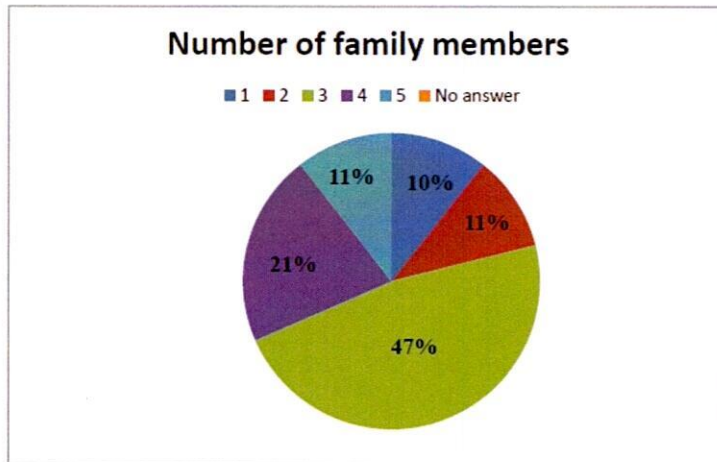
Ans- Most of the people is from the various parts of Mumbai (15/20). Two people are from Nashik. Two people are from Pune and one person is from Nagpur. I conducted the survey of outstation people on a phone call.





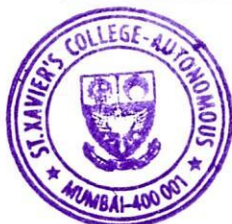
Q5. No. of Family Members

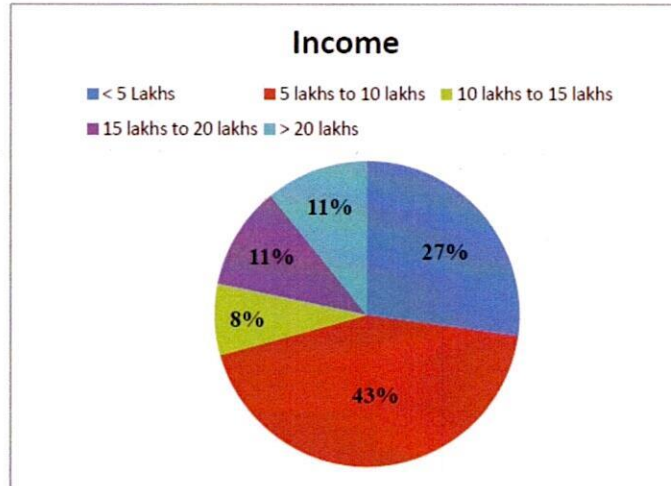
Ans- Except two people from the data who were single or living alone, all others had a family of two-four people.



Q6. Annual Income/ Annual Family Income

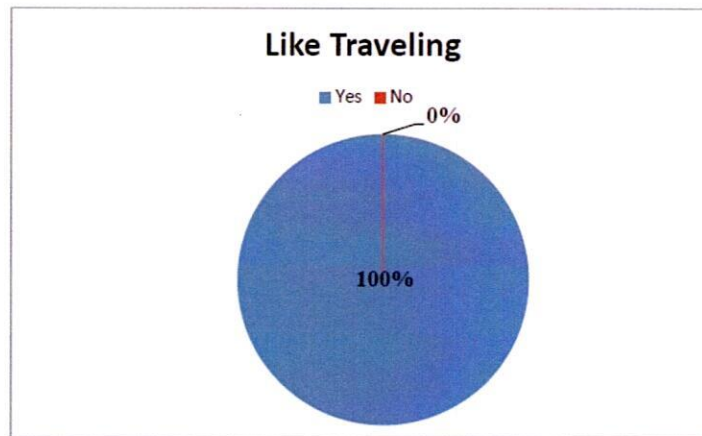
Ans- Five people out of twenty have income less than 5 lakhs annually. While most of them have income between 5 lakhs to 10 lakhs (8/20). Three people have annual income from 10 lakhs to 15 lakhs. Two people have income between 15 Lakhs to 20 Lakhs. Only two people have income above 20 lakhs.





Q7. Do you like to travel? Why?

Ans- Everyone from my data loves to travel. Most of them love to explore new places, collect experiences or try different cuisines.

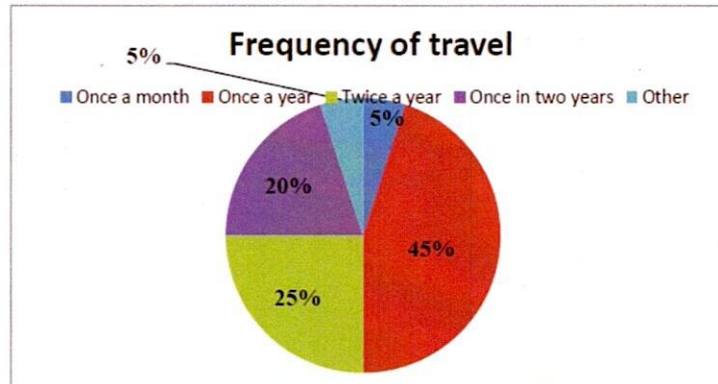


Q8. How often to do you travel?

Ans- Most of the people travel once in a year (9/20). Only one person travels once in a month. Five people travel twice in a year. Four people from my data travel once in two years. One person who has his own travel agency travels more than 6 times in a year. Here we understand that most of the people are enthusiastic and travel at least once in a year.

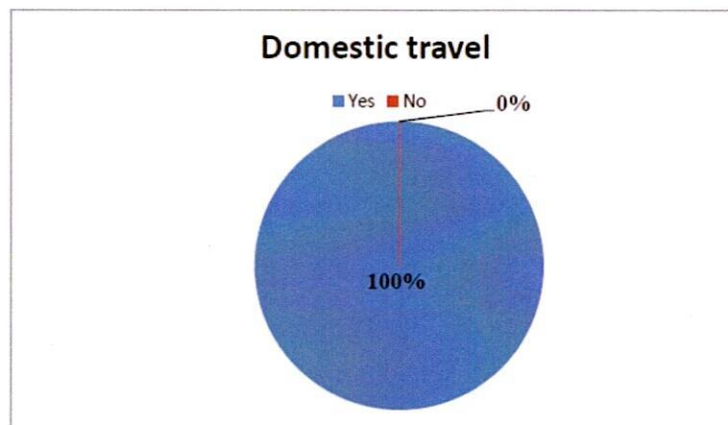
(This does not include travelling back home by outstation students or employees)





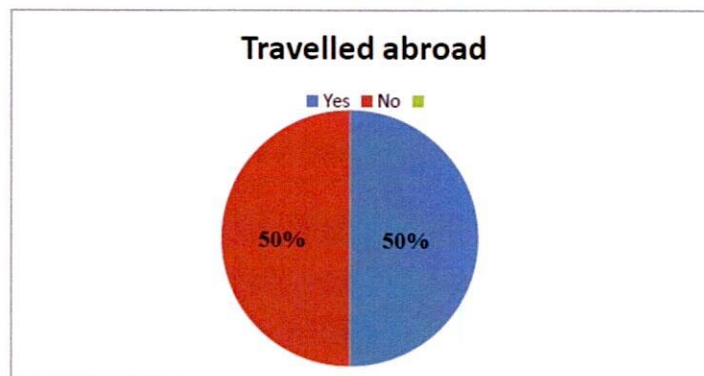
Q9. Do you travel within India?

Ans- Everyone travels within India for some or the other reason. There is not even a single person in my data who hasn't travelled within India.



Q10. Have you travelled abroad? If No, why not?

Ans- Ten people have travelled abroad in many countries. While other 10 either didn't get an opportunity to travel or they find foreign tour packages to be very expensive. But here the results are 50-50 i.e. 10 people have been abroad and 10 people are yet to go.



77 | JAPAN. ENDLESS DISCOVERY.



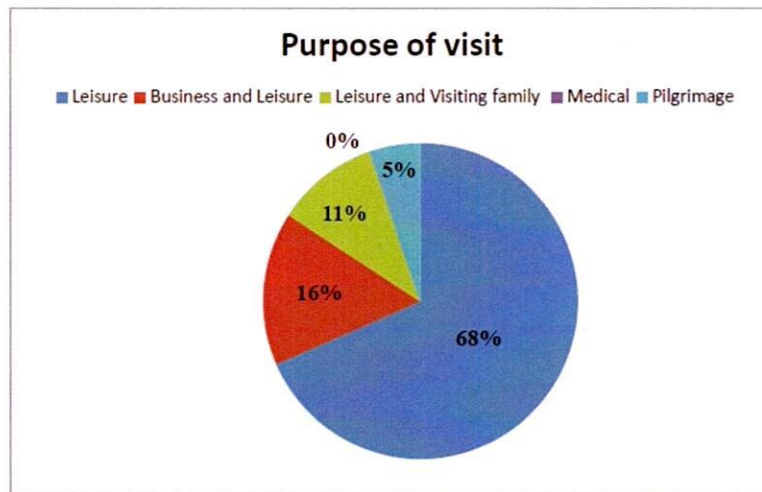


Q11. Name the countries you have already visited

Ans- Most of the people has visited countries in Europe, America, South-East Asia and Sri Lanka, Canada, Hong Kong-Macau, etc.

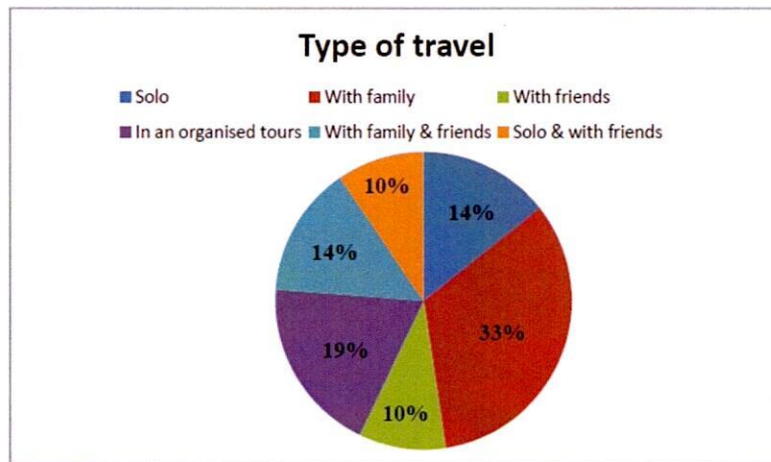
Q12. Purpose of your visit(s)

Ans- Mostly people travel for leisure and also for visiting their friends and relatives. Only one from my data travels for business purpose.



Q13. Type of Travel

Ans- Mainly people love to travel with their families and friends. Very few people especially those above 50 years opt for organised tours by some travel agency.



Q14. Trip Organizer

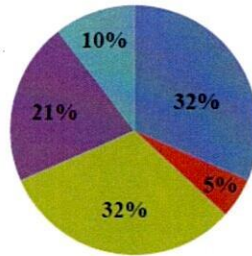
Ans- Due to great technologies, people can find any information on Google. Therefore, they can arrange for their own trips and book everything in advance. Very few people who are above 55 years and are not well-versed with the technology book their trips through a travel organiser or a travel agency.





Trip organiser

■ Self
■ Travel agent
■ Tour operator/travel companies
■ Self & tour operator
■ Self & travel agent
■ No answer

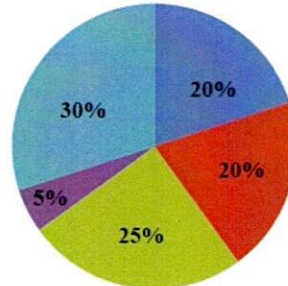


Q15. Average budget of each foreign trip

Ans. Most of the people have budget for around 50,000 to 1 lakhs. Very few people have higher budget of 2.5 lakhs or 3 lakhs. It means that very few people have disposable income and are ready to spend money for foreign tours.

Average Budget

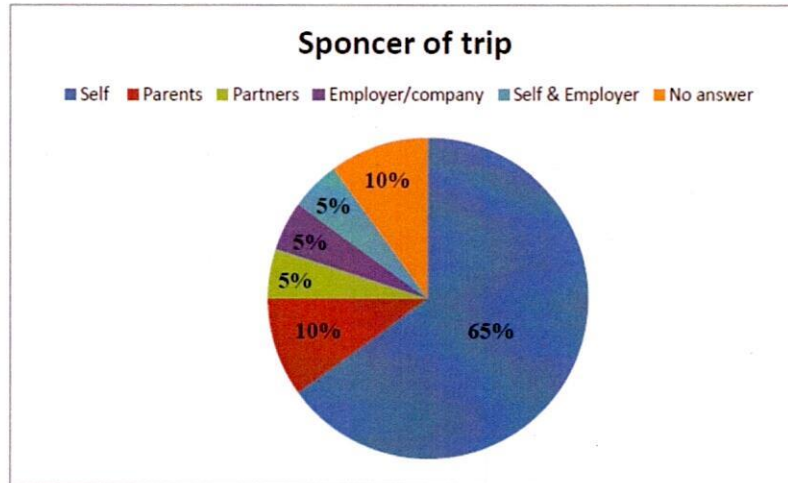
■ 50,000-1,00,000
■ 1,00,000-2,00,000
■ 2,00,000-3,00,000
■ 4,00,000 & above
■ No answer



Q16. Who pays for the trips?

Ans. Everyone from my data pays for their own trip. Only two people get their trips sponsored by their parents.





Q17. Rank in order of preference: (put number 1-5 next to it)

Sightseeing (Castles, monuments, museums) _____

Adventure activities _____

Cultural activities _____

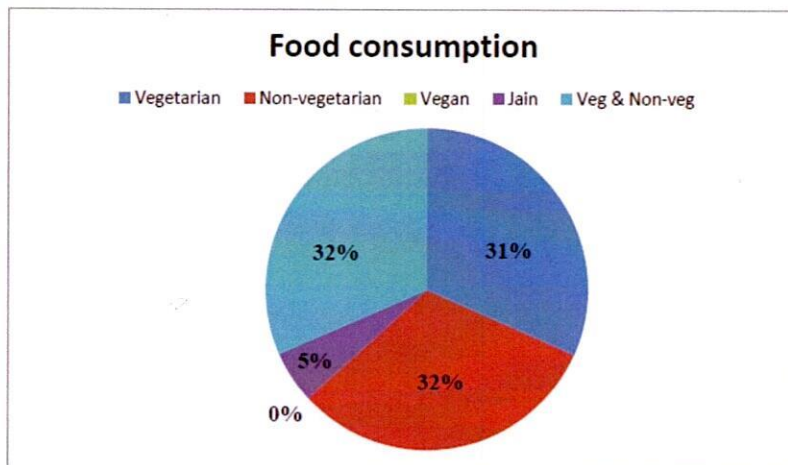
Relaxation in hotels/resorts _____

Natural Beauty (Beaches, mountains, natural wonders) _____

Ans- The preferences are different for everyone.

Q18. Food Consumption on trips

Ans- There is no person of vegan food preference in my data list. Most of the people consume vegetarian or non-vegetarian food. Only one person consumes jain food.



Q19. Food preference abroad

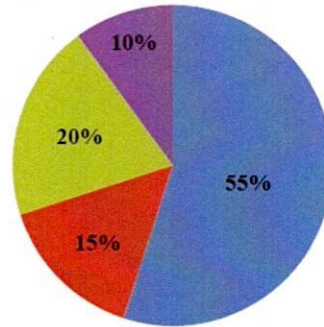
Ans- People those who are fond of trying different cuisines would love to try the local food. But, many people in my data list would prefer Indian food while on the tour. While for many of them choices will depend upon the country they visit.





Food preference

■ Indian food ■ Local food ■ No preference ■ Indian & local food

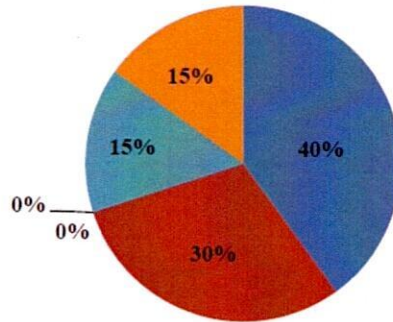


Q20. Accommodation preference

Ans- People travelling for leisure always opt for resorts or hotels. Budget travellers opt for hostels and those who are travelling to learn about the culture go for local B&B. In my data almost everyone prefers to stay in a hotel or a resort.

Accommodation preference

■ Hotels ■ Resorts ■ Hostels ■ Local B&B ■ Hotels & resorts ■ Hotels & B&B



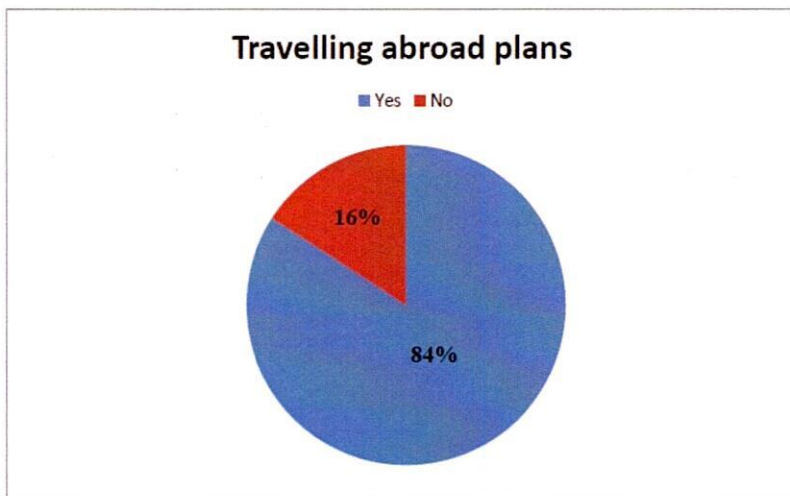
Q21. Do you wish to/ plan to travel abroad in the next 2 years?

Ans- Almost everyone is planning to travel abroad in next 2 years. We understand the eagerness of people to explore new places and cultures.





Travelling abroad plans



Q22. If this is your first trip abroad, what are you main concerns?

Ans- Everyone has a different answer.

Q23. What do you know about Japan?

Ans- Most of the people didn't have any specific idea about Japan. They didn't know the attractions or sightseeing. Many of them just knew about Cherry Blossom, Kimono, Bullet Trains, Natural Calamities in Japan, Hard Working People in Japan, Japanese technology, etc. I had to ask people if they knew about these things. No one could answer this question spontaneously.

Q24. What do you think about Japan now?

Ans- After reading my itinerary, people understood that Japan has a very rich history and a beautiful culture. It is a blend of both. Few people just knew Tokyo. But they got to know that Japan is much more than just Tokyo. They read about many different attractions and destinations and mentioned that in this question. People got to know that Japan is a combination of traditional as well as modern life. Some of them started planning a trip to Japan for Cherry Blossom which will start in March.

Q25. Which of the attractions or activities mentioned in the itinerary do you find interesting?

Ans- Indians always find Hozon-ji temple interesting as it is the temple of Lord Ganesha. Families with kids loved the option of universal studios. Arashiyama Bamboo Grove was also interesting according to many people. Different people found different places interesting as per their interests, age and purpose of travel.

Q26. Which of the attractions or activities mentioned in the itinerary do you dislike? Why?

Ans- Only one person found Nara deer park and tea house to be boring. Rest everyone loved the attractions. Japanese tea tastes very different. So not everyone will like the Japanese tea.

Q27. Will you buy the proposed tour package? If no, why not?

Ans- Only one person was sceptical about buying the tour package. Rest all of them showed their willingness to buy the package.

Q28. Suggest changes in the tour package/ itinerary, if any

Ans- Most of the people found the itinerary good to go. But, few people wanted me to include Tokyo and Mt. Fuji in the itinerary. Senior citizens found itinerary to be very hectic. Two people suggested to





Alpine route and Ashikaya Flower Park. While some wanted to learn Japanese culture especially Ikebana art (Art of flower arrangement).

7.04: FINDINGS AND CHALLENGES

Earthquakes and Tsunamis are the major setbacks for development of tourism sector. Thus people from my survey were sceptical about going there. The biggest issue with Japan, regarding sustainability is they not shout about their exciting travel opportunities i.e. cultural tours, skiing, alpine hiking, subtropical islands, family friendly, cycling remote valleys for cycling, unique traditions and almost nonexistent crime! There are hardly any issues to pick on here and yet, they aren't really developing tourism as rapidly as they might. People who travel to Japan love to go there again and again. The biggest issue in Japan is, however, change. Their traditions and rituals are so engrained that any behavioural change seems to be layered with many complex reasons for not doing something. Japanese Tourism Board should start marketing Japan more and more as it is their one of the major sources of income. Most of the people from my survey list don't know anything about Japan. Hardly few people knew about the cherry blossoms and earthquakes and tsunamis. Even though there are many natural calamities in Japan, they have developed their systems of earthquake alarm, etc very well. And they are very accurate. They have made the best use of technology. People should be made aware of that so that they won't be afraid to travel to Japan. Another perception which I found while conducting a survey was that Japan is a very expensive country so middle class cannot travel. But if you plan out everything systematically and well in advance, it can fit in your budget.



Japan Tsunami





CHAPTER 8- CHALLENGES

8.01: ENVIRONMENTAL SUSTAINABILITY

Sustainability in tourism industry, one that establishes a suitable balance between the environmental, economic and socio-cultural aspects of tourism development, plays an important role in conserving biodiversity. It attempts to minimize its impact on the environment and local culture so that it will be available for future generations, while contributing to generate income, employment, and the conservation of local ecosystems. Sustainable tourism maximizes the positive contribution of tourism to biodiversity conservation and thus to poverty reduction and the achievement of common goals towards sustainable development. The positive side of sustainable tourism is to ensure that development is a positive experience for local people; tourism companies; and tourists themselves. Sustainable Development Goals (SDGs), which follow the concept of human security in combining economic development, social inclusion, and environmental sustainability. Japan also contributed to development through its innovative TICAD (Tokyo International Conference on African Development) process, linking Japan and Africa in a strong, vibrant, long-term partnership for development and mutual well-being. Japan is a world leader in energy efficiency and in urban design that combines economic efficiency with cultural, aesthetic, and environmental values in urban life. It's not by accident that Japan has the world's highest life expectancy, a remarkable 83.7 years on the latest data, an achievement that reflects Japan's broad-based commitment to inclusive and sustainable growth. We are now in the age of sustainable development, and once again we can count on Japan's visionary role in achieving sustainable development not only in Japan but around the world with Japan as a role model and a partner to other countries. Japan is also pioneering the pathway to a low-carbon economy to fulfil the Paris Climate Agreement, by deploying Japan's world-class engineering excellence to promote energy efficiency, new materials, and new kinds of vehicles, such as Toyota's fuel-cell vehicles.

DID YOU KNOW?
**JAPAN RANKS AS TOP
ASIAN COUNTRY IN
GLOBAL
SUSTAINABILITY
INDEX**

On May 20, 2016, the Government of Japan established a new Cabinet body called the "SDGs Promotion Headquarters", headed by the Prime Minister and composed of all ministers. The SDGs Promotion Headquarters was established to foster close cooperation among relevant ministries and government agencies, and to lead the comprehensive and effective implementation of SDGs-related measures as a control tower. In the Guiding Principles, Japan established the following vision: "Become a leader toward a future where economic, social and environmental improvements are attained in an integrated, sustainable and resilient manner while leaving no one behind." Japan is still far from "chaos", especially in comparison with other societies around the world that are crumbling under war, debt, drought and disease. Japan's government and business community are displaying growing enthusiasm for taking actions in line with the U.N. agenda for green growth.

DID YOU KNOW?
**JAPANESE HOUSEHOLDS
RECYCLE THEIR
BATHWATER IN THEIR
LAUNDRY MACHINES.
DRYING CLOTHS IN SUN**





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

The Sustainable Development Goals, designed to promote prosperity while protecting the planet, are providing an incentive for both public and private sector players in Japan to launch new initiatives to support more eco-friendly economic development. The Environment Ministry is working to incorporate the goals into its policy reports and plans, while a growing number of companies are aligning their business and product strategies to the agenda. Japanese companies are beginning to make strategic responses to the SDGs. Japan may be crowded and land may be scarce, but it's certainly clean and cared for. Littering is rare in Japan, and Japanese are taught practically at birth about separating trash for recycling. You can do your part by depositing all your trash like newspapers, plastic water bottles, cans into the appropriate recycle bins found in parks, subway stations, and other public places. The Japanese are proud of their uniqueness, although never arrogant about it to visitors.

“Over the past 50 years, industrial Japan has gone through periods of destruction and renaissance, and Japan hopes to establish ‘Environmental Japanology’ as a means of uniting Japan’s modernization and cultural traditions, in pursuit of a sustainable society. Japan can offer the world a valuable paradigm for sustainable development based on Japan’s own, often contradictory experience, including traditions of nature conservation and the modern challenges of severe industrial pollution. Some initiatives taken by the country and its government and private sectors are- The maker separator, a component vital for enhancing the capacity of lithium-ion batteries often loaded to electric cars. Fuji Xerox has launched an international resources recycling system in line. In addition to recycling of parts, these centres also ensure that all materials used in the machines, such as iron, copper and aluminium will be reused or burned to extract heat. The recycling rates for Fuji Xerox products are near 100%. And the program is operated profitably. Thus, companies can benefit from incorporating the SDGs into their management policies. Most of the nation’s forests, which play a critical role in retarding runoff and soil erosion in the many mountainous areas, are protected under the Nature Conservation Law of 1972, and large areas have been reforested. Parks and wildlife are covered by the National Parks Law of 1967.

On other hand, Experts and policymakers are calling for stronger action, such as enacting basic legislation to promote the SDGs and establishing a new cabinet portfolio in charge of the initiative. Japan is one of the most important scientific and technical centres of the world, so Japanese businesses need to lead the technologies for sustainable development. Japan is still sadly doing with cetaceans. Dolphinariums are still big business in Japan. And of course, it is hard not to have heard about the highly unethical and shocking “Dolphin Drives” in Taiji, where these exquisite creatures are corralled and then either sold off to dolphinariums, or killed in a slow, cruel manner, for their meat. Whales and Dolphins are dead meat. Japan is the only market for fin whales caught in Iceland, which are all exported. Factory noise levels are regulated under a 1968 law. The Shinkansen trains must reduce speed while travelling through large cities and their suburbs. Although, Japan like rest of the developed world has lost touch with many traditions of conservation that can help in dealing with contemporary problems of waste and overconsumption.

DID YOU KNOW?

**WHALES AND
DOLPHINS ARE KILLED
IN JAPAN FOR THEIR
MEAT.**





Tokyo Olympics:

Tokyo Olympics and Paralympics Games are the world's largest sports events, and the delivery of the games has much wider-ranging impact than most people can imagine. This impact is not limited to sport, but also on society, the economy and the environment. The influence of Tokyo 2020 Games will extend far beyond the parameters of Tokyo to encompass the whole of Japan and the wider World. The Olympics and Paralympics Movement and Sustainability is precisely looking after and contributing in United Nations "The 2030 Agenda for Sustainable Development." Not only 17 SDGs but also UN's "Sport is also an important enabler of sustainable development." International Olympic Committee's "Olympic Agenda 2020" (2014) included sustainability in all aspects of the Olympic Games and within the Olympic Movement's Daily operations. Five main sustainability themes and their direction presented by Tokyo 2020. Government of Japan and other delivery partners work on towards preparations for and operations of sustainable Games. The five themes and efforts taken for themes of Tokyo 2020 Olympics are:

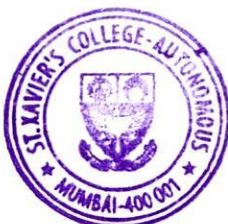
A. Climate Change- Towards Zero Carbon Use of renewable electricity for the operation of the Games. Implementing venues with energy saving technologies. This goal represents the intention of Tokyo 2020 and delivery partners to manage the Games focusing on maximum energy savings and use of renewable energy, and thereby to build the foundation of decarbonisation with the effort of everyone, ahead of the world! Major activities done would be:

- 1) Reduction of environmental load in venue development by utilising existing venues and energy saving technologies.
- 2) Electricity used in competition venues, IBC/MPC, and the Olympic/Paralympic village will be 100% renewable electricity.
- 3) Promote of transport with lower environmental load by utilising public transport and fuel cell vehicles.

B. Resource Management- Zero Wasting Reuse or recycle 99% of procured items and goods. Operation BATON - Building Athletes village with Timber of the Nation is one of the themes. It is aiming to suppress deforestation and land devastation caused by resource exploitation as well as to bring environmental load by waste into zero, on the basis of utilising resources without any wasting throughout the supply chain. Major activities done would be:

- 1) Reuse or recycle 99% of procured items and goods.
- 2) Reuse or recycle 65% of wastes generated from operations of the Games.
- 3) Promotion of the use of renewable resources by Operation BATON.

C. Natural Environment and Biodiversity- City within nature or nature within the city i.e. recycled use of rainwater in venues is planned. Greening at venues to conserve existing trees and native species is a target. Looking forward to the legacy, Tokyo 2020 will restore and form a rich ecological network





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

through the Games and contribute to the creation of a new urban system that will improve comfort and resilience. Major activities done would be:

- 1) Implementation of heat management in cooperation with Tokyo 2020, TMG, relevant governmental agencies
- 2) Effective use of water resources by using filtration facilities in the venue and utilisation of rainwater and recycled water.
- 3) Develop the ecological network while also harmonizing with the green around the ocean parks by consideration for existing trees and greening of competition venues by native species.

D. Consideration of Human Rights, Labour and Fair Business Practices- Celebrating Diversity and Inspiring Inclusive Games for everyone. The Tokyo 2020 Accessibility Guidelines are based on UN's Guiding Principles on Business and Human Rights. It aims to firmly incorporate diversity and inclusion (D&I) into every area of games operation to respect human rights of all people involving with the Games, and try to prevent or mitigate adverse human rights impacts. It also ensures fair business practices without corruptions or anti-competitive deals.

- 1) Accordance with UN's Guiding Principles on Business and Human Rights
- 2) Raise awareness of Diversity and Inclusion
- 3) Secure accessibility by "Tokyo 2020 Accessibility Guidelines"

E. Involvement, Cooperation and Communications- United in Partnership & Equality i.e. Inspiring Inclusive Games for Everyone - Tokyo 2020 Medal Project: Towards an Innovative Future for all. The Games would open to everyone with participation and cooperation of entire society through interactions and training of various parties beyond countries and generations. We share such expertise and experience with people in society in order to help building a society where diversity & inclusion and engagement by various people and bodies are ensured as the norm.

- 1) Promote "Tokyo 2020 Medal Project.
- 2) Creation of wide involvement through the project with the public including "Tokyo 2020 Nationwide Participation Programmes"
- 3) Information sharing to raise public awareness of the importance of sustainability.

Some other steps taken to make this event a sustainable one are:

1) GETTING A MEDAL FOR RECYCLING: OLD DEVICES ARE TURNED INTO OLYMPIC MEDALS FOR TOKYO 2020: Old mobile phones along with thousands of old devices, will be recycled, with the gold, silver and bronze recovered and turned into Olympic medals for the Olympic Games Tokyo 2020.


2) INTERNATIONAL OLYMPIC COMMITTEE (IOC) TAKES LEADERSHIP ROLE IN THE UN SPORTS FOR CLIMATE ACTION INITIATIVE: The Initiative was launched on 11th December 2018 by the United Nations Framework Convention on Climate Change (UNFCCC), in partnership with the IOC, at a High-Level Event of the Summit. It aims to set the course for the sports world to address climate change through concrete commitments and partnerships, while applying verified standards to measure, reduce and report greenhouse gas emissions – in line with the Paris Agreement.



87 | JAPAN. ENDLESS DISCOVERY.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



8.02: ECONOMIC ISSUES

One can say that Japan is the world's great teacher of modern economic development. In the second half of the nineteenth century, Japan defended itself against colonial rule by embracing a modern, market-based economy built on advanced technology and export-led growth. Japan's justly famous Meiji Restoration of 1868 provided a blueprint for economic development for countless countries to follow. Japan famously adopted "best practices" from abroad through a remarkable global study mission, and also defended Japan's unique and venerable culture. Thus, Japan's economic reform and catching up was built on national values and international best practices. Japan's economy has struggled with deflation since its bubble economy peaked in 1989. In 2013, Prime Minister Shinzo Abe launched a serious effort, known as Abenomics, to help end the country's deflationary struggle. Abenomics has been structured as a series of stimulus and reform packages. The 2013 initiative continued to be carried out with three critical factors

of ongoing focus. To bring on a sustained recovery, economists are steadily monitoring wage growth creation, the right value-added tax (VAT) rate and support for appreciating the value of the Japanese yen. Many investors look to capitalize on the potential for Japan to overcome its deflation problems through the Abenomics initiative. Japan's economy is relying on Abenomics to deliver meaningful reform. It has already reported many milestones including the liberalization of the electricity industry, participation in the Trans-Pacific Partnership, and the implementation of changes in corporate governance. However, Japan is still expecting a lot more. In addition to improvements from the three key metrics, economists are also hoping for improvements in the areas of labour regulation and immigration. While some great strides have been made, many critics of Abenomics feel the time is growing short. The national debt continues to be a big challenge while opportunities to postpone big policy decisions are diminishing. As such, many believe 2020 will be a critical year for determining Japan's global economic positioning.

- 1) **Wage growth**- Abe has placed an emphasis on raising wages for workers. Continuously pressuring Japanese companies to raise wages for workers, he believes wage increases create a virtuous cycle of increased consumer spending followed by higher corporate profits that lead to more latitude for further wage increases. His policies finally seem to be showing some positive results. In June 2018, real wages marked their fastest annual increase in more than 21 years, with a 2.8% year-over-year increase. Household income also marked its fastest gain in three years with a 4.4% rise over the same time period. Signs of rising wages are encouraging for Bank of Japan policymakers.
- 2) **Value-Added Taxes (VAT)** - In 2014, Japan increased its value-added tax from 5% to 8% which many economists believe to be a reason for consumer spending struggles. Japan uses the VAT as an important source of revenue to help make payments on its enormous amount of national debt. As of 2018, the country's national debt to gross domestic product (GDP) was 238.2%. While the government would be helped by raising the VAT, it has postponed increases as a spending stimulus measure. The VAT was scheduled to increase to 10% in 2017 but that increase was postponed until October 2019. Many economists predict the planned increase might trigger a wild swing in private demand that will put the brakes on the world's third-largest economy, as happened in 2014.
- 3) **The value of Japanese Yen**- From 2012 to 2016, the value of the yen against the U.S. dollar declined approximately 30%, which was a boon for corporate profits. The decline helped to make its products more attractive than many of its top manufacturing competitors in Korea, Taiwan, and China. As a result, its products were more compelling globally. However, since 2016 the yen has steadily regained against the dollar but its fluctuations have remained difficult to predict. International tourism has potential to fulfil a long standing vision of increased economic diversity and more equitable distribute of smaller communities. The 2020 Olympic Games is a good opportunity for Japan to advertise itself and engage in the world competition to attract tourists.

DID YOU KNOW?

**ECONOMIC REFORMS BY
JAPANESE PRIME MINISTER
SHINZO ABE ARE KNOWN AS
ABENOMICS.**





Japan can become well-established tourist brand if foreign visitors are well satisfied with services provided.

8.03: SOCIO-POLITICAL ISSUES

The corona virus outbreak is posing myriad challenges for the Japanese economy, including a key Abe administration policy initiative of the promotion of inbound tourism. In recent years, inbound tourism has been one of the few sectors to see rapid growth in the long-stagnant Japanese economy. "It has been confirmed that the effects from inbound tourism is turning into one of the main growth engines of the Japanese economy," declared the Japan Tourism Agency in its 2018 white paper. But that rosy vision of "a tourism-oriented country" has recently been put in doubt. In December, the number of tourists from the country who came to Japan stood at 248,000, down 63.6 percent from the same month in the previous year. Experts had already said it had become impossible for Abe's government to meet its target of 40 million foreign tourists in 2020. Then the corona virus hit. Beijing has taken the extraordinary step to ban all Chinese from going overseas on group tours, effective Jan. 27. The number of Chinese tourists, the largest group by nationality, is expected to fall drastically as a result. Some experts say the corona virus crisis is likely to continue for several months, possibly affecting the Tokyo Olympics starting July 24 — a nightmare scenario for Abe, who has tried to use the world's largest sporting event to promote the Japanese economy and thereby further drum up voters' support for his government. According to the studies, the crisis would peak between late April and early May, that means it would still continue further beyond that period. The new coronavirus, which was first officially confirmed in Wuhan on Dec. 31, has already infected at least around 9,800 and killed 213, according to the tally compiled by the South China Morning Post as of Friday. "I'm concerned. ... Now we have exactly about six months before the Olympic Games will start in July. I'd like the government to make its maximum efforts to get rid of the effects of the infectious disease by the time we will have the Olympic Games" Abe said. Safety and the sense of security must be ensured to make the Tokyo Olympics successful. On the political front, a setback in the promotion of inbound tourism is likely to deal a heavy blow to Abe as he struggles to carve out a legacy for his administration.

The latest population estimate by the Health, Labour and Welfare Ministry, released late last month, points to the accelerating decline of Japan's population with ever fewer births. The number of babies born in this country in 2018 is estimated at 9,21,000 down 25,000 from the previous year and falling short of 1 million for the third year in a row. The Abe administration has vowed to tackle this "national crisis" by taking steps to support young couples in raising children, such as making preschool education free. However, the statistics indicate that it will be extremely hard to alter the demographic trend anytime soon. While those steps should be steadily taken over the long term, the government also needs to introduce policies geared toward the reality that the aging and shrinking of the population will continue. The decline in the fertility rate has been attributed to a combination of various factors: changing lifestyles, more people marrying later in life or not marrying at all, the economic insecurity of younger generations in recent decades, which leave couples balking at having more than one child or any kids at all, and so on. The health ministry notes that after the second baby-boomer generation passed their mid-40s, the number of women of primary child-bearing age declined significantly. The Abe administration has set a target of raising the fertility rate back to 1.8 by 2025. That is still far out of reach considering that the rate of 2017 was 1.43. To make up for the tightening domestic manpower shortage in the aging and declining population, the government passed an amendment to the immigration control law through the Diet last year, opening the door for foreign workers to engage in manual labor, which it had banned earlier, at least officially. The government expects to accept up to 345,000 workers in five years under the program that begins in April. However, government figures show that the nation's population is declining at a much faster pace, and that rate is expected to accelerate.





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



People wearing masks in public spaces to avoid corona virus




Aging problem in Japan

90 | JAPAN. ENDLESS DISCOVERY.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



CHAPTER 9- MARKETING AND PUBLICITY

9.01: SWOT ANALYSIS OF DESTINATION

Strengths-

- 1) **Strong policy making-** The government of Japan has been successful in making strong and clear decisions with respect to the policy-making and public administration leading to a developed economy.
- 2) **Strong Popular Culture Serves as Natural Marketing-** Pop culture has the potential to trigger tourism. Anime, video games, manga comic, cosplay, and characters are aspects of Japanese popular culture (J-pop culture) that are widespread overseas. Japan is naturally marketed every time foreigners consume or actively seek out J-pop culture, this is because exposure to J-pop fosters fans' interest in visiting Japan where the content was created. In fact, many exchange students to Japan had their first exposure to Japan through anime, video games or manga.
- 3) **Retained Tourism Income-** Strength of Japan's tourism industry is that retained income is high, unlike other destinations such as Thailand, where it is reported that as much as 56% of all tourism income is leaked out of the economy. For such nations, a great portion of tourism receipts are lost due to high levels of foreign ownership within the tourism sector as well as the high reliance on imported food and goods which are used to provide the tourist experience. A lot of tourist spending in Japan is retained in the immediate local area of the prefecture where the spending occurs.
- 4) **Famous for being efficient** – Japan has always been famous for having the ability to manage large and complex systems efficiently and effectively making it one of the first choices for all kinds of industries.
- 5) **Skilled workforce** – The people of Japan are considered as highly skilled and committed that consistently delivers quality outcomes for whatever task they are assigned to. This helps in building Japan as a well-known brand image in terms of successful businesses.

Weakness-

- 1) **Disproportionate Weight in Regional Tourism-** There is a high degree of concentration of tourist activities in a few areas in Japan. Not only do 80% of Japan's international tourists come from less than five countries, once in Japan, more than 80% of their activities are restricted to a few limited areas, namely Tokyo, Osaka, Kyoto, Kanagawa and Chiba. The disadvantage is that the economic benefits of tourism are disproportionately distributed and these popular areas tend to be overcrowded putting pressure on the transportation system and available accommodation. Hotel occupancy rates in these five tourist towns far exceed those in other areas.
- 2) **Aging Population-** Japan is one of the countries which have the oldest population in the whole world. The median age of Japanese population is 46.1 which is a serious issue for the country's economic and social development.
- 3) **Perceived as Expensive-** An important consideration that affects customers' decision to visit a destination is affordability. One of the primary underlying obstacles to expanding inbound tourism is that Japan is considered quite expensive. This negatively affects traveller's decision to visit even when the yen is weak.
- 4) **Frequent Natural Disasters-** Japan has always been prone to many natural disasters like earthquakes, tsunamis, volcanoes, typhoons, floods, and mudslides working at the disadvantageous side of the country.
- 5) **Strict Visa Policies-** Asia is Japan's best customer and the market holds potential for significant growth. Japan has been relaxing visa requirements for selected Asian nationalities, such as those from ASEAN nations, and has seen a dramatic rise in visitors from these countries in the years following. Japan has complicated requirements for nationals of non-Asian countries that will potentially make it a challenge to widen its western tourist base. For example, nationals of Russia and former Soviet countries and the Middle East, not only require a visa, but in many cases their application requires many documents.

Opportunities-

- 1) **2020 Tokyo Olympics-** Upcoming international games will find tourists arriving from all around the world and make Japan even more recognised. The Rugby World Cup and the summer Olympic and

91 | JAPAN. ENDLESS DISCOVERY.





Paralympics Games are scheduled for Japan in 2019 (Already over) and 2020 respectively. Hosting such international games can result in a sizeable economic impact.

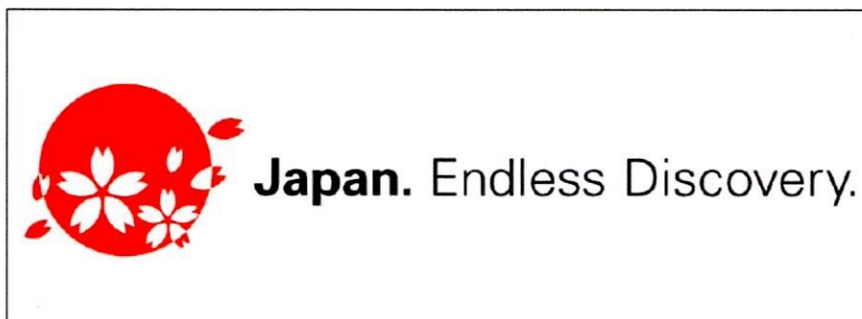
- 2) **Leverage World Class MICE Events-** Business travel makes a vital contribution to the economy of most developed and developing countries; it represents almost a quarter of the economic benefit from travel and tourism as a whole. For Japan, business travel like exhibitions, fairs, conferences, negotiations etc. represents approximately 30% of all inbound tourism. Additionally, business travellers to Japan spend an average of 35% more than leisure travellers. As such, increasing the number of business tourists can have a significantly impact on total visitor export.
- 3) **High levels of disposable income-** Japan is characterized by consumers with high levels of disposable income and companies with a strong global orientation and willingness to invest in sustainable, long-term products and services.
- 4) **Emerging Markets-** Japan, as a market, is an emerging one for global consumer products. This can be a huge opportunity for a country like Japan to tap these consumers and grow its economy further.
- 5) **Growing E-commerce-** The growth of e-commerce in the country also presents a unique opportunity to the new age entrepreneurs of Japan to explore and use this to the best of overall economic growth.

Threats-

- 1) **Military Tension with North Korea-** Since conducting its first atomic test in 2006, North Korea has been expanding its arsenal of missiles. In 1993, North Korea tested its first medium-range missile capable of reaching Japan's shore. Since then, the nation has continued to launch missiles in Japan's direction some of which have violated Japan's economic waters and or air space. This has been a source of rising diplomatic tension and conflict between the two countries. Despite opposition from the United Nations, North Korea is continuously advancing the range.
- 2) **Potential Economic Collapse-** The duration of recessions have been a bit long in Japan. The country is prone to long duration recessions which always is a potential threat to the economic collapse.
- 3) **High Tax Rate-** The tax rates in Japan are high leading to either low profitability or higher cost of products. This is another area of concern for the country like Japan to take care of.

9.02: MARKETING FEATURES AND PUBLICITY STRATEGIES

Japan Tourism uses a unique slogan "Japan. Endless Discovery!" to promote Japan as a tourism product in 2010. The Japan Tourism Agency has unveiled this slogan and logo as part of revamped up tourism promotions to increase international inbound visitor numbers. The slogan 'Japan. Endless Discovery', implies that Japan is a destination with countless historical, traditional, and cultural attractions, encouraging travellers to see the country as a destination for visiting more than once. The tourism industry in Japan will create more than 6.9 million jobs by, which will represent more than 10.9% of total Japanese employment. The industry is also a significant platform for international diplomacy. Despite the huge potential of the Japanese travel and tourism industry, the country remains a low-ranking destination for international visitors. The travel and tourism industry of Japan is not performing well by world standards. Given the present importance of this industry in the world economy, there is an urgent need for the Japanese tourism industry to improve its performance.



92 | JAPAN. ENDLESS DISCOVERY.





Few important campaigns started by Japanese Tourism board are-

- 1) **Yokoso! Japan**- 17 years ago Former Prime Minister Koizumi set the Japanese tourism industry a target of ten million visitors by 2010. In association with the announcement of this target, the JNTO initiated a "Visit Japan" campaign, which was a strategic promotion of inbound tourism with the slogan "Yokoso! Japan" (Welcome to Japan!) as the catchphrase for the campaign. The aim of "Yokoso! Japan" campaign was simply to bridge the wide gap between outbound and inbound visitors. The "Yokoso! Japan" campaign was supposed to focus on few countries in Asia, Europe and North America. However, the campaign was effectively executed only within Japan, with little or nothing of it being known in neighbouring Asian countries.



- 2) **Your Japan 2020 Campaign**- In 2020, the Japan National Tourism Organization (JNTO) is kicking off the "Your Japan 2020" campaign to provide special experiences and great deals to international visitors on an unprecedented scale. 2020 is the year that the Olympic and Paralympic Games will be held in Japan, and throughout the year, every corner of the country will be filled with a festive atmosphere. To share this buoyant mood with international visitors, the campaign offers memorable experiences and deals nationwide, including exclusive public openings, Japan-first special events, free air tickets to local areas, and large discounts. International visitors to Japan can expect a wide range of unique experiences only available in 2020, in every season and all over the country. Some features of 2020 campaign are-

- Many opportunities for free domestic flights and unprecedented discounts on both international and domestic flights.
- Amazing deals and fun shopping experiences with special events and benefits at more than 1,000 stores.
- Smoother travel. Enjoy the freedom and luxury of "hands-free" travel with half-price luggage storage and delivery services.
- New opportunities to get hands-on. Plenty of experiences, such as cooking classes for foodies.
- Pokémon and other popular characters reenergized for 2020.
- Special Exhibition (Kansai): The Thirty-three Pilgrimage Sites of Western Japan public exhibition of national treasures to mark the 1,300th anniversary of the sites founding.



First, Japan must continue to offer new and wide-ranging products and services to its tourism market to boost up the poor performance of older products and services. Japan's airlines, castles, shrines, temples, restaurants, ryokans and hotels in major cities should continue to update their services-foreign

93 | JAPAN. ENDLESS DISCOVERY.





ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

language speaking staff instead of the "Only Japanese" attitude which is seen even today at many places. To promote Japan, tourism board can make maximum use of social media. Visitors visiting Japan are totally satisfied. So customer satisfaction being great, their objectives are being achieved in recent years. Although Japan is the third-largest economy in the world (trailing only the United States and China), international tourists are still not fully aware of the country and its assets. Japan has many rich natural and cultural assets that extend far beyond its three major urban areas, but it needs to ensure that tourists across the world have a greater awareness of all it has to offer. For the tourism industry to flourish, public and private sectors need to come together to deliver a great experience for visitors. The government is currently working to turn the tide and accelerate Japan's GDP growth, and tourism will be a key industry in this endeavour. Under the guidance of a newly formed public-private partnership, Japan can make simultaneous progress in increasing its attractiveness to many different traveller segments while addressing not just surface-level challenges but also the underlying obstacles to growth in inbound tourism. The conditions and timing are right to launch Japan into the top tier of tourism-oriented destinations; what's needed now is coordinated, strategic action. Main problem for tourists visiting Japan is language barrier. Hardly few people in Japan can communicate in English. Now, the country has solidified itself as a top tourism destination, with a wide appeal for both corporate and leisure clients. Digital marketing and public relations initiatives including the 2018 "Enjoy My Japan" global campaign targeting the American, European and Australian markets have been put in place this year, and the country hosted several international events, including the Rugby World Cup (2019), the G20 Global Summit in Osaka (2019), and will soon host the Olympics in Tokyo (2020) and the Kansai World Masters Games (2021), etc. Local sellers have started to recognize how much tourism can do for the economy. So now, there's been a lot more emphasis on tourism promotion, which is why you see destination management companies sprouting up everywhere from every region, every prefecture and every city.

94 | JAPAN. ENDLESS DISCOVERY.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

CONCLUSION:

Japan is undoubtedly a magical country because of its rich history and culture. The only drawback is natural calamities hitting on Japan every now and then. Though they have improved the warning systems and built earthquake resistant buildings, people are still sceptical about going to Japan even for tourism purpose. Everyone can enjoy and learn various things here. It has a great potential for tourism industry to boost. Japan tourism was not well promoted and many tourists didn't know the potential of Japan till the country was not marketed well. 6 A's of Japan being very strong, Japan has achieved more than half of its target is achieved. Japan is a very sustainable country thus sustainable tourism can also be marketed. In the past, inbound tourism was a low priority for Japan with destination marketing focused primarily on the thriving domestic tourism segment. However, the economic impact of international tourism is evident in its increasing contribution to GDP and employment. The Japanese government's attitude has changed dramatically; it now regards inbound tourism as critical to the nation's economic growth and has the goal of attracting 40 million tourists per year by 2020. In light of this, the government needs to create or divert more resources into attracting high quality tourists, expanding or building the necessary tourism infrastructure and creating an environment that delivers a great travel experience. One more problem about Japan is the language barrier. Not many people in Japan can speak English or any other foreign language. Even if some people can speak, their accent is very different from American English or British English. Results from the SWOT analysis show that to achieve its goal Japan needs to strategically market itself with a clear message to capture visitors from both of its price points. Internally, the nation should further capitalize on its strong traditional arts and pop culture, and its competitive academic and research reputation. Externally, Japan should further capitalize on the expanding new middle class in neighbouring countries. Ageing problem is main social issue going on from many years in Japan. There were many reforms made but they were of no use. Many countries are instituting policy and system-side changes to become more competitive at attracting tourists. Japan too needs to become more strategic at optimizing its strengths and opportunities and market its uniqueness in a way that the global market can understand and respond to. If it does this well, then Japan can rebrand itself as a popular tourist destination, meet its goals for 2020 using Your Japan Campaign and enjoy the economic, social and other benefits that is a natural outcome of strategic tourism growth.

95 | JAPAN. ENDLESS DISCOVERY.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

REFERENCES:

<https://www.worldatlas.com/articles/animals-native-to-japan.html>

https://www.tokyo-icc.jp/guide_eng/cul/03.html

<http://silkpathhotel.com/ikebana-japanese-art-flower/>

https://en.wikipedia.org/wiki/Ethnic_groups_of_Japan

<https://www.mlit.go.jp/kankocho/en/shisaku/kokusai/index.html>

<https://statistics.jnto.go.jp/en/graph/#graph--inbound--prefecture--ranking>

<https://www.xe.com/currencyconverter/convert/?Amount=1&From=JPY&To=INR>

https://www.google.com/search?q=timeline+of+japanese+history&rlz=1C1CHBF_enIN789IN789&sxsrf=ACYBGNRILMT81r3JhWIS9qx_HxWcNg4tbw:1580478863471&source=lnms&tbn=isch&sa=X&ved=2ahUKEwiLt-3J_q3nAhVg4jgGHZOPCx0Q_AUoAXoECA8QAw&biw=1366&bih=625#imgrc=648eACbHKc37hM:

https://www.japan.go.jp/tomodachi/2016/spring-summer2016/tapping_potential_of_tourism_resources.html

<https://www.indembassy-tokyo.gov.in/index.html>

<https://www.bloomberg.com/graphics/2019-japan-economy-aging-population/>

<https://www.tsunagujapan.com/10-popular-japanese-festivals/>

https://en.wikipedia.org/wiki/Japanese_language

https://mea.gov.in/Portal/ForeignRelation/Bilateral_brief_India-Japan_december_2018.pdf

<https://www.holidify.com/country/japan/how-to-reach.html>

<https://www.mckinsey.com/~media/mckinsey/industries/travel%20transport%20and%20logistics/our%20insights/can%20inbound%20tourism%20fuel%20japans%20economic%20growth/the%20future%20of%20japans%20tourism%20full%20report.ashx>

<https://www.azocleantech.com/article.aspx?ArticleID=539>

<https://www.japantimes.co.jp/opinion/2018/02/15/reader-mail/strategies-increasing-tourism/#.XjPGDDIzbIU>

<https://www.japantimes.co.jp/news/2016/03/30/national/japan-doubles-overseas-tourist-target-2020/#.XjPCOTIzbIU>

<https://www.neverendingvoyage.com/things-to-do-in-japan/>

<https://www.tourism.jp/en/tourism-database/stats/>

<https://www.travelvoice.jp/english/analysis-of-japan-tour-products-in-greater-china-markets-shows-a-mainstream-itinerary-sold-in-taiwan-is-five-nights/>

https://www.japan.go.jp/tomodachi/2017/summer2017/professor_jeffrey_D_Sachs.html

96 | JAPAN. ENDLESS DISCOVERY.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

<https://www.japan-guide.com/e/e2129.html>

https://www.researchgate.net/publication/273696089_Challenges_for_the_International_Tourism_Industry_in_Japan_-_An_Agent_for_Economic_Recovery_and_Development

http://visithiroshima.net/world_heritage/a_bomb_dome/

<https://www.japantimes.co.jp/life/2009/02/22/environment/sustainability-in-a-japanese-way/#.XiRNEf4zbIU>

<https://www.data.jma.go.jp/gmd/cpd/longfcst/en/tourist.html>

<https://www.mapsofworld.com/japan/japan-location-map.html>

<https://www.planetware.com/tourist-attractions-/kyoto-jpn-ks-kyo.htm>

<http://factsanddetails.com/japan/cat26/sub160/item860.html>

<https://www.nationsonline.org/oneworld/map/japan-map.htm>

<https://www.botanicalartworldwide.info/japan>

<https://www.nytimes.com/2019/08/08/business/japan-economy.html>

<https://almatourism.unibo.it/article/view/4776>

<https://www.vfsglobal.com/Japan/India/>

<https://www.atlasobscura.com/things-to-do/japan>

<https://www.investopedia.com/articles/investing/123015/3-economic-challenges-japan-faces-2016.asp>

<https://www.marketing91.com/swot-analysis-japan/>

<https://www.planetware.com/tourist-attractions-/osaka-jpn-ks-o.htm>

Marketing Japan's travel and tourism industry to international tourists

Lonely Planet- Japan

97 | JAPAN. ENDLESS DISCOVERY.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



ST. XAVIER'S COLLEGE (AUTONOMOUS)
MUMBAI

Department of Vocation
Bachelor of Vocation in Tourism

Final Year Thematic Project on
FINLAND

By

Vinisha Glanet Mathias

UID no. 179223

TYBA

2018-2019



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde

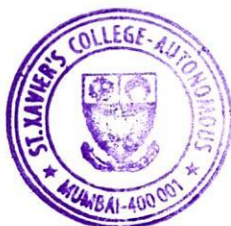
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

INDEX:

- Chapter 1: Introduction
 - 1.01 Synopsis
 - 1.02 Fact File
 - 1.03 Political Map
 - 1.04 Physical Map
 - 1.05 Tourism Map
- Chapter 2: Country Profile
 - 2.01 Geographical Features
 - 2.02 History
 - 2.03 Culture
 - 2.04 Current Political Scenario
- Chapter 3: Tourism in the Country
 - 3.01 Current Tourism Scenario – Statistics, Position in World
 - 3.02 Tourism Potential – Types, Heritage Sites
 - 3.03 Tourism Policy
 - 3.04 Relations with India
- Chapter 4: 6 As
 - 5.01 Overview
 - 5.02 Accessibility
 - 5.03 Attractions
 - 5.04 Activities
 - 5.05 Accommodation
 - 5.06 Amenities
 - 5.07 Affordability
- Chapter 5: Documentation
 - 5.01 Overview
 - 5.02 Consulate locations in India
 - 5.03 Visa – Form & Process
 - 5.04 Documents Required



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

- 5.05 Health Requirements
- 5.06 Forex
- 5.07 FAQs
- Chapter 6: Itineraries & Tour Packages
 - 6.01 SWOT analysis of existing itineraries
 - 6.02 Popular Tourist Circuits
 - 6.03 Proposed Tour Itineraries
 - 6.04 USP of proposed tour itinerary
- Chapter 7: Market Research & Analysis
 - 7.01 Overview of world economics – India & the selected Destination
 - 7.02 Target Customer Profile
 - 7.03 Interview of Reputed Tourism Company
 - 7.04 Survey Questionnaire
 - 7.05 Analysis of Survey
 - 7.06 Findings & Challenges
- Chapter 8: Challenges
 - 8.01 Environmental Sustainability
 - 8.02 Economic Issues
 - 8.03 Socio- Political Issues
- Chapter 9: Marketing & Publicity
 - 9.01 SWOT analysis of Destination
 - 9.02 Marketing Points/ features
 - 9.03 Marketing & Publicity Strategy
 - 9.04 Publicity Sample
 - Survey pie
 - Survey analysis
- Conclusion
- References



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

CHAPTER 1- Introduction to Finland.



*"As frigid mood enwraps the northern land,
with snowfalls creating a quilt of white,
the times are dark as winter's frozen hand
enfolds the forest in the dead of night.
The treetops quiver in the howling winds
with snowflakes resting on the branches bowed,
The northern borders crispy air rescinds
to cease its hold as winters rigor slowed.
In early dawn the frozen winds subside
as morn awakes to heed the light of day."*

-That's Finland for you!



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

Outstanding wilderness areas, forests populated by wolves and bears, lakeside cottages, whitewater canoeing and arctic skiing in Lapland, modern towns and cities, the Northern Lights, beer terraces, great music and film festivals. As a country to visit, Finland offers way more than the average European destination.

Finland is also one of the largest countries in Europe and Lapland, which makes up a full one third of Finland, is north of the Arctic Circle. Culturally and politically, Finland is part of Scandinavia and this is reflected in the country's culture, high standard of living, education system (one of the best in the world), its avant-garde design (and in its high taxes).

Overview:



Finland, a Nordic country in Northern Europe, is bordered by Sweden to the west, Norway to the north, and Russia to the east, while Estonia lies to its south across the Gulf of Finland. It is divided into five regions, with Helsinki as the capital. The official languages of Finland are Finnish and Swedish, and the currency is the euro (EUR).

Finland was initially a province, then a grand duchy under Sweden from the 12th to the 19th century, and later an autonomous grand duchy of Russia after 1809. It gained its complete independence in 1917. During World War II, Finland was able to successfully defend its freedom and resist invasions by the Soviet Union. In the subsequent half century, the Finns



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Alind
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

made a remarkable transformation from a farm/forest economy to a diversified modern industrial economy; per capita income is now among the highest in Western Europe.

Finland has a highly industrialised, largely free-market economy. Trade is important, with exports accounting for over one third of gross domestic product (GDP) in recent years. Finland is strongly competitive in manufacturing, principally the wood, metals, engineering, telecommunications, and electronics industries. Export for timber and several minerals. Finland depends on imports of raw materials, energy, and some components for manufactured goods. Forestry, an important export earner, provides a secondary occupation for the rural population.

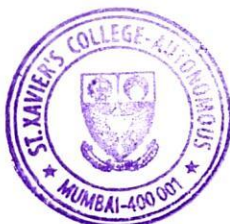
A member of the European Union (EU) since 1995, Finland was the only Nordic country to join the Euro system at its initiation in January 1999. In the 21st century, the key features of Finland's modern welfare state are a high standard of education, equality promotion, and a national social security system.

Fact File:



Flag of Finland

- Official Name: Republic of Finland
- Continent: Europe
- Capital: Helsinki
- Population: 5,537,364 (2018)
- GPS Coordinates: 61.9241° N, 25.7482° E
- IATA Location: Area 2
- Official Languages: Finnish, Swedish
- Currency: Euro (EUR)
- Form of Government: Parliamentary republic
- Climate: Cold temperate; potentially subarctic but comparatively mild because of moderating influence of the North Atlantic Current, Baltic Sea, and more than 60,000 lakes
- Total Area: 130,558 square miles (338,145 square kilometers)
- Highest Point: Halti at 4,357 feet (1,328 meters)
- Lowest Point: Baltic Sea at 0 feet (0 meters)



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.

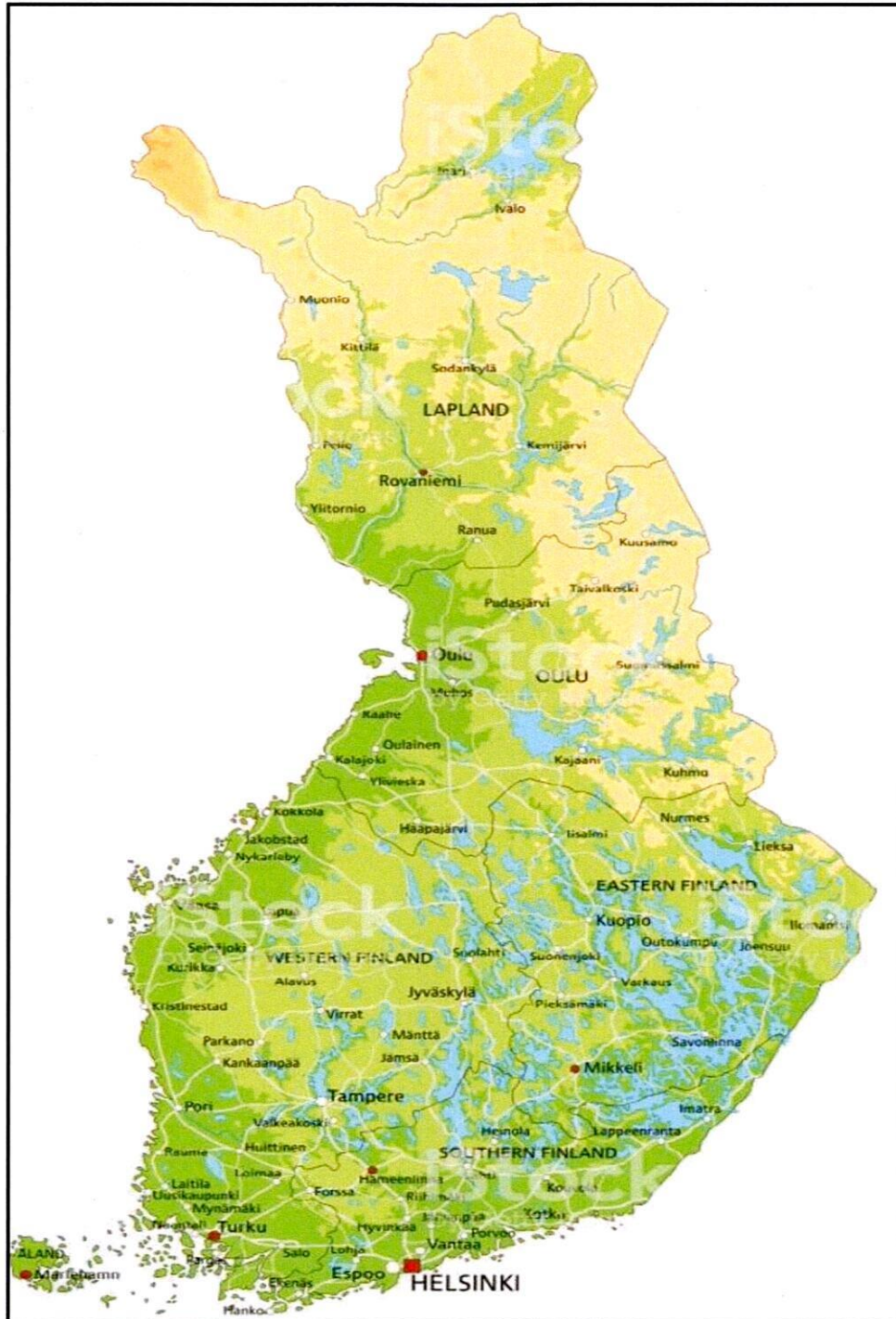


ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

CHAPTER 2- Country Profile

2.01 Geographical Features

Finland has borders with Russia to the east, Sweden to the west and Norway to the north. Finland, Norway and Sweden all meet at "trekingsgräsen" (Swedish for "three kingdom border") in the far north of Finland. It's highest mountain, Halti at 1324m. is found here (the highest mountain which has its peak entirely in Finland is adjacent to Halti, Ridnitsohkka at 1316m).

Finland is a mostly flat land, with more than 70% of it covered by thick forest. In the southern areas, water seems a more common sight than land as countless clear water lakes are everywhere.

To the north of the Arctic Circle, the terrain rises into the hills and low mountains of Lapland. The country's highest point, Haltiatunturi, at 1,328 meters, stands on the edge of its border with Norway.

The Aland Islands (*archipelago*) sits in the middle of the Gulf of Bothnia between Finland and Sweden. It contains almost three hundred islands (*80 inhabited*), and over 6,000 small rocky islands.

Directly east, in the Archipelago Sea and merging with the Aland Islands and Finland's southwestern coastline stand literally tens of thousands of islands, mostly small, with some of the larger ones inhabited.

In this land of lakes, the largest include Nasijarvi, Oulujarvi, Pajanne, Pielinen and Finland's largest, Lake Saimaa. With a few exceptions, the balance of Finland's lakes are on the small side.

Finland's most significant rivers include the Kemi, Luio, Muonio, Oulu, Teno and Torne.

Numerous canals flow lake to lake in the south. The largest, the Saimaa Canal, connects Lake Saimaa with the Gulf of Finland.

Borders: Total land borders: 2,563 km (1,593 mi)

Largest lake: Saimaa; 4,400 km² (1,700 sq mi)

Coastline: 1,250 km (780 mi)

Region: Northern Europe

Highest point: Haltitunturi; 1,328 m (4,357 ft)

Lowest point: Baltic Sea; 0 meters

Longest river: Kemijoki River; 550 km (340 mi)



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.

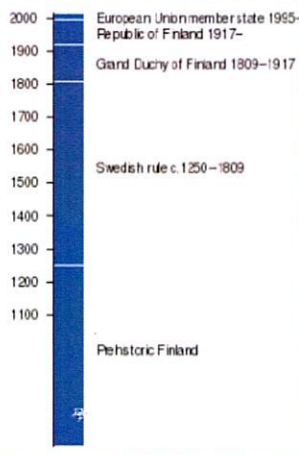


2.02 History of Finland

It is unclear where the first inhabitants of Finland came from, but most historians believe their origin is Siberia thousands of years ago. For most of its early history, Finland was associated with the Kingdom of Sweden. This began in 1154 when Sweden's King Eric introduced Christianity in Finland. As a result of Finland becoming a part of Sweden in the 12th century, Swedish became the region's official language. By the 19th century, however, Finnish again became the national language.

In 1809, Finland was conquered by Czar Alexander I of Russia and became an independent grand duchy of the Russian Empire until 1917. On December 6 of that year, Finland declared its independence. In 1918, a civil war took place in the country. During World War II, Finland fought the Soviet Union from 1939 to 1940 (The Winter War) and again from 1941 to 1944 (The Continuation War). From 1944 to 1945, Finland fought against Germany. In 1947 and 1948, Finland and the Soviet Union signed a treaty that resulted in Finland making territorial concessions to the USSR.

Following the end of World War II, Finland grew in population but in the 1980s and early 1990s it began to have economic problems. In 1994, Martti Ahtisaari was elected as president and he began a campaign to revitalize the country's economy. In 1995 Finland joined the European Union and in 2000, Tarja Halonen was elected as Finland and Europe's first female president and prime minister.





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

(Timeline)

100s - 1000s

- (100 - 400) Migrations to Finland from southern Baltic
- (400 - 800) Iron Age culture developed; Finland strengthened ties with regional powers
- (800 - 1050) Swedish Vikings established trade ties with Russia via Finland

1000s - 1600s

- (1150's) Swedish led crusades to southwestern Finland; converted Finns to Christianity
- (1155 - 1809) Finland incorporated into Kingdom of Sweden
- (1238 -1249) Second crusade to Tavastia by Swedes
- (1293) Third Crusade by Swedes to eastern Finland; established dividing line between Catholic West and Orthodox East
- (1323) Peace treaty of Pahkinasaari signed
- (1362) Finns granted right to send representatives to vote in Sweden's election
- (1523) Gustavus Vasa (King of Sweden) established Lutheran Church in Sweden and Finland
- (1550) Helsinki founded
- (1596 - 1597) "Mallet War" took place, farmers revolted against nobels
- (1617) Peace of Stolbova enacted; Sweden became ruler of Baltic Sea, controlled entire Gulf of Finland
- (1696 - 1697) Devastating famine killed one-third of population

1700s - 1800s

- (1713 - 1721) Russia invaded Finland; maintained reign of terror
- (1721) In Treaty of Uusikaupunki, Sweden gave southeastern Finland, Livonia, Estonia and Ingria to Russia
- (1743) In Treaty of Abo, Sweden ceded southeast Finland to Russia
- (1808 - 1809) "Finnish War" fought between Sweden and Russia
- (1809) Sweden ceded Finland to Russia; Finland became Grand Duchy of Russia; State Council of Finns appointed; Finland enjoys limited autonomy
- (1812) Helsinki named capital of Finland
- (1860) Finland acquired its own currency, the markka(Finnish mark)
- (1864) Finnish peasants allowed to buy land
- (1879 - 1880) Finnish explorer, A.E. Nordenskiöld, took first ship through Arctic via Northeast Passage
- (1881 - 1894) Earlier rights in Finland encroached upon by Tsar Alexander III; rural poverty led to large-scale emigration to U. S.
- (1894 - 1917) Finland lost much autonomy; russification of Finland policy initiated; censorship and conscription introduced; civil disobedience began

1900s

- (1906) Finland acquired national parliament
- (1907) Finland became first European country to give women right to vote
- (1917) Finland declared independence from Russia; Finnish Republic demanded withdrawal of Russian troops; Russia declared Finland to be independent
- (1918) Civil War in Finland occurred between "Whites"(Finland forces) and "Reds" (Russian troops); Whites victorious
- (1919) Finland became republic; K. J. Stahlberg became first president



NAAC SSR Cycle 4 (2015-2020);
2_3_1_ExperientialLearning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

- (1920) Peace of Tartu officially declared Finland's independence; Finland became member of League of Nations
- (1930) Laupa (Fascist) movement resulted in great peasants' march to Helsinki
- (1930 - 1955) Finland enacted forced sterilization program
- (1932) Finland and Soviet Union signed non-aggression treaty
- (1939) World War II began; Finland declared neutrality; Soviet Union invaded, Winter War began
- (1940) Finland forced to concede to Soviet Union; Treaty of Moscow gave 10% of Finnish territory to Soviet Union
- (1941) Germany attacked Soviet Union; Finland launched military campaign to regain territory from Soviet Union; Britain declared war on Finland
- (1941 - 1944) "Continuation War" with Russia
- (1944) Red Army (Soviets) invaded; armistice signed; Finland conceded more land to Soviet Union; paid hundreds of millions of dollars in war reparations
- (1945) Finland fought against Germany in Lapland
- (1947) Peace treaty signed between Soviet Union and Finland
- (1948) Finland and Soviet Union signed Treaty of Friendship, Cooperation and Mutual Assistance
- (1952) Olympic Games held in Helsinki
- (1955) Finland joined United Nations and Nordic Council
- (1956) Soviet Union returned Porkkala Naval Base to Finland
- (1956 - 1981) Urho Kekkonen serves as President
- (1958) "Night frost crisis" - Soviet Union intervened in composition of Finnish government
- (1961) Finland became associate member of European Free Trade Association (EFTA); Soviet Union intervened in Finnish presidential election - "the note crisis"
- (1970) Finland adopted 40-hour work week
- (1973) Finland signed free-trade agreement with European Economic Community (EEC)
- (1975) Conference on Security and Cooperation in Europe took place in Helsinki, representatives from 35 countries attended
- (1989) Finland became member of Council of Europe
- (1991) Soviet Union broke up; Treaty of Friendship, Cooperation and Mutual Assistance lapsed
- (1991 - 1993) Former Soviet Union and eastern European markets collapsed; Finnish economy suffered deep recession
- (1992) Finland applied for membership in the European Union (EU) community
- (1994) Finland became member of NATO Partnership for Peace Program; voters approved membership of European Union
- (1995) Finland became member of European Union
- (1999) Social Democratic Party returned to power by voters; EU summit held in Helsinki, expanded to 28 members
- 2000s
- (2000) Tarja Halonen elected Finland's first female president; new Constitution went into effect
- (2002) Blast in Myyrmanni shopping mall killed seven, 80 injured; Finland changed currency to Euro; Parliament approved construction of fifth nuclear reactor; Green Party withdrew from government coalition in protest



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

- (2003) Center-left government formed by three political parties;(April) Anneli Jaatteenmake became first female prime minister; (June) Prime Minister Jaatteenmake resigned due to accusations about leaks of information during campaign
- (2004) Icy road conditions in southern Finland caused bus/truck accident, killed 24, injured 15; two Finnish businessmen shot and killed in Baghdad
- (2005) Nation-wide paper industry strike due to holiday pay and work conditions
- (2006) Parliament voted in favor of EU constitution
- (2007) Center Party won parliamentary elections
- (2007) School shooting in southern Finland killed eight
- (2011) True Finn party gained significant seats in parliament.

2.03 Culture of Finland

Finnish culture is a combination of numerous native customs which are represented by their national languages (Germanic Swedish and Uralic Finnish), the sauna, and the European and Nordic traditions. Due to their geographical location and history, Finland was heavily influenced by various communities including the Russians, Swedish, plus numerous Baltic and Finnic people. The Finnish culture is built upon their traditional livelihood and their tradition of egalitarianism. Cultural differences still exist between different regions in the country mainly the difference in vocabularies and accents.

Finnish culture may be seen to build upon the relatively ascetic environmental realities, traditional livelihoods and a heritage of egalitarianism, and the traditionally widespread ideal of self-sufficiency.

There are still cultural differences between Finland's regions, especially minor differences in accents and vocabulary. Minorities, some of which have a status recognised by the state, such as the Sami, Swedish-speaking Finns, Romani, Jews, and Tatar, maintain their own cultural characteristics. Many Finns are emotionally connected to the countryside and nature, as large-scale urbanisation is a relatively recent phenomenon.

History of Finnish culture


Present-Day Finland was part of the Kunda culture up to 5000BC, and from 4200BC to 2000BC it belonged to the Comb Ceramic culture. The Kiukainen culture arrived in the southwestern coastal region around 2000BC. The Swedish crown began incorporating Finland from 1100 to 1200, but the Novgorod tried to gain control of the area, and this resulted in numerous wars which Russia and Muscovy joined from 1400 to 1700. The Swedish dominance in the Baltic region ended in 1721 with the signing of the Nystad peace treaty. The area was annexed to Russia in 1809 for over a century. Both the Russian and Swedish cultures influenced Karelia (the place where the Russian and the Swedish fought).

The people

Finns are the Finnish-speaking people living in Finland. The Finns are divided into smaller subgroups as per their dialect, but the internal migration and urbanization have reduced the



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

importance of the grouping. Their society encourages liberalism and equality. Their traditional religious beliefs were heavily influenced by the Norse and Baltic paganism, which changed during the twelfth century when Christianity arrived in Finland. Currently, about 1.1% of the population worship in the Finnish-Orthodox church while 72.8% belong to Evangelism Lutheran Church.

Native subcultures

Finland has a long history of subcultures with the biggest being the Swedish-speaking Finns. The Swedish speaking Finns have their Swedish daily newspaper based in Helsinki and the Swedish People's party which has been a crucial part of their culture. The Swedish speaking Finns have their traditions. Another subculture in Finland belongs to the Sami people who live in the Lapland area. The native language of the Sami people is not Finnish, and they lead a nomadic lifestyle just like the Gypsies who have been in Finland since the seventeenth century.

Festivals and traditions

The traditions and holidays in Finland are a perfect blend of their pagan customs and Christianity. Their Christmas follows the Christmas trees tradition and Advent calendars. The Finnish Christmas starts on December 23 and ends after December 26. Gifts are given on Christmas Eve, and people eat on Christmas day which is followed by sauna. The Finnish Easter holiday is a blend of Pagan and Christian customs. The children usually dress up and go around giving Daffodils door to door and getting sweets in return on the Holy Saturday or Palm Sunday. One of a pagan tradition done during the Easter weekend is burning of bonfires to keep the witches away. The exchange of Daffodils for sweets resembles the Halloween holiday. A sauna is a dry steam bath that is widely popular in Finland. Saunas have a Proto-Finnish origin which dates back to 7,000 years ago. The purpose of saunas is to bathe while the heat helps with cleansing and opening up of the skin pores.


Languages

More than 150 different first languages are spoken in Finland. The official languages (national languages) of Finland are Finnish and Swedish. In addition to Finnish and Swedish, there are other languages in Finland whose users' rights are laid down in law. The Saami languages are the languages of the indigenous population of Finland. Finnish Romani, Finnish sign language, Finland-Swedish sign language and Karelian are autochthonous languages that have a long history in Finland.

Finnish: Finnish belongs to the Uralic language group. In Finland, approximately 4.9 million people speak Finnish as their first language, and more than 0.5 million people speak it as a second language. Finnish is also spoken in Sweden, Norway, Eastern Karelia and Ingria (in Russia), and even in the USA and Australia. The Finnish spoken in Finland comprises several dialects. Written Finnish dates back approximately 500 years.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



Swedish: Swedish is an Indo-European language and a member of the North Germanic branch of the language family. Globally, approximately 9 million people speak Swedish as their first language; Finland has approximately 296,000 Swedish-speakers. Finland Swedish is a regional variant of Swedish. One purpose of the guidance on Finland Swedish is to prevent it from becoming too different from the Swedish used in Sweden.

Saami: The Saami languages are autochthonous languages to Europe and the closest relatives to the Finnic languages. The total Saami population is 60,000–100,000 people; approximately 10,000 of them live in Finland. There are three different Saami languages spoken in Finland: Inari Saami, Skolt Saami and Northern Saami. Each of them has its own form of written language and orthography. Since 1992, the Saami languages have had official status in Finland in the Saami native region comprising Enontekiö, Inari and Utsjoki, as well as the northern part of Sodankylä.

Karelian: The Karelian language, spoken in Finland and Russia, is the closest linguistic relative to Finnish and must not be mixed up with the Karelian (south-eastern) dialects of Finnish. There are less than 100,000 speakers of the various forms of Karelian. In Finland, their estimated number is about 5,000.

Finnish Romani: Romani is an Indo-European language and a member of the Indo-Aryan subgroup of the Indi-Iranian branch. Finnish Romani (Finnish Kalo) belongs to the north-western group of the northern Romani dialects. The Romani language has been present in Finland for approximately 450 years, mainly as a spoken, family-internal and code language. Efforts to maintain Romani and develop it as a literary language started around the beginning of the 1970s.

Sign languages in Finland: Finnish sign language is the first language for 4,000–5,000 non-hearing Finns. Another 6,000–9,000 hearing Finns use it as their first or second language. Today, there are only 90 users of Finland-Swedish sign language, which is listed as critically endangered.

2.04 Political Life of Finland

Government: The administrative district or commune (*maalaiskunta*) embodies a sense of community and self-identification for its residents. It often coincides with the historical church parish, and is a local unit of self-government that generally collects taxes, regulates economic affairs, and maintains public order. Every four years a communal council is elected to manage local affairs. Much of a council's work is implemented by a communal board composed of members appointed to reflect the council's political party composition.

The President must be a Finnish citizen by birth. The Presidential office was established in the Constitution Act of 1919. Elected in 2012 and re-elected in 2018, the current President is **Sauli Niinistö**.

- Parliamentary system - Unitary state
- Parliamentary republic - Federacy





ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

Leadership and Political Officials: With more than a dozen political parties, kunta government sometimes is represented by opposing coalitions of socialist and nonsocialist party interests. The same principle applies at the national level, where the two hundred representatives of the uni-cameral parliament (Eduskunta) are often elected by alliances of parties. The Social Democratic Party and the Agrarian Union (Centre) Party formed the basis of all majority governments well into the 1980s. Nonetheless, most parliamentary members follow the positions of their political parties and vote in blocs. The parliament promulgates laws, approves the national budget, monitors the legality of governmental activities, and, in concert with the president, exerts legislative power.

The Centre Party of Finland (Finnish: Suomen Keskusta, Kesk; Swedish: Centern i Finland) is a centrist, liberal, agrarian political party in Finland. Founded in 1906 as the Agrarian League, the party represented rural communities and supported decentralisation of political power from Helsinki.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400.001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Chapter 3: Tourism in the Finland.

3.01 Current tourism Scenario

TOURISM IN FINLAND STAYS ON RECORD LEVEL

Tourism in Finland continued to grow from the record numbers reached the year before. The number of nights spent by non-residents increased by 1.3 per cent, reaching an impressive figure of 6.8 million. The travel industry is growing fast, and Finland has major potential to become the most attractive travel destination among the Nordic countries.

3.02 Tourism Potential

- Well developed infrastructure.
- Rich cultural heritage.
- Untouched beauty.
- Easy access from India.
- Easy VISA process.

3.03 Tourism Policy

Finland is aiming to become the most sustainably growing tourist destination in the Nordic countries. Tourism is being developed as a responsible and growing service business that generates welfare and creates jobs across the country.

Finland's updated tourism strategy identifies four priorities that will facilitate the sustainable growth and renewal of the tourism sector:

1. Supporting sustainable development
2. Responding to the digital transformation
3. Improving accessibility, taking into account the needs of the tourism sector
4. Ensuring an operating environment that supports competitiveness.

In 2017, Finland's tourism exports accounted for more than 17% of the export income generated by services. The total demand for tourism was approximately EUR 15 billion, and its direct share of GDP was 2.6%. Tourism also has significant regional economic impacts. The sector maintains regional vitality and employs more than 140,000 people across Finland.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

"Tourism is a service sector with great potential for Finland, and a growing export sector. The priorities laid out in the tourism strategy will enable us to double tourism exports to EUR 8 billion by 2028," says **Jari Gustafsson**, Permanent Secretary of the Ministry of Economic Affairs and Employment.

Joint guideline for developing the tourism sector

The cross-cutting theme of the strategy is cooperation, which is essential for achieving sustainable growth and renewal in Finnish tourism. The tourism strategy serves as a joint guideline for tourism operators in the development of the tourism sector. Actions will be taken in intersectoral collaboration by a wide range of operators. The actions will be monitored by a horizontal expert group on tourism, coordinated by the Ministry of Economic Affairs and Employment.

"Collaboration plays a fundamental role in boosting growth and renewal in the tourism sector, and this is also reflected in the name of the strategy. The doubling of tourism exports requires careful and high-quality tailoring of tourism products to the respective needs of relevant target groups. We must make the products easy to buy online and ensure that the activities in the sector are developed sustainably," Gustafsson says.

The tourism strategy will be discussed at a tourism seminar organised at the request of the Permanent Secretary Jari Gustafsson in Helsinki on Friday 29 November. Representatives of the media are welcome to attend.

Finland's national tourism strategy for 2019–2028

'Achieving more together – sustainable growth and renewal in Finnish tourism' is the name of Finland's national tourism strategy for 2019–2028. The strategy defines targets for the development of tourism until 2028 and measures to be taken between 2019 and 2023. The strategy is based on the roadmap for growth and renewal in Finnish tourism 2015–2025, which was updated in 2019 under the coordination of the Ministry of Economic Affairs and Employment. The Ministry is responsible for the priorities of Finland's tourism policy and coordinates the development together with other Finnish ministries and actors in the tourism sector.

3.04 Relations with India

India – Finland Bilateral Relations

Finland and India have traditionally enjoyed warm and friendly relations. In recent years, bilateral relations have acquired diversity with collaboration in research, innovation, and investments by both sides. The Indian community in Finland is vibrant and well-placed. Indian culture and yoga are very popular in Finland.





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Chapter 4: 6 A's

5.01 Overview

Finland is well developed when it comes to getting around or staying. It has a lot of stay options to offer suiting the many budgets. It has untapped beauty which is waiting to be explored and adored.

5.02 Accessibility

Finland Taxis and Car Rental

Finland has a very organized public transport system, making travel across the country comfortable. Finnish taxis are widely available and closely regulated by the government, so you can expect safety. However, fares are often expensive. It is possible to share rides with strangers going in the same direction. Taxis come in a wide variety of colors and shapes, but they are always distinguishable by a yellow TAXI or TAKSI sign on the roof. It is nearly impossible to hail a cab on the street and you will need to walk to a taxi stand or keep a few phone numbers on hand whenever you go out. In downtown Helsinki, long cab lines can be expected on weekends, especially at night. You may contact the Finnish Taxi Owners Federation (+358-207-756 800) for more information about taxi transportation around Finland.

Renting a car is possible in Finland, but generally quite expensive. Driving is pleasant, especially in the countryside, but stay alert, as wild animal accidents are quite common, especially in the south and southwest regions. Headlights should be kept on even during daylight, and extra caution should be observed when driving on icy roads during winter. International and local car rental providers include Avis (+358-9-859-8356), Europcar (+358-40-306-2400), Scandia Rent (+358-9-478-03444 (Vantaa Airport), and Auto Alex (+358-40-522-3938).

Finland Water Taxis


Ferries ply the lakes of Finland, often on cruise-type routes with restaurants and on-board entertainment for an enjoyable day or night. Boating on the lakes is especially popular during summertime, but regular waterbus and ferry trips are available year-round. Some popular routes include Tampere to Hamenlinna and Tampere to Viikinsaari Island, which are served by Silver Line (www.hopealinja.fi). Poet's Way (www.runoilijantie.fi) operates between Tampere and Virrat, while Lake Paijanne Cruises (www.paijanne-risteilyhilden.fi) services the Paijanne Waterway and areas like Heinola, Jyvaskyla, Suolahti and Lahti. Regular ferries are also available around Kuopio and Lake Pielinen.

Finland Trains and Buses

Finland has an extensive rail network. Within cities, trams are the preferred form of transportation. Finnish Railways offers excellent inter-city routes, and taking the train from



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Helsinki to Turku, Tampere and Lahti is more convenient and definitely faster than the bus. Trips run on an hourly basis, and charges vary according to the type of train and service level. Express and overnight sleepers on long-haul routes are ideal for those wishing to get to their destinations quickly. The Finnrail Pass allows for unlimited travel three to 10 days in a month. Multi-country rail passes are also accepted in Finland.

Long distance coaches and city buses also serve the area. In Lapland, buses are the only means of public transportation, as the train network cannot reach the extreme north. Bus rides are slightly more expensive than train services, despite being slower. The local transportation systems in areas like Tampere, Turku and Greater Helsinki are very reliable. Larger towns also have integrated bus services and suburban rail lines. Multi-trip tickets and different kinds of passes are available if you want to cut down your costs.

5.03 Attractions

While not technically a part of Scandinavia, Finland boasts some of the same traits as its neighboring countries. Incredible scenery, unspoiled nature and a relatively liberal, modern political system are all positive attributes of Finland. In the winter the Northern Lights can be seen in the northernmost part of the country while in warmer months many Finns love to head to their summer cottages to enjoy some swimming, fishing, barbecuing but most of all the sauna.


Following are the best places to visit in Finland:

From the vibrant art-filled cities of Helsinki and Turku to the depths of the boreal forests and the thinly-inhabited outer archipelago, Finland remains a relatively unknown corner of Europe. This is likely because it is so far from the mainstream tourist routes, but the country's many cultural and historical attractions add to the unspoiled natural surroundings to make it an ideal destination. Its lakes, fells, rivers, and vast wild areas, along with the certainty of snow in the winter make it a Nordic playground for both winter and summer activities.

Helsinki is the main point of entry for most visitors to Finland. The busy Baltic port is where you'll find the most important museums, as well as architecture by some of the greatest Finnish architects, especially Eliel Saarinen, who designed Helsinki's Railway Station, a landmark of early modern architecture. Within easy reach of Helsinki are the charming smaller cities of Turku and Porvoo. But it would be a shame to confine a trip only to the Baltic coast, when so much beautiful open countryside beckons. To the west lie the Finnish lakes, and in the north is the vast area beyond the Arctic Circle, home of the midnight sun, northern lights, and some of



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

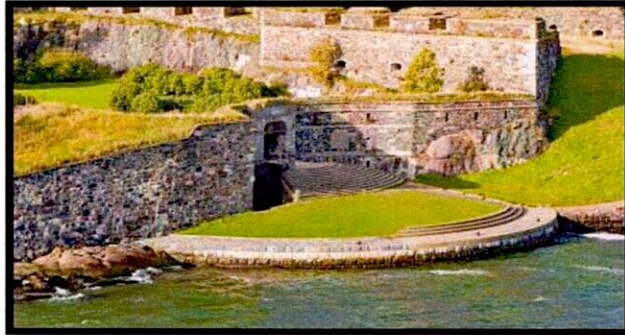

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Europe's best winter sports. Winter or summer, Finland offers plenty of things to see and do. Plan your trip with our list of the top attractions and places to visit in Finland.

1. Suomenlinna Fortress



One of the world's largest sea fortresses, the 18th-century fort on Suomenlinna is a 15-minute ferry ride from Helsinki's Market Square (a mini-cruise that has lovely views of the city as a bonus attraction). Once here, you could easily fill a day with its sights and activities. The impressive fortifications, now a UNESCO World Heritage Site, were built in 1847 by the Swedes (Finland was Swedish territory then) to scare off the Russians; they weren't scared and later captured both the fort and Finland. Begin with the audio-visual experience in the visitor center (it's in English) for a lively history, then explore its ramparts, tunnels, and museums and walk the trails around the beautiful island. Or sign up here for a guided walk to learn more about the fort and its various attractions. Among these are the 250-ton Vesikko submarine, used by the Finnish Navy from 1936 until the end of World War II. The **Ehrensward Museum** illustrates the earliest Swedish period, and the **Doll and Toy Museum** displays dolls, dollhouses, and toys in an old Russian villa. Various buildings house studios and shops of glassblowers, potters, and other craftsmen, and in the summer, you can stay for evening dance and musical performances of the **Suomenlinna Summer Theatre**.

2. Kauppatori (Market Square) and Esplanadi



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



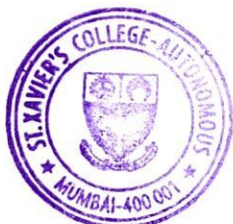
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65




Helsinki's harbor is an integral part of the city, whose important landmarks overlook it. It's also a popular gathering point, with an open-air market of local farmers, craftsmen, food producers, and fishermen, who sell directly from their boats. You may catch the fragrance of salmon cooking over cedar planks beside the boats, and depending on the season see a rainbow of glistening ripe berries or baskets of foraged woodland mushrooms. The historic 1889 market hall shelters more food vendors, but the outdoor market is a year-round tradition, protected by tarps and tents in the winter.

Stretching from one side of the Market Square, the open swath of the Esplanadi is where the entire city seems to congregate on summer evenings. The tree-lined promenade is bordered by elegant buildings and a pavilion houses the Kappeli Restaurant, whose terrace is especially popular on summer evenings when there are concerts in the bandstand. A fountain, another work by Eliel Saarinen, supports a statue of Havis Amanda, Helsinki's symbol. In December, the entire Esplanadi is filled with booths selling beautiful local crafts and holiday foods. Helsinki's most unusual museum, the **Street Museum**, climbs from market Square to Senate Square, a one-block progression from the early 1800s to the 1930s, with paving surfaces, street lights, mail boxes, and phone booths changing with each era.

3. Rovaniemi and the Arctic



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



The Arctic Circle runs across northern Finland, right through the town of Rovaniemi, giving it claim to being the **Gateway to the Arctic**. In the summer, this means the famous **Midnight Sun**. While the sun only stays above the horizon for a full 24 hours in Rovaniemi on the summer solstice in late June, from late May to early August it never drops far enough for it to get dark. Locals are out enjoying their great outdoors throughout these "White Nights" and welcome tourists to join them. Rovaniemi is in the center of a vast natural area of rushing rivers for canoeing, swimming, or fishing, with trails alongside them for hiking and cycling. The city is best known (ask any Finnish child) as the home of Santa Claus, right astride the Arctic Circle at **Santa Claus Village**. You can meet reindeer here or visit a Sami reindeer farm. To learn more about the Lapland culture and about the natural history, meteorology and geology of the Arctic, visit the stunning **Arktikum Science Museum**.

In the winter, this region is a paradise for skiers and others who love snow and ice sports. You can ride across frozen lakes and visit Sami villages on a **dogsled safari**, learn to drive your own reindeer sled, snowshoe or cross-country ski for miles, and watch the spectacular **Northern Lights**. Downhill skiers head about 170 kilometers north to **Levi**, a center for all winter recreation, with miles of scenic Nordic ski trails, lighted for night skiing. So are the pistes and slopes of Finland's largest downhill ski area. Many hotels have rooms with glass ceilings, so you can watch the Northern Lights from inside.

4. Helsinki Churches

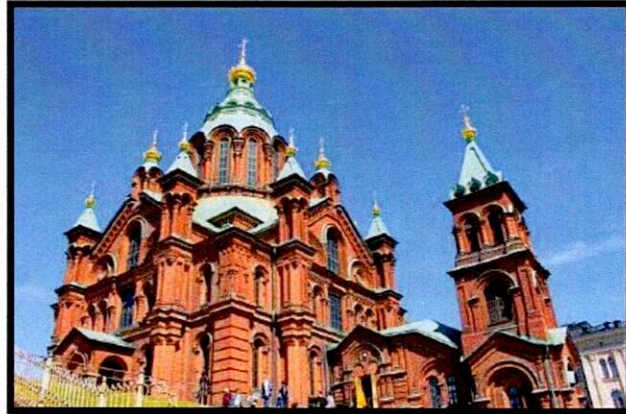


NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Uspenski Orthodox Cathedral


Three of the top places to visit in Helsinki are churches, two of them cathedrals and the third a landmark of modern architecture. **Uspenski Orthodox Cathedral** rises dramatically above the east side of the harbor, its 13 green-topped spires ending in gold cupolas. This is western Europe's largest Orthodox church, its interior glowing with gold, icons, crosses, altars, and intricately decorated arches. The cathedral serves Helsinki's large Russian population, and visitors are welcome. On the hill directly behind the harbor and an equally visible landmark to those approaching Helsinki by sea, the huge Neoclassical **Lutheran Cathedral** is so close and so large that it appears to be standing on the roofs of the harbor-front buildings. The tall green dome and broad steps of the early 19th-century cathedral form the majestic focal point of Senate Square. The buildings facing the square complete a harmonious enclosure, one of Europe's most beautiful public squares. It is used frequently for celebrations and as the starting point of parades.

While these two cathedrals are firmly in the traditions of their denomination, **Tempeliahkio Church** is an architectural experiment, carved into solid rock on a relatively small space in the center of the city. Architects Timo and Tuomo Suomalainen designed the church, covering it with a rounded, woven copper roof supported by concrete spokes. The acoustics created by the combination of copper and stone are remarkable, making this a popular venue for musical concerts of all styles.

5. Åland Archipelago



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

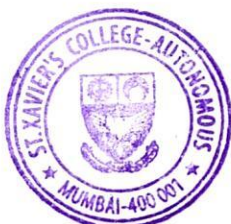


Åland Island

The Åland Islands (or Åland) are an autonomous archipelago between Sweden and Finland. A predominantly Swedish-speaking province of Finland, Åland is comprised of a few large islands and nearly 10,000 smaller ones. Åland has a unique history. It was ceded to Russia by Sweden in 1809. In 1854, a combined British/French fleet took the islands, destroying the fortress. After that, the entire archipelago was demilitarized and remains so to this day. About 27,500 people live in Åland, with about 11,000 in the main town of **Mariehamn**. The main industry of the islands has always been shipping and trade, so the Maritime Museum, the **Museum Ship Pommern**, and the Maritime Quarter in Mariehamn are worth seeing to understand the islands' fascinating maritime history.

Also worth a visit is the **Jan Karlsgården open-air museum** in Kastelholm, where you can see what a typical island farm looked like around 1890. However, the big draw to Åland these days is its unspoiled nature and beautiful landscapes. On midsummer's eve, Åland holds a massive and ancient celebration marking the longest day of the year. The lovely landscapes and seascapes make it a favorite with artists, and their studios and galleries are popular with tourists, who arrive by boat from Turku and Stockholm.

6. Northern Lights



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

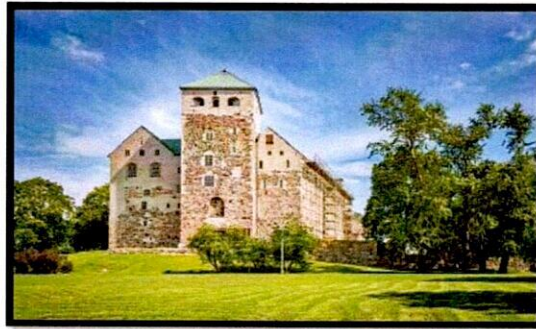
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65



For most people, seeing the Northern Lights is a once-in-a-lifetime treat. Finland is perhaps the top country in the world for seeing these blazing curtains of light drape across the sky. Although, at times, the lights can be seen even in the southern most regions of the nation, the best place to see them is in the region close to or north of the Arctic Circle. Here, between September and March, visitors are almost guaranteed a show if the sky is clear. A wide range of hotels in the north cater specifically to people wanting to see the lights. Also, the Finnish Meteorological Institute allows you to sign up for free Northern Lights email alerts.

7. Turku



Turku Castle

The southwestern Finnish town of Turku, the country's oldest town and until 1812 its capital, lies on the Gulf of Bothnia, at the mouth of the Aurajoki River. Turku lies in the area where the successors to the Swedish Vikings landed in the 12th century and set out to conquer what is now Finland. With eight centuries of history, it is today the most traditional medieval town in Finland, but in addition to its outstanding medieval buildings, you'll find examples of Art Nouveau and modern architecture, such as the **Sibelius Museum**, by Woldemar Baeckman. The river is a focal point for the city, lined with historic boats, some of which have been converted into restaurants.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.

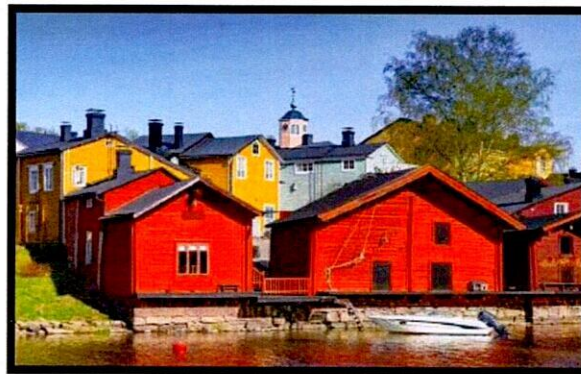


ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

In the summer, locals gather along its banks in the evening and in the winter, it becomes a giant skating rink. On the northeast side of the river is the commercial center with the **Kaupatori (market square)** shopping center and lovely **Orthodox Church**. On the opposite bank the **medieval cathedral**, consecrated in 1290, rises above the **Old Great Square**. It is a massive brick church in Late Romanesque style with Gothic and Renaissance additions and a massive 97-meter-high tower, which dominates the city. During the midsummer **Medieval Festival**, the old square's ensemble of historic buildings regains its medieval air with craft stalls and food vendors.

Just down from the cathedral along the river, **two old sailing ships** are moored — the "Suomen Joutsen," now a training school for seamen, and the "Sigyn," the last remaining wooden barque used for sea trade. Both are open to the public in summer. Nearer the harbor is **Turku Castle**, built around 1300 on what was then an island at the mouth of the river. It was enlarged in the 16th to 17th century and now houses the **Turku Historical Museum**. For a look at what Turku looked like in the early 1800s, stroll through the streets of the **Luostarimäki Handicrafts Museum**, an entire neighborhood of 40 homes, the only ones saved in the fire that destroyed Turku in 1827. Preserved as a museum village, its homes and workshops now house artisans who demonstrate period crafts.

8. Porvoo



Porvoo

The country's second oldest town, Porvoo, is 48 kilometers east of Helsinki. It rises from a picturesque riverfront lined with little red wooden buildings, through a charming tangle of old streets and ochre-colored wooden houses to its hilltop **medieval cathedral**. Highlights here are the ornate 1764 pulpit and wall paintings from the 15th century. Between the river and the hilltop cathedral is the Market Square with two museums worth visiting. One has exhibits on local history and the other, the **Edelfelt-Vallgren Museum**, is of particular interest to those fascinated by the Art Nouveau movement. It features the furniture, ceramics, and other works of several



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde

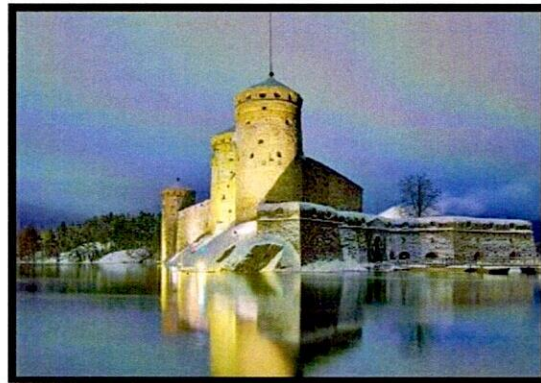
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

artists who formed an art colony here at the turn of the 20th century. Porvoo is still known for its fine crafts, so allow time for browsing the shops and studios. In the summer, you can visit Porvoo from Helsinki by boat.

9. Lake Saimaa and Savonlinna



Castle Olavinlinna, Savonlinna

The entire eastern portion of Finland is more sea than land. With literally tens of thousands of lakes, rivers, marshes, and ponds, eastern Finland is a fabulous aquatic playground. The dominant lake of the region is massive **Lake Saimaa**, the "lake of a thousand islands." Lake Saimaa itself has an area of some 1,300 square kilometers — excluding its numerous islands. The whole lake system is drained by the river Vuoksi, which leaves Lake Saimaa to the north of the town of **Imatra** and flows into **Lake Ladoga** in Russia. The hilly shores of the lake and most of the islands are almost entirely covered with coniferous forest, with some birch forest farther north.

Savonlinna is the main city of Finland's lake region. A popular spa and holiday resort, Savonlinna grew up around **Olavinlinna Castle**, begun in 1475 and Europe's northernmost medieval stone fortress still standing. The castle, which has been beautifully restored, contains a number of handsome rooms, among them the **King's or Knights' Hall**, the **Congress Hall**, and the **Great Hall**. Three massive round towers have survived, and in one of them, the **Church Tower**, is a small chapel. In the Great Bastion is a summer café.

East of Savonlinna lies **Kerimäki** and the largest wooden church in the world. A must do when in the lake region are the boat cruises. From Savonlinna, there are boat trips to the other towns on Lake Saimaa, to **Punkaharju**, with the **Retretti Art Center**, the largest in the Nordic countries, to the monasteries of **Uusi Valamo** and **Lintula**. Another day trip option is a cruise down the Saimaa Canal to **Vyborg** in Russia on the Baltic Sea.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

10. Vaasa




Established in the 1300s, Vaasa was an important town in the time that Sweden ruled Finland. The original town burned down in 1852 and was relocated six kilometers northwest near a better harbor. The ruins of the old city are now a giant park (Vanha Vaasa, Gamla Vasa). The town is about 34 percent Swedish speaking and retains many ties to Sweden. Surrounded by a wide range of cafés, restaurants, and shops, the large market place is the center of city life. This peaceful town offers plenty of attractions. Visitors can walk along the waterfront, which begins in front of the town and extends for miles along the coast.

Other attractions include the **Kuntsi Museum of Modern Art**, down at the harbor, the **Ostrobothnian Museum**, the **Terranova Kvarken Nature Center**, the **Tikanoja Art Museum**, and the **Vaasa Maritime Museum**. Just to the east of the city center, on an island, is **Tropiclandia and tropical spa**, a waterpark inside a heated dome packed with pools, slides, and saunas. South of Vaasa is the famed **Söderfjärden** crater caused by a meteor millions of years ago. To the north lies the **Kvarken National Park**, a wild archipelago hosting many great hikes and excellent bird-watching opportunities. Vaasa also hosts a number of notable cultural events, including the **Night of the Arts**; the **Korsholm Music Festival**, one of the most noted of chamber music festivals; and the **Vaasa Choir Festival**. Vaasa claims to be the sunniest town in all of Finland, so soak up some rays on one of the many beaches.

11. Tampere



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Orthodox Church in Tampere

Founded in 1779 as an industrial settlement, Tampere is Finland's third largest town, but doesn't feel like a large urban center. It lies between two lakes: Näsijärvi, to the north, and Pyhäjärvi, to the south, which are linked by the **Tammerkoski**, a stretch of rapids nearly a kilometer long. Along with its industry, Tampere is known for its active cultural life with an open-air theater and frequent festivals. These include the November **Tampere Jazz Happening**, a tradition now for more than 35 years, when world-renowned names in jazz perform throughout the city in small concert venues and clubs. In the Vapriikki Museum, you'll find the Natural History Museum and other exhibitions. Three churches are of note: **Tampere Cathedral** is known for its unusual paintings and frescoes depicting skeletons in black hooded capes, created in the early 1900s by Finnish symbolist painter Hugo Simberg. The **Kaleva Church**, a soaring concrete building constructed in the 1960s has a floor plan in the shape of a fish, an ancient Christian symbol. The green-domed brick **Orthodox Church** of Saint Alexander Nevsky and Saint Nicholas has a sumptuously decorated interior.

12. Lemmenjoki National Park



NAAC SSR Cycle 4 (2015-2020):
2_3_1 *Experiential Learning*

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Lemmenjoki National Park

Anyone seeking an Arctic wilderness experience will love Lemmenjoki National Park. The tract of boreal forest is the largest park in Finland and one of the most extensive chunks of wildlands in all of Europe, covering more than 2,589 square kilometers. For the trekker, there are hundreds of kilometers of marked trails, as well as free and open wilderness huts and more sophisticated rental huts with sauna and campfire places. The namesake of the park, the **Lemmenjoki River**, is a sight to behold as it flows down from the fells into a stunning valley of towering pines. Visitors can either rent a boat or take a tour. This is the place to find brown bear, wolves, and wild golden eagles, as well as moose and reindeer.

13. Oulu



Oulu



NAAC SSR Cycle 4 (2015-2020):
2_3_1 Experiential Learning

Alinda
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.

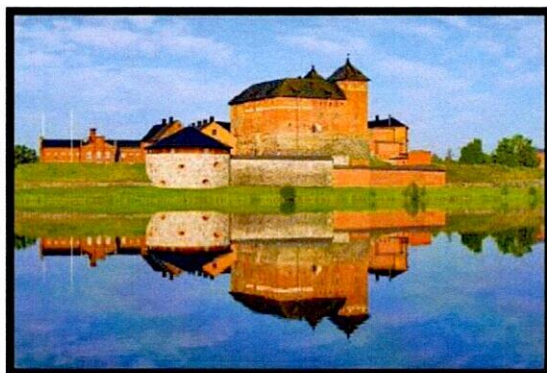


ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Sweet little Oulu lies near the north end of the **Gulf of Bothnia**, at the mouth of the Oulujoki river. It began as a village clustered around the late 16th-century castle built by King John III of Sweden on the island of Linnansaari at the mouth of the Oulujoki.

At the north end of the busy **Kirkkokatu** stands the **cathedral**, originally built in 1770-72. Beyond, at the north end of **Kirkkokatu**, a small bridge leads into the beautiful island of **Ainola**, where you'll find a park and the **Provincial Museum**. Farther north is the **Botanic Garden**, and on the island of **Hupisaari**, a summer theater. Another popular tourist attraction is the **Tietomaa Science Center** to the east of the Oulu Botanic Garden. In the summer, spend some time at the **Market Square** over coffee and classic Finnish pastries. A few kilometers up the Oulujoki is the island of **Turkansaari**, once the home of Russian traders in the city and now an open-air museum.

14. Hämeenlinna




Like many Finnish towns, Hämeenlinna began near a castle, in this case the 13th-century **Tavastehus Castle**. Its distinctive red-brick fortifications top the list of places to see in Hämeenlinna. The other place you shouldn't miss seeing is **Aulanko Nature Reserve**. Part garden park, part forest reserve, it is the first National Urban Park in Finland. The English-style park was constructed between 1883 and 1938, and in addition to hiking its well-kept trails among exotic and native trees, you can climb the 30-meter-tall granite tower on **Aulangonvuori Hill** for views across a typical Finnish forest and lake landscape. More than 50 different species of trees and shrubs are identified along the nature trail round Lake Joutsenlampi. Two historic pavilions and the ruins of a late 19th-century castle are also in the park.

Hämeenlinna was the birthplace of the Finnish composer Jean Sibelius (1865-1957) and north of the market square is the **Sibelius Museum**; a little bit farther on is the **Sibelius Park** and the nearby **Hämeenlinna Historical Museum**.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



5.04 Activities

10 BEST THINGS TO DO IN FINLAND

First, you need to decide if you are going to come here during summer or winter – or somewhere in between. Whether you come in the winter or summer makes all the difference. The two main seasons are polar opposites: one is characterized by darkness, the other of extreme light.

Second, you need to choose where to go. Finland is a large country and to make the most of it, we recommend exploring only one or two of the four main regions: Helsinki area, Lakeland, Archipelago and Lapland. Unless, of course, you have all the time in the world.

To help you, we made a list of 10 different experiences. There is “something for all” as the list covers all of Finland and all seasons. The experiences are mainly nature-oriented. Why? Because that's what Finland is mostly about: beautiful forests, clean lakes and amazing seaside. Culture, design, food and festivals can be found in other articles – why not see them next?

- **SLEEP IN A GLASS IGLOO**

Finland is a land of stark contrasts. In the summer months, the sun does not set at all in the northernmost parts of the country – hence Finland's nickname “The Land of the Midnight Sun”.

In the winter, the opposite happens: the sun disappears for months. This time is called “kaamos”. During kaamos it is not completely dark, however. The bright snow, the moon and the stars, and, if you are lucky, the Northern Lights, create magical surroundings.

Perhaps the best way to experience these two extreme seasons is to sleep in a glass igloo or cottage, surrounded by nature.

- **VISIT A LIGHTHOUSE ISLAND**

Finland's coast has the largest archipelago in the world. And when there are islands, there are lighthouses. And what kind of lighthouses they are! Many are possible to visit during a day trip, some you can spend a night in.

Bengtskär on the west coast is majestic sight. It is the tallest lighthouse in the Nordic countries. It is situated on a beautiful island that is accessible by boat from beginning of June to end of August. If you wish to stay the night, the island has six lighthouse keeper's rooms to stay in. Book early to avoid disappointment.

For Helsinki daytrippers, Söderskär lighthouse is a must-see. It is possible to visit Söderskär by boat from Helsinki. The journey takes just over an hour and the visit itself is for two hours. Just enough to climb the lighthouse and have a cup of coffee in the little lighthouse keeper's cottage next to it.

- **STROLL AROUND AN OLD WOODEN TOWN**





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

In the olden days all of Finland's houses were built of wood. Why, of course, over 70% of our land is covered by forest – that's more than any other country in Europe.

Today, it is still possible to see those wooden houses that date back hundred, even three hundred years. Such Helsinki districts as Käpylä and Vallila are good places to start. Old Porvoo, an hour's drive from the capital, is another easy stop. Beautiful wooden towns can be also be found in Rauma in the West and Loviisa in the South. All of these three offer beautiful little B&B's to stay in should you wish to stay longer.

- **VISIT A UNESCO SITE**

Finland holds seven Unesco World Heritage sites of which six are cultural and one is natural. Perhaps the most well-known is the fortress island Suomenlinna in Helsinki.

Suomenlinna was added to the UNESCO World Heritage List in 1991 as a unique monument of military architecture. Comprising of seven islands, Suomenlinna is full of old fortresses and dungeons. Moreover, it is also an inhabited district of the city of Helsinki and a much-loved getaway for many helsinkians.

Suomenlinna is only 15 minutes ferry ride away from the central market square Kauppatori.

- **HIKE IN ONE OF FINLAND'S 40 NATIONAL PARKS**

There are 40 national parks in Finland. They are scattered around the country's archipelago, lakes, forests and fells. In the winter, one can try snow shoeing or skiing and in the summer, hiking.

Finland's "Everyman's rights" mean that you can venture just about anywhere in the parks as long as you respect the nature and clean after yourself.

- **RIDE A REINDEER OR A HUSKY SLEIGH**

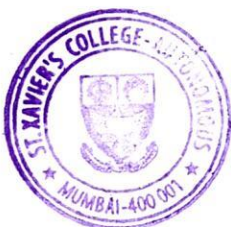
What better way to experience the white, cold wilderness than to be wrapped tightly under a reindeer hide in a sled pulled by a pack of huskies or Santa's number one mode of transport – Rudolph the Reindeer?

Lapland's vast fells and guaranteed snow make it the best place to experience sledding. You can try riding with a pack of huskies from 15 minutes to excursions that last for days. Reindeer rides are usually shorter and more suitable for small children. Both husky and reindeer rides are usually available from late October till late spring, even early summer.


- **MEET THE REAL SANTA**

Everyone knows Santa – the one and only – comes from Finland.

What some people don't know, however, is that it is possible to meet him in person all year round. Santa's official office, situated on the mysterious Arctic Circle, in the city of Rovaniemi



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

is open each day of the year. There, children and adults can enjoy a private chat with him and revel in the enchanted atmosphere.

- **PICK BERRIES AND MUSHROOMS IN A FOREST**

To truly experience the Finnish way of living and the closeness to nature that the Finns have, one should go berry or mushroom picking in the forest.

Bilberries, cloudberries and lingonberries are not called "superfood" for no reason. They are uniquely tasty and packed with high levels of vitamins and flavonoids, after ripening under the white summer nights. Best berry-picking season lasts from end of July until September.

Mushrooms can be picked from late summer until the snow comes.

Everyman's right in the country's forests guarantees that you are allowed to pick almost anything your heart and mouth desires. Forests are everywhere you go. In the Helsinki region, the best place to go berry and mushroom picking is in Nuuksio national park. Nuuksio is less than an hour's bus journey away. It is hard to believe such places exist so near the capital – you will feel out of this world.

- **SKI UNDER THE NORTHERN LIGHTS OR THE MIDNIGHT SUN**

How is that possible, you may ask? In Finland, it can be.

In the northernmost parts of the country, seeing the Northern Lights is almost guaranteed every other winter night. On the other hand, the days are so long by May that sometimes the fells are still covered in snow when the sun decides to stay up all night.

These conditions, especially in places like Kilpisjärvi, make it amazing to go cross-country skiing. Imagine skiing in the middle of the night but with the sun shining over you? Or, in the middle of the darkest day of the year but with the Northern Lights guiding your way?

- **SWEAT IN A SAUNA AND HOP INTO THE LAKE**

There are over three million saunas in Finland and around 188 000 lakes. The greatest past-time of the Finns is to go to the sauna – every week. Some go every day.


Finnish Lakeland is an area where there is most water, and most summer cottages. And perhaps the most saunas too. Winter does not prevent a Finn from jumping into a lake – on the contrary. We Finns love ice swimming. We simply make a hole in the ice and enjoy the cold. If there is no lake nearby, you can always go out of the sauna and roll in the snow. It works just as well!

5.05 Accommodation

Furnished rental dwellings and apartment hotels



NAAC SSR Cycle 4 (2015-2020):
2_3_1 *Experiential Learning*


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Real estate agencies and private persons also rent out dwellings for short periods of time. The term of housing may be anything from a day to several months. Short-term rental dwellings are usually furnished. The amount of rent varies according to the location of the dwelling. Prices will be higher in the central areas of towns.

Homelike apartment hotels with their own kitchens, for example, are also available. The average price of such an apartment is usually 100 euros a day. If you live in the apartment longer, for several weeks, for example, the price may be lower. Living in a hotel is somewhat more expensive in Finland than it is in most European countries. The prices of hotels also vary a lot depending on the season and the location of the hotel. On average, a single or double hotel room costs 60–100 euros a day.

Accommodation in a hostel is cheaper than in a hotel, but the service level is more modest and it is not always possible to get your own room. The price for a night is approximately 20–50 euros. It is cheapest to stay in a shared room.

Home accommodation

You can also stay at regular Finns' homes as their guest. You can find information on home accommodation online. The duration of accommodation is usually a few days or weeks. The owner of the dwelling determines the prices. However, accommodation is usually somewhat cheaper than in hotels.

Student housing

If you come to Finland to study, you are eligible to receive a student dwelling where you can live for as long as your studies in Finland last. If you are a student, it is advisable to apply for student housing, as they are usually cheaper than other rental housing.

5.06 Amenities

Finland offers:

- Hotels that will redefine luxury for you.
- Rejuvenating SPAs.
- Food that will make you crave for more.
- The best Sauna experiences.
- Best of your time without having anything to worry about.

5.07 Affordability





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Finland is the eighth most expensive country in Europe according to a Eurostat study of 2017. Followed by Switzerland, Norway, Iceland, Denmark, Sweden, Ireland, and Luxembourg, the Nordic country has shown to be an expensive country.

The Eurostat study focuses primarily on price levels for food, beverages and tobacco in 38 European countries. The study shows that in Europe Switzerland is the most expensive country for food and Iceland for alcoholic beverages, whereas, among the EU Member States, Finland has the highest price level for alcoholic beverages (alcohol being priced in Finland at 177 % of the EU average) and Romania the lowest prices for both food and non-alcoholic beverages. Although the figures might seem grim for the Finns, it is worthwhile noticing that Finland has lost its fifth place as EU's most expensive country since a Eurostat study conducted in 2009. Nowadays, Finns pay more for alcohol, restaurant visits, and hotel stays than other Europeans whereas electricity and communications services are cheaper, YLE reports.

The Finns pay more on restaurant visits than what is the European average.


... and 20th most expensive country in the world

According to another study by Numbeo, the world's largest database of user contributed data about cities and countries worldwide, Finland ranked the 20th most expensive country in the whole world, losing slightly to France, Belgium, and Sweden, with Bermuda being the most expensive country in the world. The Numbeo database takes into account the price of around 50 items, including, for example, accommodation, food and drink, clothing, taxi fares, leisure activities, utilities, internet and mobile phone bills.

According to Numbeo, an inexpensive meal in Finland costs about 10 euros, whereas a meal for two in a mid-range restaurant costs 60 euros. The figures for Romania are 5 and 21 euros and in France 12 euros and 50 euros respectively.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

How did Finland become the 8th most expensive country in Europe:

One reason for the difference in price levels around Europe and worldwide is the variation in levels of taxation. The Finnish standard VAT is set at 24%, whereas VAT in Denmark is 25%. Romanian VAT, on the other hand, is 19%. The elevated price level in Finland is often attributed to the low level of competition in the closed-sector industries. Bank of Finland Bulletin explains. Food prices began to decline in Finland soon after Finland's accession to the EU in 1995 but the decline was temporary. In fact, the real food prices have gone up again since the turn of the millennium.

Finland also has high alcohol and tobacco taxes, and a tax on soft drinks has driven up the prices of non-alcoholic beverages. There are also signs of higher margins being charged within the food production chain by producers, industry, and stores. The price increase on restaurant services and other services reflects the stronger wage developments in Finland compared to other euro area countries. All and all, the Eurostat study shows that Denmark is Europe's most expensive country where consumer goods cost 42 percent more than the EU average. Bulgaria has the lowest price levels, with price tags 52 percent below the overall average.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



Chapter 5: Documentation

5.01 Overview

If you need a Schengen Visa, you must opt to travel to Finland which easily offers VISA without having much to do. One must have all documents sorted to avail the Finnish VISA.

5.02 Consulate locations in India



- Embassy of Finland
Embassy
New Delhi, Delhi
Opens 8AM Tue · 011 4149 7500
- Consulate Of Finland
Foreign consulate
Chennai, Tamil Nadu
Opens 10AM Tue · 044 2852 4141
- Consulate of Finland
Foreign consulate
Kolkata, West Bengal
033 2287 4328

5.03 Visa Form & Process

The Embassy has recently outsourced much of its customer service and all of its appointment bookings to a private company, VFS Global. Read more below on how to book interviews and





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

appointments to submit visas and residence permits, and customer service hours at the Embassy and the Application Centre.

Contact information

Address

Finland Application Centre for Visas and Residence Permits
Shivaji Stadium Metro Station, Mezzanine Level
Baba Kharak Singh Marg, Connaught Place
New Delhi – 110001

Opening hours

Monday–Thursday 9.00AM–4.00PM residence permits

Monday– Friday 9.00AM–5.00PM visas

Making an appointment

You have three options:

1. Make a booking on the VFS website for visas and for residence permits
2. Call the VFS helpline: **022-67866026** (from 7:00 AM to 5:00 PM)
3. Send an email to: info.finlandin@vfshelpline.com

The Embassy of Finland will no longer reply to inquiries regarding visas and residence permits by telephone or by email.

The Embassy still accepts a limited amount of both visa and residence permit applications per week. However, appointments for the Embassy should also be booked through VFS - either via telephone or via email (see contact details above). You can choose whether you want to submit at the Embassy or at the Finland application centre, but please notice that appointment slots are limited to a certain number per week at the Embassy, so if you are on a tight schedule you may not have an option.

* The VFS charges a service fee for each application.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Visa types

- **Single-entry visa**
allows the holder to enter Finland once and stay for up to 90 days in any 180-day period.
- **Double-entry visa**
allows entry into Finland twice and may be valid within the Schengen area for up to 90 days in any 180-day period.
- **Multiple-entry visa**
is granted for several consecutive visits to the Schengen area. The total duration of the stays may not exceed the number of days stated on the visa sticker, that is, up to 90 days in a 180-day period. A multiple-entry visa is valid for a maximum of five (5) years.
- **Airport transit visa**
allows the visa holder transit via the international zone of the airport during a stopover or change between two flights. Entry in the national zone is prohibited. Citizens of the following countries need a transit visa:
 - Afghanistan
 - Bangladesh
 - Eritrea
 - Ethiopia
 - Ghana
 - Iraq
 - Iran
 - Democratic Republic of Congo
 - Nigeria
 - Pakistan
 - Somalia
 - Sri Lanka

Service Fees

Permits for entry and residence

Schengen visa	60	INR4,700
---------------	----	----------






ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Visa fee for children 6-11 years and for the citizens of following countries: Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Georgia, Macedonia, Moldova, Montenegro, Russian Federation, Serbia, Ukraine. For more information, please see: Visa facilitation agreements	35	INR2,800
Visa for children under 6 years, family members of EU citizens and school pupils, students, postgraduate students and accompanying teachers who undertake stays for the purpose of study or educational training. For more information on cases where the amount of the visa fee may be waived or reduced, please see: Visa Code, Article 16	0	INR0
Residence permits (including family relations)	520	INR41,100
Residence permits (including family relations), electronic application	470	INR37,200
First residence permit for work or a self-employed person	640	INR50,600
First residence permit for work or a self-employed person, electronic application	490	INR38,800



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

First residence permit, no labour market testing (other work, specialist, researcher, athlete, coach or trainer)	560	INR44,300
First residence permit, no labour market testing (other work, specialist, researcher, athlete, coach or trainer), electronic application	410	INR32,400
Residence permit for studies	450	INR35,600
Residence permit for studies, electronic application	350	INR27,700
Residence permit for a minor (under 18 years)	270	INR21,400
Residence permit for a minor (under 18 years), electronic application	240	INR19,000

5.04 Documents Required

India: travel documents to Finland

Visa required


- Visa required to Schengen area and Finland

Visa exemption:

- Diplomatic passport holders: exemption from the visa requirement to Finland



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Travel documents accepted by Finnish authorities

- Ordinary passport
- Diplomatic passport
- Service passport / Official duty passport
- Aliens's travel document (Identity Certificate) (Y-series), if the holder is a Tibetan refugee.
- Seaman's book (on duty)

Entry requirements

Your conditions of entry to Finland are re-evaluated upon arrival in the country. In addition to your visa, you are asked to produce a valid passport or travel document, an insurance document for the duration of your stay and the supporting documents.

You must prove that you have enough funds (EUR 30 per day) to support yourself. The funds need to be sufficient for your stay and return or continuation trip. If you have a valid return ticket, its value reduces the amount of funds you are required to have with you.

You must not have an entry ban to the Schengen area. Your entry into the country can be prohibited also if you are considered to constitute a danger to the public order and security, public health, or Finland's relations with other countries.

Furthermore, your entry may be refused if there is reason to suspect that you intend to earn money by dishonest means.

Extending the visa's validity while in Finland

Local police authorities can extend the visa's period of validity in Finland, if you cannot leave Finland and the Schengen area due to a force majeure or humanitarian reason.

Decisions on extending the validity of a visa are made by the Police.

5.05 Health Requirements

Some vaccines are recommended or required for Finland. The CDC and WHO recommend the following vaccinations for Finland: hepatitis A, hepatitis B, rabies, meningitis, polio, measles, mumps and rubella (MMR), Tdap (tetanus, diphtheria and pertussis), chickenpox, shingles, pneumonia and influenza.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Recommended Travel Vaccinations for Finland


VACCINE	HOW DISEASE SPREADS	DETAILS
<u>Hepatitis A</u>	Food & Water	Recommended for most travelers
<u>Hepatitis B</u>	Blood & Body Fluids	Accelerated schedule available
<u>Rabies</u>	Saliva of Infected Animals	Vaccine recommended for long-term travelers and those who may come in contact with animals.

Routine Vaccinations for Finland

VACCINE	HOW DISEASE SPREADS	DETAILS
<u>Measles Mumps Rubella (MMR)</u>	Various Vectors	Given to anyone unvaccinated and/or born after 1957. One time adult booster recommended.
<u>TDAP (Tetanus, Diphtheria & Pertussis)</u>	Wounds & Airborne	Only one adult booster of pertussis required.
<u>Chickenpox</u>	Direct Contact & Airborne	Given to those unvaccinated that did not have chickenpox.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

<u>Shingles</u>	Direct Contact	Vaccine can still be given if you have had shingles.
<u>Pneumonia</u>	Airborne	Two vaccines given separately. All 65+ or immunocompromised should receive both.
<u>Influenza</u>	Airborne	Vaccine components change annually.
<u>Meningitis</u>	Airborne & Direct Contact	
<u>Polio</u>	Food & Water	Considered a routine vaccination for most travel itineraries. Single adult booster recommended.

5.06 Forex

Trading forex (currencies) in Finland is popular among residents. While recommended, forex brokers are not required to become authorised by the Financial Supervision Authority (FIN-FSA) to accept residents of Finland as customers. The Financial Supervision Authority is the financial regulatory body in Finland. Website: <https://www.finanssivalvonta.fi/>. We recommend residents of Finland follow the FIN-FSA on Twitter: https://twitter.com/fin_fsa.

The FIN-FSA was formed in 2009 and is responsible for the regulation of financial markets in Finland. For a historical breakdown, here's a link to the Financial Supervision Authority webpage on [Wikipedia](#).


Best Forex Brokers Finland

To find the best forex brokers in Finland, we created a list of all brokers that list Finland as a country they accept new customers from. We then ranked brokers by their Trust Score Ranking. Here is our list of the best forex brokers in Finland.

- IG - Best Overall Broker 2020



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

- Swissquote - Best banking services
- Saxo Bank - Best VIP client experience
- Plus500 - Best for beginners overall
- Markets.com - Easy-to-use platform
- FOREX.com - Great platforms and pricing
- City Index - Excellent all around offering

Residents of Finland can search the [FIN-FSA company register](#) to verify whether or not a broker is authorized. If a company is authorized, a company profile will be available with a registration number and date upon searching.

5.07 FAQs

1. WHEN IS THE BEST TIME TO VISIT FINLAND?

It depends on what you'd like to experience: for plenty of snow and winter activities, December to March is the best time. For springtime sun and the revival of nature after the winter, April to May is the period. For long and warm summer days and plenty of events, opt for June, July and August. For autumn leaf colour, visit in September-October.

2. I DON'T SPEAK ANY FINNISH, WILL I MANAGE?

If you speak English, you should not have any difficulties as most Finns speak fluent (or at least understandable) English.

3. ABOUT FINLAND

Full of interesting contrasts, such as the four seasons, the Midnight Sun and winter darkness, urban and rural, East and West.

4. WHEN AND WHERE CAN I SEE THE NORTHERN LIGHTS?

In northern Lapland the lights shine about every other clear night between August and April. In southern Finland they are visible on about 10-20 nights a year. Auroral activity peaks often occur at the beginning and the end of the season.

5. HOW ABOUT THE MIDNIGHT SUN?

Also in Lapland. In Utsjoki, the very north of Finland, the sun stays above the horizon for more than two months between mid-May and late July. In southern parts of Lapland, the sun stays up constantly for a month in June-July. However, nights are white throughout the country for most of the summer.

6. WHAT ABOUT TEMPERATURES – HOW COLD DOES IT GET AND WILL THERE BE SNOW?



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

During the winter months, temperatures can drop as low as -35 degrees Celsius. Luckily, this is not the norm: regular winter temperatures fall somewhere between -5 and -15.

In the summer, it gets as hot as 30 degrees Celsius, sometimes even more. Normal summer temperature is a bit over 20 degrees. In Finland, it is common to have up to a 70 degree difference in temperature between January and July.

During January and February, there is almost always snow in northern and eastern Finland. Even if there's little snow in Helsinki, there's often up to a metre or more on the skiing slopes of Lapland. The snow season in northern Finland begins in November and lasts at least until April-May. In the inland regions of southern and central Finland, the first snow falls at the beginning of December and melts during March.

7. WHAT SHOULD I WEAR?

If you are planning a winter visit, get a warm, padded winter jacket. Thermal underwear, a warm hat, thick socks and gloves help out a lot when temperatures drop below freezing.

If you have trouble finding winter gear where you come from, don't worry – everything can be purchased in Finland. Warm clothing is included in guided safaris and other winter excursions.

In the autumn and spring, waterproof footwear comes in handy if you intend exploring the outdoors. In the summer, casual wear is pretty much the same as in other parts of northern and central Europe – light trousers, shorts, tee-shirts and so on.

8. WHAT ARE THE EVERYMAN'S RIGHTS I'VE HEARD OF?

One of the great concepts in Finland is called "Everyman's Rights". This gives you the right to roam freely in natural areas like forests, fells, lakes and rivers, without permission from landowners. The concept has evolved over time and started as an unwritten code created by a sparse population living in a vast, densely forested country.

Some guidelines: you can pick wild berries and mushrooms, but not someone's apples or plums. You can go canoeing and camping, but not too close to someone's house. In many areas, fishing requires a permit. Don't leave litter, and leave the place the way you found it.


Simply put: Enjoy the great outdoors, but be responsible and respect nature as well as other people and their property.

9. IS FINLAND SAFE?

Very. It's one of the few countries in the world where lost wallets and mobile phones get returned to their rightful owner.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

10. WHAT SHOULD I DO IN CASE OF AN EMERGENCY IN FINLAND?

Dial 112, free of charge.

11. WHAT DOCUMENTS DO I NEED TO ENTER FINLAND?

You need a valid national passport or other equivalent official document that satisfactorily establishes your identity and nationality. If you aren't a citizen of Finland or another European Economic Area (EEA) country, you may also need a visa. Please check with your local Finnish Embassy.

12. DO I NEED TO GET VACCINATED BEFORE ENTERING FINLAND?

Finland is one of Europe's safest countries in terms of health and hygiene. No vaccinations or inoculations are required before arrival. Finnish pharmacies are well stocked with all the basic medicines, but note that some medicines that are available in stores and supermarkets in other countries – such as Aspirin and various ointments – are only available in pharmacies in Finland.

13. CAN I SHOP TAX FREE IN FINLAND?

Anyone permanently resident outside the EU and Norway can shop tax free in Finland, thus saving about 12 (max. 16) per cent on purchases of over 40 €. Only stores with "tax free shopping" signs will provide customers with a cheque covering the VAT refund; this can be cashed upon leaving the last EU country visited.

14. WHAT ARE THE COMMON SHOPPING HOURS?

Most shops are open until 6 pm or 8 pm on weekdays and close between 3 pm and 6 pm on Saturdays. Some are open until 6 pm on Sundays, while others are closed.

Bigger supermarkets are open until 9 pm and smaller ones until 11 pm on weekdays, and 6 pm and 11 pm on weekends, respectively. Exceptions occur on public holidays, bank holidays etc.

15. WHAT CREDIT CARDS ARE ACCEPTED IN FINLAND?

American Express, Diner's Club, Eurocard, Access, Master Card and Visa are accepted in hotels, restaurants, larger shops, and department stores. Visa Electron is also accepted in many shops and department stores.

16. HOW LATE ARE BARS AND NIGHT CLUBS OPEN?

Most bars stop serving at 1.30 am and close at 2 am. Night clubs stop serving at 3.30 am and close at 4 am at the latest.



NAAC SSR Cycle 4 (2015-2020):
2_3_1 Experiential Learning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

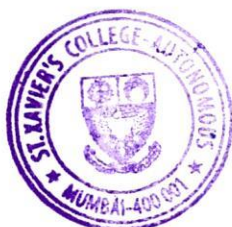
17. WHAT IS THE LEGAL DRINKING AGE IN FINLAND?

The sale of alcohol to persons under 18 years of age is prohibited by law. People over 18 can buy alcoholic drinks such as wines and beers containing at most 22 per cent alcohol by volume.


A person aged 20 can buy alcoholic drinks of any kind from an Alko (state monopoly) store. Customers may be asked to show a passport, identification card or driving licence as proof of age. Beer and cider is sold in supermarkets and other food stores until 9 pm every day. Wines, liquors and spirits are sold in Alko stores. Most Alko stores are open from Monday to Friday between 9 am and 8 pm, and 9 am to 6 pm on Saturdays.

18. I'VE HEARD THERE ARE SOME NASTY MOSQUITOES IN FINLAND, IS IT TRUE?

Finnish mosquitoes are a nuisance rather than a hazard, but there can be quite a few at times during the summer. There are practically no mosquitoes in cities, as they mostly bother you in the countryside in the northern parts of the country. The mosquitoes are not dangerous, and repellent is available in shops, supermarkets and pharmacies.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



Chapter 6: Itineraries & Tour Packages

6.01 SWOT analysis of existing itineraries

6.02 Popular Tourist Circuits

Capital Helsinki is a southern port city, dressed with imposing Art Nouveau architecture and a spacious, sea-focused elegance. If its hoary wilds you're after, head for AKK National Park, where you can discover the wildernesses of Lapland on a sled pulled by dogs, heading into the heart of one of Europe's most deserted areas. Climb to Kilpisjarvi, where Finland meets Norway and Sweden, or head east and explore Isomantsi, where aboriginal Karelians live among supposedly continuous wilds. The areas near Kuusamo are an outstanding place to eye the haunting lights of the Aurora Borealis, the world's natural northern light show.

6.03 Proposed Tour Itineraries

Itinerary 1

Finnish Wanderlust! (6N/7D) (1,50,000 INR)

Known as "the land of the midnight sun" and "the land of a thousand lakes", Finland is one of those hidden treasures of the world that hasn't been trampled to the ground by busloads of tourists. For many travellers, its a new country to be explored.

Finland Itinerary

Day	Location	Schedule	Activity	Cost (€)	Transport
1	Helsinki	7am-5pm	Arrival	5	Bus from airport
2	Helsinki	9am-7am (Day 3)	Helsinki City Art Museum; Torni Bar; Harbour Markets; Helsinki Cathedral; Havis Amanda	10 (museum entry)	On Foot
3	Tallinn	9am- 7:30pm	Fat Margaret; Old Tallinn; cobblestone roads; flower	45	Ferry





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
 5, Mahapalika Marg, Mumbai - 400 001,
 INDIA.
 ☎ 2262 0661/65

			market		
4	Espoo	9am-7pm	Nuoksio National Park; Espoo Museum of Modern Art	12 (museum entry)	Bus
5	Iso Vasikaari	9am-2pm	Fishing; yachting; sunbathing; swimming	5 (return ferry ticket)	Ferry
6	Rovaniemi	8pm-7am	Santa's Village Lapland; Sky Enontekio	180 (return train ticket)	Train
7	Rovaniemi	9am-7.30pm	Departure	5 (airport bus)	Train & Bus

Day 1: Arrival in Helsinki



Helsinki Vantaa Airport is by no means special. Depending on when you arrive, you may or may not be so fortunate as to experience the airport at its dearest. I was one of the more fortunate ones.



NAAC SSR Cycle 4 (2015-2020):
 2_3_1_ExperientialLearning

Shinde
 PRINCIPAL
 ST. XAVIER'S COLLEGE
 (AUTONOMOUS)
 MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Have lovely gastronomic tour of the city, featuring several small but unknown food trucks (only present in the summer), and ended up forgoing a choice of pita pockets, and gourmet burgers, for salmon on rye.

Follow that up with ice cream from Helsingin Jäätelötehdas, a Helsinki Ice Cream Factory by the beach. Also, right by the ice cream parlour is a 'carpet-washing pier', where people go to wash their carpets with eco-friendly pine soap and leave them to dry on a wooden drying rack made for the same ecological purpose.


Tips

- **Airport Bus** – There is a bus service to and from the airport to the city centre, running every half-hour or so, and Finnair has their own shuttle service as well. Bus schedules can be checked online at www.finavia.fi/en
- **Never a Double** – The scoops at the Helsingin Jäätelötehdas were rather large in size, so be sure to avoid my mistake of getting a double (orange and vanilla) and having too much to eat.

Day 2: Helsinki



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

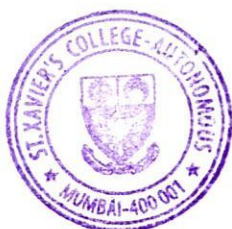


Ask any Helsinki native, and they'll tell you that you haven't seen Helsinki until you:

- Have a photo with Havis Amanda, a bronze statue of a woman housed in a fountain in market square.
- Get a bite to eat at the harbour front market and maybe browse through the local souvenirs.
- Drink a beer at and see the view from Ateljee Bar atop Hotel Torni, a building which survived WWII and has a 360 degree view of Helsinki.

Helsinki City Art Museum, also known as Helsingin taidemuseo, and the picturesque Senate Square. Trip to the Kamppi Chapel of Silence, a minimalistic birch, pine and spruce chapel located in the heart of the city.

Also, be sure to hit up the local bar scene in Helsinki, like Storyville Jazz: an underground jazz club with really swinging bands playing at night. It was a personal favourite of mine. It was



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

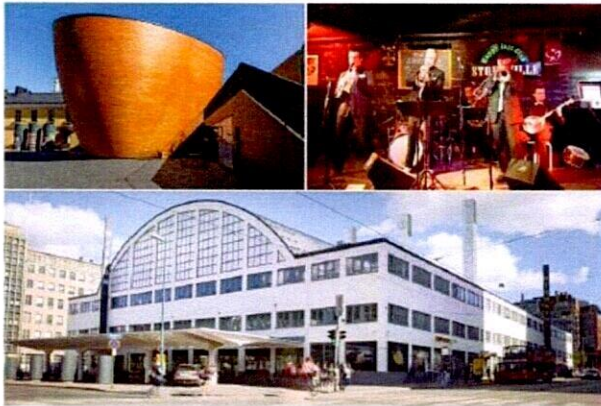
Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

actually at Storyville Jazz bar that I was introduced to Finnish brews like Lapin Kulta, Karhu, and a delectable gin drink aptly named Lonkero, which translates to Long Drink.

On a completely different note, bars in Finland are a great place to meet local people. Most people relax after a few drinks and Finns are their friendliest with a drink in hand.



Tips

- **Art Museum Tickets** – Tickets for the Helsinki City Art Museum must be purchased in person and the museum is closed on Mondays. Students with an ISIC and senior citizens get a discounted ticket for €8 (as opposed to €10), and children below the age of 18 enter for free! Entrance is also free for everyone on the first Friday of the month.
- **After-beer-munchies** – Most restaurants close down well before their beverage serving counterparts. But fear not, there are plenty (okay, maybe like 10) kiosks around the city serving greasy food for people in your position. Depending on the



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

time of morning (or night, if you're not too much of a party animal) you visit them, they may or may not have a breakfast menu complete with bacon and eggs.

Helsinki Red Bus 24h Hop-On Hop-Off Ticket



Take advantage of the hop on hop off bus which gives you unlimited rides to all the major attractions in Helsinki including Senate Square, Olympic Stadium, Swedish Theatre and Market Square. It's the easiest way to get around.

Day 3: Day Trip to Tallinn, Estonia



Tallinn, the capital of Estonia, is a hop, skip and a jump (via ferry) from Helsinki. It is one of the most picturesque towns of its kind, especially during summer.

Tallinn is divided into two main parts; New Tallinn and Old Tallinn. Old Tallinn is the epitome of romance with its cobblestoned roads, hole-in-the-wall cafés and flower market. On arrival, I



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

tried my hand at medieval archery (complete with a leather wrist bracer sans Velcro) outside Fat Margaret, the aptly named plump tower that is home to the Estonian Maritime Museum.

Estonian coffee, which is so delicious, and spend much of the day taking in the sights of Old Tallinn on foot whilst munching on freshly roasted cinnamon-sugar almonds (also utterly delicious).

Leave Tallinn a little before sundown to take in the views from the ship on the way back and spent the rest of the evening enjoying the cool ocean breeze and shopping on-board before reaching land and making my way back to Helsinki.



Tips

- **Boat Drinking** – If you're feeling exceptionally adventurous, I'd suggest trying Jalo-kola, a cut brandy (Jalovina) and cola concoction, on the route back, or some Saaremaa vodka. Note: these drinks, especially the latter, are not for the faint of heart.
- **Ferry Tickets and Schedules** – There are two main ferry lines that run between Estonia and Finland. I took the Silja Line, but both have similar if not identical on-board facilities. Roundtrip tickets start at €30 and increase depending on which class



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

you choose and whether or not you return the same night. Tickets are cheapest if purchased in advance. I paid close to €50 for what would have been a €30 ticket had I booked online a week earlier. The Silja Line fleet runs several times a day to and from Tallinn and Helsinki. Their timetables can be found on their website.

- **Last Ferry** – I recommend that the last ferry back to Helsinki (at 10:30pm) should be avoided if traveling with younger children. Apart from the fact that it is crowded beyond belief, most of the people returning are fairly inebriated, and while there is security on-board and situations rarely get out of hand, there is the odd drunkard or two who can be annoying.

City Sightseeing Tallinn Hop-On Hop-Off Tour




When you arrive in Tallinn, the city sightseeing bus will be the easiest option to see all the main attractions in the city. Main stops include Russalka Monument, Toompea Castle and City Harbour Cruise Ship Terminal (where you can catch a cruise back to Helsinki).

Day 4: Espoo



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



The nearby town of Espoo is a roughly 20-minute bus ride from Kamppi Station, Helsinki. Being the second largest town in Finland, it has a lot to offer, including a lovely little marina that features the Haukilahden Yacht Club, which has a stunning collection of boats and yachts.

Visit the Nuuksio National Park, which was a beautiful area full of picturesque nature.

Public beaches stretch far and wide in Espoo, but I only got around to exploring a couple.

Mellsten Café, a small, cosy eatery with a lovely wooden deck, was a splendid change from the city. Their coffee, panini and gelato were absolute perfection. On every following trip to Espoo, I made it a point to stop by Mellsten Café and sit with a coffee while enjoying the sea breeze.

Espoo is also home to EMMA, the Espoo Museum of Modern Art. I won't lie, not being one for 'modern art', I'm not sure I felt overly enriched (culturally speaking) once I'd left the museum.

On the flip side, the same building that houses EMMA has a really neat clock museum.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

EMMA offers discounted tickets for groups, students, senior citizens and children. Tickets are €10 for ISIC holders, €12 for adults, and free for seniors above 70, children below 18 and on Wednesdays between 6pm and 8pm.

Helsinki Card



I would highly recommend you get a Helsinki card if you're planning on visiting a few attractions in Espoo. Not only does it cover the main attractions in Helsinki, but it also covers transport around Espoo, allowing you to easily venture out to all the main points of interest in the city.

Day 5: Iso Vasikaari



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Boat trips to offshore islands run frequently, especially in the summer, and one such popular island destination is Iso Vasikaari. I spent most of the day watching others fish, while I tamed, enjoyed a picnic and a book, and treated myself to a gelato with traditional Finnish cloudberry jam from a family-run, shack-type establishment.

Although Finnish waters are actually quite choppy year-round, even in the summer months, Finns have a term for conquering one's fears, embracing courage, and diving in the deep end: Sisu. So I, under the pressure of many a Finn, Sisu-ed my way into the cold waters and Un-sisu-ed my way right back within a good five minutes!


Back in Espoo, End the day with a dinner at E.T. Charlie and a night time stroll around the harbour, before catching the night train to Rovaniemi.

Boat schedules and prices can be checked on VisitEspoo.fi. I definitely recommend skimming over the boat schedule the night before and arriving early since queues and crowds are aplenty on sunny days.

Day 6: Rovaniemi

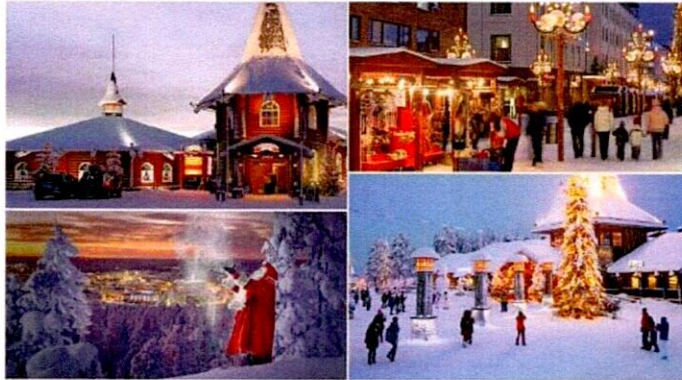


NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65




Rovaniemi, for those unfamiliar, is a city in Finland's most northern province, Lapland. However, more importantly, it is home to the Claus Family. Yes I mean Santa and Mrs. Claus.

The Santa Claus Village is Rovaniemi's biggest tourist attraction. 'Santa' is a government employee who patiently sits on a chair with his impeccably groomed beard and listens to the likes of Suzie and Johnny talk about what they'd like for the following Christmas.

A must-do in Rovaniemi, apart from a touristy photo with one leg on either end of the line marking the Arctic Circle, is a meal at Sky Enontekio, a Michelin starred restaurant at the Sky Ounasvaara. Mushrooms are especially good during summer, so if you can, I'd opt for a dish with mushrooms in it. The restaurant also has a balcony with an amazing view of the surrounding forest and you occasionally get a good glimpse of reindeer.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



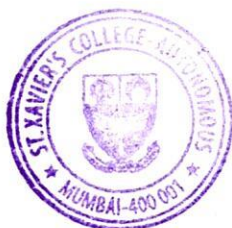
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65




Incidentally, for any first-timers in Finland, I'd suggest Rovaniemi to be a good starting point for an authentic Finnish sauna, primarily because it's a tad cooler than places further south. Not for the weak minded, I'll have you know, the authenticity factor comes two-fold. First, an ice cold shower or dip in a lake is a must midway through your time in the sauna. And second, you'll be joined by many friendly tourists and residents all enjoying beer, making the sauna a great social event. End your time in Rovaniemi with a traditional Finnish dinner of reindeer, potatoes, carrots, pickles, turnips and lingonberry sauce, all washed down of course with wine.

Tips

1. **Santa's Village** – Certificates for crossing the Arctic Circle can be purchased at Santa's Post Office for €5. There is little to do in Santa's Village during the summer apart from feeding and petting reindeer. So if you desperately want to get the most out of Santa's Village (anyone visiting with young children), then I suggest visiting during the winter months when rides are running.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

2. **Aurora Borealis** – Those visiting Rovaniemi before and after March and August respectively might be fortunate enough to catch the Aurora Borealis (The Northern Lights). The Finnish Meteorological Survey website provides more information on the auroras themselves, and forecasts can be checked on www.AurorasNow.fi, under the geomagnetic activity forecast.

Day 7: Rovaniemi to Helsinki

Leave Rovaniemi mid-morning and catch the train back to Helsinki with enough time to have a final browse of the city, revisiting old sights before heading to the airport.

Itinerary 2

The Mesmerising Finland! (11N/ 12D) (2,00,000 INR)

Day 1 – Fly into Oulu

Oulu is just over an hour away from Helsinki. The two cities are well connected through multiple flights a day. You will find a white landscape, laden with snow, when you land in Oulu. Once you're in Oulu, you could stay there for the night or take the train to Kemi, a small Finnish city close to a deep harbour.

Tips :

- Take bus no. 9 from Oulu Airport to the city centre/train station.
- You can book your train tickets to Kemi in advance on this website : www.vr.fi/cs/vr/en/

Days 2 and 3- Float with Icebergs in Kemi

This is when the fun begins in real earnest. On this day, you will witness a castle made entirely out of ice and hop aboard an ice-breaker cruise ship. Ice-breaker sampos are used to transport goods from one port to the other in this part of the world but Kemi's ice-breaker sampo is one of the very few that allow tourists on board.

A free shuttle bus ferries passengers from Kemi's train station to the Ice Breaker Sampo. A short drive later, you will see a ship looming large in the distance. Chunky boulders of ice surround it.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

This is the Gulf of Bothnia, Europe's largest mass of frozen ice. You might have been on many a cruise but nothing like this one. A loud horn heralds the start of an unforgettable journey – the ship leaves the harbour, cutting through the frozen Baltic Sea.

It might be cold outside but it's hard to tear yourself away from the surreal sight of a frozen sea stretching out in front of your eyes. Our favourite part? A short pit-stop in the middle of the journey where passengers are given the opportunity to don bright floatation suits and plunge in ice-cold waters with a few other fellow crazies for company.

The free shuttle bus is waiting for passengers when the cruise ship gets back. It drops tourists at the snow castle of Kemi, which is straight out of the fairytales. You could wander around and walk back to the train station (a pleasant 20 minute walk) or spend the night at one of their unique ice-rooms. Did you ever think you would be sleeping on a bed of ice? Now is the chance to make that dream come true.

Tips:

- This should be one of the first things you book because cruise tickets get sold out months in advance. The cruise can be booked here :- www.visitkemi.fi. You could also send an email to sales@visitkemi.fi
- The Sampo Icebreaker Cruise costs €270 per person. This cost includes food, polar plunge experience, and the return journey on the cruise ship
- There is a free shuttle bus that ferries tourists from Kemi train station to the Ice Breaker Sampo and the Snow Castle
- Entry to the Snow Castle costs €15. If you want to spend a night in the ice hotel, prices start at €155. More information on their website www.visitkemi.fi/en/

Day 4 – Settle into Rovaniemi

A short train ride will get you to Rovaniemi, the bustling capital of Lapland situated on the Arctic Circle. Rovaniemi is also famous for being the home of Santa Claus. Did we not say Lapland is straight out of our childhood fantasies?


Rovaniemi is the perfect base for exploring Lapland and all it has to offer. No wonder it features heavily on most itineraries of Lapland. We stayed at Santa's Hotel Santa Claus and loved it. The hotel's location is perfect – it's less than a five minute walk away from most of Rovaniemi's supermarkets, restaurants, and excursion providers.

Our spacious suite was on the sixth floor, overlooking the river. The room was modern, kitted out with a private Finnish sauna (where Vid spent most of his time). Breakfast was plentiful with a wide variety of vegetables, salmon, eggs, meat, fruits, cookies, and cheese on offer.

Tips:



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

- Stay in a centrally-located hotel in Rovaniemi. We stayed at Santa's hotel Santa Claus and will happily recommend it. You can find the best rates here
- Make sure you spend time in the Finnish sauna – it's unique and rejuvenating.
- Breakfast at Santa's Hotel Santa Claus in Rovaniemi

Days 5 and 6 – Experience the best of Lapland's safaris

Once you've settled into Rovaniemi, it's time for the adventures to begin. There are photo opportunities galore. You can spend your days snowmobiling on frozen rivers, driving through stunning Arctic forests, visiting husky dog farms and playing with furry creatures, or hunting for the mysterious Northern Lights. Northern Lights' excursions in Rovaniemi involve driving out of town, spending hours listening to Sami folk tales and BBQing sausages in a tent in the Arctic Wilderness – SO good.

Tips :

- Lapland Safaris offer husky-dog safaris, snowmobiling, visits to reindeer farms, and Northern Lights excursions. Safaris start at €100/person.
- We recommend pre-booking all your safaris with Lapland Safaris. That way you can keep their Arctic overalls, ski gloves, even snow boots for the length of your stay in Rovaniemi for free. You'll keep warm and you won't need to pay a penny.

Day 7 – Meet Santa Claus on a day trip

Did you know that Finnish folklore has it that the 'real' Santa Claus resides in Rovaniemi's Santa Claus Village with Mrs. Claus and an army of elves. No wonder it's Christmas 365 days an year in Lapland

Santa Claus Village is a short bus ride away from the centre of Rovaniemi. You will hear Christmas carols and festive music as soon as you enter the hallowed gates of this dreamy village. Of course, there's no better way to arrive at Mr. Claus' house than on a reindeer sleigh. Now let me tell you something. This might not be your first skirmish with Arctic Safaris but one thing is for sure – it'll be your favourite one. It belongs in a fairytale, nowhere else.


Once you've exhausted yourself by playing in the snow, giggled at the little elves in the village, and hugged snow-men, head to **Kotahovi Restaurant** in Santa Claus Village for a warm meal. The restaurant is housed in a traditional Lappish wooden hut. The roaring fire at the centre of the restaurant is comforting and made us feel cosy almost immediately. We devoured the creamy salmon soup with rye bread (€14) and the sautéed reindeer with mashed potatoes, lingonberries, and pickled cucumbers (€26) and spent hours looking at the snow falling outside the window.

Tips:

- Bus number 8 takes you from the Rovaniemi city centre to Santa Claus Village. Bus tickets cost €2.20/per person.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

- Entry to Santa Claus Village is free. You can meet the 'real' Santa Claus for free too.
- Don't leave Santa Claus Village without hopping on a reindeer sleigh. It will take you through magical snow-laden trains and Arctic forests. It was one of our favourite experiences on our entire trip of Lapland. The owner at Santa Claus Reindeer, Janne, is a great photographer. Make sure you ask him for a frame-worthy photograph once you're in the sleigh ☐
- Reindeer Sleigh rides start at €22/per person. We opted for the 3 km ride and loved it. The warm, cosy interiors of Kotahovi Restaurant.

Day 8 – Devour a traditional Lappish meal and say bye to Rovaniemi

Sampling local food is the easiest way to acquaint oneself with a new culture. If you're a regular reader of Bruised Passports, you'd know we never leave a new place without trying out all the local delicacies we can get our paws on. We had a fair few Finnish meals in Lapland but Restaurant Nili came out triumphant by a mile (and a half).

The evening we spent at Restaurant Nili made us so happy that we just had to go to the kitchen to give the chef a hug. The unassuming exterior makes it seem like a small neighbourhood eatery but locals swear by Nili's exquisitely-crafted Finnish food. We loved the fact that the food was modern without being excessively experimental.

The meal kicked off with a delectable Lappish blini, perfectly complimented by whipped sour cream and grainy fish roe. Main course was reindeer rack on a bed of fluffy parsnip purée, braised root vegetables, and a creamy sauce. We opted for a full-bodied Merlot with the reindeer meat and the two were a match made in heaven. A refreshing scoop of Nili's black currant sorbet followed – the perfect palate cleaner to prepare our taste buds for the Cheese Plate. We wound up the feast with a glorious panna cotta (the creamiest I've ever had!) garnished with apples and wild raspberries. But we didn't stop there – a couple of shots of Finnish Tar liqueur followed. We could fly back to Rovaniemi just to have a meal at Nili all over again.

Tips:

- Don't leave Rovaniemi without trying delectable Finnish food at restaurant Nili.
- Reserve in advance because Restaurant Nili can get really busy in the evenings.
- We loved their sensational set menu called The Rovaniemi Menu (€58/per person) but you can go the *à la carte* route too. More information on their website www.nili.fi


Day 9 – Sleep on a bed of ice at The Arctic Snow Hotel

After you've explored Rovaniemi to your heart's content, it's time to go to a snow haven 30 kms outside Rovaniemi. Arctic Snow Hotel is built from scratch in November every year. It's nestled in Lappish wilderness and provides a fairytale experience.

The reception area, communal toilets, and breakfast rooms are heated. However the fun begins when you enter the main building made of ice. The corridors are full of ice-carvings and



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

sculptures and bright LED lights lead visitors to the Ice Bar and Restaurant. Here drinks are served in glasses made of ice and food is served on intricately carved ice plates. Finnish specialities such as creamy soups and elk are on the menu. Stools and benches might be carved out of chunky blocks of ice but they're covered with Finnish fur rugs that keep guests warm.

Each ice suite has a different theme – we loved the playful Angry Bird themed room. Stunning beds are carved out of ice. Artic-style sleeping bags are provided to guests so they keep warm as they doze off. But doze off you mustn't. For there is a lot of fun to be had.

Don't miss the outdoor jacuzzi for the world – there is nothing quite like sitting in a hot tub in the middle of an Arctic forest and feeling warm when it's -20°C out. You can count stars and if you're lucky, you can spot the mysterious Northern Lights. Bucket list or not, an open-air hot tub is one experience that NEEDS to feature on your itinerary of Lapland.

Tips:

- Arctic Snow Hotel is open to visitors from November to April
- It is possible to visit only for a meal but we suggest sleeping in an ice room for 1 night for a once-in-a-lifetime experience. Prices for overnight stays start at €125. You can compare and book [here](#).

Days 10, 11, and 12 – Immerse yourself in Arctic Wilderness in Saariselka and spot the Northern Lights

It's time to head north to delve deeper into the Arctic wilderness. Frozen slanting trees, ice-laden hills, and fields covered with untarnished snow – the scenery at the northern tip of Lapland is beyond your wildest imagination .

A 3 hour bus ride from Rovaniemi will get you to Saariselka. There is a variety of accommodation on offer in Saariselka – log cabins are a popular choice. But we are partial to the Kakslauttanen Arctic Resort, where you can sleep in a heated igloo under the Northern Lights. The bus will drop you at the gate of Kakslauttanen Arctic Resort. To say we had the time of our lives here would be the understatement of the decade. We spotted the Northern Lights ever so often while we were there. We were so taken in by the surreal beauty of this hotel that we decided to extend our stay by 2 days.

Spend your days trying to absorb the immense beauty of Finnish Lapland. Reindeer safaris provide a glimpse into the life of Sami people (indigenous people living at the very northern tip of Europe) and will convince you that you're in a fairytale. Just when you're drifting into your dream world, the reindeer will stop in the tracks to pee or grace the ground with perfectly-shaped reindeer droppings



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Munde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Tips:

- The bus journey from Rovaniemi to Saariselka is gorgeous. The bus has wifi and is extremely punctual. Bus tickets can be bought in person or booked online on this website :- <https://www.matkahuolto.info/lippu/en/>
- Read our [detailed review of Kakslauttanen Arctic Resort](#) with photos, tips, and more before you flesh the itinerary for your trip to Lapland.
- We suggest staying in the glass igloos at Kakslauttanen Arctic Resort for 1-2 nights and their rustic log cabins for 2-4 nights depending on how much time you have. You can compare prices and book [here](#).

Day 12 Take the flight back from Ivalo

Ivalo airport is close to Saariselka and Kakslauttanen Arctic Resort offers regular transfers to the airport. Take the flight back to Helsinki – we promise you'll spend the flight thinking about all the surreal panoramas you saw on your trip to Lapland and counting the crazy experiences you had. One thing is for sure – it'll be hard to pick favourites. After all, how often does one get to pick between petting a reindeer and sleeping in an igloo ☐

Planning your trip to Finland – The Essentials

One trip – dozens of surreal & dreamy experiences

When To Go

If you're there for winter sports and the Northern Lights, then visit Lapland between December and March. If you want to drive around, then summer is a good time since Finnish Lapland boasts of sunlight 24*7. Winter Wonderland transforms to the Land of the Midnight Sun during the months of June, July, and August.

Length of the trip

We suggest setting aside at least 10-12 days for a trip of your lifetime to Finnish Lapland. A rough breakdown is as follows (scroll down for the detailed itinerary) :-

- Fly into Rovaniemi/Oulu from Helsinki
- Kemi: 2 nights
- Rovaniemi and surrounding areas: 4-5 nights
- Saariselka: 3-4 nights
- Fly back from Ivalo to Helsinki

Budget



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Finnish Lapland is not the place for backpackers. Scandinavia is infamous for being notoriously expensive and Finnish Lapland is no exception. Moreover it's an extremely remote corner of the world. Consequently transport, hotels, food, and excursions can get pricey here. Try to set aside approximately €200 per person/day when budgeting for your trip. This includes the hotel rooms, excursions, food, and transportation within Lapland but excludes flights from your hometown.

Don't come back without trying these typical Finnish things

1. Finnish Sauna (Finnish people are obsessed with it and with good reason!). We love Visit Finland's [introduction to the Finnish Sauna](#)
2. Reindeer meat – a local delicacy. Finns sure know how to dish up the perfect reindeer steak. Ok you can skip this and opt for creamy salmon soup if you're a bit squeamish about devouring Rudolph's li'l red nose.
3. Spending a lazy evening in a Sami lavu/teepee making pancakes, BBQing sausages or just acquainting yourself with Sami Folklore.
4. Sipping on dozens of glasses of warm lingonberry juice – this local speciality the perfect antidote for Lapland's Arctic winter.
5. Spending an evening in an outdoor hot tub while it's -20°C outside. It's a surreal experience to watch your drink freeze as you lounge comfortably in warm water and stare at Lappish sky, coloured green by the Northern Lights. Words can't do justice to such an experience, can they?!



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Itinerary 3

Historic and Snowy Finland (7N/8D) (1,00,000 INR)

Finland is fast gaining popularity as the ultimate European destination amongst Indian travelers.

Not only is it rich in culture and history but the country also offers a good mix for all age groups

and gender. An 8 days trip is not enough to explore this beautiful country. But if you are short on

time, then this is the guide you need.

When to go:


Finland is a year round destination. Different seasons have different feel to it. If winter sports are on your mind then December to April is a good time to be in Finland. May is spring followed by summer.

Day 1

Helsinki cathedral



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Centrally located, it wows the travelers with its brilliant architecture and attention to details. It can often get very crowded due to its popularity. An early morning visit is advised if you want to appreciate the real beauty of the church.

Enjoy cafes: The cafes of Helsinki are charming. Not only are they big on coffee, different varieties of teas are also quite popular. You can spend quality time café hopping. Option for vegetarians and vegans are available.

Helsinki harbor

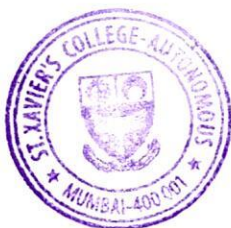
The vibrant harbor of Helsinki is perennially buzzing with activity. You can soak in the views, stroll lazily along the beautiful waterfront. In case you are a shopaholic, you can venture into the local shops.

Uspenski Cathedral


There is no way you can miss visiting the largest orthodox church in Western Europe. It was built in late 19th century. Located near the market square, the church has 5 onion shaped domes.

The domes are topped with 22 carat gold. It is a Russian church.

The Esplanade:



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Located close to the waterfront, the Esplanade dazzles with its exquisite architecture. This area of Helsinki is known for its expensive boutiques, pricey cafes and restaurants, luxury hotels, the works. Even if you do not want to spend on luxury, a visit to this area is a must. A simple stroll never burned hole in the pocket, eh!

Market Square:

Not far away from the Esplanade and Uspenski Cathedral, the market square is an interesting open air market. Click selfies by the beautiful Havis Amanda fountain or pick souvenirs, buy local produce. There is never a dull moment here. It is even more exciting to visit it during Christmas time.

Old Market Hall:

A visit to the market hall will educate you about the local lifestyle. Different sections will vie for your attention as soon as you reach the Market hall. Whether it is 'Farm to Table' products, local produce or even local cuisine, you will be spoilt for choices here. It is close to the Market square. You can also buy traditional giftware or check out gourmet food boutiques.

Day 2

Turku

Just 2 hours away from Helsinki by train, a visit to Turku is a must. It is the oldest city of Finland, known for its medieval castle and cathedral. The historical capital of Finland has a lot to offer.

Turku Castle: Built in the 1280s, it is already popular with tourists thanks to its grand architecture and age. It is well preserved



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Turku Cathedral: Entry is free to this beautiful cathedral. You can join a guided tour.

Luostarinmäki is another historical place. You can visit the handicrafts museum

here. **Kakolanmäki hill:** The 19th century prison is very popular along with the superb views that the Kakolanmäki hill offers.

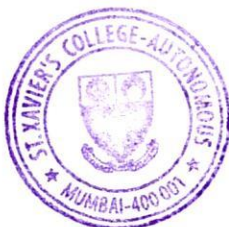
Museum Hopping:

While Wäinö Aaltonen Museum of Art will acquaint you with the work of Finnish artist and sculptor Wäinö Aaltonen, the Sibelius Museum will educate you about Finnish composer Jean Sibelius and hundreds of years old musical instruments.


Day 3

Suomenlinna

Suomenlinna is a sea fortress and also an UNESCO World Heritage site. Built in the mid 1700s by the Swedish, Suomenlinna is also known as the "Gibraltar of the North". You can board a HSL ferry from the Market square and make a day trip. The ferry takes only 15 minutes and runs every 30 minutes.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Day 4

Kittila is 4hrs 15 minutes away from Helsinki by flight. It is a perfect destination for a skiing holiday. Even if you are not into skiing, you can still enjoy plenty of snow as its located north of Arctic Circle in the Lapland region famed for its gorgeous landscapes.

Day 5

Keeping Kittila as base, visit LUVATTUMAA- Levi Ice Gallery. Built from frozen blocks, this 1,10,000 square feet structure is completely built of snow and houses hotel rooms, bar and even a chapel. Later visit the snow village. The temperature here can be as low as -22°C.

Days 6-8

Rovaniemi and Oulanka National Park

Kittila to Rovaniemi is just 2 hours by car. Buses are also available. Rovaniemi is another snow paradise you will not want to leave. Set in the arctic wilderness, Rovaniemi will catch your fancy like no other place in Finland. Visit the Santa Claus Village on the first day. Do visit the Oulanka National Park which is just 2 hours 30 minutes away from Rovaniemi. You will need an entire day to explore the beauty of this place. You can try snowshoeing , canoeing and Hiking here.

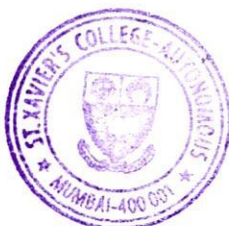
Marttiinin Wanha Tehdas is also a must visit place in Rovaniemi

6.04 USP of proposed tour itinerary


Finland is an unknown destination to most of the people. It has a lot to offer. But it is usually clubbed with other European countries and itineraries covering only the capital city.

Be it culture, cuisine, winter landscapes, national parks, adventure activities, historic sites or anything Finland has it all.

Hence, I have taken itineraries of Finland which give you a glimpse of the mesmerizing beautiful Finland.



NAAC SSR Cycle 4 (2015-2020):
2_3_1 Experiential Learning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Chapter 7: Market Research & Analysis

7.01 Target Customer Profile

Finland is not the place for backpackers. Scandinavia is infamous for being notoriously expensive and Finnish Lapland is no exception. Moreover it's an extremely remote corner of the world. Consequently transport, hotels, food, and excursions can get pricey here. Try to set aside approximately €200 per person/day when budgeting for your trip.

Hence, my target customers will be the elite class, businessmen, MICE employees.

7.02 Survey Questionnaire

AVT 0606 Thematic Project: Survey Questionnaire

Student Name: _____

UID No: _____

Destination Country: _____

For Respondents

Put a tick in front of the correct option

Age: _____

Sex: Male Female Other

Occupation: Student Employed Business Home Maker

Other _____

Residential Location: _____

No. of Family Members: _____

Annual Income/ Annual Family Income: < 5 lakhs

5 lakhs to 10 lakhs

10 lakhs to 15 lakhs

15 lakhs to 20 lakhs

> 20 lakhs

Do you like to travel? Yes No

Why? _____

How often to do you travel? Once a month

Once a year

Twice a year

Once in two years

Other _____

(This does not include travelling back home by outstation students or employees)

Do you travel within India? – Yes No


Have you travelled abroad? – Yes No

If No, why not? _____

Name the countries you have already visited - _____



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Purpose of your visit(s): Leisure/ Holiday Business/Work trip
 Visiting family/ relatives Pilgrimage
 Medical
Other- _____
Type of Travel: Solo With Family With Friends In an organized tours
Trip Organizer: Self Travel Agent Tour Operators/ Travel Companies
(e.g. - Thomas Cook)
Average budget of each foreign trip - _____
Who pays for the trips? Self Parents Partners Employer/ Company
Rank in order of preference: (put number 1-5 next to it)
Sightseeing (Castles, monuments, museums) _____
Adventure activities _____
Cultural activities _____
Relaxation in hotels/resorts _____
Natural Beauty (Beaches, mountains, natural wonders) _____
Food Consumption on trips - Veg Non-Veg Vegan Jain
Food preference abroad: Indian food Local food No preference
Accommodation preference - Hotels Resorts Hostels local B&B
Other _____
Do you wish to/ plan to travel abroad in the next 2 years? Yes No
(This does not include moving abroad for higher education)
If this is your first trip abroad, what are you main concerns?
 Planning Budget Value for Money Travel & Documentation
 Food Other
What do you know about _____ Country?

(At this stage, student should explain his/her tour package and itinerary to the respondent)

What do you think about _____ Country now?

Which of the attractions or activities mentioned in the itinerary do you find interesting?

Which of the attractions or activities mentioned in the itinerary do you dislike?

Why? _____

Will you buy the proposed tour package? Yes No

If no, why not? _____

Suggest changes in the tour package/ itinerary, if any



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Devi Nde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Signature of the respondent:

Date:

7.03 Analysis of Survey

Sample Size: 20.

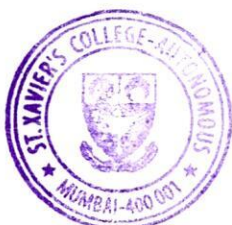
It was a face to face interview of students, homemakers, businessmen and employed individuals.

It was an amazing experience and learning. It was time consuming yet resourceful. The budget did not hold them back when asked if they would love to visit the country. So it shows that people would not mind spending if the destinations are worth visiting. Experiences and nature was the most common thing that people like. Also, because of the winter landscape and the many activities they agreed upon the itinerary.

Most of the people weren't aware of the country. And after explaining about the itinerary and the country they were willing to go see the country for themselves.

7.04 Findings & Challenges

The itinerary is expensive. But Europe is an expensive location. Hence the upper middle and the higher class were be willing to travel. It is not a backpacker's paradise so it would be difficult for budgeted travelers. The itinerary received good feedbacks. The respondents were amazed at what the country has in store. Finland has "Northern Lights" to offer which was appealing to the people.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Chapter 8: Challenges

8.01 Environmental Sustainability

Finland provides many good examples of how to protect the natural environment. Wide-ranging and detailed environmental data and high levels of technological skill form the basis of Finland's effective environmental protection policies. As one of the world's wealthiest industrialised countries Finland is also able to afford vital environmental investments. Finland's low population density and comparatively unspoilt natural environment also facilitate nature conservation.

The fruits of successful environmental policies are clearly visible around the country. Many polluted lakes and rivers have been cleaned up. Air quality has improved greatly around industrial locations. An extensive network of protected areas has been built up to safeguard biodiversity. Forests – Finland's most valuable natural resources – are managed more sensitively than in the past, and the overall annual growth rate clearly exceeds the total timber harvest.

Emissions from large industrial facilities have particularly been curbed significantly. There has also been progress in controlling emissions from agriculture, transport and homes, although these trends have not been as favourable as for industry. There is still a need to reduce airborne emissions of carbon dioxide, noise and particles from traffic, as well as waterborne nutrient emissions generated by farms and by scattered settlements not connected to sewerage systems.

Efforts to halt the ongoing decline in biodiversity have also been insufficient in spite of progress in the conservation of certain threatened species. The struggle to combat climate change must also be continued more resolutely both in Finland and globally. But the successful reduction of acidification problems shows that well-planned strategic environmental policies can achieve their goals.

8.02 Economic Issues

Often cited as a model example for its economic performance, competitiveness and innovative success, Finland has nevertheless faced difficulties to recover from the global financial and the Eurozone crisis. In fact, Finland is vulnerable to the international conjuncture and the country also suffered from the EU sanctions against Russia. In 2019, the IMF estimated the economy's growth at 1.2% of GDP - slightly below 2018 levels, at 1.7% - amid a weakening private consumption and lower residential and business investment. The IMF forecasts a 1.5% growth for 2020 and 2021, although figures from the European Commission and OECD are more conservative, with a growth rate of around 1%. Private consumption should remain the main driver, whereas the contribution from net exports should turn negative.

Economic growth has strengthened the position of the public finances in recent years, and the country's public debt stood at an estimated 58.9% of GDP in 2019. Although it is expected to increase slightly in the next years, it should remain below the 60% benchmark ratio. The general government balance stood at -0.7% in 2019, and should deteriorate further in 2020 (-1.1%) due to the government's plan to increase spending in education, health, social security, and infrastructure investment. Inflation – at 1.2% in 2019 – stood below the euro area average and



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



should remain subdued in 2020 and 2021 (1.3% and 1.5%, respectively – IMF).

Finland's GDP per capita is among the highest in the world, allowing the country to offer a high living standard. The distribution of wealth is relatively balanced, although social inequalities have risen in the recent years. The unemployment rate was estimated at 6.5% in 2019 (from 7.4% the previous year) and is expected to further decrease to 6.4% in 2020. Finland is the European country most impacted by an ageing population and a fall of its labour force, a phenomenon that weighs heavily on its public finances. Other challenges that the country will be facing are the decreasing productivity in traditional industries and the need for reduction of high labour costs.

Main Indicators	2017	2018	2019 (e)	2020 (e)	2021 (e)
GDP (billions USD)	252.87e	274.21e	269.65	280.71	292.81
GDP (Constant Prices, Annual % Change)	3.0e	1.7e	1.2	1.5	1.5
GDP per Capita (USD)	45,948e	49,738e	48,869	50,774	52,866
General Government Balance (in % of GDP)	-0.7e	-0.6e	-0.7	-1.1	-1.3
General Government Gross Debt (in % of GDP)	61.3e	59.3e	58.9	59.1	59.9
Inflation Rate (%)	0.8	1.2e	1.2	1.3	1.5
Unemployment Rate (% of the Labour Force)	8.6	7.4e	6.5	6.4	6.3
Current Account (billions USD)	-1.85	-4.40e	-1.81	-1.47	-1.32
Current Account (in % of GDP)	-0.7	-1.6e	-0.7	-0.5	-0.5

Source: IMF – World Economic Outlook Database, Latest available data





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Main Sectors of Industry

Agriculture represents 2.5% of the Finnish GDP and employs around 4% of the population (World Bank, 2019). Due to the unfavourable climate, agricultural development is limited to the maintenance of a certain level of self-sufficiency in basic products. Moreover, Finland's accession to the EU has further accelerated the process of restructuring and downsizing of the agriculture sector. The country has around 48,000 farms with an average arable area of 47 hectares (12% of the country's arable land is destined to organic cultivations). Cereal production dominates, followed by milk production and animal husbandry. Dairy farming is the sub-sector that generates the largest turnover.

Industry accounts for nearly 24.5% of GDP, employing roughly 22% of the active population. Forestry is a traditionally well-developed sector for Finland as the country exports a rich variety of goods, ranging from simple wooden products to high-tech tags, labels, paper, cardboard and packaging. Other key industrial sectors are metal production, mechanical engineering and electronic goods. Finland also specialises in exporting information and communication technologies and is among the countries that invest substantially in R&D (around 2.76% of its GDP, World Bank).

The services sector employs three-quarters of the workforce and accounts for 59.4% of the GDP. It is also responsible for generating the largest number of new businesses. The Finnish banking system is dominated by three major groups of deposit banks: OP Group, Nordea Bank Finland, and Danske Bank Plc Group. The information technology sector is growing at a fast pace, and so are the cleantech and biotechnology sectors.

Breakdown of Economic Activity By Sector	Agriculture	Industry	Services
Employment By Sector (in % of Total Employment)	3.7	21.8	74.5
Value Added (in % of GDP)	2.5	24.6	60.1
Value Added (Annual % Change)	1.9	0.4	2.8

Source: World Bank, Latest available data.

Indicator of Economic Freedom

Score: 74.9/100

World Rank: 20

Regional Rank: 11



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

[Economic freedom in the world \(interactive map\)](#)

Source: [2019 Index of Economic Freedom, Heritage Foundation](#)

Business environment ranking

Score: 8.18

World Rank: 9/82

Source: [The Economist - Business Environment Rankings 2014-2018](#)

Sources of General Economic Information

Ministries

[Ministry of Economic Affairs and Employment](#)

[Ministry of Agriculture and Forestry](#)

[Ministry for Foreign Affairs](#)

[Ministry of Justice](#)

Statistical Office

[Statistics Finland](#)

Central Bank

[Bank of Finland](#)

Stock Exchange

[Nasdaq OMX Stock Exchange](#)

Other Useful Resources

[The CIA World Factbook](#)

Main Online Newspapers

[Helsinki Times \(in English\)](#)

[This is Yle](#)

[Kauppalehti online \(in Finnish only\)](#)

[Taloussanomat \(in Finnish only\)](#)

[Tekniikka & Talous \(in Finnish only\)](#)

[Tietoviikko \(in Finnish only\)](#)

Economic Portals

[Finnguide](#)

8.03 Socio- Political Issues

Current Political Leaders



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

President: Sauli Niinistö (since 1 March 2012; re-elected for a second six-year term on 28th January 2018)

Prime Minister: Antti RINNE (since 6 June 2019) - Social Democratic Party

Next Election Dates

Presidential: January 2024

Parliament: April 2023

Current Political Context

The presidential elections held at the beginning of 2018 saw the re-election of the incumbent Sauli Niinistö, from the liberal-conservative National Coalition Party. Parliamentary elections were held in April 2019, with three political parties – the Social Democratic Party, Finns, and the National Coalition Party – obtaining a similar number of seats (40, 39 and 38, respectively). Following the elections, the leader of the Social Democratic Party - Antti Rinne - formed a coalition government with the Centre Party (that recorded its lowest vote share since 1917), the Green party, Left Alliance and Swedish People's Party.

Main Political Parties

Finland has a multi-party system to ensure a single party does not have a chance to gain power alone. Parties work with each other to form coalition governments. The Social Democratic Party, Finns, and National Coalition Party obtained a similar result in the most recent national elections (40, 39 and 38 seats, respectively). The largest parties include:

- Social Democratic Party (SDP): centre-left
- The Finns (PS): left-wing, nationalist
- National Coalition Party (KOK): centre-right, liberal conservatism, strongly pro-European
- Centre Party (KESK): centre, wields political influence in smaller agrarian communities
- Green Party (VIHR): centre, green politics, liberal
- Left Alliance (VAS): left-wing
- Swedish People's Party (RKP): centre, represents the minority of Swedish speaking people in Finland
- Christian Democrats (KD): centre/centre-right
- The Blue Reform (ST): right, liberal, conservative, soft Eurosceptic.

Type of State


Finland is a democratic parliamentary republic.

Executive Power

The President of Finland is the Head of State, leader of foreign policy, and the commander-in-chief of the defence forces. He/she is directly elected by absolute majority



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65


for a six-year term, renewable once. The President appoints the Prime Minister. The main executive power lies in the Cabinet which is appointed and headed by the Prime Minister. Before the constitutional rewrite completed in 2000, the President enjoyed more power.

Legislative Power

Legislative power is vested in the Parliament of Finland (Eduskunta), with the Government holding limited rights to amend or extend legislation. It is composed of 200 deputies elected for four years by proportional representation. The President has the power of veto over parliamentary decisions although it can be overruled by the parliament.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Chapter 9: Marketing & Publicity

9.01 SWOT analysis of Destination

Strengths:

- Untouched beauty.
- Winter landscape.
- Well developed infrastructure.
- Great amenities.

Weakness:

- Expensive Country.
- Bad weather (Hail, Snowfall etc.)
- Health Concerns.

Opportunities:

- Student Education Universities/ Centres.
- MICE customers.
- Honeymooners looking for a luxurious getaway.

Threats:

- Lack of Marketing.
- Scandinavian Itineraries making more business.
- Rising prices.

9.02 Marketing & Public Strategy

I will use social media (Instagram posts, Facebook advertisements) to promote my itineraries and sell my destination. Also since bloggers and their content is a trend I would collaborate with some and market my destination.

Brochures and newspaper advertisements also will help me reach out to customers.



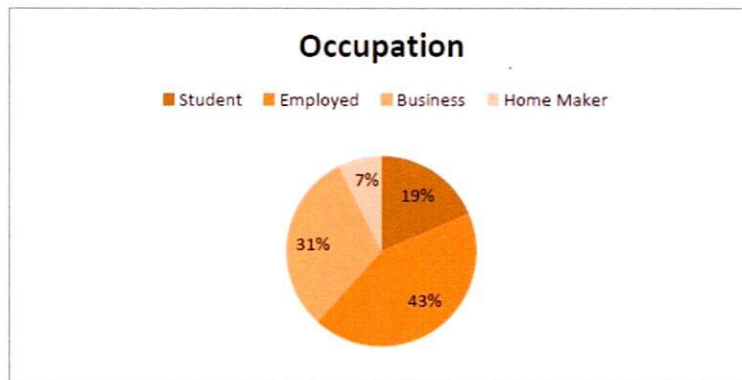
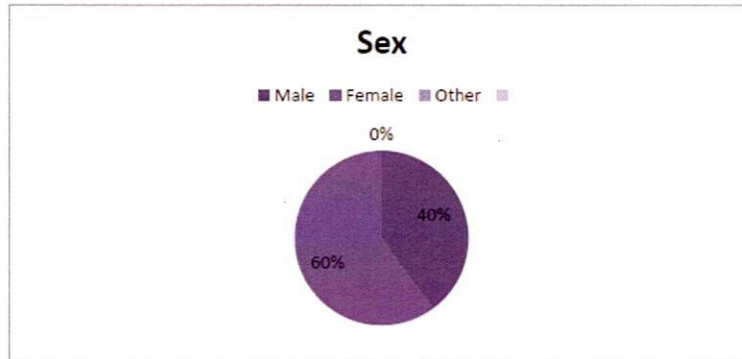
NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Survey Pie Charts:



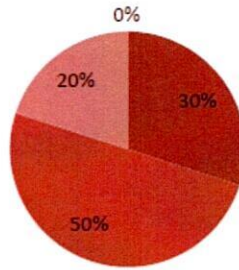
NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



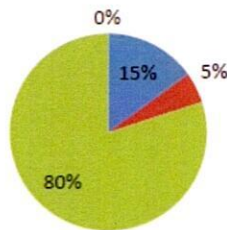
Annual Income/ Family Income

■ < 5 lakhs ■ 5 - 10 lakhs ■ 10-15 lakhs ■ > 20 lakhs



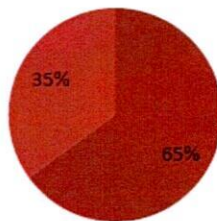
How often do you travel?

■ Once a month ■ Once a year ■ Twice a year ■ Once in two years



Have you travelled abroad?

■ Yes ■ No

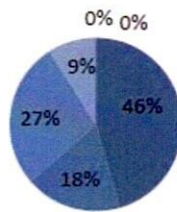




ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

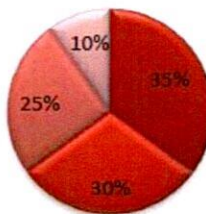
Purpose of Visit

- Leisure/ Holiday
- Business/ Work trip
- Visiting family/ relatives
- Pilgrimage
- Medical
- Other



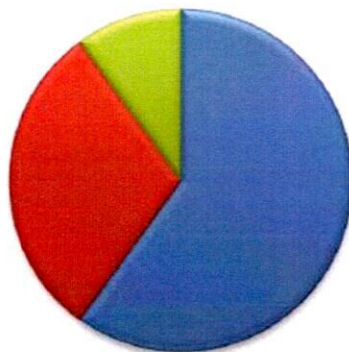
Type of Travel

- Solo
- With family
- With friends
- In organized tours



Trip Organizer

- Self
- Travel Agent
- Tour Operator/ travel Companies



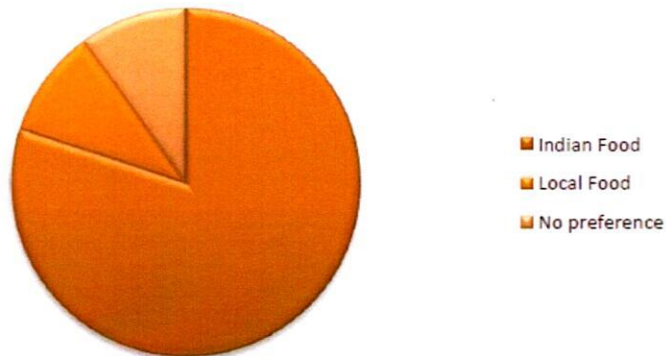
NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Alinda
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.

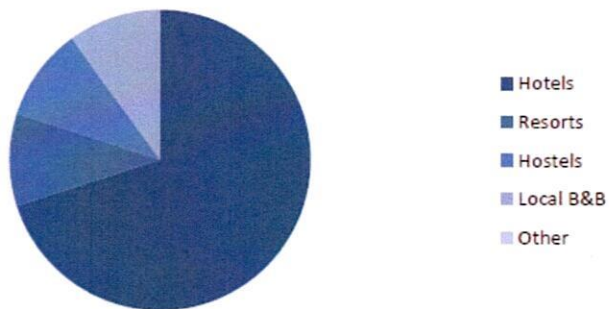


ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Food preference abroad-



Accommodation preference



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

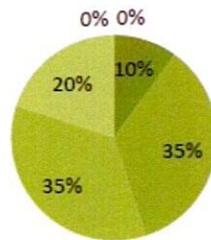
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

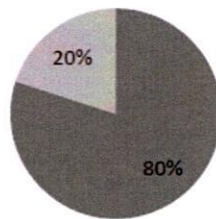
Main concerns while traveling-

- Planning
- Budget
- Value for money
- Travel & Documentation
- Food
- Other




Will you buy the proposed tour package?

- Yes
- No



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

SURVEY ANALYSIS

It was an amazing experience and learning. It was time consuming yet resourceful. 75% respondents were females. The budget did not hold them back when asked if they would love to visit the country. So it shows that people wouldn't mind spending if the destinations are worth visiting. Experiences and nature was the most common thing that people like. Also, because of the winter landscape and the many activities they agreed upon the itinerary.

Finland to my respondents was a new country, they were not much aware about it. And after explaining about the itinerary and the country they were willing to go see the country for themselves.

Conclusion: The itinerary is expensive. But Europe is an expensive location. Hence the upper middle and the higher class would be willing to travel. It is not a backpacker paradise so it would be difficult for budgeted travelers. The itinerary received good feedbacks. The respondents were amazed at what the country has in store. And most of them wanted to visit to because of "Northern Lights." And also to experience the winter landscape.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

Conclusion

Finland is an amazing country to visit. There is so much to see and explore in this country like northern lights, the village of Santa Claus, lakes, Christmas markets. It is infact one of the safest countries in the world. It is unexplored and not known to many people but as per my research I would say that it is a one of a kind destination and should be made popular.

This thematic project helped me learn more about Finland. I can now recommend my friends and relatives to visit this country and guide them about the same because of the in depth research that I've done of the country.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL

ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

References

- <https://www.britannica.com/place/Finland>
- <https://www.britannica.com/place/Finland/Plant-and-animal-life>
- <https://www.euronews.com/tag/finland-politics>
- <https://www.google.com/search?q=current+political+scenario+in+finland&oq=current+political+scenario+in+finland&aqs=chrome..69j3317j3317&sourceid=chrome&ie=UTF-8>
- <https://www.worldatlas.com/webimage/countrys/europe/finland/fitimeln.htm>
- <https://www.worldatlas.com/articles/the-culture-customs-and-traditions-of-finland.html>
- <https://www.thoughtco.com/geography-of-finland-1434596>
- <https://twissen.com/destinations/in-finland-the-government-focuses-on-new-tourism-segments/>
- <https://www.businessfinland.fi/en/whats-new/news/2019/tourism-in-finland-stays-on-record-level/>
- <https://www.worldatlas.com/webimage/countrys/europe/finland/finland.htm>
- <https://www.everyculture.com/Cr-Ga/Finland.html>
- <https://finlandabroad.fi/web/ind/entering-finland>
- <https://www.passporthealthusa.com/destination-advice/finland/>
- <https://finland.fi/life-society/environmental-protection-in-finland/>
- <https://www.ftd.travel/finland-tourist-circuits/>
- <https://santandertrade.com/en/portal/analyse-markets/finland/economic-political-outline>
- <https://www.visitfinland.com/article/finland-facts-faq/>
- <https://www.infofinland.fi/en/living-in-finland/housing/temporary-housing>
- <https://www.iexplore.com/articles/travel-guides/europe/finland/transportation>
- [Central Intelligence Agency CIA - The World Factbook - Finland.](#)
- [Infoplease.com. \(n.d.\). Finland: History, Geography, Government, and Culture- Infoplease.com.](#)
- [United States Department of State. \(22 June 2011\). Finland.](#)



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

DEPARTMENT OF CHEMISTRY PROJECTS



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Department of Chemistry – Projects-List of Students (2019-20)

Sr. No.	Title of Project	No. of Students enrolled
1	Title: Chemistry in Context 1. Ros Paul UID172092 (Roll no. 062) TYBSc 2. Aqsa Majgaonkar UID182065 (Roll no.01) SYBSc 3. Mahek Anmber Sajid Khan UID192615 (Roll no.315) FYBSc 4. Merlin Ajayan UID191425 (Roll no. 378) FYBA	04
2	Research Project in food and Environmental Chemistry	08
3	Research Project in Inquiry based Practical's for Organic Chemistry 1. Orchishma Mukherjee (UID 192341) 2. Astha Sharma (UID 192267) 3. Pranav Johar (UID 192111) 4. Roshni Sahoo (UID 192131) 5. Hrishik Mukherjee (UID 192480) 6. Alesha Jobi (UID 192704) 7. Christy Moncy (UID 192472)	07



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Reduction of nitro derivatives

Christy Moncy & Pranav

Abstract: Nitro compounds were reduced to corresponding amines with Tin (II) chloride and Iron in presence of conc. HCl and ethanol was used as a solvent. With stannous chloride, nitro compounds formed crystals with satisfactory yields which were amines whereas with iron nitro compounds did not show any such transition. The experiment was carried out in a reflux condenser.

Introduction:

Nitro compounds:

Nitro compounds are organic compounds containing one or more nitro groups. A nitro group makes a compound explosive and are therefore called explosives. Nitro groups are electron withdrawing. As a result, aromatic nitro compounds favour nucleophilic substitution and retard electrophilic substitution. Aromatic nitro compounds are synthesized by nitration. Nitration is carried out by mixture of nitric acid and sulphuric acid which gives nitronium ion.

Nitro compounds are classified as: Aliphatic nitro compounds and Aromatic nitro compounds.

- **Aliphatic nitro compounds:**

Aliphatic nitro compounds are compounds in which nitro group is directly attached to an alkyl group. Aliphatic nitro compounds are further classified into primary, secondary and tertiary nitro alkanes depending on the nature of carbon atom to which nitro group is attached.

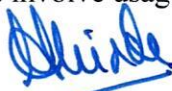
- **Aromatic nitro compounds:**

Aromatic nitro compounds contain one or more benzene rings. There are two types of aromatic compounds - Compounds in which nitro groups are directly attached to the benzene ring are called nitroarenes. Compounds in which nitro group is attached to the side chain are called phenyl derivatives of nitro alkanes.

Nitro compounds are precursors for amine derivative synthesis. There are a variety of reductants in organic chemistry. Electropositive metals such as magnesium, sodium, lithium, iron, aluminium, zinc, etc are good reducing agents. Other reducing agents like sodium borohydride and lithium aluminium hydride are also used. Other reductions involve usage of hydrogen gas in presence of palladium, platinum, or nickel catalyst.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Reduction of nitro compounds is an important reaction in organic chemistry. Reduction of nitro derivatives under acidic conditions produce amines. Reduction of aromatic nitro compounds can be carried out using Raney Nickel or palladium on carbon, Tin (II) chloride, Titanium (III) chloride and other such reducing agents. Tin (II) chloride is a white crystalline solid and is also known as stannous chloride. It has a stable form known as dihydrate. Hot SnCl_2 in presence of an acid solution is used as a reducing agent.

Amines: Amines are derivatives of ammonia in which one or more hydrogen atoms are replaced by an alkyl or aryl group. According to the number of substituents, amines are classified as – Aliphatic amines and Aromatic amines. Aliphatic amines contain hydrogen atom and alkyl substitutes. Aromatic amines have a nitrogen atom connected to an aromatic ring. Based on the number of carbon atoms attached to nitrogen, they are further classified into primary amines, secondary amines and tertiary amines.


Uses of amines:

Primary aromatic amines are widely used in

- Chlorpromazine is a tranquilizer used to relieve stress, anxiety, excitement, restlessness or even mental disorders. Chlorpheniramine is an antihistamine used to relieve allergic disorders due to cold, fever, insect bites and stings.
- dyeing industries such as Methyl orange, Sunset yellow FCF, Direct Brown 138, etc.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.




ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Department of Chemistry – Projects-List of Students (2018-19)

Sr. No.	Title of Project	No. of Students enrolled
1	Conserving Artifacts: A Chemical View	09
2	Research Project: Metal oxide semiconductors as effective photocatalyst: pros and cons	05
3	Research Project: Complex Chemistry	02
4	Research Project in Food and Environmental Chemistry	15
5	Instrumentation Workshop in Analytical Chemistry	21
6	Applications of Chem-Draw: A tool in Chemistry	07
7	“Water analysis in a Major Chemical Industry” at Hindustan Organic Chemicals Limited, Ambalamugal, Kochi, Kerala.	01
8	“Preparation and analysis of pharmaceutical preparations and food products” at Food and Drug Administration (FDA) Laboratory, BKC, Mumbai.	01
9	“Effect of Actinides on Transferrin” at Bhabha Atomic Research Centre, Trombay, Mumbai.	01
10	“Role of indicators and experiments related to dye chemistry” at Vignan Sagar Science and Technology Park, Thrissur, Kerala.	01
11	“Instrumentation in Quality Control Department” at Orchid Pharma Ltd., Alathur, Chennai, Tamil Nadu.	01
12	“Tests in Clinical Pathology lab” at SRL lab, Fortis Hiranandani Hospital, Vashi.	01
13	“Tests in Clinical Pathology lab” SRL Diagnostics, Fortis Hospital, Mulund.	01
14	“Analysis of iron, nickel and magnesium and instrumentation” at Peekay Steel Castings Pvt. Ltd., Calicut, Kerala	01
15	“Content Writing” at Ashva Motors Pvt. Ltd., Mumbai	01
16	Industrial visit to Nipra Packaging Pvt Ltd., Alok Industry and Parle Agro Pvt Ltd., Silvassa.	42



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

CHEMISTRY IN ARTS (REPORT ON CONSERVATION OF ARTIFACTS)

DONE BY:- RAHUL GHODASARA

UID:-172399

CLASS:-SYBSc



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

INTRODUCTION

Art and chemistry have been linked since the day the first cave dweller smeared mineral pigments on a rock wall. Today's chemists formulate pigments and dyes to precise specifications and ensure that they maintain their colors for decades. They develop polymers suitable for use in 3D printers. And they authenticate, preserve, and restore artifacts, from 1950s kitsch to 10,000-year-old cave paintings. Because many art supplies are made from toxic or hazardous materials, occupational health and safety is another career area for chemists.

Chemists may also develop makeup and special effects for theater and movie productions. Chemists and materials scientists work in the music industry as well, developing synthetic materials for manufacturing, maintaining, repairing, and restoring musical instruments and for use in electronic components, speakers, and amplifiers.

OXIDES

Oxide, any of a large and important class of chemical compounds in which oxygen is combined with another element. With the exception of the lighter inert gases (helium [He], neon [Ne], argon [Ar], and krypton [Kr]), oxygen (O) forms at least one binary oxide with each of the elements.

Stable oxides


Due to its electronegativity, oxygen forms stable chemical bonds with almost all elements to give the corresponding oxides. Noble metals (such as gold or platinum) are prized because they resist direct chemical combination with oxygen, and substances like gold(III) oxide must be generated by indirect routes.

Unstable oxides

Compounds in which oxygen is unable to form stable chemical bond with another elements is known as unstable oxides.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

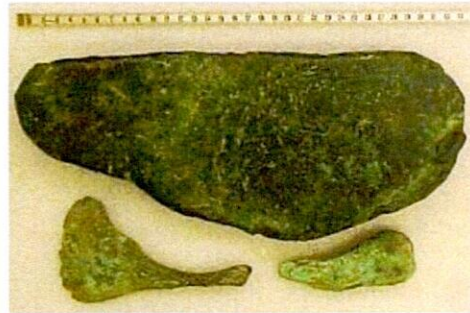

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



Artifacts

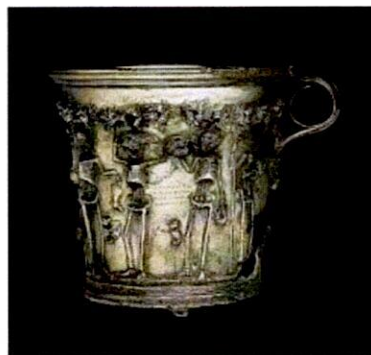
Metal artifacts lose their original look due to formation of a layer of metal oxides over the surface of artifacts.

Copper artifacts are spoiled due to layer formation of copper oxides which is greenish in colour.



copper artifacts

Similarly silver loses its nature due to formation of silver oxide which is black in colour and so on.



Silver artifacts





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

PIGMENTS

Pigment, any of a group of compounds that are intensely coloured and are used to colour other materials. Pigments are insoluble and are applied not as solutions but as finely ground solid particles mixed with a liquid. In general, the same pigments are employed in oil- and water-based paints, printing inks, and plastics. Pigments may be organic (*i.e.*, contain carbon) or inorganic. The majority of inorganic pigments are brighter and last longer than organic ones. Organic pigments made from natural sources have been used for centuries, but most pigments used today are either inorganic or synthetic organic ones. Synthetic organic pigments are derived from coal tars and other petrochemicals. Inorganic pigments are made by relatively simple chemical reactions—notably oxidation—or are found naturally as earths.

Some of the pigments are:-

Pigment	Colour	Type
Chlorophyll	green	Organic
carotenoids	yellow	Organic
flavonoids	yellow	Organic
Metallic salts precipitated from solutions	multiple	Inorganic

PRESERVATION OF CLOTHES

Preservation of valuable textiles such as wedding dresses, christening gowns, jackets, military uniforms, flags and banners is common place, not only in museums and archives, but in households worldwide.

Muslin clothes should be used to preserve clothes such as cotton and silk sarees.

Textiles similar to blazers should be wrapped under butter paper.

Also neem leaves should be kept around clothes to help it prevent from cockroaches, moths and such similar insects.


PRESERVATION AND CONSERVATION

For preservation and conservation of an artifact the following procedure is to be followed:-

- 1) Know the source.
- 2) Write the conditions on which it was found. Seal it under plastic bag or similar item to protect it further.
- 3) Take the artifact to the conservator.
- 4) Follow the treatment as per the conservator.
- 5) Wash the artifact with distilled or ionised water.
- 6) Dry the artifact using a hair dryer or vacuum dryer.
- 7) Coat the artifact with corrosion inhibitor such as wax, oil etc.



NAAC SSR Cycle 4 (2015-2020):
2_3_1 Experiential Learning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

PRESERVATIONS OF IRON ARTIFACTS

The following procedure is to be followed for cleaning and preserving iron artifacts:-

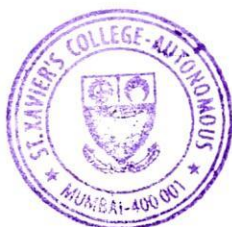
- 1) Take the measurements of the artifacts with all its dimensions.
- 2) Remove the dust from the artifact with the help of a brush.
- 3) Wash the artifact with distilled or ionised water.
- 4) Wash the artifact with 5% E.D.T.A solution.
- 5) Dry the artifact with the help of clean cloth and cover it with oil to preserve it.

E.D.T.A solution is prepared as follows:-

5 gm E.D.T.A in 100ml of distilled water

pH to be maintained = 4.5

If the solution has a pH greater than 4.5 than add a drop of 1M HCl to it and if the solution has a pH lesser than 4.5 than add a drop of NaOH to it.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

COPPER ARTIFACT(Ganesha Statue)

Among the Shaivite deities, mention may be made of the ever popular Ganesha, the elephant headed god, offspring of Shiva and Parvati. Many legends tell of his origin, some of them quite amusing. Although comparatively a minor deity, Ganesha the god of wisdom and the remover of obstacles is widely worshipped by all Hindus and finds a place in every devout Hindu home, prayers being offered to him before any other god. He is certainly the easiest god to identify, whether standing, sitting, or dancing, on account of his elephant head, and is best known outside India of all the Hindu gods.

Artifact No. 0.116 is a statue of Lord Ganesha in a sitting posture with four arms. It is an artifact made of an alloy of copper with had lost its look due to formation of a layer of copper oxide which gave it a greenish tint. The four arms of Ganesha is observed to hold different objects in different statues. In artifact 0.116 Lord Ganesha is seen holding a rosary, a noose(pasa), the elephant god, and sweets in each of his four hands.

Such artifacts are made by the method of casting. There are two types of casting. Namely Cire perdue technique or lost wax method and hollow casting method.

Lost-wax process, also called cire-perdue, method of metal casting in which a molten metal is poured into a mold that has been created by means of a wax model. Once the mold is made, the wax model is melted and drained away. A hollow core can be effected by the introduction of a heat-proof core that prevents the molten metal from totally filling the mold. Common on every continent except Australia, the lost-wax method dates from the 3rd millennium BC and has sustained few changes since then.


To cast a clay model in bronze, a mold is made from the model, and the inside of this negative mold is brushed with melted wax to the desired thickness of the final bronze. After removal of the mold, the resultant wax shell is filled with a heat-resistant mixture. When cool, the outer plaster and core are removed, and the bronze may receive finishing touches.

Hollow casting is a method to suppress displacement of the core during casting when making hollow blades by applying the lost wax method using a core. A wax pattern is made which comprises a core and a layer of wax covering the core. Then at least one pin of the same material as the blade is inserted into the wax layer such that this pin engages the core and part of the pin projects from the outer surface of the wax layer, after which, with the portion of the pin which projects from the outer surface of the wax layer being held in a casting mold, the wax is removed, followed by casting.

Artifact No. 0.116
Dimensions
Height-6.5cm
Breadth-3cm
Width-4cm



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

PRESERVATION OF COPPER ARTIFACTS


The following procedure is to be followed for cleaning and preserving iron artifacts:-

- 1) Take the measurements of the artifacts with all its dimensions.
- 2) Remove the dust from the artifact with the help of a brush.
- 3) Wash the artifact with distilled or ionised water.
- 4) Wash the artifact with a solution of NaOH and Rochelle Salt.
- 5) Dry the artifact with the help of clean cloth and cover it with oil to preserve it.

BEFORE



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

AFTER



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

PRESERVATION OF LIMESTONE WALLS

St.Xavier's College Mumbai is a heritage college and has a lot of walls that are made up of carved limestones. We were given to clean a specific part of a wall in the Heras institute of St. Xavier's College.

The following procedure was followed by us to preserve the carved limestone.

1. Firstly we cleaned the wall with the help of soft brush for minute areas and with hard wired brush for scrubbing off the hard dirt.
2. Secondly we cleaned the stone with the help of water spray along with a brush to remove the left over dirt.

BEFORE



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



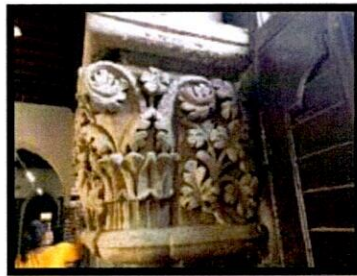
ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

AFTER



NAAC SSR Cycle 4 (2015-2020):
2_3_1 Experiential Learning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

VISIT TO CHHATRAPATI SHIVAJI MAHARAJ VASTU SANGRAHALAYA CONSERVATION CENTRE

The Chhatrapati Shivaji Maharaj Vastu Sangrahalaya, abbreviated CSMVS and formerly named the Prince of Wales Museum of Western India, is the main museum in Mumbai, Maharashtra. It was founded in the early years of the 20th century by prominent citizens of Mumbai, with the help of the government, to commemorate the visit of Edward VIII, who was Prince of Wales at the time. It is located in the heart of South Mumbai near the Gateway of India. The museum was renamed in 1998 after Chhatrapati Shivaji Maharaj, the founder of Maratha Empire.

Firstly we went to the museum and understood on what is the initial procedure of carrying out conservation at professional level.

1. The conservators first of all takes the photos of the artifact before starting the procedure.
2. Then they carry out research on the artifact and find out their relative details.
3. Later they find out exact measurements of the artifact i.e. their length, weight, etc.
4. Then they start with their initial procedure

We were made to see conservation of some artifacts like:-

1. Artifact made of himalayan bronze
It was observed by them that the artifact was affected by copper chloride bronze disease.
As a result they were using silver oxide or zinc dust in order remove it as it produces insoluble salt.
2. Oil painting
Then they showed us a painting that was of Prince Charles' rebellion statue in Scotland. It helped us understand how were they using equipments like suction table and light table.
3. Sadi conservation
Lastly they showed us how a heritage sadi was conserved by attaching extra piece of cloth that was made of special material known as silk kaplin and was made of similar colour in order to camouflage along with the original colour.

Not only this but they also showed us an ongoing exhibiton in their campus and explained us that how all the artifacts present there were conserved and what all difficulties were faced by them. In all it was a great experience to learn about conservation at such professional level.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

BIBLIORAPHY

1. Title: -Ganesa: The enchanter of the three world

Place of Publication: -Mumbai

Name of Publisher: -Franco Indian Research Pvt. Ltd.

Year of Publication: - 1997

2. Title: -Masterpieces of Indian bronzes and metal sculptures

Place of Publication: -Mumbai

Name of Publisher: -DB Taraporewala Sons and Co. Pvt Ltd.

Year of Publication: -1981

3. Some of the websites include

- http://www.industrialmetalcastings.com/casting_hollow_casting.html
- <https://www.britannica.com/technology/lost-wax-process>
- <https://www.preservationequipment.com/Blog/Blog-Posts/Textile-storage-Stresses-and-Hangups>
- <https://www.britannica.com/technology/pigment>
- <https://www.britannica.com/science/oxide>
- <https://www.acs.org/content/acs/en/careers/college-to-career/chemistry-careers/arts.html>



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65


Department of Chemistry – Projects-List of Students (2017-18)

Following mentioned activities/projects were held under Honours Programme

Sr. No	Title of Project	Prof-In-charge	Level of students
1.	Synthesis of and isolation of some organic compounds: An Analytical Approach	Dr. Gulshan Shaikh Dr. Ashma Aggarwal	FY, SY and TY
2.	Research project in Pharmaceutical Chemistry	Dr. Pralhad Rege Dr. Ashma Aggarwal	SY and TY
3.	Research project in Food and Environmental Chemistry	Dr. Pralhad Rege Dr. Gulshan Shaikh	FY, SY and TY
4.	Research project on Ayurvedic Bhasma	Mr. Marazban Kotwal Dr. Ashutosh Mishra	TY
5.	Two day Workshop on "Instrumentation in Analytical Chemistry in Ruia College"	Dr. Pralhad Rege	SY and TY
6.	Chemistry In Art	Dr. Geeta Kotian\Prof Saima Khan	SY and TY



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Chemistry In Art

Synthesis of Pigments

Lab Report

Druhi Vaid

TY BSc

(152426)



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



AIM To synthesis a set of synthetic and natural pigments and finally create an egg tempura painting.

Pigment 1 – Synthetic Malachite

CHEMICAL NAME/FORMULA Basic copper (II) carbonate $[\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2]$

REQUIREMENTS 0.5M copper (II) sulphate, Sodium hydrogen carbonate

PROCEDURE

- 1) To 150 mL of 0.5M copper (II) sulphate at RT, sodium hydrogen carbonate was added till the fizzing stopped.
- 2) The solution was left to mature for 3 days.
- 3) The solution was filtered using a Buchner funnel.
- 4) The obtained residue was dried on a water bath and crushed using a mortar pestle once completely dry.

OBSERVATIONS

It was observed that the maturation process took more than 3 hours, which was the suggested time as per the procedure. The colour of the pigment resembled that of azurite and hence required a longer time to mature and finally from the true malachite colour.

RESULTS

The bulk yield of Malachite was 50.4g



Malachite





Pigment 2 – Lemon Yellow

CHEMICAL FORMULA Barium Chromate (BaCrO_4)

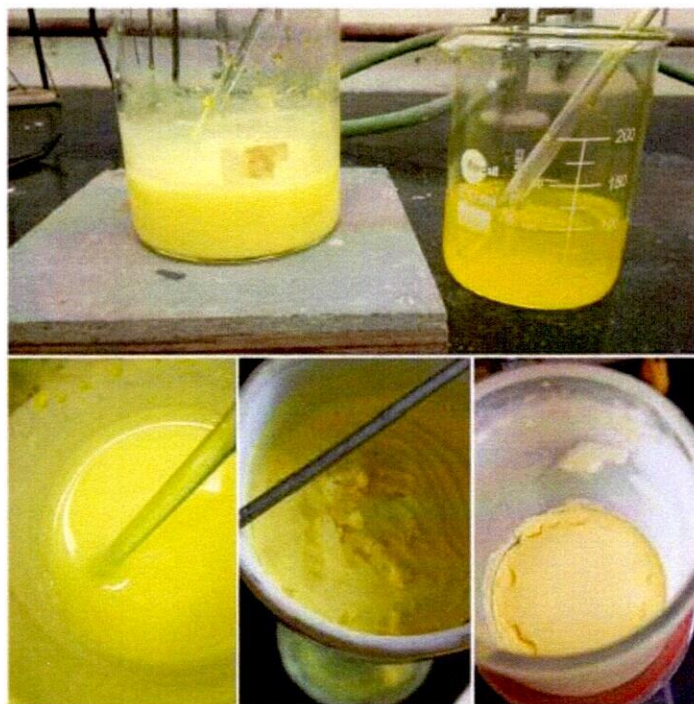
REQUIREMENTS 2N Acetic acid, 10% Potassium Chromate, 0.5M Barium chloride

PROCEDURE

- 1) 80mL of 0.5M Barium chloride solution was acidified with 2N acetic acid (checked with litmus paper).
- 2) The solution was heated and then 10% Potassium Chromate was added till precipitation was complete.
- 3) The solution was filtered using a G4 crucible.
- 4) The obtained residue was dried on a water bath and crushed using a mortar pestle once completely dry.

OBSERVATIONS

It was observed that the particle size of the precipitate was very small and hence a Buchner funnel was of no use. Several G4 crucibles were hence used to filter out the sample.



Lemon Yellow

Pigment 3 – Chrome Yellow





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

CHEMICAL NAME/FORMULA Lead (II) chromate (VI) [PbCrO₄]

REQUIREMENTS 0.5M Potassium Chromate, 0.5M Zinc Sulphate, 6M NaOH

PROCEDURE

- 1) 5mL of 0.5M Potassium Chromate was added to 5mL of 0.5M Zinc Sulphate and stirred together.
- 2) 6M NaOH was added dropwise to the solution to obtain a bright yellow solution.
- 3) The solution was filtered using gravity.
- 4) The obtained residue was dried on a water bath and crushed using a mortar pestle once completely dry.

RESULTS

For bulk preparation, the starting materials were scaled up by 10x to finally obtain a yield of 111.72g



Chrome Yellow

Pigment 4 – Prussian Blue



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

CHEMICAL NAME/FORMULA Hydrated iron(III) hexacyanoferrate (II) $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3 \cdot x\text{H}_2\text{O}$

REQUIREMENTS 0.5 M solution of iron (III) chloride, 0.25 M solution of potassium ferrocyanide

PROCEDURE screen

- 1) 200mL of 0.5 M solution of iron (III) chloride was mixed with 200mL of 0.25 M solution of potassium ferrocyanide and heated.
- 2) It was allowed to mature overnight.
- 3) The solution was filtered using a Buchner funnel.
- 4) The obtained residue was dried on a water bath and crushed using a mortar pestle once completely dry.

OBSERVATIONS

On mixing the two solutions a very dark blue colour is obtained with a slightly viscous solution. When the glass rod is removed from the above solution, the fluid and a few particles stick to it.

The filtrate drops are yellow in colour but the rest of the filtrate actually turns blue (normal as per the procedure)

It is best to use a large funnel and filter, and keep it overnight for filtration. It takes at least 4 days to filter. The sample sticks to every surface it gets. When it dries up, it looks black and burnt but is actually a very dark shade of blue. It forms a crystal like ppt which can be crushed in a mortar pestle to a certain limit as again it sticks to the surface of the equipment and leads to product loss.

Pigment 5 – Cobalt Blue

CHEMICAL NAME/FORMULA Cobalt Aluminate (CoOAl_2O_3)

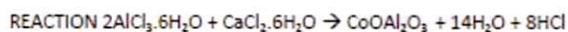


NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



REQUIREMENTS Cobalt (II) chloride hexahydrate, Aluminium chloride hexahydrate

PROCEDURE

- 1) 17.84g of Cobalt (II) chloride hexahydrate and 72.4g of Aluminium chloride hexahydrate were grinded gently in a mortar.
- 2) The mix was transferred into a crucible and heated on a burner for 5-6mins.
- 3) The blue cakes obtained were crushed to fine powder.

OBSERVATIONS

Instead of glass tubes, crucibles were used. Moreover, HCl fumes are released during the reaction, which are harmful. A sky blue colour is finally obtained.

RESULTS

The bulk amount prepared was 80g, while the % yield was 56%.



Cobalt Blue

Pigment 6 – Cobalt Violet

CHEMICAL NAME/FORMULA Cobalt (II) phosphiate ($\text{Co}_2(\text{PO}_4)_2$)



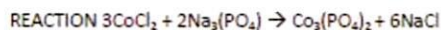
NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



REQUIREMENTS Cobalt (II) chloride, Sodium Phosphate Dodecahydrate

PROCEDURE

- 1) 20g Cobalt (II) chloride and 13g Sodium Phosphate Dodecahydrate were grinded separately in mortars and dissolved in D.W.
- 2) The two solutions were mixed and heated slowly.
- 3) The solution was filtered using a vacuum and dried on a water bath.

OBSERVATIONS

The solution had to be heated (which was not mentioned in the procedure) to obtain a good amount of precipitate.

RESULTS

The yield for this procedure was 30g of Cobalt Violet



Cobalt Violet

Pigment 7 – Yellow Ochre

CHEMICAL FORMULA Iron (III) Hydroxide $\text{Fe}(\text{OH})_3$



NAAC SSR Cycle 4 (2015-2020):
2_3_1 Experiential Learning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

REACTION $\text{FeSO}_4 + \text{O}_2 + \text{H}_2\text{O} \rightarrow 4\text{Fe}(\text{OH})_3 + 4\text{H}_2\text{SO}_4$

REQUIREMENTS Ferrous Sulphate

PROCEDURE

- 1) 13g of Ferrous sulphate was heated in a crucible
- 2) The colour starts changing from green to yellow
- 3) The obtained product was crushed into a fine powder.
- 4) Several batches were made

OBSERVATIONS

The green crystals starts losing their water of crystalization due to the drying heat until it loses all its water and hence there is a color change from green to yellow.

RESULTS

7.42g of Yellow ochre was obtained from one batch. The % yield of the procedure was seen to be 57.68% . A total of 102g was prepared.

Pigment 8- Red Ochre

CHEMICAL NAME/FORMULA Iron (III) Oxide Fe_2O_3

REACTION $\text{FeSO}_4 \rightarrow \text{Fe}_2\text{O}_3 + \text{SO}_2 + \text{SO}_3$

REQUIREMENTS Ferrous Sulphate

PROCEDURE

- 1) 13g of Ferrous sulphate was heated in a crucible
- 2) The colour starts changing from green to yellow to a brick red color
- 3) The obtained product was crushed into a fine powder.
- 4) Several batches were made

OBSERVATIONS

The green crystals starts losing their water of crystalization due to the drying heat until it loses all its water and hence there is a color change from green to yellow to finally red. Crushing the product makes the red colour brighter.

RESULTS

7.5g of Red ochre was obtained from one batch. The % yield of the procedure was seen to be 53% . A total of 128g was prepared.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
© 2262 0661/65



Red and Yellow Ochre



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



Pigment 9 – Barium White

CHEMICAL NAME/FORMULA Barium Sulphate BaSO_4

REACTION $\text{Na}_2\text{SO}_4 + \text{BaCl}_2 \rightarrow \text{BaSO}_4 + 2\text{NaCl}$

REQUIREMENTS Sat. sodium sulphate, Sat. Barium chloride

PROCEDURE

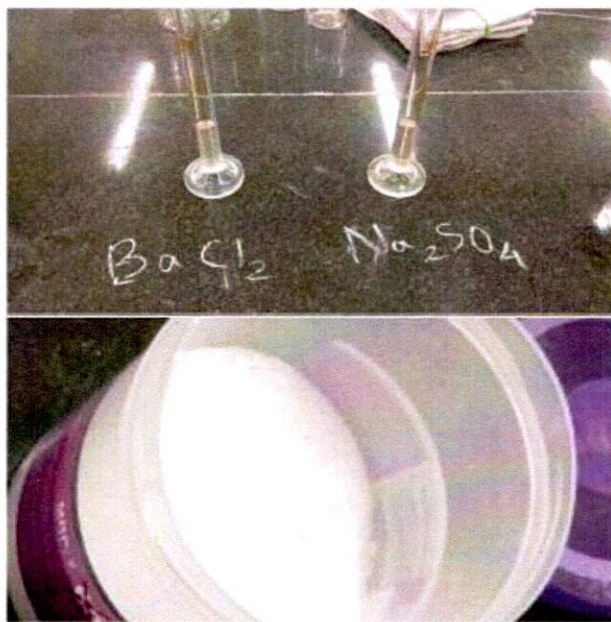
- 1) 150 mL of a saturated solution of sodium sulfate and 150 mL of a saturated solution of barium chloride were mixed well together.
- 2) The mixture was centrifuged and the clear liquid obtained was decanted.
- 3) The precipitate was dried and crushed.

OBSERVATIONS

The white colour obtained was not pure white but it has patches of greyish-brown.

RESULTS

The bulk yield obtained was 100g of Barium white.



Barium White



Shinde



Pigment 10 – Azurite

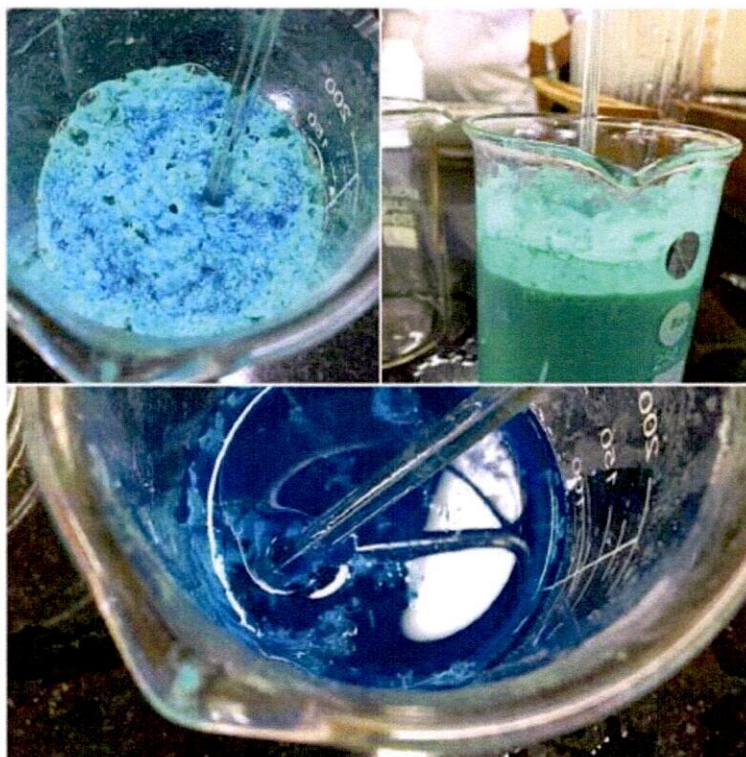
REQUIREMENTS Hydrated Copper (II) Sulphate, Sodium Carbonate

PROCEDURE

- 1) 125 g hydrated Copper (II) Sulphate was added to 250 mL distilled water.
- 2) 60g sodium carbonate dissolved in 55 mL deionized water
- 3) The sodium carbonate solution was slowly added to the copper sulphate solution, till the effervescence ceased.
- 4) A turbid blue solution was obtained which was filtered and the precipitate was washed with distilled water 3 or 4 times.

RESULTS

The bulk yield was 30g of Azurite.



Azurite



Shinde



Pigment 11 – Verdigris

REQUIREMENTS Hydrated Copper (II) Sulphate, Liquor NH₃, 2M NaOH, Vinegar

PROCEDURE

- 1) 150g of CuSO₄.5H₂O was added to 100 mL of water in a 250mL beaker then stirred vigorously.
- 2) 100mL of ammonia was added to a 100 mL beaker and the transferred via pipette into the previous solution, drop by drop until the solution turns a deep blue color. (Between 25mL and 35mL maybe added). This mixture was stirred for 5 minutes and then filtered through vacuum using a Büchner funnel.
- 3) After the vacuum filtration was completed the damp precipitate was mixed with 80mL of distilled water and stirred followed by addition of 2.0M sodium hydroxide till a precipitate is obtained. The solution is filtered using Büchner funnel for a second time.
- 4) The precipitate was dried with a filter paper
- 5) 80mL of Vinegar was added to a 250mL beaker and then to the precipitate. The mixture was stirred for 4 minutes.

OBSERVATIONS

The addition of liquor ammonia is dependent on the colour change, one should look out for the right blue colour. The solution at this stage should be clear.

RESULTS

The bulk yield of Verdigris was 84.5g



Verdigris





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

DEPARTMENT OF LIFE SCIENCE
PROJECTS EXCURSIONS EXHIBITIONS



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Department of Life Science and Biochemistry – List of Projects (2018-19)

Student Research Projects (UG):

2018 - 19

SYBSc S.LSC.4.03 Biostatistics 32 students

SY 403 CIA2 - 4 surveys carried out by SYBSc students as examples of convenience sampling, which utilizes readily available resources to be reflective of a population.

1. Determination of prevalence of various genetic traits.
2. Merits and demerits of the Extracurricular credits system in St Xavier's College (Autonomous), Mumbai.
3. Mobile games and their impact on human behavior.
4. Dependence of outstation students on canteen food and its effect on health.

SYBSc S.LSC.4.01 Comparative Physiology II 32 students

Effect of various physical and mental activities on physiological parameters.

Students worked in groups of 6 to design a module of physical activities (climbing, push-ups, etc) and/or mental activities (mental maths, watching a scary movie, etc).

Individuals subjected to these modules were assessed for changes in heart rate and blood pressure, pre- and post the activities.

TYBSc S.LSC.5.01.PR

Isolation and Identification of Unkonwn Bacteria from Soil


Students isolated bacteria from soil samples collected from different parts of the college campus. They further identified the isolate by performing cultural and biochemical characterisation of it and comparing with organisms listed in the Bergey's Manual.

TYBSc S.LSC.5.04 Sustainable Development and Carbon Management 21 students

1. Leopard Ecology and human interactions in SGNP. (5 students)
2. Effects of different concentrations of CuSO₄ and detergent on germination of *Vigna radiata*. (4 students)
3. Butterfly diversity in Maharashtra Nature Park and Ovalekarwadi. (4 students)
4. Floral diversity in Yeoor forest. (4 students)
5. Study of Lichens in Mumbai. (4 students)



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

TYBSc S.LSC.6.AC Environmental Science 60 students

The students were asked to make working models for the following topics as their practical CIA worth 15 marks. Each group had 10 students:


1. Aquaponics
2. Community-managed Sustainable Agriculture
3. Electro Coagulation
4. Renewable Energy Vermicompost
5. Water Harvesting
6. Waste water Management

Department of Life Science and Biochemistry – List of Projects (2018-19)

Project Title (Biochemistry)	No. of Students
1. Lycopene content of raw and boiled, and skinned and unskinned tomatoes	8
2. Effect of gender and lifestyle on the production and activity of alpha-amylase in saliva	8
3. Estimation of Vitamin C content in packaged fruit juices beyond expiry date	8
4. Effect of boiling on iron content of green leafy vegetables	7
5. Isolation of Invertase from baker's yeast	8
6. Chromatic stability of betalain from beetroot extracts across varying temperature and pH conditions	7
7. Estimation of the total phenolic content of green and normal tea	8
8. Extraction and semi-purification of Hen egg Lysozyme	7



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Study of Vitamin C content in Packaged Orange Juices on Storage

Iqbal.Z; Mahadevan.R; Adhikari.S; Saha.S; Mittal.R; Joseph.M; Alva.N; John.L. and Manglore.N

Abstract: Oranges are known to be rich in vitamin C and are hence a great source for the same. The performed experiment hence focused on estimating the maintenance of vitamin C content in 3 brands of packaged orange juices over the claimed period of 5 days. Iodimetric titrations were used to determine the amount of vitamin C in fixed volumes of the sample packs in triplicates for the assigned period of 5 days. The hypothesis made was to see an expected decrease in the vitamin C content over time due to its repeated exposure to air on multiple openings of packs and days of storage. The results however support the claim of the brands suggesting an insignificant decrease in the vitamin C content after 5 days. The studied brands hence suggest that packaged orange juices sustain the initial amount of vitamin C for a minimum period of 5 days on suitable storage under refrigerated conditions and are hence a good source for vitamin C due to stability in their amounts over days.

Keywords: Iodimetric titrations; repeated exposure; refrigerated conditions

Introduction:

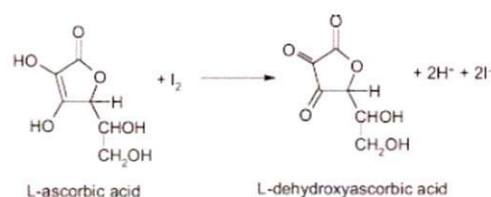
Ascorbic acid has an important nutritional value due to its antioxidant capacity and its biological role in the synthesis of collagen. Vitamin C increases the rate of absorption of iron, calcium and folic acid, reduces allergic reactions, boosts the immune system, stimulates the formation of bile in the gallbladder, and facilitates the excretion of various steroids(3). Hence foods rich in vitamin C are often recommended for good health. However due to easy destruction of essential elements in food there has been an urging attempt to maximize the nutrient retention in both processing and storage of the foods containing vitamin C(1). Fruits are generally rich and convenient sources of vitamin C due to their easy processing into juices etc. Hence fruit juices are one of the most recommended foods for vitamin intake and most citrus fruit juices in specific are highly known to be rich sources of vitamin C. However, ascorbic acid is thermolabile and hence very sensitive to processing temperatures and is prone to degradation under unsuitable storage temperatures, exposure to air, light, etc.

Orange juices from the longest time are being consumed as a source of vitamin C and hence are one of the very common nutritional foods. The loss of vitamin C over time for such packaged juices is however a critical factor since storage of such packaged juices for long durations has been a common trend in most households. Repeated usage of these packs lead to its multiple exposure to air which can lead to loss of ascorbic acid from the fruit juice. It is likely that during storage of the orange juice the ascorbic acid is degraded following two consecutive or parallel pathways, aerobically and anaerobically at rates depending on storage conditions and the processing techniques and temperatures applied during production. The chemical degradation of ascorbic acid is due to its oxidation when exposed to air to give dehydroascorbic acid(2).



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



Materials and Methods

Materials

Commercially available orange juices (one litre tetra packs) of three different brands were used for this analysis. Each brand was analysed in triplicates using three different packages for a week and were stored at 4 degree Celsius.

Methods

Standardisation

The Vitamin C content in the juice samples were estimated by iodimetry. For this, the true normality of the iodine solution, prepared and stored in an amber bottle, was determined by titrating 5 ml of it with a standard solution of 0.01N sodium thiosulphate (Na₂S₂O₃) from a burette. Freshly prepared 1% starch was used as an indicator and the end point was blue to colourless.

Estimation of Vitamin C in the juice samples

The juices were first strained to prevent the interference of pulp if present and 5ml of it was titrated against the standardised Iodine solution. 1ml of 1% freshly prepared starch was used as an indicator and the point at which the solution turned purple was noted as the end point.

Results:

The vitamin C content in the orange juice samples were calculated per day through titration for each of the brands in triplicates ie: 3 packs of each brand. The trend of the results throughout the period of 5 days is depicted for each brand including a comparison of the trends for each brand.

Table 1: Amounts of vitamin C in each of the packs of brand 1, brand 2, and brand 3 over a period of 5 days.

		Amount of Vitamin C (mg)				
		Day 0	Day 1	Day 2	Day 3	Day 4
Brand 1	Pack 1	42.8	40.12	39.81	38.72	36.96
	Pack 2	36.12	59.91	40.55	41.68	36.12
	Pack 3	53.43	41.81	46.88	45.62	44.31
Brand 2	Pack 1	30.76	30.76	28.82	28.16	24.64
	Pack 2	28.09	32.38	26.05	24.05	24.01
	Pack 3	28.09	34	22.81	23.44	24.07
Brand 3	Pack 1	31.68	28.16	28.16	28.16	27.59
	Pack 2	42.09	36.12	27.88	28.65	31.68
	Pack 3	40.48	30.76	28.61	27.88	26.61





Fig 1: Ascorbic acid variations in the three packs of Brand 1 across the 5 days (Day 0-Day4)

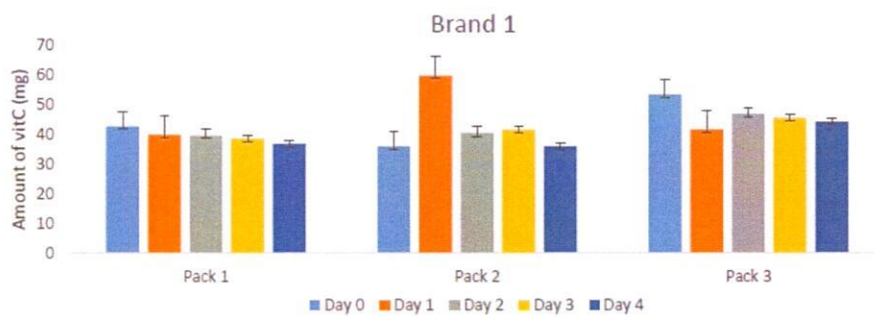


Fig 2: Ascorbic acid variations in the three packs of Brand 2 across the 5 days (Day 0-Day4)



Fig 3: Ascorbic acid variations in the three packs of Brand 3 across the 5 days (Day 0-Day4)

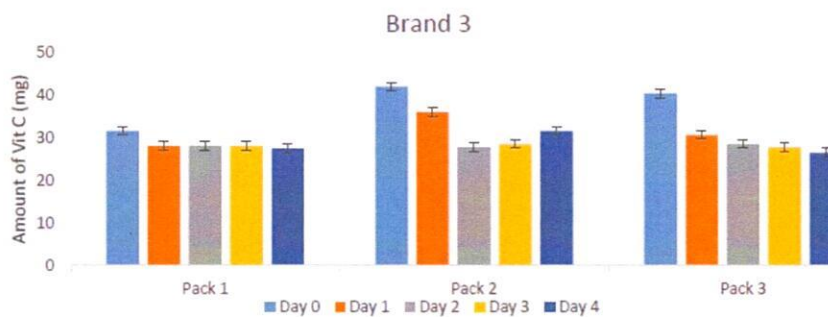




Fig 4: The graph depicts an average comparison of vitamin C trends for each of the 3 brands used over the period of 5 days.

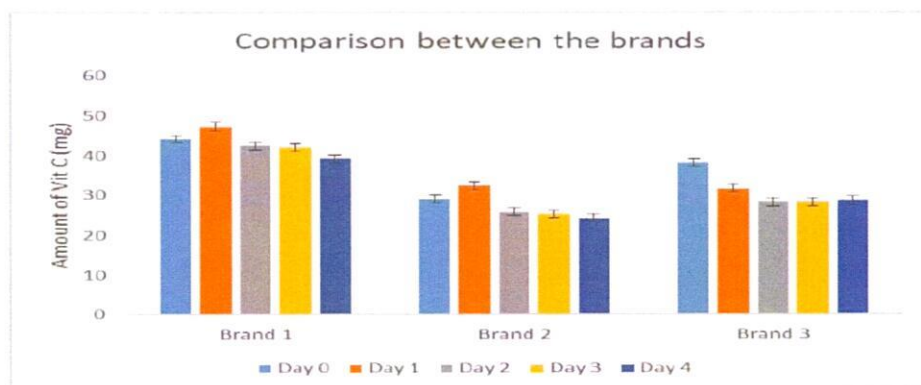


Table 3: The comparative data interpreted from the graphs.

Source of Variation	F	P-value	F crit
Between Groups	0.551446	0.702657	3.47805
Within Groups			

Discussion:

The aim of the performed experiment was to govern the trend of an expected decrease in vitamin C contents of packaged orange juices by iodimetric titration where the standard used is iodine which is titrated against the sample to be estimated in the flask. This procedure was continued over a storage period of 5 days for all the three brands in triplicates. The decrease was expected due to multiple openings and storage of the packs that mimics the household usage of such 1L packs of orange juices. This manner of usage makes the juice get exposed to air which could degrade the ascorbic acid. The packages of each of the brand did show certain variations throughout the period but these when compared showed an Fvalue much lower than the Fcritical value which clearly suggested that the changes observed were insignificant and are hence expected to be seen due to errors in experimentation and storage since the trend did not show any sort of consistent decrease throughout the five days. The results of the conducted experiment hence suggested that as rightly claimed by the brands themselves the vitamin C content in the packaged juices is sustained over a minimum period of 5 days and is hence suitable for consumption ensuring to gain the initial claimed amount of vitamin C. Hence the three brands used and other packaged orange juices In general are suggested to be good and stable sources for vitamin C diets due to the stability in the vitamin





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

C content inspite of storage for a minimum claimed period as rightly mentioned on the packs. However, chances are that the trends could show a decrease after the assigned period of 5 days however this was beyond the study of this experiment as it solely focuses on the check of the claimed period on most packaged juices which is that of 5 days.

References:

1. Burdurlu, H. S., Koca, N., & Karadeniz, F. (2006). Degradation of vitamin C in citrus juice concentrates during storage. *Journal of Food Engineering*, 74(2), 211-216.
2. Du, J., Cullen, J. J., & Buettner, G. R. (2012). Ascorbic acid: chemistry, biology and the treatment of cancer. *Biochimica et Biophysica Acta (BBA)-Reviews on Cancer*, 1826(2), 443-457.
3. Rahmavati, S. (2009). *KINETICS OF THE OXIDATION OF VITAMIN C*. Institut Teknologi, Bandung, Indonesia.
4. Polydera, A. C., Stoforos, N. G., & Taoukis, P. S. (2003). Comparative shelf life study and vitamin C loss kinetics in pasteurised and high pressure processed reconstituted orange juice. *Journal of Food Engineering*, 60(1), 21-29.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

INTRODUCTION

Butterflies are the insects which come under the order Lepidoptera along with moths.^[1] They are one of the most widespread insect order in the world.^[2] Butterflies fascinate many people with its bright colours, wonderful shapes and their flights around the flowers.^[8] They are one of the most noticeable and observable species of earth's biodiversity. They are known as to be bio-indicators due to their high specificity for habitat and also due to their response to any change in the environment.^[3] Thus they are an indicator of healthy environment and ecosystem. They are the prey for bats, birds, and other insects and thus act as an important element of the food chain. Impact of climate change, habitat loss and many other factors were studied by ecologists using butterflies.^[8] They play an important role in pollination. Being the most widespread insects make them a good pollinator in forest and other ecosystems. Thus they also have a key role in functioning of forests.^[2] Butterflies are studied for different reasons such as survival strategies of butterflies, diversity of butterflies at a particular location, study of interaction between the insects and many others.

The world hosts more than 18,000 species of butterflies out of which about 1,500 species are found in India. In Mumbai, about 168 species of butterflies were recorded and the total count of butterfly species at Maharashtra Nature Park reached to 76 species (June 2010) which has now increased.^[7] Butterfly gardens maintain the butterfly species and provide a habitat for butterflies. It helps in maintaining the food chain and also diversity of butterflies. As a result of habitat destruction and habitat loss, many butterflies were becoming less abundant. But by creating butterfly gardens the numbers of butterflies have increased. The number of the butterflies which are endangered can be maintained by providing the plants required for butterflies.^[6]

The main aim of the project was to study on butterflies in common and diversity of butterflies at two manmade butterfly gardens, Maharashtra Nature Park and Ovalekarwadi butterfly garden. This project was as a field work which included detail observation and study of the host and nectaring plants, eggs and caterpillars of different butterflies at the two parks and butterflies present during that time.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

MATERIALS AND METHODS

Study area: The study was done in Maharashtra Nature Park and Ovalekarwadi Butterfly garden at two different days in the month of September.

The monitoring of butterflies was started in the year 1998 in Maharashtra Nature Park. The park covers 37 acres area situated at Dharavi in Mumbai. The study was done on 07th of September 2018. Maharashtra Nature Park has a large manmade forest and is also covered by natural ecosystem of the mangroves. The park was established in 1982 by Dr. Saleem Ali, an ornithologist by planting 6 plants. Now the park has almost 14 thousand trees, more than 100 varieties of birds, insects, butterflies and almost 300 varieties of different plants.^[7]

The second field visit was to Ovalekarwadi butterfly garden located at Thane in Mumbai. The study was done on 09th September 2018. Ovalekarwadi is a 2 acre farm located in Ovala village in Thane that attracts many butterflies. The garden was started in 2004 by Rajendra Ovalekar and now there are more than 5000 plants and trees.^[6]

Butterfly observation and identification: The observation of butterflies was done by walking around the park and observing the butterflies present and capturing the photos using cameras. The guide helped the members of the project in identification of butterfly observed while walking in the park. The study was done from 12.30 pm to 3.30 pm in Maharashtra Nature Park with the help of the guide. A lecture was conducted in the starting of the field work by the guide giving information on butterflies and about the history of the park. Butterflies observed and all the details were recorded. The second study was done from 8.30 am to 11.30 am in Ovalekarwadi with the help of the owner/guide. A lecture was also conducted here by the owner and method used for id of butterfly was similar to Maharashtra Nature Park.

OBSERVATIONS AND RESULTS

Butterflies and moths belong to the order Lepidoptera. They are insects having scales.^[7] Their wings are covered with many scales. These scales are arranged in a particular pattern and colourful designs which make butterflies unique and colourful. Butterflies are further classified into super family Papilionoidea.^[1]

In India, about 1500 species of butterflies are found whereas around 168 species are documented from Mumbai. And the world has more than 18,000 species of butterflies.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



Mumbai provides habitat for 5 families of butterfly. Also the Blue Mormon butterfly is the Maharashtra's state butterfly. The best time to see butterflies are from September to March.^[7]

Ways to differentiate butterflies from moths

Butterflies will have cup shaped antenna whereas moths have feathery antenna. Almost all butterflies are diurnal that means they are active during day time whereas almost 80% moths are nocturnal that means active during night. But 20% of moths are diurnal. These moths will be colourful and poisonous and mostly will have feathery antenna which can be differentiated from butterflies.^[7] While sitting on the flower butterflies will close its wings first then later opens it after sitting on the flower. But in moths, they will directly sit on the flower with open wings. Also 80% of moths do not have proboscis whereas all butterflies have it. Proboscis is a straw like thing which is used by butterfly for drinking nectar or for sucking liquid foods.^[7]



antenna at

Picture 2: Banded awl butterfly drinking nectar with proboscis at MNP

Host plants and nectar plants

There are three important factors which are required for butterflies to live and reproduce. They are Host plant, Nectar plant and Sunlight. Female butterflies are attracted to the host plants by the chemical or odour released from the plants which can be sensed by butterflies. The host plants thus attract butterflies to lay their egg. Each butterfly has a particular host plant on which they will lay their eggs. Males are also attracted towards the host plant where the females are present. Thus host plants provide the site for mating, laying of eggs and further development. Nectar plants are also important element which provides butterfly nectar for growth. Some nectar plants that were seen in Maharashtra Nature Park and



Shinde



Ovalekarwadi Butterfly garden were Jamaican spikes, Lantanas, Ixora, Duranta, Hibiscus and many wild plants.^[7]

Host plants of the specific species of butterfly which were seen in Maharashtra Nature Park and Ovalekarwadi are tabulated below:

Host Plants	Butterflies
1. Chitrak plant	Zebra Blue
2. Curry plant 3. Lime trees	Common Mormon
4. Bryophyllum	Red Pierrot
5. English Tamarind	Common Yellow
6. Milk weed plant	Glassy, Plain and Stripped Tigers
7. Mango trees	Common Baron
8. Citrus	Common Lime
9. Salvadora (Miswak)	Salmon Arab
10. Castor oil plant	Common Castor
11. Fig Tree 12. Black Berry	Common crow
13. Sonchafa	Tailed Jay
14. Bamboo	Banded awl
15. Passion Flower	Tawny Coster
16. Calotropis	Plain Tiger

Table 1: Names of butterflies and their Hosts plants seen in the parks



Shinde



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Picture 3: Nectar plant at Ovalekarwadi



Picture 4: Nectar plant Lantana at MNP



Picture 6: Milk weed-Host plant of all
Tiger butterflies seen at MNP

nt of Zebra
NP

Life cycle of butterflies

To become an adult butterfly, it goes through 4 stages namely egg, larva, pupa and butterfly.^[6] Egg is the first stage where the female butterfly lays eggs on the leaves or stems of the host plants. Each species of eggs can be different in size and shape. This stage lasts for about some days to weeks. The second stage is where eggs hatch and caterpillars appear. During this phase caterpillar feeds on leaves as much as possible. Third stage is pupa where larva gets transformed into cocoon. In this stage feeding is not done, it gets energy from the food eaten in larva stage. The last stage is adult butterfly which arises from the cocoon when it opens up after complete development.^[4]



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



Following is the list of eggs and caterpillars seen in Maharashtra Nature Park and Ovalekarwadi:

CATERPILLARS (butterfly's name)	EGGS (butterfly's name)
1. Plain Tiger	1. Palm Fly
2. Common Mormon	2. Red Pierrot
3. Common Yellow	3. Common yellow
4. Red Pierrot	4. Common Mormon
5. Common Baron	5. Common Castor
6. Common Castor	6. Common emigrant
7. Common Bob	
8. Moth butterfly	
9. Common Jezebel	
10. Tawny Coster	
11. Blue family	

Table 2: Names of the butterflies whose caterpillar and eggs were seen during the field work

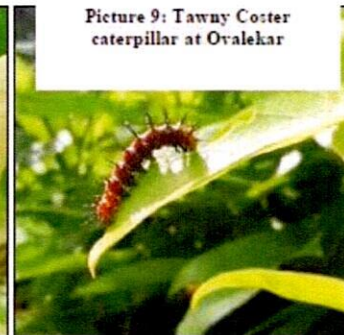
Picture 7: Eggs of Common mormon on the leaf (yellow and white color)



Picture 8: Plain tiger Caterpillar at MNP

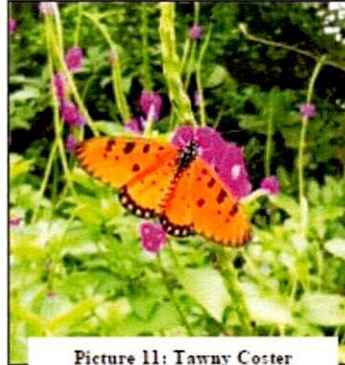


Picture 9: Tawny Coster caterpillar at Ovalekar





Picture 10: Cocoon of a butterfly at Ovalekar



Picture 11: Tawny Coster Butterfly at Ovalekar

Different activities done by Butterflies:

1. **Feeding:** Butterflies and Caterpillars have completely different food preferences. Caterpillars mostly feed on leaves of the host plant and do not tend to move much from the host plants. They have mandibles which allow them to eat leaves. Whereas butterflies are completely different. They feed on liquids by proboscis which helps them to suck liquids. They move around and search for food. Butterflies feed on nectars of flowers, rotten food, sap from trees, and animal poop or blood. ^[1, 7] Some butterflies feed on the latex of milkweed plant which helps them to become poisonous. Thus due to poison, predators will avoid those butterflies. ^[7]
2. **Basking:** Butterflies bask so that they warm up their muscles for flying. If they become cold then they will not be able to fly. Also they cannot regulate their body temperature thus basking becomes an important factor. ^[1]
3. **Mud Puddling:** Mud puddling is mostly done by males where butterflies gather near mud puddles or some moist region and take in mineral rich water, salts and mainly sodium. These are then required during mating. ^[1, 7] In the months of September, October and November butterflies usually are found on flowers and after that they do mud puddling. ^[7]
4. **Camouflage and Mimicry:** These are the main survival strategies found in many butterflies and caterpillars. These strategies help them to avoid predators and help some caterpillars to catch their prey. ^[7] Some examples which were seen and learned in Maharashtra Nature Park and Ovalekarwadi are as follows.



Shinde



- All the three stages of life cycle of Common Mormon and Common Lime butterfly look like a bird dropping. Thus it helps them to avoid predators since they cannot be identified by them. [7]
- Also caterpillar of Common Mormon looks like a snake and has two false eyes on its body. They pull out a tongue like part called osmetorium to scare the predators. [7]
- Blue Oak leaf butterfly looks like a dry leaf and thus camouflages with the background. [6, 7]
- The table below shows butterflies which do mimicry of poisonous butterflies.

Poisonous Butterfly	Butterfly which mimics poisonous butterfly
Stripped Tiger	Palm Fly Females
Plain Tiger	Danaid Eggfly Females
Common Rose	Common Mormon Females
Common Crow	Great Eggfly Females

Table 3: Mimicry seen in butterflies [7]




From the above table, it was seen that females more usually mimic poisonous butterfly to fool the predator so that they can lay eggs without any risk.





a caterpillar
g with the

ron
Ova



Picture 14: Common grass yellow caterpillar camouflaging with the stem at Ovalakar

Picture 15: Common Baron Caterpillar camouflaging with the leaf at MNP

Picture 16: Common emigrant feeding on flower which looks like a leaf

There are five families of butterflies found in Mumbai. They are as follows:

1. **Family Papilionidae:** It is the biggest family and mostly swallow tail butterflies are found in this family. They have outside wings pointed and butterflies are big. Examples are Blue Mormon, Tailed Jay. Southern bird wing is the biggest butterfly from this family. [7]
2. **Family Hesperidae:** These are the fastest butterfly and are commonly known as skippers. [7] They have a skipping flying pattern. They sometimes have a hairy body and their eggs are very small. Some species have very long proboscis which help them to sip in nectar from flowers easily. [4] Examples are Common Awl and banded awl.
3. **Family Lycaenidae:** This family consists of small butterflies. They are commonly known as blue butterflies because many species have blue uppersides. Examples are Red Pierrot, Gram Blue. [4, 7]
4. **Family Pieridae:** This family has normally yellow and white butterflies. Examples are Common grass yellow, Common emigrant. [7]
5. **Family Nymphalidae:** These are brush footed butterflies because their forelegs have hair. Examples are Black Rajah, Common Nawab. [7]





Picture 17: Caterpillar of Blue family camouflaging with the flower at Ovalekarwadi

Following is the list of the butterflies which were seen in Maharashtra Nature Park and Ovalekarwadi during the visit.

Butterflies observed	Park where butterfly was seen	
	Maharashtra Nature Park	Ovalekarwadi
1. Tailed Jay	✓	✓
2. Common Jay	✓	✗
3. Glassy Tiger	✓	✓
4. Blue Tiger	✓	✓
5. Striped Tiger	✗	✓
6. Banded Awl	✓	✗
7. Common Awl	✓	✗
8. Common Crow	✓	✓
9. Common Emigrant	✓	✓
10. Common Grass Yellow	✓	✓
11. Common Rose	✗	✓
12. Common Mormon	✓	✓
13. Common Baron	✓	✓





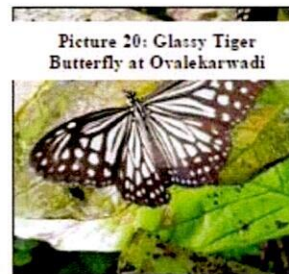
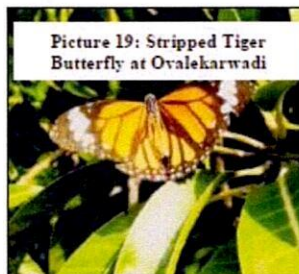
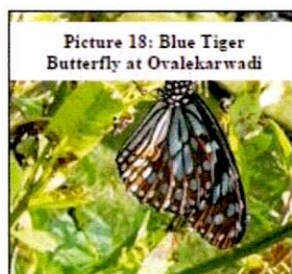
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

14. Common Wanderer	✗	✓
15. Common Jezebel	✗	✓
16. Palm Fly Female	✓	✗
17. Danaid Egg Fly Female	✓	✗
18. Tawny Coster	✗	✓
19. Yellow Orange Tip	✗	✓
20. Red Pierrot	✓	✓
21. Chocolate Pansy	✓	✗


Table 4: Butterflies observed in both parks

Around 21 species of butterflies were able to spot during the visit which are given in the Table 4.

SOME PHOTOS OF BUTTERFLIES SEEN AT BOTH SUDY AREAS:



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



Picture 21: Danaid eggfly butterfly at MNP



Picture 22: Common Crow Butterfly at MNP



Picture 23: Jezebel Butterfly at Ovalekarwadi



Photos of caterpillar, egg and host plant of Red Pierrot butterfly (the only of family Lycaenidae that were present in both parks) seen at MNP:



Picture 24: Egg



Picture 25: Caterpillar



Picture 26: Host plant
bryophyllum



Picture 27: Red Pierrot
Butterfly





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Picture 28: Caterpillar at MNP



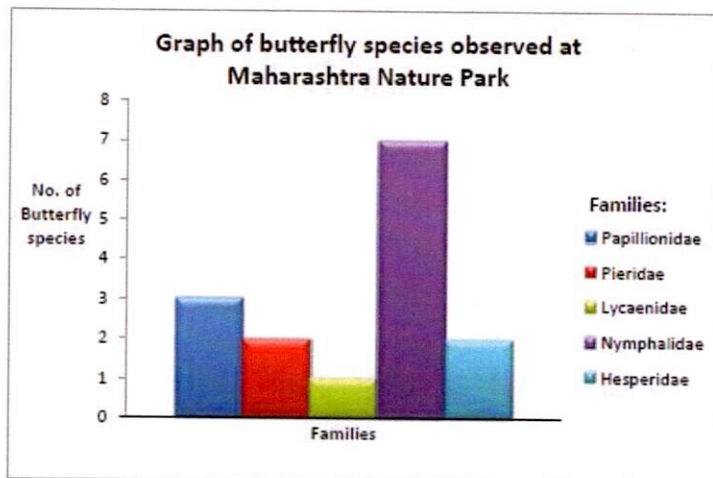
Picture 29: Palm Fly egg



Picture 30: Moth Caterpillars



Following are the graphs showing the different species of butterflies of five families which were observed in Maharashtra Nature Park and Ovalekarwadi Butterfly Garden:

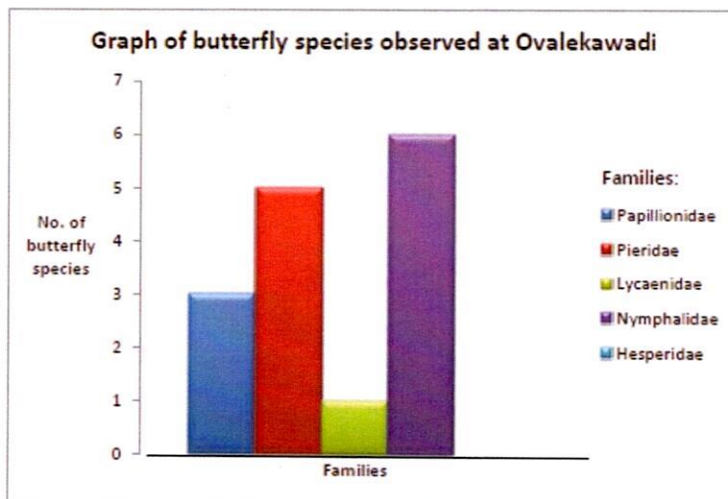


Graph 1



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



Graph 2

DISCUSSIONS

When comparing the diversity of butterflies in Maharashtra Nature Park and Ovalekarwadi, both were found to have almost similar butterflies though there were some species which were present in one park but not in other one. The graph 1 and graph 2 highlight the families which were seen in the MNP and Ovalekar. Family Lycaenidae had only one species of butterfly in both the gardens. Family Hesperidae was only seen in Maharashtra Nature Park. Nymphalidae is the family which had highest number of butterflies which were observed during the visit. Tiger butterflies were more present in numbers in Ovalekarwadi than Maharashtra Nature Park whereas Tailed Jay butterflies were more in Maharashtra Nature Park. Only one Tailed Jay butterfly was spotted in Ovalekarwadi whereas in MNP, there were many near Jamaican Spikes plants.

The best months to visit the butterfly garden are late September to March where butterflies will be flying around flowers. Both the parks will have more species of butterflies than the number mentioned in the results during butterfly season. Caterpillars and eggs were present in greater numbers in both parks. Many moth caterpillars were also seen.





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Since our field work was during the first week of September lesser butterflies were observed. During the afternoon visit in Maharashtra Nature Park, butterflies were very active and were flying. There were difficulties in observing and capturing the pictures. So it might have led to an error in the results. Thus the best time to visit is morning when butterflies will be lesser active. If the visits were done for more days then more species of butterflies could have been spotted which would have given a better result. Butterflies were flying before clicking the photos because of the presence of compound eyes which can sense the movement. Thus making noise would not let the butterfly fly because they cannot hear but movements of hand, leg or anything can trigger them to fly. Thus the project includes detail study of butterflies and its diversity which was done with the help of guide by observing and the lecture delivered by the guides.

ACKNOWLEDGEMENT


We thank Mrs. Nandita Mangalore, Head of the Department of Life science and biochemistry of St. Xavier's College, Mumbai and Dr. Seema Das, Associate professor of the same department for helping us and providing us this opportunity. We would like to thank Maharashtra Nature Park for providing us guide and allowing us to study butterflies in MNP. We also thank Mr. Sachin Rane, the guide at Maharashtra Nature Park and Mr. Rajendra Ovalekar, owner of Ovalekarwadi Butterfly garden for helping us in observing and identification of butterflies and also for delivering a lecture on butterflies.

References:

1. All about butterflies. Retrieved September 15, 2018, from <http://www.uky.edu/hort/butterflies/all-about-butterflies>
2. Durairaj, P., & Sinha, B. (2015). Review of butterflies (Lepidoptera : Rhopalocera) from Arunachal Pradesh : Conservation status and importance of research in Protected Areas. *Zoological Survey of India*, 61-77.
3. Harsh, S. (2014). Butterfly Diversity of Indian Institute of Forest Management, Bhopal, Madhya Pradesh, India. *Journal of Insects*, 2014, 1-4. doi:10.1155/2014/254972
4. Kasambe, R. (2016). *Butterflies of Western Ghats*. An e-Book. Self Published. Pp.327+vii.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.




ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

5. Narasimmarajan, K., et. al. (2014). Butterflies Diversity in Gugamal National Park, in the Melghat Tiger Reserve, Maharashtra-Central India. *World Journal of Zoology*, 9(2), 71-79. doi:10.5829/idosi.wjz.2014.9.2.83190
6. Ovalekar, R. (2018, September 09). *Butterflies*. Lecture presented in Ovalekarwadi Butterfly Garden, Mumbai.
7. Rane, S. (2018, September 07). *Butterflies*. Lecture presented in Maharashtra Nature Park, Mumbai.
8. Why butterflies matter. Retrieved September 16, 2018, from <https://butterfly-conservation.org/butterflies/why-butterflies-matter>



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Department of Life Science and Biochemistry – List of Projects (2017-18)

Projects: Life Science

1. Effect of Chemical and Organic Fertilizers on the Growth of *Micrococcus luteus* and *Micrococcus roseus* in soil.
No. of students = 5
2. The effect of ultraviolet (UV) radiation on germination and chlorophyll content in wheatgrass (*Triticum aestivum*).
No. of students = 5
3. Effect of different types of music on the growth of *Ocimum tenuiflorum* (holy basil).
No. of students = 4
4. Phytoremediation of lead using *Eichhornia crassipes* and *Spirodela polyrhiza*.
No. of students = 4



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Department of Life Science and Biochemistry – List of Projects (2017-18)


Projects: Life Science

The students were asked to make working models for the following topics as their practical CIA worth 15 marks. Each group had 10 students:

1. Biogas plant
2. Solar cell
3. Microbial fuel cell
4. Biological compost
5. Rainwater harvesting
6. Wastewater treatment plant
7. Algal scrub



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.




ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Department of Life Science and Biochemistry – List of Projects (2017-18)

Project Title (Biochemistry)	No. of Students
1. Estimation of the effect of inorganic salts on activity of crude amylase extracted from sweet potatoes (<i>ipomea batatas</i>)	8
2. Comparison of the proteolytic activity of natural and synthetic protease using casein as a substrate.	7
3. Comparison of proteolytic effect of different protease tablets on gelatin using a viscometer	7
4. Synthesis of biodegradable antimicrobial polymers- a green alternative.	9
5. Extraction and characterisation of crude bromelain from pineapple and in silico annotation of the protein	7
6. Determination of flavonoid concentration at various stages of growth in wheat grass (<i>Triticum aestivum</i>)	9
7. Quality determination of the chemical properties of different branded edible oils when subjected to frying temperatures	9
8. To determine the effect of green tea on dopa oxidase activity of mushroom tyrosinase.	6



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Effect of Ultraviolet radiation on germination and chlorophyll content in wheatgrass- *Triticum aestivum*

Shiv Ramveer Vasa, Dhruv Singh Chauhan, Aarti Jaswa, Devanshi Bhargava and Asmita Dubey.

Department of Life sciences and Biochemistry, St. Xavier's College Autonomous, Mumbai, Maharashtra.

Abstract:-

Climatic changes due to anthropogenic activities increase in ultraviolet radiation (400- 280nm) at Earth's surface, due to destruction of stratospheric ozone layer. UV-C radiation impacts biological systems drastically causing deleterious effects, including agricultural crops which can be severely affected by UV-C, decreasing the production and adding on to the world's food shortage crisis. To assess the impact of UV radiation on one of the major agricultural crop, common wheat (*Triticum aestivum*) was exposed to UV-C radiation (253.7nm) at different time intervals and the radiation effects were analysed through measurement of chlorophyll content, composition and germination rate. No significant change in chlorophyll content and composition was observed with interrupted 3 hours exposure, uninterrupted 8 hours exposure and 24 hours exposure, though germination rate and height of the plumules was observed to decreased significantly with 3.5 hours exposure for three days.

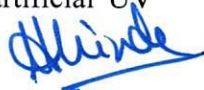
Introduction:-

About 8% of solar irradiance reaching the earth's surface consists of ultraviolet radiation, which is divided into UV-A (320-400 nm), UV-B (280-320 nm) and UV-C (200-280 nm). UV-C has an acute germicidal action and can induce delirious reactions in plant systems. Most of UV-C radiation is strongly absorbed by stratospheric ozone layer, hence except on high mountains, the UV-C radiations incident on the earth's surface is inconsequential [2]. Nevertheless, due to anthropogenic activities involving the production of substances which alter the composition of ozone layer such as chlorofluorocarbons, in the past century has led to major depletion of the ozone layer, which was discovered in 1985. Research efforts have been directed towards determining the effects of UV radiation on the biological systems, largely due to growing concerns about the increased UV radiation reaching the Earth's surface as result of ozone layer depletion. [1]

Wheat being one of most consumed plants by humans; is cultivated around the globe in distinctly different environment and is often principal food in many regions of the world [3]. In a scenario, where the UV-C radiation on Earth's surface increases drastically, the knowledge about its impact on such major agricultural crops becomes pertinent, in order to adapt and mitigate the losses in the production output. To assess damage, artificial UV



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

radiation is exposed to the wheatgrass at different time intervals. The effect of repair mechanisms of the plant was also taken into consideration as one set of UV exposure was interrupted, providing time for the grass to activate repair mechanisms. Germination rate, chlorophyll content and composition are parameters considered to indirectly analyse the effect of UV-C on the fitness of the plant.

Leaf Chlorophyll content and composition indirectly provides essential information about how plants react to various external environmental factors and therefore is used as physiological parameter to determine UV-C sensitivity of the species [3]. Acetone was used to extract chlorophyll pigments from the grass and was measured using spectrophotometer; TLC was performed to check for changes in the pigment composition [4]. During germination stages, as plants are more susceptible to environmental stresses, length of plumules of the wheatgrass after 3 days UV exposure was measured to determine the germination rate.[5]

Materials and methods:-

8 hours and 24 hours exposure

Seeds of common wheat, *Triticum aestivum* was obtained from the local grocery store and grown in 6 paper cups with 10 to 15 grams of soil. The seeds were regularly watered and were allowed to grow in constant conditions for 9 days. On the 10th day after the seeds are sown, 3 cups (test) were exposed to UV radiation from the UV lamp which provided a 253.7 nm irradiation for either 8 or 24 hour time period without any interruption in the exposure. The other 3 cups (control) were maintained under constant conditions during the exposure time.

After the exposure, both control and test shoots were cut and 10g from each cup was weighted and homogenized with 20 ml of 90% acetone individually using mortar and pestle to extract the chlorophyll pigments from the leaves blades. The homogenate from each cup was labelled separated, centrifuged at 5000 rpm for 5 minutes twice with subsequent washing and the supernatant was diluted to equal volume (50ml) using 90% acetone. The absorbance was measured using Phramaspec UV-1700 UV-Visible Spectrophotometer by Shimadzu using the spectrum analysis protocol and the readings were recorded. This procedure was repeated thrice to obtain 9 control and 9 test readings with absorbance values at 430 nm and 663nm (Chlorophyll A peaks), for 8 hour and 24 hour exposure separately. The readings were compiled and statically analysed using two tailed t test.

To examine any changes in chlorophyll pigment composition, 4 ml of acetone extract was evaporated to dryness in individual petri plates and 2 ml of diethyl ether was added and the solution was spotted onto pre-activated TLC Silica gel 60G F₂₅₄ plates. The TLC plates were placed in the TLC chamber containing solvent system (petroleum ether: diethylamine: ethylacetate in 58:30:12 ratio) for 5 to 10 minutes. The pigment bands of the control were compared to the test pigment bands and the results were recorded.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

3 hours interrupted exposure

Same protocol was followed as above, except the plants were exposed to the UV for 3 hours on 3rd, 4th and 5th day after sowing. The plants for homogenized on the 5th day and measured using spectrophometric and TLC was performed. The readings were compiled and statically analysed using two tailed t test.

Germination

15 seeds were placed in 12 petri plates each, using water absorbent cotton as substratum for the seed germination. 6 of the petri plates (test) were exposed to UV for 3.5 hours for three days, including the day seeds were sown while the other 6 remained in constant conditions. After the three day staggered exposure, the plumules length was measured in centimetres and recorded. The seeds with no germination were recorded as 0 centimetres. The reading were compiled and the statically analysed using a two tail t test.

Results:-

Exposure	t Stat	t critical two tail	P(T<=t)	df
3 hours interrupted	1.60698593	2.1199053	0.12760979	16
8 hours	1.03742972	2.1199053	0.31496089	16
24 hours	-1.9133856	2.1199053	0.07376425	16

Table 1: Statistical results of two tailed t test at 430nm absorbance readings.

Exposure	t Stat	t critical two tail	P(T<=t)	df
3 hours interrupted	1.88474299	2.1199053	0.07776215	16
8 hours	1.0634555	2.1199053	0.30336303	16
24 hours	-2.2754787	2.1199053	0.03698341	16

Table 2: Statistical results of two tailed t test at 663nm absorbance readings.

3 hours staggered exposure


As shown in table 1 and table 2, t Stat of both 430nm and 663nm are lower than t critical, hence there is no significant difference between chlorophyll content of test and control.

8 hours

As shown in table 1 and table 2, t Stat of both 430nm and 663nm are lower than t critical, hence there is no significant difference between chlorophyll content of test and control.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

24 hours exposure

As shown in table 1, t Stat of 430nm is lower than t critical, hence there is no significant difference between chlorophyll content of test and control at 430nm.

From table 2, t Stat of 663nm is greater than t critical, hence there is a significant difference between chlorophyll content of test and control at 663nm.

Germination

For germination; the t critical two tail was 1.97338089, t Stat was 2.58524922, P (T<=t) is 0.01053127 and df is 178. As, t Stat is greater than t critical, the difference was statically significant and figure 1 depicts an sharp decrease in the length of plumules of UV exposed seeds vs control.

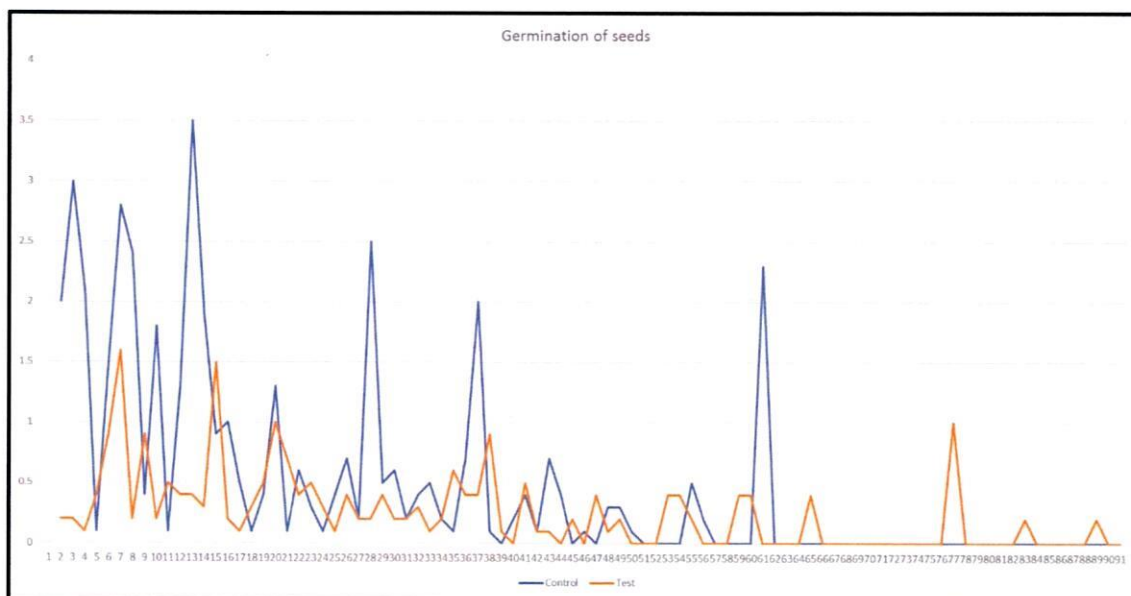


Figure 1: Graph depicting, difference in plumule lengths of control (blue) and test (red).

Thin layer chromatography (TLC)

There was no change observed in the pigment bands obtained using TLC, between test and control of 3 hours, 8 hours and 24 hours exposure.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

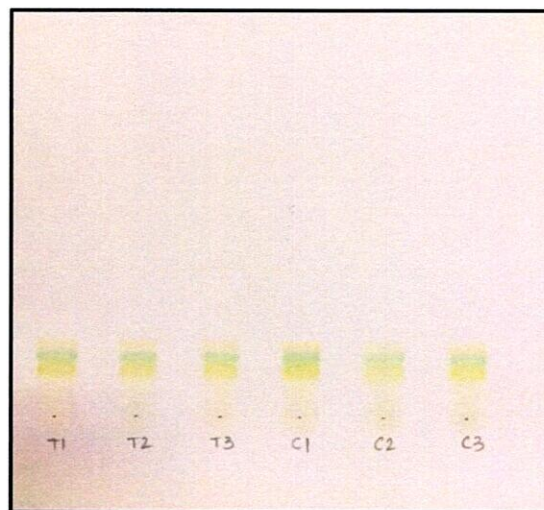


Figure 2: TLC plate with 24 hours exposure extract.

Discussion:-

Exposure of UV-C to germinated plants does not seem to have any significant effect on the chlorophyll content or composition, as showed by the statistical tests. Though, there is significant difference between test and control chlorophyll content at 663 nm of 24 hours exposed plants; this trend can be attributed to low statistically power as all the other trends of the study and background literature review is contrary to increase in chlorophyll content by UV exposure [6]. The similar chlorophyll levels and pigments composition in control and test plants portray the resilience of the wheat grass to external stress such as UV provided by the action of photo-protective flavonoids. The production of a class of secondary plant phenolics, flavonoids which have significant anti oxidative and chelating properties is upregulated, as these accumulate at the leaf surfaces and form a 'sunscreen' by absorbing most of the UV radiation, preventing the exposure to chloroplasts. Furthermore, flavonoids are involved in transferring electrons free radicals, chelate metal catalysts, activate antioxidant enzymes and inhibit oxidases and scavenge UV generated ROS. [8]

Germination of the seeds is significantly affected by the UV-C irradiation, as the seeds exposed to UV during germination periods showed shorter plumule length as compared to control. These results correlated with those of Noble (2002), who concluded that prolonged UV-irradiation leads to shunted root and shoot growth in cabbage, radish and agave seeds. Noble (2002), also portrayed the increase in germination rate of the UV exposed seeds, which was not include in our study, therefore is possible limitation, which if overcome would provide more data to support the previous literature.[7]



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.




ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

References:-

- [1] Gao, W., J.R. Slusser, R.H. Grant, and G.M. Heisler. 2003. UV Radiation and Its Impacts on Agriculture and Forests, Journal of Agricultural and Forest Meteorology, Volume 120, Number 1-4
- [2] Castronuovo, Donato & Tataranni, Giuseppe & Lovelli, Stella & Candido, Vincenzo & Sofo, Adriano & Scopa, Antonio. (2013). UV-C irradiation effects on young tomato plants: first results. Pakistan Journal of Botany.
- [3] Abdelghafar M. Abu-Elsaoud and Heba M. Hassan 2015 AMERICAN-EURASIAN JOURNAL OF SUSTAINABLE AGRICULTURE. 9(8) December 2015, Pages: 12-21
- [4] Vidyasagar P, Jagtap S, et al. Effects of hypergravity on the chlorophyll content and growth of root and shoot during development in rice plants, In: Photosynthesis. Energy from the Sun, Springer Netherlands, (2008), 1599–1602.
- [5] Hock M, Beckmann M, Hofmann RW, Bruelheide H, Erfmeier A (2015) Effects of UV-B radiation on germination characteristics in invasive plants in New Zealand. NeoBiota 26: 21-37. <https://doi.org/10.3897/neobiota.26.4405>
- [6] Bridgen, M.P. (2016). Using ultraviolet-C (UV-C) irradiation on greenhouse ornamental plants for growth regulation. Acta Hort. 1134, 49-56 DOI: 10.17660/ActaHortic.2016.1134.7 <https://doi.org/10.17660/ActaHortic.2016.1134.7>
- [7] Noble, R., 2002. Effect of UV irradiation on seed germination. The Sci. of total Environ., 299: 173-176.
- [8] Saewan N, Jimtaisong A. Photoprotection of natural flavonoids Journal of Applied Pharmaceutical Science. 3: 129-141. DOI: 10.7324/JAPS.2013.3923



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Study of effect of heat treatment on oil quality based on acid value, peroxide value and carotenoid content

Geervani M, Anish Ittoop John Vazhapilly, Anushika Paul, Bibakhya Saikia, Lavanya Kandothakandy, Mubasshira Mazharul Haque, Rebekah Emelina D'Cunha Ritvik Chandavarkar, Tracy Richard Dsilva,

Department of Biochemistry and Life Sciences,
St. Xavier's College- Autonomous
Mumbai

Abstract

This work reports the use of analytical methods namely volumetric estimation and colorimetry to detect the changes in the edible oil samples with respect to acid value, peroxide value and carotenoid content after being subjected to various heat treatments which represents shallow frying and repeated deep frying. This involves the comparison of the values immediately after being subjected to the heat treatment and after 24 hours of storage of the treated oil samples. A two way ANOVA test was carried out and the results showed a significant variation in the acid value and peroxide value. Carotenoid content of Mustard oil could be detected while that of other oil samples could not be detected. Further statistical analysis needs to be carried out.


Introduction

There are several types of oils available in the market for various purposes. These oils comprise fatty acid molecules that have a methyl terminus and a carboxylic acid head group with a variable length of carbon chain [3]. They are categorised based on the degree of saturation of their carbon chains [3]. Maximum numbers of hydrogen atoms are present in saturated fatty acids as in Coconut oil, while monounsaturated as in olive oil and polyunsaturated fatty acids as in corn oil have one, two or more double bonds, respectively [3]. PUFAs are classified based on the location of the first double bond with respect to the methyl terminus of the chain [3].

These various types of oils include edible oils, oils used in cosmetics etc. One of the oldest procedures known in human history includes food frying which is carried out using oils and fats [1]. The major composition of these frying mediums which is triacylglycerols and fatty acids get oxidised during frying and form primary oxidation products which include hydroperoxides, epoxides, epidioxides, hydroxides and several other products [1]. Thus, estimation of the peroxide value after the heat treatment is an important determinant of the quality of the oil.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Another aspect that is important is the acid value of the oil which indicates the quality of the edible oil. Acid value can be expressed as the amount of KOH (in milligrams) necessary to neutralize the free fatty acids contained in 1g of oil [4]. The acid value of oil increases during storage and therefore, relies upon the free fatty acid content.

Carotenoids found in oils are major groups of natural pigments that have been utilized in the food industry widely due to their nutritional and colorant properties [5]. The carotenoids have provitamin A and antioxidant function due to which they also play a significant role as food ingredients. The antioxidant activity is beneficial by way of reduced risk of lung and colon cancers.

These three parameters were chosen to study since these play an important role in determining the quality, shelf life and health benefits.

Null Hypothesis: No significant change in quality parameters of oil that is the acid value, peroxide value and carotenoid value is observed exposed to elevated temperatures of relevance to cooking and kept standing for one business day.

Materials and Methods

Sample source

Four different oil samples such as Paneri Coconut oil (RP 11), RRO Mastdil Mustard Oil (A50), Figaro Olive Oil (L73369) and Liberty Sunflower Oil (SHA110) were used for our study. These oils were subjected to different temperatures to check their various characteristics. To imitate shallow frying, heating was done at 150° C for 3 minutes and repeated deep frying at 170° C for different time intervals. (The time intervals chosen were 6 minutes, 6 followed by 8 minutes with an interval of 5 minutes and; 6, followed by 8 and 3 minutes with intervals of 5 minutes). These samples were aliquoted, wherein the first aliquot was studied immediately and the second aliquot was used after 24 hours for the study of the parameters.

Parameters study

1. Determination of Acid Value

Volumetric estimation method was carried out to determine the acid value of the oil samples. 2ml of the sample was dissolved in 10ml of neutral solvent and was titrated against 0.1N KOH using phenolphthalein as the indicator.


Neutral solvent: mix 25 ml ether, 95% (V/V) ethanol and 1 ml phenolphthalein and neutralize with 0.1 N alkali.

0.1 N KOH: dissolve 0.36g of KOH in 100ml distilled water.

Phenolphthalein: 1g in 100ml of 95.6 (V/V) ethanol.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

2. Determination of Peroxide Value

Volumetric estimation method was carried out in order to determine the peroxide value of the oil samples. 5g of sample was dissolved in 30 ml of organic solvent. 0.5ml of saturated KI solution followed by 3ml of distilled water was added and this solution was titrated against 0.01 M sodium thiosulphate until the solution turned pale yellow. 1 ml of 1% starch was used as the indicator and titrated until the blue colour disappeared.

Organic solvent: Acetic acid: Chloroform: 3:2

Mix 300 ml of Acetic acid with 200 ml of Chloroform

1% starch: Mix 1 g of Starch in 100 ml of boiling water

3. Determination of the Total Carotenoid Content

4 ml of diethyl ether was added to 0.5ml of the oil sample. 0.5ml of saturated KOH was added to saponify the mixture and this was incubated in dark for 30 minutes. After the incubation period was over, 5ml of distilled water was added and centrifuged at 3600 rpm for 4 minutes. The top layer of diethyl ether containing the total carotenoid content from the oil samples was measured colorimetrically at 450nm, using diethyl ether as the blank.

4. ANOVA

A two way ANOVA test was carried out for the results obtained for the acid value and the peroxide value which was carried out twice in triplicates. This test was carried out in excel sheets and graphs were plotted based on that while the results have been recorded as 'mean value \pm standard deviation'.

RESULTS and DISCUSSION

Standardisation of KOH

Acid Value

Acid Value = $\frac{\text{Titre value} * \text{normality of KOH} * \text{molecular weight of KOH}}{\text{Weight of the sample}}$

Weight of the sample



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



Table 1: Acid Value before 24 hours

ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Oil samples	1.335429	9	0.148381	49.6093	8.88E-33	1.975806
Heat Treatments	9.504889	11	0.864081	288.8945	5.27E-70	1.886684
Error	0.296108	99	0.002991			
Total	11.13643	119				

Table 2: Acid Value after 24 hours

ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Oil Samples	2.125668	8	0.265709	20.50468	3.62E-17	2.045414
Heat Treatments	8.44291	11	0.767537	59.23072	7.51E-36	1.899171
Error	1.140342	88	0.012958			
Total	11.70892	107				

Table 3: Before and after 24 hours

ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Oil Samples	3.862145	19	0.203271	23.90903	2.86E-42	1.636538
Heat Treatments	18.36994	11	1.669995	196.4274	1.1E-103	1.834681
Error	1.776885	209	0.008502			
Total	24.00897	239				

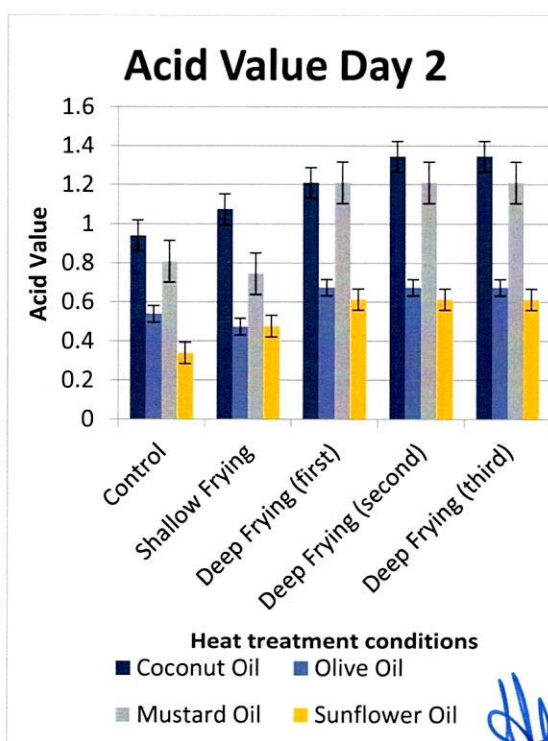
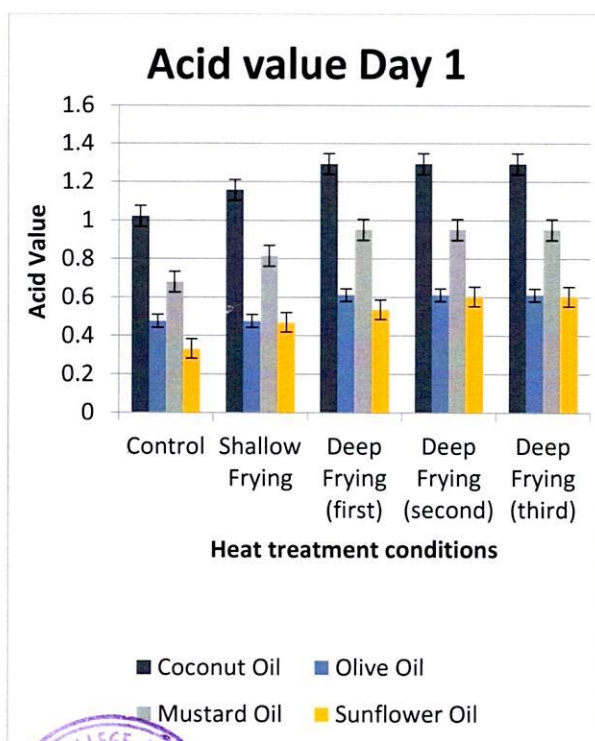
The two way ANOVA test was carried out for the acid value as shown in Table 2, 3 and 4; and a significant variation in the results were observed within the oil samples and also across the four groups of oil samples. The F critical value is much smaller than the F value which shows that there is a high variation in the results and thus the null hypothesis is rejected.





Table 4: Acid Value after 24 hours

ACID VALUE					
Oil Samples	Control	Shallow Frying	Deep Frying (first)	Deep Frying (second)	Deep Frying (third)
Coconut Oil	1.021±0.086	1.157±0.088	1.293±0.089	1.293±0.089	1.293±0.089
Coconut Oil (After 24 hours)	0.940±0.126	1.074±0.123	1.209±0.120	1.344±0.112	1.344±0.112
Olive Oil (Day 1)	0.476±0.070	0.476±0.070	0.612±0.067	0.612±0.067	0.612±0.067
Olive Oil (Day 2)	0.538±0.013	0.473±0.085	0.673±0.015	0.673±0.015	0.673±0.015
Mustard Oil (Day 1)	0.680±0.007	0.816±0.009	0.952±0.011	0.952±0.011	0.952±0.011
Mustard Oil (Day 2)	0.808±0.018	0.744±0.238	1.210±0.026	1.210±0.026	1.210±0.026
Sunflower Oil (Day 1)	0.334±0.066	0.470±0.063	0.536±0.135	0.604±0.060	0.604±0.060
Sunflower Oil (Day 2)	0.340±0.078	0.476±0.080	0.6125±0.081	0.6125±0.081	0.6125±0.081





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

It was observed that there was a gradual increase in the acid value in all the four oil samples on day 1 of the experiments which indicates that repeated heating causes an increase in the acid value. The acid value of Coconut oil surprisingly decreased with storage though the final value showed an increase while other three oil samples showed an increase in the acid value.

Olive oil and Sunflower oil had little change with repeated deep frying, so, they are relatively stable and hence better for consumption. Acid value of the oil also increases with time as shown in Table 1; this decreases the shelf life since the oil becomes rancid. Coconut oil has the highest acid value, mustard oil has the second highest acid value and; sunflower oil has the least acid value among the samples as shown in the two graphs for acid value.

The bar graph depicts the heat treatment conditions that the samples were subjected to and the acid values of each along with standard errors.

PEROXIDE VALUE

Table 5: Before 24 hours

ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Oil Samples	1074.603	9	119.4003	23.5339	5.89E-21	1.975806
Heat Treatments	4714.809	11	428.619	84.48116	3.18E-45	1.886684
Error	502.281	99	5.073545			
Total	6291.693	119				

Table 6: After 24 hours

ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Oil Samples	601.1467	8	75.14333	16.85859	6.57E-15	2.045414
Heat Treatments	2996.2	11	272.3818	61.10952	2.27E-36	1.899171
Error	392.24	88	4.457273			
Total	3989.587	107				



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Table 7: Before and after 24 hours

ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Oil Samples	2011.644	19	105.876	13.38604	8.58E-27	1.636538
Heat Treatments	7634.868	11	694.0789	87.75328	5.04E-72	1.834681
Error	1653.072	209	7.909435			
Total	11299.58	239				


The two way ANOVA of the peroxide value of the four oil samples were recorded as shown in table 6 and 7. It shows a high degree of variation which reflects on the difference in the values obtained for oils within the groups and also across the groups. Thus, the null hypothesis will have to be rejected.

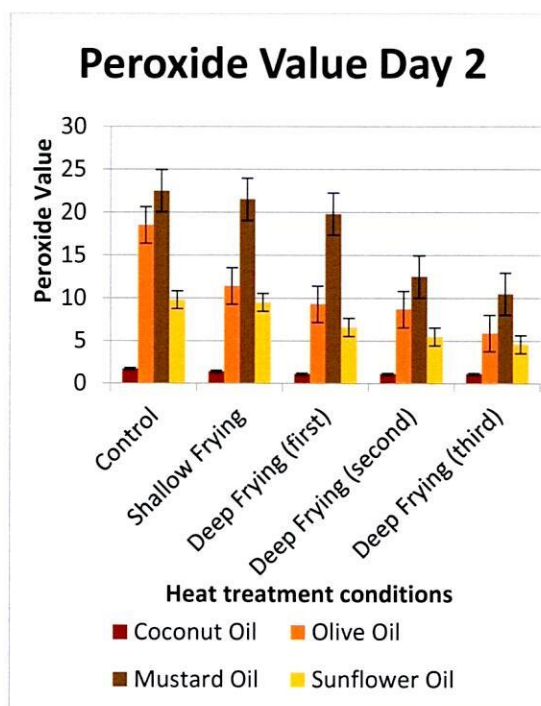
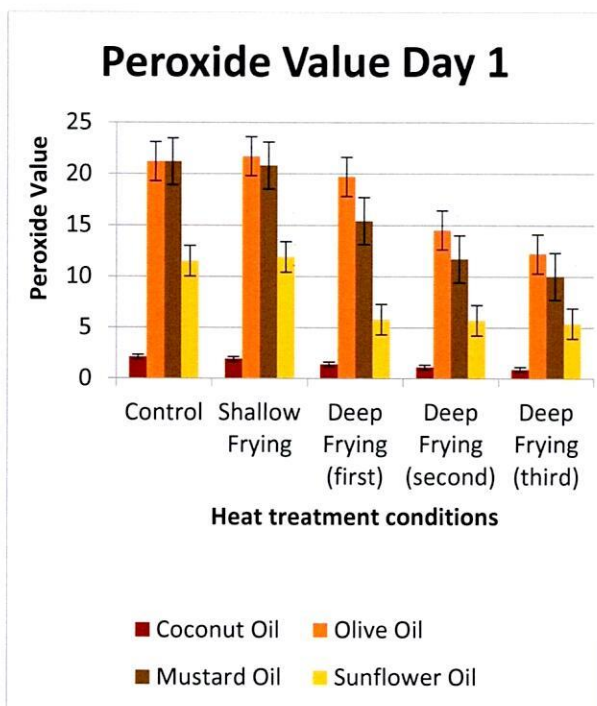
Table 8

PEROXIDE VALUE					
Oil Samples	Control	Shallow Frying	Deep Frying (first)	Deep Frying (second)	Deep Frying (third)
Coconut Oil (Day 1)	2.1±0.109	1.9±0.109	1.4±0.219	1.1±0.109	0.9±0.109
Coconut Oil (Day 2)	1.7±0.109	1.4±0.219	1.1±0.109	1.1±0.109	1.1±0.109
Olive Oil (Day 1)	21.2±0.657	21.7±1.424	19.7±0.329	14.5±1.643	12.2±0.219
Olive Oil (Day 2)	18.5±0.548	11.4±0.876	9.3±0.328	8.7±0.766	5.9±0.328
Mustard Oil (Day 1)	21.2±1.314	20.8±1.314	15.4±5.039	11.7±1.862	10.0±0.00
Mustard Oil (Day 2)	22.5±1.643	21.5±1.643	19.8±0.219	12.5±1.205	10.5±0.548
Sunflower Oil (Day 1)	11.5±0.109	11.9±0.109	5.8±0.219	5.7±0.109	5.4±0.219
Sunflower Oil (Day 2)	9.8±0.219	9.5±0.109	6.6±0.219	5.5±0.109	4.6±0.00



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



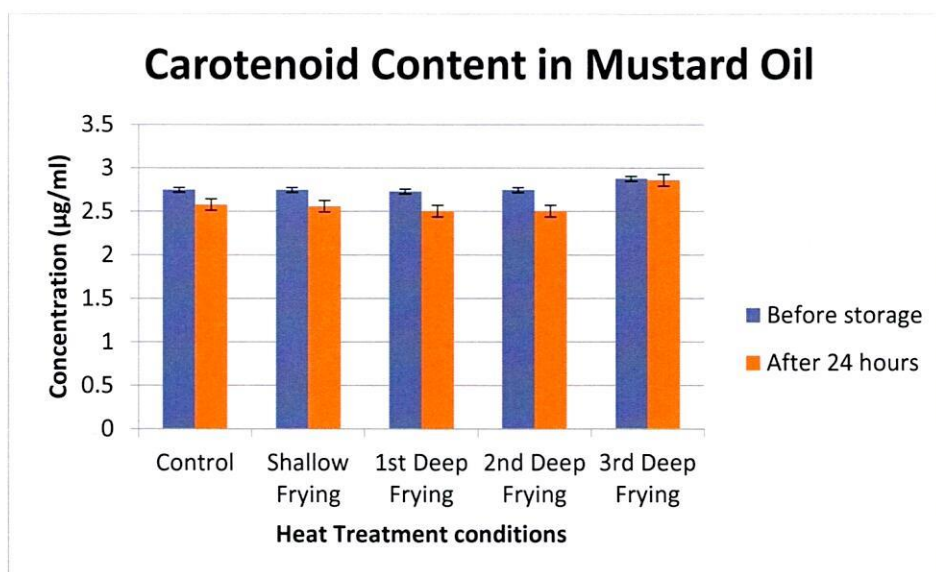
A gradual decrease of the peroxide value was observed for three oil samples: Coconut, Olive and Sunflower that were subjected to the heat treatment and this inaccuracy could be attributed to experimental error. There has been an increase in the peroxide value in Mustard oil which is the ideal result. The peroxide value is least for coconut oil and maximum for mustard oil which indicates that mustard oil has undergone maximum hydrolysis due to which it has a higher content of free fatty acids compared to the other three samples, while, coconut oil has undergone very little hydrolysis. Peroxide value provides an initial evidence of rancidity, i.e. primary oxidation.

Table 9: Carotenoid Content

MUSTARD OIL

Oil Sample	Control	Shallow frying	1 st deep frying	2 nd deep frying	3 rd deep frying
Mustard oil	2.748±0.266	2.748±0.00	2.729±0.079	2.748±0.106	2.879±0.133
Mustard oil (After 24 hours)	2.579±0.186	2.560±0.053	2.503±0.027	2.503±0.027	2.861±0.00





Interestingly, only the carotenoid content in mustard oil could be detected while the values for other samples could not be detected by this method. It is observed that the carotenoid content for mustard oil decreased which contradicts the ideal result of increase in the value with time.

The results of peroxide value and the carotenoid content of the mustard oil is contradicting since the carotenoids are antioxidants and prevent oxidation of fats and oils. Hence, the mustard oil should have had lesser peroxide value. The results obtained in the peroxide value could be due to experimental error or this result might be accurate if the peroxide values of other three samples are not considered but this also means other oil samples should have had detectable carotenoid content.

An alternative method could be used to rectify these errors.

Conclusion

Four edible oils were chosen on the basis of popularity among consumers, economic value and health benefits and these were Paneri Coconut oil (RP 11), RRO Mastdil Mustard Oil (A50), Figaro Olive Oil (L73369) and Liberty Sunflower Oil (SHA110). Analytical methods: Volumetric estimation and colorimetry were carried out to study the quality of edible oils that were subjected to heat treatment of elevated temperatures of relevance to cooking. The parameters chosen were acid value, peroxide value and carotenoid content since these parameters provide a significant evidence about the rancidity, free fatty acids, extent of oxidation and therefore, the quality and shelf life of the edible oil. A two way ANOVA test was carried out after obtaining the results of volumetric estimation and colorimetric analyses. Bar graphs were plotted based on the results obtained using ANOVA. A high degree of variance was observed in the acid value and also in the peroxide value both within the oil sample subjected to different heat treatments and also across the four different oil samples.





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Sunflower oil had the least acid value while mustard oil, the highest. Mustard oil also seemed to have the highest peroxide value and also showed a decrease in the peroxide and carotenoid content which reflects contradicting results. Ideally, the peroxide value and the carotenoid content should increase but mustard oil sample showed the exact opposite results for both. This could be attributed to the experimental error where the reagents used could be faulty or the oil sample might be wrong. Alternative methods must be carried out to confirm the same since the results are inaccurate in some cases. Further statistics is required to be carried out which couldn't be carried out due to lack of time

References:

1. Zeb, Alam and Ullah, Fareed. A simple spectrophotometric method for the determination of thiobarbituric acid reactive substances in fried fast foods. *Journal of Analytical Methods in Chemistry* (2016).
2. Ander, B.P., Dupasquier, MCC, Prociuk, A.M., Pierce, G.N. Polyunsaturated fatty acids and their effects on cardiovascular disease. *Experimental and Clinical Cardiology* (2003).
3. Kardash, E. and Tur'yan Y. I. Acid value determination in vegetable oils by indirect titration in aqueous-alcohol media. *Croatica Chemica Acta* (2005). Vol 78(1). Pp: 99-103.
4. Méndez, D.H., Gálvez, A. P. and Mosquera M.I.M. A rapid spectrophotometric method for the determination of peroxide value in food lipids with high carotenoid content. *Journal of the Americal Oil Chemists' Society* (2011). Vol 78 (11). Pp: 1151-1155.
5. Kaur, k., Shivhare U.S., Basu, S. and Raghavan G.S. Kinetics of Extraction of β -carotene from Tray Dried Carrots by Using Supercritical Fluid Extraction Technique. *Food and Nutrition Sciences* (2012). Vol 3 (5)
6. Falade, A.O. and Oboh G. Thermal Oxidation Induces Lipid Peroxidation and Changes in the Physiocochemical Properties and β -carotene Content of Arachis Oil. *International Journal of Food Science* (2015).


APPENDIX

Oils:

BRAND	OIL	BATCH	DATE OF MANUFACTURE	DATE OF EXPIRY
RRO Mastdil	Mustard Oil	A50	12.2017	12.2018
PANERI	Coconut Oil	RP11	11.2017	04.2019
FIGARO	Olive Oil	L73369	08.17	08.20
LIBERTY	Sunflower Oil	SHA110	11.2017	05.2017



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Department of Life Science and Biochemistry – Projects (2016-17)

Comparison between two varieties of bananas based on changing reducing sugar and starch content during ripening

V. Gupta*, A. Kathilal, K. Kale, K. Shah, J. Varkey, S. Dbritto

Department of Biochemistry, St. Xavier's College, Mumbai 400001, India

Abstract

This research was carried out to determine which variety of banana would be suitable for a diabetic person. Two varieties of bananas were used in this research – velchi and green banana. Banana is considered to be a healthy fruit for a diabetic person due to its low glycemic index. To determine the reducing sugar content of the fruit, refractometer and DNSA methods were used and the results of the two varieties of bananas used were compared using graphs, T tests and two way ANOVA. An increasing trend for the concentration of reducing sugars was observed as the bananas ripen which was expected. It was observed that velchi has a higher concentration of reducing sugars than green banana but its portion size and therefore further research needs to be carried out with more varieties of bananas.

Keywords: Velchi, Green banana, DNSA, refractometer

Introduction

Banana is a tropical fruit belonging to the Musaceae family. It is known that as bananas ripen, their reducing sugar content increases, they soften and their starch content decreases. Amylase is the enzyme that makes them sweet and pectinase is what makes them soft with time by breaking down pectin. When bananas are kept together in a closed container, they tend to ripen faster as they (and all fruits in general) release ethylene gas. As they ripen, the amount of chlorophyll in them decreases which allows carotid pigments to show their yellow colour (Omulo, 2015). However this doesn't happen in all types of bananas. Some bananas remain green even after they ripen. The bananas that are sold in the market are kept in the gas chamber for a day as this significantly enhances their ripening process which otherwise takes more than a couple of weeks. Bananas have a low glycemic index. The glycemic index is a value assigned to a food item based on how slowly or how quickly it causes increases in blood glucose levels. Bananas also have resistant starch, starch that resists digestion because of high amylase content. It is fermented by bacteria in large intestine to give short chain fatty acids and some metabolites which appear to alter secretion of hormones, reduce colon cancer precursors and regulate

macronutrient metabolism which can lead to improved mental and physical health (Burt, 2013). This research project was undertaken to determine which of the two varieties of bananas (green banana and velchi) has less reducing sugar content and is healthier for individuals suffering from diabetes mellitus. Banana was selected for the project because it is inexpensive and the ripe and the unripe stages can be clearly distinguished.

Materials and Methods:

3 different Batches of Safed Velchi and Green Banana were bought from Gupta Vendor, Dadar Market (Shop No. 153/154, SVS. Market, D'silva Road, Dadar (W) Mumbai-28).

Reducing sugars estimation using DNSA


Approximately 5g of it was weighed using the Electronic balance (from CONTECH Instruments Ltd., model number – CA-223). It was blended using a mixer grinder and washed with a total of 40ml of distilled water. The contents were poured into centrifuge tubes and they were balanced by weight. The tubes were centrifuged at 4000rpm at 25°C for 5 minutes in the Eppendorf Centrifuge (5810 R, REMI C-24 PLUS, rotor number 13), REMI CM 101 cyclo mixer. The volume of the supernatant was measured using a measuring cylinder. It was diluted depending upon what day banana was blended and DNSA (Miller, 1958) [It was prepared by dissolving 20g of DNSA powder (from Loba Chemie) in 400 ml of 2N NaOH to which 100ml of distilled water was added. After complete dissolution, 600g of Sodium potassium tartarate was added and the volume is made up to 2000ml.] was performed with the diluted supernatant. The absorbance values were taken at 520nm using the Elico CL 63 calorimeter. The concentration of reducing sugars in the supernatant was calculated.

Starch

Approximately, 10 g of banana was weighed. It was blended and washed with a total of 60 ml of 1% NaHSO₃ (was prepared by dissolving 5g of the compound in a little amount of water and diluting it up to 500ml, from West Coast Laboratories. It was obtained from the Department



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



of Chemistry, St.Xavier's College). The contents were centrifuged at 5500rpm at 4°C for 20 minutes. The supernatant was decanted and the pellet was then suspended in ethanol (from M/S Gogia and Company) and transferred to a beaker. 3 ethanol washes were performed. It was left overnight in the refrigerator and the next day with solvent ether (from Industrial Solvents and Chemicals Pvt. Ltd.) 3 washes were performed. It was dried in the incubator (from TEMPO Industrial Corporation) at 37°C till the product was completely dried and the smell of ether was no longer there. The starch weight was measured using electronic balance and the percent yield was calculated.

Reducing sugars estimation using refractometer:

For calibration of the Erma hand refractometer, 3 drops of distilled water was put on the measuring surface. The day light plate was put down such that no air bubbles were formed. It was viewed through the eye piece and the calibration screw was turned until the boundary between the upper blue field and the lower white field meets exactly at zero. Once the calibration was done, the calibration screw was not used anymore. The measuring surface was cleaned with a soft tissue. 3 drops of the sample was added and readings were then taken.

Results:

Reducing sugars v/s Starch

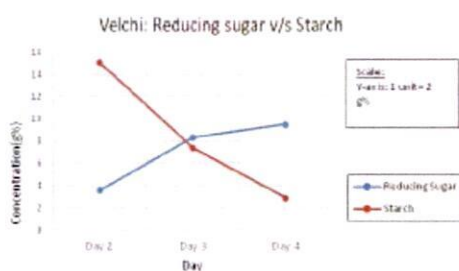


Fig1: Velchi: Reducing sugars v/s starch

Green Banana- Starch vs Reducing Sugar

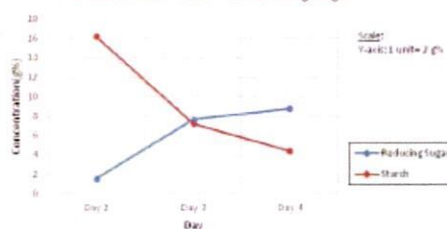


Fig 2: Green banana: Reducing sugars v/s starch

A graph was plotted to observe the trend of reducing sugars and starch as the banana ripens. In both green banana and velchi, the reducing sugar content increases more between the second and the third day than between the third and the fourth day and the starch content decreases more between the second and the third day than between the third and the fourth.

Comparison between the reducing sugar concentration of green banana and velchi by DNSA method

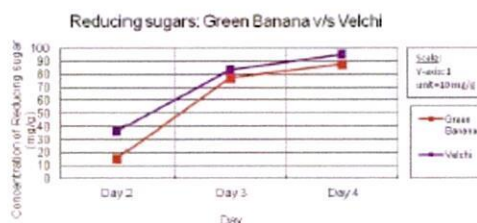


Fig 3: Reducing sugars in green banana and velchi by DNSA method

It was found that the reducing sugar concentration in velchi is more than that in green banana, but the trend is almost similar. T test was carried out to check difference in sugar content between different days. No significant difference was observed between day 3 and day 4. Two way ANOVA was carried out for the differences in the reducing sugar content between the 2 varieties and no significant difference was found between sugar content of the varieties.

Comparison between the reducing sugar concentration of green banana and velchi by refractometer



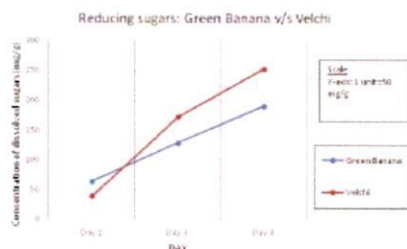


Fig 4: Comparison of reducing sugars in green banana and velchi by refractometer

It was observed that on day 2 the concentration of reducing sugars is more in green banana than in velchi and on all the subsequent days, it is more in velchi. T test was carried out and significant differences between the reducing sugar content were observed between all 3 days.

Discussion

The basic purpose of the project was to determine which variety of the banana is suitable for a diabetic patient. Based on the results, it can be concluded that velchi banana has a higher concentration of sugars, but

the portion size of a velchi banana is much less than the portion size of a green banana. Thus, it can't be determined, on the basis of this project, which one would be a better choice for a diabetic patient. However, eating a day 3 banana is better as at that point it is not very raw and it also doesn't have a lot of sugar content. Further experimentation could be based on testing more varieties of banana and taking more sets of observations to reduce the error margin.

References

1. Burt, D. F. (2013). Resistant Starch: Promise for Improving Human Health. *Advances in Nutrition*, 15.
2. Miller, G.L. (1958). Use of Dinitrosalicylic Acid Reagent for Determination of Reducing Sugar.
3. Omulo, G. (2015). Harnessing of banana ripening process for banana juice extraction in Uganda

Acknowledgements

We thank the Department of Life Science and Biochemistry for giving us the necessary facilities to carry out this project.





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Estimation of total polyphenol content in light chocolates and dark chocolates

Khyati Patel¹*, Judith Evangeline, Lizanne Oliveira, Mohammed R. Ansari, Pranjali Divekar, Vinsea AV Singh

Department of Life Sciences and Biochemistry, St. Xavier's College, Mumbai 400001, India

Antioxidants have various metabolic functions in our body, they can be formed naturally or obtained through diet. They help quenching the free radicals and prevent severe tissue damage. Chocolates are a common source of dietary antioxidants. Cocoa beans which form a major ingredient of chocolates are high in polyphenols and flavonols that are known to have antioxidant activity. However the amount of compounds having antioxidant activity varies as the quality, manufacturing of beans and chocolates vary. This study compares six easily available and commonly consumed chocolates of different brands, Dairy milk, Galaxy, Nestle, Amul, Don Monte, Bournville for their total polyphenol content. Amongst the light chocolates tested, Galaxy and Dairy milk showed the least and the highest polyphenol content respectively. Whereas in the dark category, Amul showed the highest polyphenol content but the maximum hydrogen peroxide scavenging was shown by Don Monte.

Key words: Antioxidants, chocolates, total polyphenols, hydrogen peroxide scavenging.

Oxidants are known to cause serious damage to the body tissues, these are also known to cause DNA damage often leading to diseases like cancer, immune system decline, brain dysfunction etc. (Ames Bruce et. Al, 1993) Antioxidants help relieve this oxidative stress by

quenching the free radicals (oxidants), these antioxidants can be obtained from various sources. Most common sources of antioxidants are tea, berries, beans and chocolate. Infact some studies state that cacao beans have a higher total polyphenol and flavanol content than commercially known 'superfruits' (Stephen Crozier et al., 2013) and these flavonols can act as strong antioxidants.

As the cocoa content and the manufacturing processes of the chocolates vary, the total polyphenol and flavanol content also varies. There are studies that also suggest the vascular health benefits of cocoa polyphenols. (Visioli et al. 2009; Galleano et al. 2009; Corti et al. 2009). Cocoa also contains various compounds such as theobromine, caffeine and methylxanthine apart from polyphenols (Greer et al. 2001; Rios et al. 2003). Thus it cannot be said that the health benefits of cocoa are contributed only by polyphenols, however this study aims at estimating the total polyphenolic content in various chocolates, light and dark to study the variation in the content due to variation in the cocoa concentration and manufacturing processes.

Materials and methods:

Chocolates studied:
Mars Galaxy milk chocolate, Cadbury dairy milk, Nestle Milk chocolate were the light chocolate (less cocoa content) samples studied

1

*for correspondence (email: khyati.patel@xaviers.edu.in)





and 55% Amul Dark chocolate. Don Monte Dark chocolate and Cadbury Bournville were the dark chocolate (more cocoa content) samples studied.

Chemical sources and instruments used:
The Folin & Ciocalteu's Phenol reagent used was sourced from Sisco Research Laboratories, Sodium carbonate (Na_2CO_3) was sourced from West Coast Laboratories, Hydrogen peroxide (H_2O_2) was sourced from Fisher Scientific, Qualigens. All other chemicals used were analytical lab grade chemicals.

Preparation of the chocolate extract:
5g of chocolate sample was weighed using an electronic balance (Contech Instruments Ltd) and 1:1 diluted ethanol (ethanol, distilled water) was added to it to make a 50% (w/w) solution. This solution was kept in a -37°C incubator (Tempo industrial corporation) for 60 mins with intermittent stirring and then centrifuged at 4°C for 12 minutes at 16,000g in a refrigerated centrifuge (Centrifuge 5810 R, Eppendorf). The top layer containing cocoa butter and fats and the precipitate containing the cocoa solids were discarded, the middle aqueous layer was used as the chocolate extract for all the assays (McShea *et al.*, 2010)

Estimation of total polyphenolic content:
Folin-Ciocalteu assay was used to determine the total polyphenolic content in the chocolate sample extracts (Velioglu *et al.*, 1998). In brief, 0.1 mL of appropriately diluted extract sample was added to 0.75 mL of 1:10 diluted Folin Ciocalteu reagent (Folin Ciocalteu, distilled water). After 5 minutes of incubation at room temperature, 0.75 mL of 6% (w/v) Na_2CO_3 solution was added to it and the absorbance was measured after 90 minutes of incubation at room temperature at 765 nm using an ultraviolet (UV)-Vis spectrophotometer (Shimadzu UV-1700 Pharmaspec). Gallic acid in the concentration range 5mM to 50mM was used as the standard calibration curve and the results were expressed as g% of Gallic acid equivalence. (Maleyki and Ismail, 2010)

Hydrogen Peroxide Scavenging Assay:
A hydrogen peroxide scavenging assay was performed by the method of Ruch *et al.*, 1989. 40mM H_2O_2 was prepared in pH 7.2 phosphate

buffer. 0.2 mL of the undiluted chocolate extract was added to 1.2 mL of 40mM H_2O_2 in a 1.5mL eppendorf tube and kept for incubation at room temperature for 10 minutes. Absorbance readings were taken at 600nm using a Systronics colorimeter against a blank solution containing phosphate buffer and extract without the H_2O_2 . (Keezer *et al.*, 2012)

Statistical analysis:
Data was presented in the form of mean value \pm standard deviation (SD) for four sets of readings. The data was analyzed using Student's t-test and f-test. All statistical calculations were done using Microsoft Excel 2007 & 2013.

Results and discussion:

Estimation of total polyphenol content:

Chocolate	g% equivalence of Gallic acid
Dairy milk	1.587 \pm 0.514
Nestle	1.191 \pm 0.535
Galaxy	1.072 \pm 0.489
Bournville	4.322 \pm 1.925
Amul	6.862 \pm 1.877
Don Monte	3.320 \pm 0.367

Fig.1: Total polyphenol content

According to the data in the above table, the total polyphenol content of the three light chocolates samples i.e. Dairy Milk, Nestle, and Galaxy was estimated to be 1.587 \pm 0.514 g%, 1.191 \pm 0.535 g% and 1.072 \pm 0.489 g% equivalents of Gallic acid respectively. Similarly the polyphenol content of the dark chocolate samples, Bourneville, Amul, and Don Monte was found to be 4.322 \pm 1.925 g%, 6.862 \pm 1.877





g% and 3.32 ± 0.367 g% equivalents of Gallic acid respectively. The statistical analysis considered only the first three sets of readings as the fourth set was determined to be an outlier.

t-Test: Two-Sample Assuming Equal Variances

	Galaxy	Dairy Milk
Mean	1.295633	1.8079
Variance	0.060297	0.106409
Observations	3	3
Pooled Variance	0.083353	
Hypothesized Mean Difference	0	
df	4	
t Stat	-2.17311	
P(T<=t) one-tail	0.047739	
t Critical one-tail	2.131847	
P(T<=t) two-tail	0.095478	
t Critical two-tail	2.776445	

Fig.2: t-test between Galaxy & Dairy milk

t-Test: Two-Sample Assuming Equal Variances

	Nestle	Dairy Milk
Mean	1.4195	1.8079
Variance	0.11792	0.10640
Observations	5	9
Pooled Variance	0.11216	
Hypothesized Mean Difference	0	
df	7	
t Stat	-1.42034	
P(T<=t) one-tail	0.11426	
t Critical one-tail	2.13184	
P(T<=t) two-tail	0.22853	
t Critical two-tail	2.77644	

Fig.3: t-test between Nestle & Dairy milk

t-Test: Two-Sample Assuming Equal Variances

	Nestle	Galaxy
Mean	1.4195	1.29563
Variance	0.11792	0.06029
Observations	5	7
Pooled Variance	0.08911	
Hypothesized Mean Difference	0	
df	4	
t Stat	0.5082	
P(T<=t) one-tail	0.31902	
t Critical one-tail	2.13184	
P(T<=t) two-tail	0.63805	
t Critical two-tail	2.77644	

Fig.4: t-test between Nestle & Galaxy

The statistical analysis of the polyphenol content of light chocolates using t-tests (figures 2, 3, 4) showed that the polyphenol content of Dairy Milk is significantly higher than that of galaxy; however as the p-value in this case was determined to be 0.047, but further experimentation is required to establish this relationship.

t-Test: Two-Sample Assuming Equal Variances

	Bourneville	Amul
Mean	5.123333	7.714333
Variance	1.710945	0.926536
Observations	3	3
Pooled Variance	1.318741	
Hypothesized Mean Difference	0	
df	4	
t Stat	-2.76333	
P(T<=t) one-tail	0.025338	
t Critical one-tail	2.131847	
P(T<=t) two-tail	0.050676	
t Critical two-tail	2.776445	

Fig.5: t-test between Amul and Bournville





t-Test: Two-Sample Assuming Equal Variances			t-Test: Two-Sample Assuming Unequal Variances		
	Amul	Don Monte		Bourneville	Don Monte
Mean	7.714333	3.178667	Mean	5.123333	3.178667
Variance	0.926536	0.081222	Variance	1.710945	0.081222
Observations	3	3	Observations	3	3
Pooled Variance	0.503879		Hypothesized Mean	0	
Difference	0		Difference	0	
df	4		df	2	
t Stat	7.825705		t Stat	2.516034	
P(T<=t) one-tail	0.00072		P(T<=t) one-tail	0.064134	
t Critical one-tail	2.131847		t Critical one-tail	2.919986	
P(T<=t) two-tail	0.001439		P(T<=t) two-tail	0.128268	
t Critical two-tail	2.776445		t Critical two-tail	4.302653	

Fig.6: t-test between Amul and Don Monte

Fig.7: t-test between Don Monte and Bourneville

The statistical analysis using t-tests (figures 5, 6, 7) of the dark chocolate samples showed that Amul had significantly higher Polyphenol content than that of Bourneville (p-value=0.025) and Don Monte (p-value=0.0007).

As discussed earlier these significant differences in the polyphenol content may be due to the difference in the source of the cocoa bean, or the processing of the cocoa beans and the manufacturing process of the chocolate.

Hydrogen peroxide scavenging assay:

Chocolate	g% equivalence of Vitamin C
Dairy milk	44.71±52.31
Nestle	93.73±57.18
Galaxy	113.14±36.34
Bourneville	234.56±176.68
Amul	321.83±206.56
Don Monte	384.07±70.54

Fig.8: Hydrogen peroxide scavenging assay





As mentioned in Figure 8 the hydrogen peroxide Scavenging capacities of the six chocolate samples Dairy Milk, Galaxy, Nestle, Bournville, Amul and Don Monte were determined to be 44.71 ± 52.31 g%, 113.14 ± 36.34 g%, 93.73 ± 57.18 g%, 234.56 ± 176.68 g%, 321.83 ± 206.56 g% and 384.07 ± 70.54 g% of vitamin C respectively.

However, as hydrogen peroxide is unstable inconsistent readings were obtained for the assay when replicated, giving high values of standard deviation and variance. Thus, although analysis of the total hydrogen peroxide scavenged using t-tests showed no significant difference between activity for either light or dark chocolates, more tests are required to be performed to establish these findings.

t-test :Two sample assuming equal variances

	Amul	Don Monte
Mean	321.832	384.0733333
Variance	42667.39427	4976.52648
Observations	3	3
Pooled Variance	23821.96037	
Hypothesized Mean	0	
Difference		
df	4	
t Stat	0.493896295	
P(T<=t) one-tail	0.323635496	
t Critical one-tail	2.131846786	
P(T<=t) two-tail	0.647270991	
t Critical two-tail	2.776445105	

Fig.9: t-test between Amul and Don Monte

t-Test: Two-Sample Assuming Equal Variances

	Amul	Bournville
Mean	321.832	234.559
Variance	42667.39427	31215.45967
Observations	3	3
Pooled Variance	36941.42697	
Hypothesized Mean	0	
Difference		
df	4	
t Stat	0.556120239	
P(T<=t) one-tail	0.303884336	
t Critical one-tail	2.131846786	
P(T<=t) two-tail	0.607768672	
t Critical two-tail	2.776445105	

Fig.10: t-test between Amul and Bournville

	Bournville	Don Monte
Mean	234.559	384.0733333
Variance	31215.45967	4976.52648
Observations	3	3
Pooled Variance	18095.99307	
Hypothesized Mean	0	
Difference		
df	4	
t Stat	-1.361247978	
P(T<=t) one-tail	0.122536221	
t Critical one-tail	2.131846786	
P(T<=t) two-tail	0.245072441	
t Critical two-tail	2.776445105	

Fig.11: t-test between Bournville and Don Monte





The highest hydrogen peroxide scavenging capacity within the dark chocolate samples was seen in Don Monte, even though the total polyphenol content in it was lower than the others.

t-test: two sample assuming equal variances

	Nestle	Dairy milk
Mean	93.72633333	44.71033333
Variance	3269.997806	2736.664058
Observations	3	3
Pooled Variance	3003.330932	
Hypothesized Mean Difference	0	
df	4	
t Stat	1.095423119	
P(T<=t) one-tail	0.167430423	
t Critical one-tail	2.131846786	
P(T<=t) two-tail	0.334860846	
t Critical two-tail	2.776445105	

Fig. 12: t-test between Nestle and Dairy milk

t-test: two sample assuming equal variances

	Nestle	Galaxy
Mean	93.72633333	113.1416667
Variance	3269.997806	1320.264681
Observations	3	3
Pooled Variance	2295.131244	
Hypothesized Mean Difference	0	
df	4	
t Stat	0.496348505	
P(T<=t) one-tail	0.322842981	
t Critical one-tail	2.131846786	
P(T<=t) two-tail	0.645685962	
t Critical two-tail	2.776445105	

Fig. 13: t-test between Nestle and Galaxy

t-test: two sample assuming equal variances

	Dairy milk	Galaxy
Mean	44.71033333	113.1416667
Variance	2736.664058	1320.264681
Observations	3	3
Pooled Variance	3003.330932	
Hypothesized Mean Difference	0	
df	4	
t Stat	1.860873879	
P(T<=t) one-tail	0.068131264	
t Critical one-tail	2.131846786	
P(T<=t) two-tail	0.136262529	
t Critical two-tail	2.776445105	

Fig. 14: t-test between Dairy Milk and Galaxy





The highest hydrogen scavenging capacity in light chocolate samples was seen in galaxy which again had the lowest value of total polyphenols.

Conclusion:

The results obtained state that the highest polyphenol content was found in Dairy milk (1.587 ± 0.514 g% equivalents of Gallic acid) amongst the light chocolates and in Amul (6.862 ± 1.877 g% equivalents of Gallic acid). So, overall the dark chocolates contained more total polyphenols than light chocolates.

Whereas for the hydrogen peroxide scavenging assay, the highest values were for Galaxy (113.14 ± 36.34 g% equivalents of Vitamin C) and Don Monte (384.07 ± 70.54 g% equivalents of Vitamin C). Both of these had low amounts of polyphenols.

Hence, it can be said that only the hydrogen peroxide assay and total polyphenol content are not enough to conclude which chocolate is better in terms of its antioxidant activity. More elaborate tests need to be performed to draw concrete results and establish relationships.

Also, here the antioxidant activity of the samples is measured in terms of its hydrogen peroxide scavenging capacity. Vitamin C was used as a standard and the values obtained from the assay are expressed in terms of g% of Vitamin C. Most of the antioxidant studies use Vitamin C as a standard to compare the antioxidant activity. Thus to ensure an easy comparison across studies which have used the same assay, the final values are expressed as equivalents of Vitamin C.

References:

1. Ames, B. N., Shigenaga, M. K., & Hagen, T. M. (1993). Oxidants, antioxidants, and the degenerative diseases of aging. *Proceedings of the National Academy of Sciences*, 90(17), 7915-7922.

2. Crozier, S. J., Preston, A. G., Hurst, J. W., Payne, M. J., Mann, J., Hainly, L., & Miller, D. L. (2011). Cacao seeds are a "Super Fruit": A comparative analysis of various fruit powders and products. *Chemistry Central Journal*, 5(1), 5.

3. Vizioli F. Polyphenols in Sport: Facts or Fads? In: Lamprecht M, editor. *Antioxidants in Sport Nutrition*. Boca Raton (FL): CRC Press/Taylor & Francis; 2015. Chapter 6.

4. Galleano M., Oteiza P.I., Fraga C.G. (2009) Cocoa, chocolate, and cardiovascular disease. *J Cardiovasc Pharmacol* 54: 483-490.

5. Corti, R., Flammer, A. J., Hollenberg, N. K., & Luscher, T. F. (2009). Cocoa and Cardiovascular Health. *Circulation*, 119(10), 1433-1441.

6. Greer EL, Dowlatsbahi D, Banko MR, Villen J, Hoang K, Blanchard D, Gygi SP, Brunet A. An AMPK-FOXO pathway mediates longevity induced by a novel method of dietary restriction in *C. elegans*. *Curr Biol*. 2007;17(19):1646-1656.

7. Laurent Y, Rios, Marie-Paule Gonthier, Christian Rémesy, Isabelle Mila, Catherine Lapiere, Sheryl A. Lazarus, Gary Williamson, Augustin Scalbert. Chocolate intake increases urinary excretion of polyphenol-derived phenolic acids in healthy human subjects. *Am J Clin Nutr*. 2003 Apr; 77(4): 912-918.

8. Velioglu, Y. S., Mazza, G., Gao, L., & Oomah, B. D. (1998). Antioxidant Activity and Total Phenolics in Selected Fruits, Vegetables, and Grain Products. *Journal of Agricultural and Food Chemistry*, 46(10), 4113-4117.

9. Maleyki, M. A., & Ismail, A. (2010). Antioxidant Properties Of Cocoa Powder. *Journal of Food Biochemistry*, 34(1), 111-128.

10. Ruch, R. J., Cheng, S., & Klaunig, J. E. (1989). Prevention of cytotoxicity and inhibition of intercellular communication by antioxidant catechins isolated from Chinese green tea. *Carcinogenesis*, 10(6), 1003-1008.

11. Keser, S., Celik S., Turkoglu S., Yilmaz O., Turgoklu I (2009). Hydrogen peroxide Radical





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

scavenging and total antioxidant activity of hawthorn. Chemistry Journal, 02(01), 09-12.

12. Prasad.m.p, P., & Rajkumar.r, A. (2012). Determination of Antioxidant Activity of Citrus Species using Different Solvent Extracts by Hydrogen Peroxide Scavenging Method. International Journal of Scientific Research, 3(6), 37-38.

13. Moore, J., & Yu, L. (n.d.). Methods for Antioxidant Capacity Estimation of Wheat and Wheat-Based Food Products. Wheat Antioxidants, 118-172.


14. Estimation of Antioxidant Power in Various Extracts of Euphorbia helioscopia L. with Five Different in vitro Antioxidant Models. (2014). Asian Journal of Chemistry, 26(4).

15. Lal, G., & Mantri, M. (2011). In-Vitro antioxidant and free radical scavenging activity of Butea Frondosa Roxb. Flower. Pharmacognosy Journal, 3(21), 65-68.

Acknowledgements:

We thank Dr. Nandita Mangalore, Mr. Prashant Ratmaparkhi, Dr. Maya Murdeshwar, Mr. Joshua Miranda, Dr. Manasi Kanuga, Dr. Bhaskar Saha for their guidance and Department of Life Sciences and Biochemistry, St. Xavier's College, Mumbai for providing us the facilities to conduct this study.




PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65


Department of Life Science and Biochemistry – List of Field Trips (2018-19)

Educational Trips/Field Trips:

- Students of TYBSc 6U were taken on a field trip to Maharashtra Nature Park, Dharavi in Sept. 2018, as part of their SLSC504 Ecology and Biodiversity course.
- SY and TYBSc students were taken on a visit to the National Institute for Research on Reproductive Health (NIRRH) on 28th Sep. 2018.
- Khandala Educational Seminar for SY and TYBSc students on 23rd and 24th Nov 2018.
- 2 TYBSc and 8 MSc Part II students attended the Open Day at ACTREC, Kharghar, Navi Mumbai, on 6th Dec. 2018.
- TYBSc 6U were taken on a field trip to Sewri to observe the Flamingoes on 22nd Jan. 2019 as part of their SLSC604 Ecology and Biodiversity course.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

LIFE SCIENCE AND BIOCHEMISTRY DEPARTMENT

Annual Khandala Seminar Report 2018-19

Place:	St. Mary's Villa, Khandala
Date:	23 rd and 24 th November, 2018
Class:	S.Y.B.Sc. and T.Y.B.Sc. students
Number of students:	-
Faculty in-charge:	Dr. Nandita Mangalore
Accompanying faculty members:	Dr. Nandita Mangalore, Dr. Seema Das, Dr. Binoj C. Kutty and Dr. Manasi Kanuga

The annual Khandala seminar organized by the Department of Life Science and Biochemistry aims at helping students develop varied life skills and as well as allowing the second year and third year students interact and get to know each other better in an informal setting. The two-day seminar was organized by the faculty members keeping these objectives in mind and coordinated by Dr. Nandita Mangalore.

Day 1: 23rd November; the students and faculty members arrived at the Sts. Mary's Villa, settled in the allotted rooms and had breakfast. The first session was called 'Creative Science Story/Script Writing' Workshop which was conducted by Ms. Katie Bagli. Ms. Katie Bagli an alumnee of St. Xavier's College, completed B.Sc. in Microbiology but being a nature lover used this to make a career out of it. Ms. Bagli writes children's books on various subjects of nature and has several published titles to her credit. The second year and third year students have a science communication course so idea behind inviting Ms. Bagli was to introduce to the students other, fun ways of communicating science. Ms. Katie's session encouraged the students to explore their creative side. Through the workshop the students wrote poems, short-stories and wrote and performed skits. Ms. Katie Bagli managed to pique their creativity and got them enthused to come up with some interesting and engaging stories, poems and plays.

After lunch, the third year students took initiative and organized and conducted an interactive session involving the second year students, faculty members and themselves. The third year students had planned some fun games and activities and this helped the students to mix and interact and through the games and dance they got to de-stress and got to know each other.

The session after tea was "Nature Trail and Photography Competition" and Dr. Binoj Kutty took charge of this session. The students were allotted time to relax with their friends, walk around the St. Mary's campus or go on a nature trail. While doing so, the second year students were given a topic 'Grape and Drape' and while on their walk they needed to take a picture that would best describe this topic. The third year students were to take a look at pictures sent by the second year students and deliberate and announce the winner. The second year students did a good job of taking interesting pictures and showcasing their interpretation of the topic.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

This made the task of judging these pictures by the third year student immensely difficult. The Photography Competition ended with Josette Misquitta as the winner of the competition.

For the later part of the evening of day 1, the students were given time to mix with each other and plan a post-dinner presentation where they can potentially use something they may have taken from the sessions earlier in the day. The day ended with a small bonfire where the students of both the years sang songs or listened to music and just enjoyed the warm fire and a cool breeze.

Day 2: 24th November; after breakfast Mr. Animesh Das delivered talk on 'Sacred Geometry'. Mr. Das is from Mass Media, an alumna of St. Xavier's College, Department of Mass Media and is now a faculty member in the same department. Mr. Animesh's talk was about the Fibonacci series and its presence in nature as well as in art. His talk brought to light the concept of Golden ratio in art and how humans appreciate knowingly or unknowingly are that follows the Golden ratio. Mr. Das's talk was engaging and got the students thinking about symmetry in nature and it's relationship to mathematics. Mr. Das started the talk with a question, 'is beauty objective or subjective?' while most of us thought it was subjective; the talk left us really thinking if it was objective after all.


Dr. Seema Das conducted the last session of the Khandala seminar; the Creativity session. In this session the students were given biological terms and they had to come up with a creative ways to depict those topics. The students put up interesting skits and poems and overall had a great time exploring their creative side.

The Khandala seminar ended with a short talk by Dr. Seema Das and then the students were asked fill in the feedback forms and submit them to the teachers and prepare to leave after lunch.

The overall feedback of the students was a positive one where they got to explore their creative side, got to know about the geometry in nature and art and most importantly created memorable moments with their friends; ones they would cherish for life.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

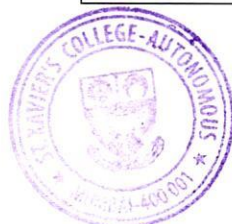
Khandala Seminar Schedule 2018-19

Day 1: Friday, 23rd November, 2018


Time	Session	Faculty Co-ordinator
7:00 am	Bus Departs from St. Xavier's College gate.	Dr. Nandita Mangalore
9:45 am	Expected arrival time at, St. Mary's Villa, Khandala	
9:45 am - 10:30 am	Breakfast, Room Allocation	
10:30 am- 1:00 pm	"Creative Science Story/Script Writing" Workshop by Ms. Katie Bagli	Dr. Nandita Mangalore
1:00 pm -2:00pm	Lunch	
2:00 pm - 3:00 pm	"Icebreaker Session" Interactive Session (Ms. Steffie and Mr. Ishaan - TY students)	
3:30 pm - 4:00 pm	Tea	
4: 00 pm - 6:30 pm	Nature Walk and Mobile Photography competition -SYBSc	Dr. Binoj Kutty
6:30 pm- 8:30 pm	Preparation for post dinner presentation	
8:00 pm - 9:00 pm	Dinner	
9:00 pm - 10:00 pm	Post-dinner presentation	Dr. Manasi Kanuga

Day 2: Saturday, 24th November, 2018

Time	Session	Faculty Co-ordinator
8:00 am - 9:00 am	Breakfast, Packing	
9:00 am- 10:30 am	"Sacred Geometry" workshop by Mr. Animesh Das	Dr. Nandita Mangalore
10:30 am- 12:30 pm	"Creativity Workshop"	Dr. Seema Das
12:30 pm -12:45 pm	Feedback form, Checking out	
12:50 pm - 1:30pm	Lunch	
1:40 pm	Departure from St. Mary Villa to St. Xavier's College	



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65


Department of Life Science and Biochemistry – List of Field Trips
(2017-18)

Educational Trips/Field Trips:

1. Khandala Educational Seminar for SY and TYBSc students on 1st-2nd Dec 2017.
2. MSc-II students were taken on a visit to the *In Vitro* Fertilization (IVF) Centre, Leelavati Hospital, Mumbai, on 25th Jan. 2018.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

LIFE SCIENCE DEPARTMENT
Annual Khandala Seminar Report

Place:	St. Xavier's Villa, Khandala
Date:	1 st and 2 nd December, 2017
Class:	SYBSc and TYBSc students
Number of Students:	67 (10 boys + 57 girls)
Faculty Coordinator:	Dr. Manasi Kanuga
Faculty Accompanying:	Dr. Manasi Kanuga, Dr. Radhika Tendulkar, Dr. Maya Murdeshwar, Dr. Bhaskar Saha and Mr. Aditya Sethi.

The annual Khandala seminar organized by the Life Science department aims at developing essential life skills of students while giving an opportunity to second year and third year students to interact and get to know each other better. The entire two day seminar, coordinated by Dr. Manasi Kanuga, was structured by the faculty based on achieving this objective. Upon arrival at the villa on the morning of 1st December, the students were given time to settle into their respective rooms and have breakfast. The first session, called "Music & Theatre in Stress Management" was an ice-breaker session, which was conducted by our very own Fr. Roy Pereira and his sister Ms. Rochelle Pereira. Considering that at this stage in life, students undergo a lot of academic and social stress, the session was based on teaching the students about the magic of music and theatre in coping with this stress. Fr. Roy interactively conducted the session by allowing the students to break into song and dance, while beautifully explaining the neuroscience involved behind stress and its management. Post lunch, there was a two hour "Team Building and Social Relations" session, which involved two activities – The Tower Game, where students were divided into seven group (SY and TY mixed) and Treasure Hunt, where the second year students competed with the third year students. The Tower Game concluded with Dr. Maya Murdeshwar teaching the students about the importance of team work, leadership and how to be a better individual in society by being conscious and empathetic of the people around them. It was an important exercise in personal reflection. The students, then implemented their lessons learnt in team work and leadership by participating in the following activity, which was Treasure Hunt. Fatigued from all the running around during treasure hunt, the next activity – "Photography Competition", was planned such that the students get time to relax and enjoy their surroundings. The theme of the competition was "Symmetry in Nature", which kept the students' creative juices running throughout. The competition ended with the best two photographs of each group being displayed on the projector in the hall and the students themselves voted for the best picture. Next, the students were given time to prepare for their post-dinner presentations. After dinner,



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

the students were asked to perform a skit/play based on the skills they had learnt from the theatre workshop conducted by Fr. Roy in the morning. The night concluded with a small bonfire in the open area using firewood collected by the students themselves, where the students could enjoy some soft music before heading to bed.

The next morning, after breakfast, there was a “Creativity Workshop”, conducted by Dr. Manasi Kanuga, where the students were given random topics in groups and were asked to come up with something creative to depict the topic. While some students sang and danced, some students enacted the topic. However, the group that won the competition and everyone’s hearts, was the group that depicted the topic in the form of a game. The Khandala seminar concluded with a talk by Dr. Aamir Shaikh, the founder of a Health Care Consultancy called Assansa. Dr. Aamir Shaikh spoke about his journey from academics to entrepreneurship and the life lessons he learnt along the way. The heart of the talk was about cultivating focus, trust and resilience in our lives. The students enjoyed the talk and also meaningfully gained from it. The bus departed back for Mumbai from the villa after lunch. Overall, the students had a positive feedback about the seminar and found most of the sessions useful, although many of the students suggested having a less strict schedule and more free time for them to explore on their own. However, one thing was sure, the students had a great time and formed memories that they would cherish for life.

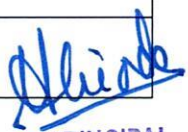
Khandala Seminar Schedule

DAY 1: DECEMBER 1ST

Time	Session	Faculty Coordinator
7:00 am	Bus Departs from St. Xavier’s College	Dr. Maya Murdeshwar Aditya Sethi
10:00 am	Expected Arrival Time at Khandala	
10:30 – 11:30 am	Breakfast, Villa & Room Allotment	
11:30am – 1:00 pm	“Music-Theatre Stress Management Workshop” by Fr. Roy	Dr. Radhika Tendulkar
1:00 – 2:00 pm	Lunch	
2:00 – 4:00 pm	“Team Building & Social Relations” Interactive Session	Dr. Maya Murdeshwar
4:00 – 4:30 pm	High Tea	
4:30 – 6:30 pm	Nature Walk and Photography Competition	Aditya Sethi
6:30 – 8:00 pm	Preparation for Post-Dinner Presentation	



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Time	Session	Faculty Coordinator
8:00 – 9:00 pm	Dinner	
9:00-10:00 pm	Post-Dinner Presentations	Dr. Bhaskar Saha

DAY 2: DECEMBER 2ND (Saturday)

Time	Session	Faculty Coordinator
8:00 – 9:00 am	Breakfast	
9:00 – 11:00 am	“Creativity Workshop”	Dr. Mansi Kanuga
11:00 – 12:30 pm	“Social Entrepreneurship” Talk by Dr. Aamir Shaikh	Dr. Maya Murdeshwar
12:30 – 1:00 pm	Distribution & Collection of Feedback Forms	
1:00 – 2:00 pm	Lunch	
2:00 pm	Bus Departs for St. Xavier's College	



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

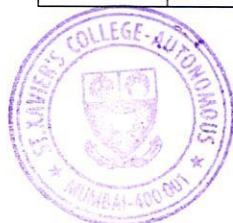
Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Course No: SLSC06.AC (ES EXHIBITION - 5th Feb. 2020)			
Name of Paper: ENVIRONMENT SUSTAINABILITY & LEGISLATION			
Sr. No.	Name	Roll No.	UID No.
1	Zeenal Sebastian Lobo	1	172175
2	Agnes Thomas	24	172147
3	Manica Ram Agrawal	25	172014
4	Alex Louis Berrhto	29	172100
5	Achsah Thirupati Bommera	31	172151
6	Marissa Pradeep Carvalho	32	172156
7	Marissa Pradeep Carvalho	32	172156
8	Marissa Pradeep Carvalho	32	172156
9	Simran Cerejo	33	162368
10	Nidhi Nitin Chati	34	172425
11	Fleur Rui Rosario Colaco	37	172019
12	Donna Jacob	38	172076
13	Melcom Robert Dsilva	39	172162
14	Jovita Joseph Dsouza	40	172163
15	Vijaya Narendra Gawner	41	172079
16	Jesni Joseph	45	172008
17	Jahnavi Pradeep Jeswani	46	172121
18	Jahnavi Pradeep Jeswani	46	172121
19	Jisha Joseph	47	172170
20	Shania Alan Pereira	60	172136
21	Pearl Thomas Rozario	65	172033
22	Grefin Prasad Varghese	69	172037
23	Anugraha Varghese	105	172015
24	Annet Francis Dsouza	108	172046
25	Riwaj Khemananda Ghimire	110	172022
26	Mercy Stephen	112	172027
27	Josette Deanne Mckenzie Misquitta	113	172058
28	Nimisha Thomas	115	172060
29	Craigston Manuel Neville Fernandes	121	172002
30	Infant V	125	172007
31	Kavya Nitin Batra	177	172099



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Course No: SLSC06.AC (ES EXHIBITION - 5th Feb. 2020)			
Name of Paper: ENVIRONMENT SUSTAINABILITY & LEGISLATION			
Sr. No.	Name	Roll No.	UID No.
32	Saniket Sunil Bhosle	179	172101
33	Mural Edwin Dabre	180	172075
34	Maria James Dcosta	182	172106
35	Ishita Puneet Dewandewan	183	172107
36	Arpitha Michelle Fredricks George	184	172113
37	Saily Mangesh Kamble	190	172083
38	Diana Andrew Menezes	195	172086
39	Nidhi Ranji	199	172133
40	Pranita Atul Shinde	204	172143
41	Rashmi Rekha Jyotish Rabha	283	172140
42	Sayali Sudhir Kute	284	172124
43	More Pratik Kishore	53	142451

Life Science & Biochemistry

TYBSc - Environmental Science – Model Making Exhibition


2019-20

Students of TY Environmental Science course (**spanning students from Dept. of Botany, Zoology, Life Science, Chemistry and Physics**) presented their learning in the form of an exhibition of working models they had made on various aspects of conservation, renewal and recycling of resources in the College Woods on **5th Feb. 2020**. The exhibition was open to all and aimed at spreading environmental awareness on campus. Dr Nandita Mangalore, Dr Manasi Kanuga, and Dr Bhaskar Saha were the evaluators of this activity.

Students: 43 Teachers: 3



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

ENVIRONMENTAL SCIENCE EXHIBITION (2019-20)

5th Feb. 2020



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

TYBSc - Environmental Science – Model Making Exhibition


2018-19

Students of TY Environmental Science course (spanning students from Dept. of Botany, Zoology, Life Science, Chemistry and Physics) presented their learning in the form of an exhibition of working models they had made on various aspects of green technology and sustainability in the College Woods on **6th Feb. 2019**. The exhibition was open to all and aimed at spreading environmental awareness on campus. Dr Nandita Mangalore, Dr Manasi Kanuga, and Dr Binoj Kutty were the evaluators of this activity.

Students: 60 Teachers: 3



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

TYBSc - Environmental Science – Model Making Exhibition

2017-18

Students of TY Environmental Science course (**spanning students from Dept. of Botany, Zoology, Life Science, Chemistry and Physics**) presented their learning in the form of an exhibition of working models they had made on various aspects:

1. Biogas plant
2. Solar cell
3. Microbial fuel cell
4. Biological compost
5. Rainwater harvesting
6. Wastewater treatment plant
7. Algal scrub

The exhibition was open to all and aimed at spreading environmental awareness on campus. Dr Nandita Mangalore, Dr Manasi Kanuga, and Dr Binoj Kutty were the evaluators of this activity. Held on 7th Feb 2018.

Students: 60 Teachers: 3

TYBSc - Environmental Science – Model Making Exhibition


2016-17

Students of TY Environmental Science course (**spanning students from Dept. of Botany, Zoology, Life Science, Chemistry and Physics**) presented their learning in the form of an exhibition of working models they had made on various aspects of Renewable Energy and Carbon Management in the College Woods. The exhibition was open to all and aimed at spreading environmental awareness on campus. Dr Nandita Mangalore, Dr Radiya Pacha Gupta, Dr Manasi Kanuga, and Dr Archana Pawar were the evaluators of this activity.

Students: 60 Teachers: 4



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

DEPARTMENT OF MATHEMATICS
PROJECTS EXHIBITION
COMPETITION



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Department of Mathematics – List of Projects, TYBSc (2019-20)

Sr. No.	Title of the Project (TYBSc)	Group Members (UID)
1	Bivariate interpolation using Newton's divided differences	172349, 172363, 172417
2	Newton Raphson method for a system of two non-linear eqns	172400, 172224
3	Error Propogation in Forward Difference Table	172242, 172392
4	Milne's Predictor Corrector method	172302, 172216
5	Hermite interpolation using Newton's divided differences	172270, 172397
6	Chebyshev Convergence	172332
7	Piecewise cubic interpolation by Newton's Divided difference	172248, 172351
8	Romberg Integration	172409, 172331
9	Inverse interpolation by Lagrange's fundamental polynomials	172398, 172387
10	ill conditioned system	172385
11	Piecewise cubic interpolation by Hermite divided difference	172326, 172424



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

NEWTON RAPHSON METHOD

FOR A SYSTEM OF TWO NONLINEAR EQUATIONS IN TWO VARIABLES

Neha Goregaokar (172400)
Nancy Jindal (172224)

ITERATIVE METHODS

An iterative method is a mathematical procedure that uses an initial guess to generate a sequence of improving approximate solutions to a problem, in which the n^{th} approximation is derived from the previous ones.

While in many cases direct methods exist that can solve a given problem in a finite sequence of operations and give an exact answer, iterative methods are used when using the direct method would be extremely expensive or even impossible even with great computing power. Iterative methods are also often the only choice for nonlinear equations.

1



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



SYSTEM OF NONLINEAR EQUATIONS

We define a system of two nonlinear equations in two variables as follows :

$$f(x,y) = 0$$

$$g(x,y) = 0$$

Where at least one of f and g is nonlinear, i.e. not of the form $Ax + By + C$, where A,B,C are constants.

A point $r = (a,b)$ is a root of the system if it satisfies the equations.

NEWTON RAPHSON METHOD

Let the initial approximation of the root (a,b) be (x_0, y_0) . Then $a = x_0 + h$ and $b = y_0 + k$, where h and k are to be found.

Then the first iteration of the root, $x_1 = x_0 + h$ and $y_1 = y_0 + k$ is given by

$$\begin{bmatrix} x_1 \\ y_1 \end{bmatrix} = \begin{bmatrix} x_0 \\ y_0 \end{bmatrix} - J_0^{-1} \begin{bmatrix} f(x_0, y_0) \\ g(x_0, y_0) \end{bmatrix}$$

Where

$$J_0 = \begin{bmatrix} f_x(x_0, y_0) & f_y(x_0, y_0) \\ g_x(x_0, y_0) & g_y(x_0, y_0) \end{bmatrix}$$

The general iteration of Newton Raphson method is given by

$$\begin{bmatrix} x_{n+1} \\ y_{n+1} \end{bmatrix} = \begin{bmatrix} x_n \\ y_n \end{bmatrix} - J_n^{-1} \begin{bmatrix} f(x_n, y_n) \\ g(x_n, y_n) \end{bmatrix}$$

where J_n is the Jacobian matrix evaluated at (x_n, y_n) .

This can be written in vector notation as $\mathbf{x}^{(n+1)} = \mathbf{x}^{(n)} - J_n^{-1} \mathbf{F}(\mathbf{x}^{(n)})$

where $\mathbf{x}^{(n)} = [x^{(n)} \quad y^{(n)}]^T$ and $\mathbf{F}(\mathbf{x}^{(n)}) = [f(x_n, y_n), g(x_n, y_n)]^T$





EXTENSION

Newton Raphson method can be extended for a system of m nonlinear equations in m variables x_1, x_2, \dots, x_m .

The $(n+1)^{\text{th}}$ iteration of a root using Newton Raphson method is given by

$$\mathbf{x}^{(n+1)} = \mathbf{x}^{(n)} - \mathbf{J}_n^{-1} \mathbf{F}(\mathbf{x}^{(n)})$$

where $\mathbf{x}^{(n)} = [x_1^{(n)}, x_2^{(n)}, \dots, x_m^{(n)}]^T$ $\mathbf{F}^{(n)} = [f_1^{(n)}, f_2^{(n)}, \dots, f_m^{(n)}]^T$
 \mathbf{J} is the Jacobian of functions f_1, f_2, \dots, f_m evaluated at (x_1, x_2, \dots, x_m) , i.e.

$$\mathbf{J}_n = \begin{bmatrix} f_{1x_1} & f_{1x_2} & \dots & f_{1x_m} \\ f_{2x_1} & f_{2x_2} & \dots & f_{2x_m} \\ \vdots & \vdots & \ddots & \vdots \\ f_{mx_1} & f_{mx_2} & \dots & f_{mx_m} \end{bmatrix}$$

Newton Raphson method converges if the initial approximation is chosen close to the exact root and it ~~is a quadratic rate of convergence~~ is the partial derivative of f_i with respect to variable x_j .

EXAMPLE

Use Newton Raphson method to solve the following system of equations by taking the point (2, 3) as initial approximation

$$\begin{aligned} x^2 - y &= 10 \\ y^2 - x &= 6 \end{aligned}$$

Soln:

$$f(x, y) = x^2 - y - 10, \quad g(x, y) = y^2 - x - 6$$

$$f_x(x, y) = 2x, \quad f_y(x, y) = -1$$

$$g_x(x, y) = -1, \quad g_y(x, y) = 2y$$

$$\mathbf{J}_0^{-1} = \begin{bmatrix} 4 & -1 \\ -1 & -6 \end{bmatrix}^{-1} = -\frac{1}{25} \begin{bmatrix} -6 & 1 \\ 1 & 4 \end{bmatrix}$$

Then first iteration is $\begin{bmatrix} x_1 \\ y_1 \end{bmatrix} = \begin{bmatrix} 2.76 \\ -2.96 \end{bmatrix}$

$$\begin{bmatrix} x_2 \\ y_2 \end{bmatrix} = \begin{bmatrix} 2.66852 \\ -2.94259 \end{bmatrix}$$

Second iteration is $\begin{bmatrix} x_3 \\ y_3 \end{bmatrix} = \begin{bmatrix} 2.63665 \\ -2.94222 \end{bmatrix}$

Third iteration is





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65


REFERENCES

- Fundamentals of Numerical Methods, 2.50 - 2.52

4



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Department of Mathematics – List of Projects, SYBSc (2019-20)

Sr. No.	Title of the Project (SYBSc)	Group Members (UID)
1	The Riemann Hypothesis	172320, 172340, 182526, 182558 182297, 182229, 182173, 182376
2	The Fourier Transform	182543, 182506, 182381, 182361 182542, 182234, 182307, 182343
3	Cryptocurrencies	182279, 182172, 182399, 182248 182369, 182287, 182420, 182253
4	Hilbert's Curve	182396, 182316, 182346, 182508 182535, 182383, 182390
5	The Borsuk-Ulam theorem	182098, 182014, 182395, 182548 182031, 182239, 182255
6	Neural Networks	182408, 182364, 182185, 182200 182196, 182205, 182043
7	Inscribed Rectangle Problem	182126, 182264, 182171, 182221 182144, 182217, 182186
8	Euler's Formula and Group Theory	182389, 182311, 182384, 182388 182275, 162284, 182247
9	Fractals	182405, 182060, 182258, 172412 172357, 182216, 182392
10	Quaternions	182020, 182139, 182193, 182109 182385, 182145, 182360
11	Maxwell's Equations	182138, 182136, 182129, 182347 182048, 182037, 182302
12	Methods to solve Partial Differential Equations	182053, 182142, 182315, 182424 182339, 182378, 182177
13	The Basel Problem	182120, 182404, 182179, 182382 182178, 182150, 182227
14	The Brachistochrone	182133, 182140, 182246, 182167 182141, 182352, 182345



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

The Basel Problem


Group 13

SR NO.	NAME	UID	EMAIL ID
1	RHEA CHAWLA	182382	rheachawla13@gmail.com
2	VISHAKHA SINGH	182404	vishakha12singh@gmail.com
3	JUI WAKADE	182179	wakadejui@gmail.com
4	ISHITA MOHTA	182178	ishita.in.21@gmail.com
5	BRANDON DCOSTA	182227	dcostabrandon1@gmail.com
6	VRITIKA MEHTA	182120	vritikamehta11@gmail.com
7	SANSHYA KAPOOR	182150	sanshy Kapoor@gmail.com

1



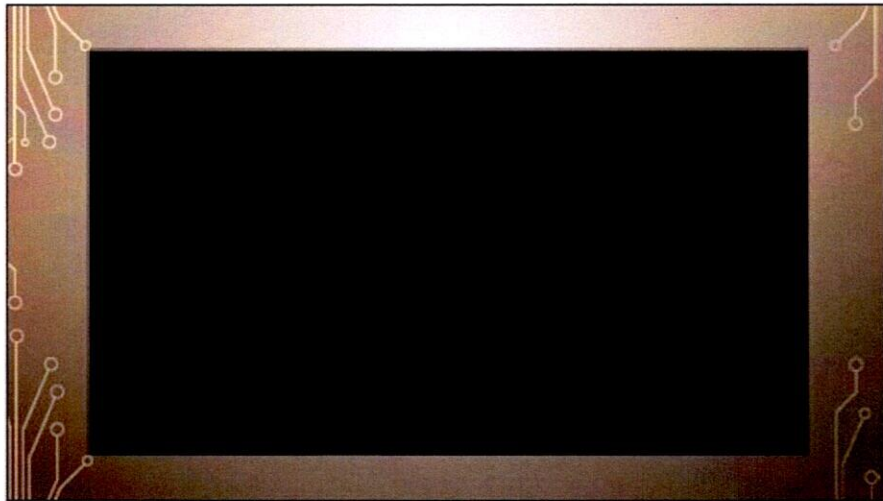
NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



Introduction

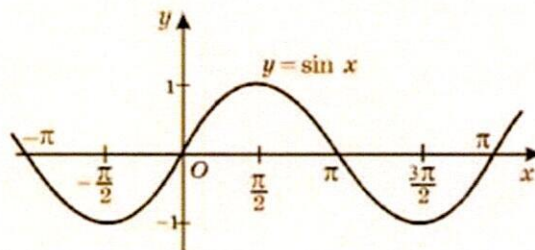
The Basel problem is a problem in mathematical analysis with relevance to number theory, first posed by Pietro Mengoli in 1650 and solved by Leonhard Euler in 1734, and read on 5 December 1735 in The Saint Petersburg Academy of Sciences. Since the problem had withstood the attacks of the leading mathematicians of the day, Euler's solution brought him immediate fame when he was twenty-eight. Euler generalised the problem considerably, and his ideas were taken up years later by Bernhard Riemann in his seminal 1859 paper "On the Number of Primes Less Than a Given Magnitude", in which he defined his zeta function and proved its basic properties. The problem is named after Basel, hometown of Euler as well as of the Bernoulli family who unsuccessfully attacked the problem.





EULER'S PROOF TO THE BASEL PROBLEM

GRAPH OF SIN X



Hence, we have

$$\sin(x) = 0 \quad \text{when, } x = n\pi$$

i.e. $x = 0, +\pi, -\pi, +2\pi, -2\pi, \dots$





TAYLOR SERIES

Using Taylor's Series the expression of $\sin(x)$ that we get is

$$\sin(x) = \sum_{k=0}^{\infty} \frac{(-1)^k}{(2k+1)!} x^{2k+1} = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \dots$$

We can write it as.

$$\sin(x) / x = 1 - x^2/3! + x^4/5! - \dots \longrightarrow 1$$

We can treat $\sin(x)$ as a polynomial. Hence $\sin(x)$ in factorised form can be expressed as:

Factorising we get:

$$\sin(x) = A (x - 0) (x - \pi) (x + \pi) (x - 2\pi) (x - 3\pi) (x + 3\pi) \dots$$

As, $0, \pm\pi, \pm 2\pi, \pm 3\pi \dots$ are the zeros of $\sin(x)$





Simplifying we get,

$$\sin(x) = A (x - 0) (x - \pi) (x + \pi) (x - 2\pi) (x - 3\pi) (x + 3\pi) \dots$$

$$\sin(x) = A x (x - \pi^2) (x - 4\pi^2) (x - 9\pi^2) (x - 16\pi^2) \dots$$

$$\sin(x) = A x (1 - x^2/\pi^2) (1 - x^2/4\pi^2) (1 - x^2/9\pi^2) (1 - x^2/16\pi^2) \dots$$

$$\sin(x) / x = A (1 - x^2/\pi^2) (1 - x^2/4\pi^2) (1 - x^2/9\pi^2) (1 - x^2/16\pi^2) \dots$$

Applying limits with $x \rightarrow 0$,

$$\lim_{x \rightarrow 0} \sin(x) / x = 1$$

Hence, $A = 1$

$$\sin(x) / x = (1 - x^2/\pi^2) (1 - x^2/4\pi^2) (1 - x^2/9\pi^2) (1 - x^2/16\pi^2) \dots$$

Multiplying the terms we get,

$$\sin(x) / x = 1 - x^2/\pi^2 - x^2/4\pi^2 - x^2/9\pi^2 - x^2/16\pi^2 \dots$$

$$\sin(x) / x = 1 - x^2 (1/\pi^2 + 1/4\pi^2 + 1/9\pi^2 + 1/16\pi^2 \dots) - x^4 \dots$$

Comparing with 1 we get, (just compare the coefficient of x^2 in both the equations)

$$-1/3! = - (1/\pi^2 + 1/4\pi^2 + 1/9\pi^2 + 1/16\pi^2 \dots)$$

Hence, we get our answer

$$\pi^2/6 = 1 + 1/4 + 1/9 + 1/16 + \dots$$





THE APPLICATIONS OF BASEL PROBLEM

The Riemann zeta function

The Riemann zeta function $\zeta(s)$ is one of the most significant functions in mathematics because of its relationship to the distribution of the prime numbers. The zeta function is defined for any complex number s with real part greater than 1 by the following formula:

$$\zeta(s) = \sum_{n=1}^{\infty} \frac{1}{n^s}.$$

Taking $s = 2$, we see that $\zeta(2)$ is equal to the sum of the reciprocals of the squares of all positive integers:

$$\zeta(2) = \sum_{n=1}^{\infty} \frac{1}{n^2} = \frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots = \frac{\pi^2}{6} \approx 1.644934.$$

6





Convergence can be proven by the integral test, or by the following inequality:

$$\begin{aligned}\sum_{n=1}^N \frac{1}{n^2} &< 1 + \sum_{n=2}^N \frac{1}{n(n-1)} \\ &= 1 + \sum_{n=2}^N \left(\frac{1}{n-1} - \frac{1}{n} \right) \\ &= 1 + 1 - \frac{1}{N} \xrightarrow{N \rightarrow \infty} 2.\end{aligned}$$

This gives us the upper bound 2, and because the infinite sum contains no negative terms, it must converge to a value strictly between 0 and 2. It can be shown that $\zeta(s)$ has a simple expression in terms of the Bernoulli numbers whenever s is a positive even integer. With $s = 2n$

$$\zeta(2n) = \frac{(2\pi)^{2n} (-1)^{n+1} B_{2n}}{2 \cdot (2n)!}.$$

The Fourier Series

Use Parseval's identity (applied to the function $f(x) = x$) to obtain

$$\sum_{n=-\infty}^{\infty} |c_n|^2 = \frac{1}{2\pi} \int_{-\pi}^{\pi} x^2 dx.$$

where

$$\begin{aligned}c_n &= \frac{1}{2\pi} \int_{-\pi}^{\pi} x e^{-inx} dx \\ &= \frac{n\pi \cos(n\pi) - \sin(n\pi)}{\pi n^2} \\ &= \frac{\cos(n\pi)}{n} i \\ &= \frac{(-1)^n}{n} i\end{aligned}$$

for $n \neq 0$, and $c_0 = 0$. Thus,





where

$$|c_n|^2 = \begin{cases} \frac{1}{n^2}, & \text{for } n \neq 0, \\ 0, & \text{for } n = 0, \end{cases}$$

and

$$\sum_{n=-\infty}^{\infty} |c_n|^2 = 2 \sum_{n=1}^{\infty} \frac{1}{n^2} = \frac{1}{2\pi} \int_{-\pi}^{\pi} x^2 dx.$$

Therefore,

$$\sum_{n=1}^{\infty} \frac{1}{n^2} = \frac{1}{4\pi} \int_{-\pi}^{\pi} x^2 dx = \frac{\pi^2}{6}$$

as required.

Euler's Approach

Euler's original derivation of the value $\pi^2/6$ essentially extended observations about finite polynomials and assumed that these same properties hold true for infinite series.

Of course, Euler's original reasoning requires justification (100 years later, Karl Weierstrass proved that Euler's representation of the sine function as an infinite product is valid, by the Weierstrass factorization theorem), but even without justification, by simply obtaining the correct value, he was able to verify it numerically against partial sums of the series. The agreement he observed gave him sufficient confidence to announce his result to the mathematical community.





Consequences of Euler's proof:-

By Euler's proof for $\zeta(2)$ explained above and the extension of his method by elementary symmetric polynomials in the previous subsection, we can conclude that $\zeta(2k)$ is always a rational multiple of π^{2k} . Thus compared to the relatively unknown, or at least unexplored up to this point, properties of the odd-indexed zeta constants, including Apéry's constant $\zeta(3)$, we can conclude much more about this class of zeta constants. In particular, since π and integer powers of it are transcendental, we can conclude at this point that $\zeta(2k)$ is irrational, and more precisely, transcendental for all $k \geq 1$.

REFERENCES

- <https://proofwiki.org>
- <https://youtube.com/d-o3eB9sfls>
- <https://youtu.be/NmSBnOaAjjQ>





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Department of Mathematics – Exhibition Competition (2019-20)

Maths Exhibition competition was organized on 13th January 2020 to celebrate the National Mathematics day in memory of Prof. Srinivasa Ramanujan in which 20 groups (72 students) from different colleges in Mumbai actively participated as listed below:

Group No.	Name of Participants	Name of College (Class)	Topic of Presentation
1.	Ayesha Khan, Kaniel Pinto, Qassah Pandit, Jazeel Ekhlis	St. Xavier's College, (FYJC Sci)	Origami
2.	Kshitij Singh, Yugant Tandel, Yash Tandel, Akhil Jaiswar, Huda Alam, Ansari Tuba, Akhilesh Gupta	St. Xavier's College, (FYJC & SYJC Sci)	Platonic Solids, 7 bridge problem
3.	Neha Goregaokar, Nancy Jindal, Ritu Maurya, Nimita Nanvani, Gurneet Dolla	St. Xavier's College, (SYBSc & TYBSc)	5 colour theorem
4.	Hrutuja Kandale	SICES college, (SYBSc)	Art and Mathematics
5.	Munira Kothawala, Megha Pandey	ICLES Motilal Jhunjhunwala College, (FYBSc & SYBSc)	Fractals
6.	Tuba Shaikh, Shweta Singh	ICLES Motilal Jhunjhunwala College, (FYBSc & SYBSc)	Math in Nature
7.	Teresa Fernandes, Samiha Bhombal, Natasha Martis, Abijeet Reddy, Abhishek Soni	St. Xavier's College, (TYBSc)	Number guessing game
8.	Pravishna Priyadarshini, Astle Fernandes, Prakhar Kandpal, Arjun Shiv	St. Xavier's College, (TYBSc)	Fractals
9.	Anita Verma, Mansi Mahajan, Sinal Vaz, Ruchika Yadav, Angela Menezes	St. Xavier's College, (TYBSc)	5 pirate puzzle
10.	Plammoottil Sneha, Angel Mary, Jini Shaji, Sannia Sajive, Himanshi Srivastav	St. Xavier's College, (TYBSc)	Mathematical Games
11.	Aaron Alex, Bonny Boben, Aleya Choudhary, Stephin George, Joanne Simon	St. Xavier's College, (TYBSc)	Applications of Fourier Series



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.




ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Group No.	Name of Participants	Name of College (Class)	Topic of Presentation
12.	Shivaksh Mishra, Cathielisa Dias, Shubh Bansal, Abraham G K	St. Xavier's College, (TYBSc)	Planimeter
13.	Aryan Muchhala, Insha Durwesh	St. Xavier's College, (FYBSc)	Golden ratio
14.	Mohammad Laik Shaikh, Shivam Kanaujiya	Guru Nanak College, (FYBSc)	Mathematics in Investing
15.	Oliver Pereira	St. Xavier's College, (TYBSc)	Bezier Curves
16.	Chirag Gupta	SICES college	HCF/LCM Theorem
17.	Anshul Laikar, Ananya Mehta	St. Xavier's College, (FYBSc & SYBSc)	Applications of Taylor Series
18.	Theodore Coelho, Amolka Thomas, Khushi Chauhan, Joshua Lopez, Sanskar Halwai, Prakash Amberkar	St. Xavier's College, (FYJC & SYJC Sci)	Fun with Maths
19.	Akshita Makhija, Vinod Pisharody, Vatsal Patel, Ekta Makhija	St. Xavier's College, (FYBSc & SYBSc)	Goldbach and Collatz Conjectures
20.	Keziah Joseph, Pahulpreet Kaur, Sylvia Vincent, Yannick Furtado, Nihaar Thakkar	St. Xavier's College, (SYBSc)	Mathematical Game



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.




ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Department of Mathematics – Exhibition Competition (2018-19)

Topic (Title of Project)	Group Members (UID--Name)
Logic-Truth tables, Algebra of propositions, three way switches, logical arguments, etc.	172414 – Anvita Rastogi 172374 – Priyamvada 172401 – Disha 172353 – Achyut 172369 – Pradyumn 172371 – Glynel
Compound statements like And, Or, Implication, Converse of an implication, Negation, Contrapositive, etc.	172349 – Jini Shaji 172363 – Sneha 172387 – Bonny 172398 – Stephin 172407 – Abhijit Mahakal
Proofs in Mathematics- Direct proof, proof by cases, proof by contrapositive, proof by contradiction	172383 – Anoushka Arora 172344 – Nishant 172421 – Varkey 172399 – Rahul 172267 – Angel
Sets-Equality, subsets, power set, operations, Cartesian product, etc.	172408 – Zeheb Makani 172402 – Samriddhi 172417 – Sannia 172355 – Aadharsh 172405 – Rohan
Binary relations, Higher order relations, equivalence relations, Partial orders	172400 – Neha Goregaonkar 172423 – Mohit 172379 – Sudhanshu 172367 – Ethel 172336 – Aishwarya
Chinese postman problem, Digraphs, Scheduling problems	172388 – Manya Chadha 172345 – Rhea 172312 – Aleya 172409 – Natasha
Functions- Inverses and compositions, 1-1 correspondence, cardinality, continuum hypothesis etc.	172384 – Shazia Bandukwala 172350 – Tanishka Johri 172393 – Swareena 172370 – Zainab 172411 – Muskan 172378 – Jaanvi
Trees, minimum spanning trees, Kruskal's algorithm	172403 – Joanne Simon 172420 – Elizabeth 172394 – Lisa 172358 – Tanishk 172418 – Nikky
Division Algorithm, Euclidean Algorithm, Prime numbers	172422 – Darshna Verma 172413 – Nishi 172389 – Abhijeet Reddy 172416 – Rose 172385 – Shubh
Congruence and its applications- universal product codes, Chinese remainder theorem, cryptography	172354 – Teena Tomy 172397 – Teresa 172386 – Samiha 172375 – Akhila 172360 – Merlin



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.




ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Topic (Title of Project)	Group Members (UID--Name)
Mathematical induction and its various forms.	172424 – Prakhar Kandpal 172327 – Maitri 172302 – Arjun 172328 – Siddharth 172330 – Pooja 172216 – Astle
Recursively defined sequences, solving recurrence relation	162524 – Aqsa Tambre 172202 – Zubair 172351 – Abraham 172242 – Shivakh 172229 – Aqib 172352 – Kaustubh
Principle of Inclusion-exclusion, addition and Multiplication rules, pigeonhole principle	172232 – Dev Lunawat 162272 – Aaron 172203 – Rishabh 172237 – Adnan 172260 - Kazim



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Department of Mathematics – Exhibition Competition (2018-19)

Topic (Title of Project)	Group Members (UID--Name)
Permutation and combinations with and without repetition	172205 – Omkar Chavan 172256 – Ragansu 172220 – Prerna 172236 – Ritu 172248 – Nimita 172224 – Nancy
Probability Theory and elementary probability	172347 – Tanvi Goswamy 172326 – Pravishna 172410 – Shruti 172332 – Himanshi 172359 – Sonal
Derangements, Binomial Theorem	172318 – Tanishqa Khanted 172210 – Nandan 172207 – Deeptanu 172331 – Abhishek
Pascal triangle and its properties	172392 – Cathelisa Dias 172406 – Shanelle 172395 – Abigail 172390 – Sherly 172356 – Angela
Algorithms and their complexity	172268 – Sinal Vaz 172234 – Mansi 172270 – Ruchika 172263 – Sudina

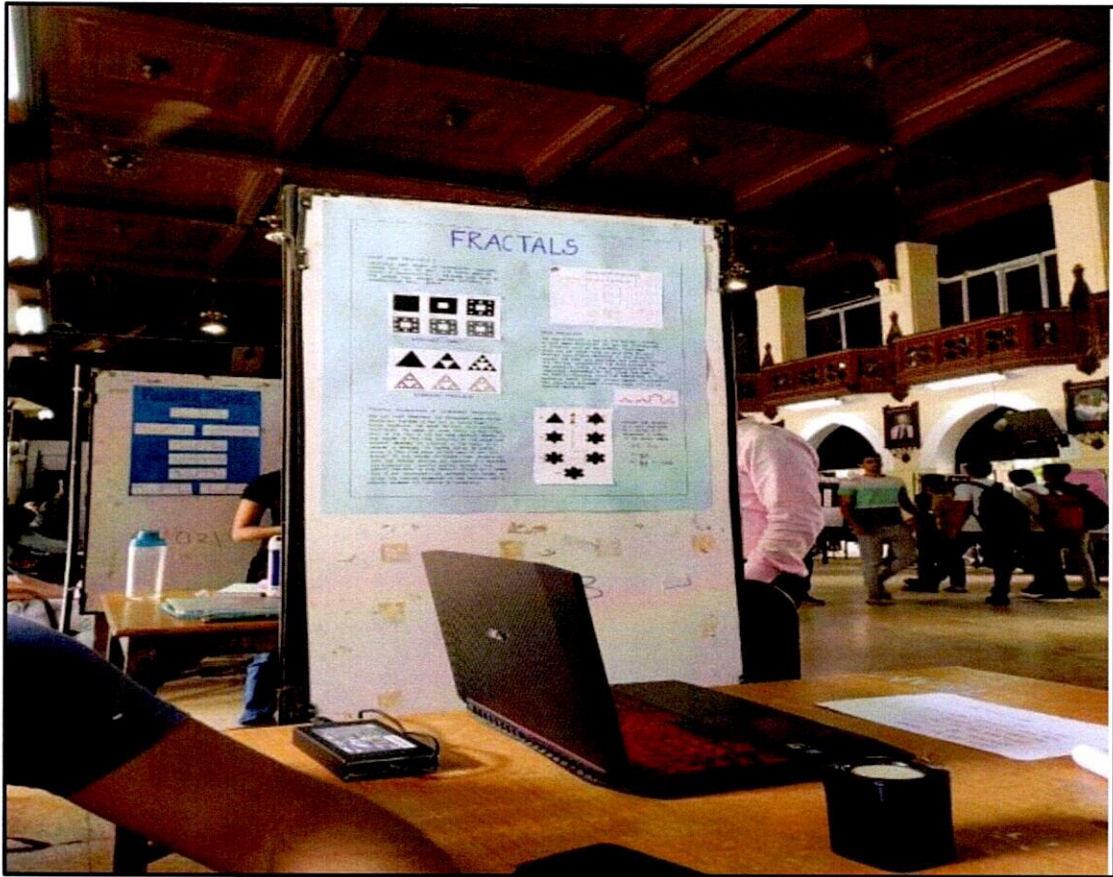


NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

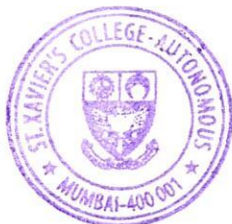
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Department of Mathematics – Exhibition Competition (2018-19)



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

**DEPARTMENT OF MICROBIOLOGY
PROJECT TITLES & CERTIFICATES
EXHIBITION PHOTOS**



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

**Role of conserved amino acids in the active site region of KatB, a
Mn-containing catalase from nitrogen fixing cyanobacterium**

***Anabaena* PCC 7120**

A dissertation submitted to St. Xavier's College- Autonomous
For the partial fulfilment of the degree of Master of Science in Microbiology

By

Ankita Vishnuprakash Lakhotia

M. Sc. (Microbiology)



St. Xavier's College- Autonomous
5, Mahapalika Marg, Mumbai-400001.

Under the guidance of
Mr. Dhiman Chakravarty,
Scientific Officer,
Bhabha Atomic Research Centre, Trombay,
Mumbai- 400085 .

May 2019- August 2019



Bhabha Atomic Research Centre, Trombay

Mumbai-400085

1



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Bhabha Atomic Research Centre

भाभापरमाणुअनुसंधानकेन्द्र

Trombay,

ट्रॉम्बे,

Mumbai-400 085

मुंबई-400 085



सत्यमेव जयते

भारतसरकार

GOVERNMENT OF INDIA

CERTIFICATE

I certify that the research work presented in this thesis titled "**Role of conserved amino acids in the active site region of KatB, a Mn-containing catalase from nitrogen fixing cyanobacterium Anabaena PCC 7120**" has been carried out by **Ms. Ankita Vishnuprakash Lakhotia** under my supervision and this is her bonafide work. The research work is original and has not been submitted for any other degree of this or any other institute. Further, she was a regular student and has worked under my guidance as a full time student at "**Molecular Biology Division, Bhabha Atomic Research Centre, Mumbai**" until the submission of the thesis to the Department of Microbiology, St. Xavier's College (Autonomous).

This work was conceived and executed in BARC and has not been reported in any scientific communication earlier. No part of the data included herein would be published in any form without prior permission of the Head, Molecular Biology Division, BARC.

Place: Mumbai

Date: 13/12/2019

Mr. Dhiman Chakravarty

Scientific Officer,

Molecular Biology Division, BARC

Dr. Anand Ballal

2



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

POST GRADUATE DEPARTMENT OF MICROBIOLOGY

St. Xavier's College – Autonomous
5, Mahapalika Marg, Mumbai – 400001



Certificate

This is to certify that Ms. Ankita Vishnuprakash Lakhota, student of M.Sc. (Microbiology) - Semester III, at the Department of Microbiology, St. Xavier's College (Autonomous) has submitted the dissertation work titled **“Role of conserved amino acids in the active site region of KatB, a Mn-containing catalase from nitrogen fixing cyanobacterium *Anabaena* PCC 7120”** for the partial fulfilment of the Master's degree in Science in Microbiology, during the academic year 2019-2020.

This work was conceived and executed in BARC and has not been reported in any scientific communication earlier. No part of the data included herein would be published in any form without prior permission of the Head, Molecular Biology Division, BARC.

Date: 13th Dec, 2019

Place: MUMBAI

Ms. Miriam Stewart

Head of the Department, Department of Microbiology




Examined
Dr. M. Shihaya
M. Shihaya
19/20/12/19

3



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

**Characterization of Flagellar Associated Protein FAP147
mutant of *Chlamydomonas reinhardtii***

A dissertation submitted to St Xavier's College - Autonomous
For the partial fulfilment of the degree of Master of Science in Microbiology

By

Valamcottu Rickson Varghese Saly

MSc. (Microbiology)



St Xavier's College- Autonomous

5, Mahapalika Marg, Mumbai-400001

Under the guidance of

Prof. Jacinta S. D'Souza

School of Biological Sciences, UM DAE Centre for Excellence in Basic Sciences,
Kalina, Santacruz (East), Mumbai - 400098, Maharashtra

May 2019 - August 2019



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

POST GRADUATE DEPARTMENT OF MICROBIOLOGY

St. Xavier's College – Autonomous
5, Mahapalika Marg, Mumbai – 400001



Certificate

This is to certify that Valamcottu Rickson Varghese, student of M.Sc. (Microbiology) - Semester III, at the Department of Microbiology, St. Xavier's College (Autonomous) has submitted the dissertation work titled '**Characterization of Flagellar Associated Protein FAP147 mutant of *Chlamydomonas reinhardtii***' for the partial fulfillment of the Master's degree in Science in Microbiology, during the academic year 2019-2020.

Date: 13th Dec, 2019

Place: MUMBAI

MStewart
Ms. Miriam Stewart


Head of the Department, Department of Microbiology



Examined
MS Shetty
Dr MS Shetty
20/12/19



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

University of Mumbai

Nurturing talent... promoting excellence
मौलिक विज्ञान प्रकर्ष केंद्र

प ऊ वि
DAE

150
YEARS OF
CELEBRATING
THE MAHATMA

मुंवि - पऊवि मौलिक विज्ञान प्रकर्ष केंद्र
UM-DAE Centre for Excellence in Basic Sciences
Registered under the Society Registration Act, 1860

Certificate

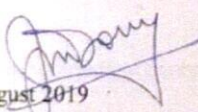
This is to certify that Valamcottu Rickson Varghese Saly, student of MSc Microbiology at St Xavier's College (Autonomous) has completed four months training/ Research Project at School of Biological Sciences, UM-DAE Centre for Excellence in Basic Sciences during the academic year 2019-20.

He has completed the dissertation work entitled "Characterization of Flagellar Associated Protein FAP147 mutant of *Chlamydomonas reinhardtii*" for the partial fulfilment of MSc. (Microbiology) degree. During this project he was exposed to the following techniques: Bacterial and *Chlamydomonas* culturing, PCR, gene cloning, Western blotting and immunoprobng, SDS-PAGE, Agarose gel electrophoresis, Immunofluorescence and *Chlamydomonas* flagellar mutant screening.

This carefully written report represents the experiments and literature related to the same carried out by him during the period from 1st May 2019 to 30th August 2019.

We/I found Valamcottu Rickson Varghese to be a sincere and hard-working student. His overall conduct was good.

PI/supervisor: Jacinta S. D'Souza

Signature 


Date: 30th August 2019

Chairperson
School of Biological Sciences
University of Mumbai-Department of Atomic Energy
CENTRE FOR EXCELLENCE IN BASIC SCIENCES
CEBS Building, University of Mumbai
Vidyanagari Campus, Santacruz (E), Mumbai-400098

Seal of the institute



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Department of Microbiology - Exhibition



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Abhinav
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

DEPARTMENT OF PHYSICS

EXHIBITIONS



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Physics department organized an exhibition where in all the SY and TY students displayed exhibits. Science as well as Arts faculty students and Teachers as well as some school children visited the exhibition.



Department of Physics – Exhibition (2017-18)



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

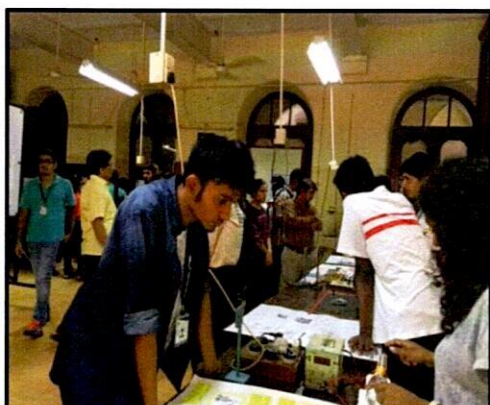
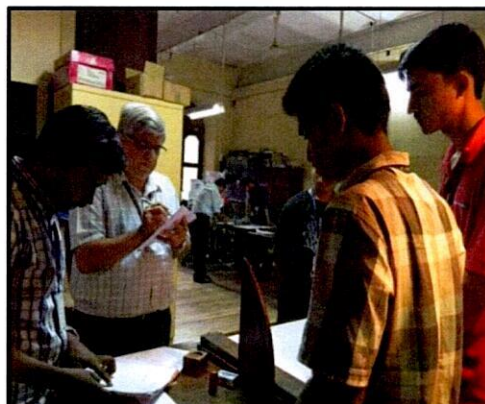
Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Physics exhibition was held where in all the SY students and few TY students displayed exhibits.

1. TY students were taken to Khandala for two days seminar.
2. FY students were taken to HBCSE for educational visit.



Department of Physics – Exhibition (2016-17)



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Alinda
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

DEPARTMENT OF SOCIOLOGY
PRIVILEGE WALK



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

LIST OF STUDENTS FOR PRIVILEGE WALK: 2017-18

Menezes Seltzer	151155
Michael Nathan Denzil	151216
Kher Lakshmi Satish	151244
Podder Suravi Vivek	151440
Fernandes Ignatius Paul Leonard	161018
Fernandes Joelle Francis	161026
Madhura Muralidharan	161029
Brownson Mahima Moses	161033
Shetty Nidhi Vishwanath	161037
Nayak Anupamaa Krishnamurthy	161041
Dhonde Pamela Prashant	161050
Dsouza Danica Dominic	161053
Agarwal Advika Praful	161078
Vaz Bernadine Valerian	161080
Dodti Serah Simon	161083
Thoppil Sanjna Sebastian	161084
Munjaj Mahima Mayank	161087
Valladares Sanath Ray Kieran	161104
Shaikh Sara Arshad	161119
Braganza Kimberly Ann Jocelynn	161120
Kotian Mahima Sukumar	161125
Fernandes Amanda Steven	161127
Concessio Kyle Glenn	161132
Lemos Minolette Melanius	161134
Varghese Hannah Jayan	161136
Surve Shalmali Shekhar	161138
Pardawala Khadija Husain	161140



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

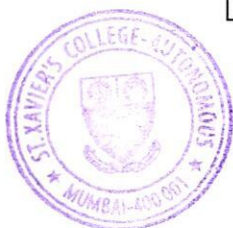
Alinda

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Mascarenhas Chris Maxim	161141
Dsouza Ryan Xavier	161142
Alphonso Jessica Jonas	161144
Jani Jessica Ketan	161146
Buhril Joseph N Ginlianlal	161147
Mendonca Wendy William	161154
Sequeira Prudence Bosco	161158
Kottaramkunnel Sonamerin Roy	161159
Nair Harun Hariharanandan	161160
Andrades Schnelle Lynn Dean	161161
Vaz Chelsea Nathalie Darral	161162
Kundhadia Diandra Pradhuman	161165
Deshpande Srushti Ravindra	161172
Dcunha Maria LENIN Lenin	161177
Collaco Amber Lourdes Sibert	161178
Lalan Shivani Ajay	161192
Kooliyadan Mercy Anthony	161195
Iyer Vaibhavi Chudamani	161197
Vaz Verena Angel Damascus	161198
Khajotia Vahbeez Darayas	161213
Misquitta Georgia Ann Ignatius	161216
Crasto Ivannah Oscar	161217
Gonsalves Marc Damian	161219
Kurshingal Celeste Gerald	161220
Pooja Pradish Kumar	161223
Khobare Aishwarya Kiran	161225
Dmello Lynel Annie Damien	161226
Gonsalves Simran Raymond	161235



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.




ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Rodrigues Simren Esther Lazarus	161236
Rumao Glarina Leonard	161243
Yadav Yojana Sanjay	161245
Rodrigues Bianca Francis	161248
D'Souza Joshua Joseph	161252
Rathod Hazel Mahendra	161258
Dsouza Sania Oliver	161274
Kumar Anshul Gyanendra	161288
Dongre Nidhi Prashant	161304
Tanha Mariam Samji	161319
Margaret Merrina	161326
Sangvai Tanvi Ravindra	161333
Elizabeth Ann Thomas	161341
Pereira Zoiya Ivanna Mcewen	161343
Joshua Eugene	161345
Nunes Ileen Sunny	161349
Sachdev Mallika Rakesh	161376
Alvares Romaine Shayne	161380
Dhingra Aanya Singh Kulvinder	161392
Manasvini Shravan	161400
Punjabi Tanya Manoj	161404
Jacob Rose James	161409
Dosi Isha Paras	161415
Kumar Debashish Dilip	161418
Pottenkulam Varkey Thomas	161419
Kesarkar Utkarsha Sandesh	161420
Shahi Ishika Madhusudan	161421
Acharekar Tania Yogesh	161426



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Fernandes Reva Maria	161428
Mascarenhas Carol Joseph	161429
Regina Jennifer Joseph	161430
Abdulla Mohd. Daniyal Afzal	161431
Okamoto Hideki Masayoshi	177003
Fujimoto Shusei Hideshi	177004
Tsurumi Aya Tetsuya	177005
Patel Rucha Piyush	177025
Changkija Meyinaro	151366

Mehta Sakshi Vijay	161048
Sheth Arnav Ketu	161051
Majmudar Bhuvan Gaurav	161052
Thakkar Ritu Bhadresh	161054
Gomes Aldina Roman	161062
Dbritto Lynn Godfray	161063
Choudhury Aradhana Joydeep	161073
Dias Vanessa Victor	161082
Nair Richa Babu	161085
Lemos Silvi Justin	161112
Paul Sonal Roshan	161145
Rodrigues Jean Joseph	161166
Crasto Sahiban Brendan	161173
Shirke Kavya Mahesh	161188
Jain Muskaan Atul	161211
Shwetha Maria James	161268
Aishwaria Anna Aby	161280
Basu Bikramjit Arijit	161330
Rodrigues Gitali Dorothy Camillus	161334
Jain Mallika Mohit	161385
Jha Shalini Sravan	161019
Creado Simran Rekky	161021
Pandharkame Prutha Nitin	161028



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Soares Kenneth	161044
Lavania Gokul Nitin	161045
Dsouza Samantha Stephen	161057
D'souza Sydelle Zeferinho	161067
Dsilva Larissa Ivan	161079
Shaikh Zubia Hamid	161086
Ravishankar Supriya	161093
Lobo Simran Anneka Lawrence	161103
Phalke Ganesh Hanamant	161105
Rodrigues Liam Antonio	161106
Dharani Xinelli Zanasha Sultan	161107
Matta Prabhmeet Kaur Manjit Singh	161121
Crasto Joshua Jude Dominic	161133
Thorat Anugraha Ashish	161139
Christopher Anika Hans	161149
Dsouza Alyssa Anastasia Anselm	161157
Reena Mathew	161196
Sawant Adhish Yogesh	161207
Murdeshwar Rahul Sandeep	161222
Sequeira Dione Diago	161227
Lopes Liwisa Philip	161240
Lopes Symrun Johnson	161242
Dcunha Sybil Adrian	161246
Fernandes Svetlana Jude	161257
Parikh Srishti Sachit	161267
Alen Sandra Prakash	161283
Bishaya Ankita Dinesh	161305
Mane Rishikesh Vijay	161381
Kinoshita Kouhei Shigeru	177001
Bhatia Ria Rohit	161006
Gonsalves Lorraine Louis	161007
Jukar Salonee Rahul	161010
Vaz Shrishti Maryann Edsel	161012
Fernandes Adelle Lloyd	161015
Pathare Mrunmayee Ravindra	161023



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.




ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Vengsarkar Ketaki Shantanu	161024
Mhatre Prachiti Sanjay	161025
Anushka Benny	161030
Shrivastava Shraddha Rajkumar	161036
Bhatia Shanaya Vinay	161038
Menon Nethra Sanjiv	161040
Krishnan Shruti	161043
Shah Roshni Arpan	161055
Gidwani Tanya Mahinder	161059
Diya Mahesh	161064
Patil Sara Vivek	161065
Prerna Shreeram	161066
Kaur Sukhnidh Jaijeet Singh	161071
Bhosale Payal Satish	161074
Somani Hiral Nilesh	161075
Delsy Hannah James	161081
Mehta Vallari Chaitanya	161090
Doshi Isha Rajen	161095
Anant Vishwanathan	161096
Shah Darshil Hitesh	161099
Sneha Santosh	161100
Talsania Harshi Nimish	161102
Vaz Samantha Ivanna Charles	161110
Vartak Shivani Prashant	161111
Vartak Isha Umesh	161113
Kamat Tanisha Prashant	161114
Fernandes Tiffany Mary Desmond	161123
Rozario Danica Luke	161124
Noronha Candida Angela George	161128
Shethia Urmi Samir	161129
Joshi Yamini Sanjay	161131
Mistry Rayomand Jamshed	161148
Dsouza Maria Lawrence	161156
Pereira Leanne Clarence	161163
Tauro Althea Ashley	161175



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Joshi Supriya Vishwas	161179
Rebello Meagan Rachel Ralph	161182
Rubens Leora Levi	161189
Silveira Ninoshka Joseph	161190
Dsilva Neala Walter	161191
D'silva Rebecca Tanya Richard	161194
Arya Prasad	161200
More Shambhavi Waman	161201
Lobo Marushka Walter	161203
Jain Akshata Sanjeev	161204
Shah Darshi Mahendra	161208
Mahatme Divya Prasad	161224
Mahadar Meera Nitin	161228
Gonsalves Shirley Clement	161234
Allams Denise Dirk	161256
Matilda Liza Dethose	161264
Ashmitha Joseph	161269
Mathews Feba Mary Sabu	161286
Joshi Archie Nilesh	161290
Jain Shreya Amit	161321
Gondalia Khushali Vijay	161328
Zakaria Maleeha Asif	161332
Akiba Nanae Hidetaka	177002
Ghurye Namrata	177027



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Privilege Walk – Department of Sociology and Anthropology 2017-18

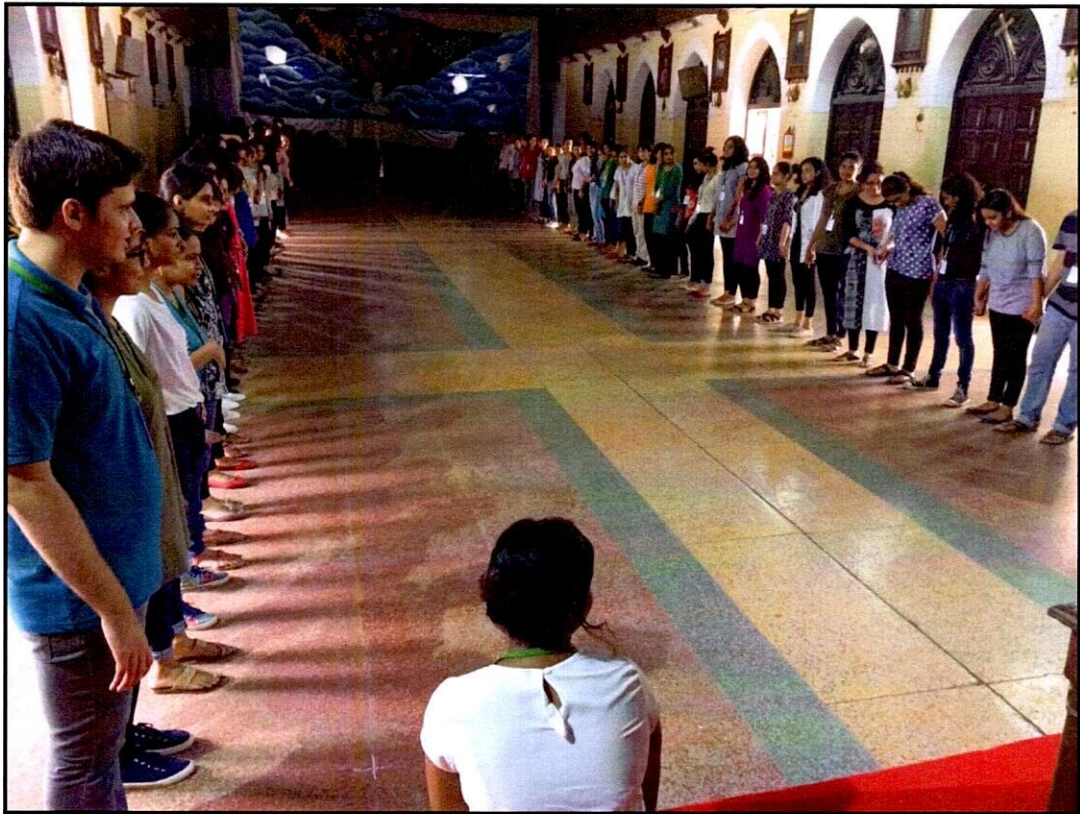


NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shirish
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Privilege Walk – Department of Sociology and Anthropology 2017-18



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

DEPARTMENT OF ZOOLOGY
PROJECTS EXCURSIONS
EXHIBITION




ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

DEPARTMENT OF ZOOLOGY
STUDENT ZOOLOGY AND ENTOMOLOGY PROJECT REPORT
(2019-20)

Sr. No	Names of Members	Project title	Number of students
1	Jewel Carvalo, Isha Bansal, Anciya Colaco, Premal Mascarenhas, Mayuri Chavan, Jemima Joseph	Determination of LC50 of Copper Sulphate on Daphnia and Chironomous Larva	06
2	Aashra Iype, Akhilesh Tambe, Anciya Colaco, Premal Mascarenhas	Determination of LC50 of Neemark Biopesticide Riceweevil	04
3	Aayushi Rawat, Pooja Kumari, Shail Dave, Simrin Patrao	Comparative Analysis and Assessment of Potency of Natural Repellent Against Riceweevil in Stored Comestibles	04
4	Shreya Yadav, Tanaya Nair, Rohan D'souza, Gayatri Mishra	Effect of Larval Crowding on Egg to Adult Viability and Body Size of Canton S., Drosophila Melano Gaster	04
5	Aashra Iype, Aayushi Rawat, Simrin Patrao, Muskan Mishra, Taneya Samant, Noah Jacob	Study of Insect Succession in Decaying Pork Exposed to Sleeping Medication Restyl Overcoating Days	06
6	Jewel Carvalo, Mayuri Chavan, Jemima Joseph, Noah Jacob, James Gonsalves, Sayali Kute	Effect of Chemicals on the Heart Rate of Order Cladocera	06
7	Rashmi Raba, Glynelle Almeida, Clarissa Kitikal, Vaibhavi Bandgar, Abhijit Pege	A Study of Milk Adulterants on Some of the Milk Constituents of Popular Milk Brands in Mumbai	05



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



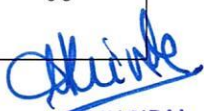
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

DEPARTMENT OF ZOOLOGY
STUDENT PROJECT REPORT
(2018 – 19)

Sr. No	Names of Members	Project title	Number of students
1	Aditya	To the study the antifeedant and feeding deterrancy in insects	01
2	Melissa, Sharon, Swanandi	A study of adult Flesh flies to check food/ reproductive (egg laying) preference of differently treated pork samples.	03
3	Amartya, Malaika, Shimontika, Ishaan, Salama, Shania	LC ₅₀ using tobacco extract on tropical aphids	06
4	Magdalene, Anushia, Clarissa, Swetlana, Theresa, Yashashree	A study of ant behaviour (pheromones) and efficacy of household repellants/deterrents against ants	06
5	Ankita, Shiva, Kartikeyan, Vidisha, Clarita, Himrekha	Effect of light intensity and varying concentrations of Nicotine on the development of Flesh flies	06
6	Shamika, Rochelle, Trish, Ruchira, Mrunal	Study of the behaviour and bait preferences of tropical household ants	05
7	Alina, Sudipta, Reshell, Daphisa, Radhika, Neelam	Exploring insect species associated with <i>Calotropis</i> and <i>Lantana</i> at BPT garden, Mumbai	06
8	Victoria, Violet, Lizanne, Kim, Raveena	Effect of different culture media on the life history parameters of <i>Drosophila melanogaster</i>	05
9	Nikhil, Vishal, Khwahish, James	A study of the species index of insects observed on different meat types	04
10	Ashley, Stacey, Sunidhi, Joanne, Pragya, Anagha	A study of the effect of different insecticides on insect succession	06



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.




ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

DEPARTMENT OF ZOOLOGY
STUDENT ZOOLOGY PROJECT REPORT
(2017 – 18)

Sr. No.	Name	Topic	Guiding Teacher
1	Dolsy David, Pradyut Rao, Clive D'costa, Siona Fernandes, Pooja Kanojia	Effect of Temperature variation on survivorship and body size of <i>Drosophila melanogaster</i>	Dr. Sujata Deshpande
2	Sandra Pereira, Varun Rawal, Joshua Kevin Rajan, Jasmine Pereira, Ena Shaikh, Jason Coutinho	Green Synthesis and characterization of silver nanoparticles using leaf extract of <i>Nicotiana tabacum</i> L	Dr. Pushpa Sincar
3	Dolsy David, Asmita Dubey, Daniel Raj, Aarohi Sanghvi	Mortality rate of Rice weevils on exposure to varying concentrations of Neem oil	Dr. Smita Krishnan
4	Shreya Dimri, Isha, Aishwarya Chavan, Violet Nunes, Shyla Shyamsunder, Jaison D'sa	Delayed spatial alternation (DSA) in Zebrafish (<i>Danio rerio</i>) and Goldfish (<i>Carassius auratus</i>) to test the effect of nicotine on short-term memory	Dr. Smita Krishnan
5	Zachary Borthwick, Shanelle Pereira, Jacinta Pereira, Daniella Salazar, Shafaq Teli, Keren Pereira,	Screening of Teratogenicity of Over the Counter Medication using Chick Embryo	Mr. Conrad Cabral



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

DEPARTMENT OF ZOOLOGY
STUDENT ZOOLOGY PROJECT REPORT
(2016 – 17)

Sr. No.	Roll. No.	Name	Topic	Guiding Teacher
1	338, 342, 345, 340, 339, 343, 21	Karan Deshpande, Khyati Patel, Vinsea Singh, Jacqueline Varkey, Vagmi Gupta, Pearl Pires, Sean D'souza	Effect of population density on life history parameters in Drosophilla	Dr. Sujata Deshpande
2	341, 336, 337, 14, 10	Simran Mascarenhas, Shraddha Agarwal, Sindhuja Bhesette, Athira Rajan, Kristan Dodhi	Effect of pH on zebra fish Development	Dr. Pushpa Sinkar
3	344, 9, 20, 17	Subarna Ray, Sweta Carvalho, Komal Tade and Hussainbee Sheikh	Regeneration in Earthworm	Dr. Madhuri Hambarde
4	15, 19, 13, 18, 16, 12, 11	Udit Nair, Harshit Singh, Harshini Jhala, Shivira Shukla, Marishia Rodrigues, Brandon Rodrigues, Prinson Dsilva	Aggression in Siamese Fighter Fish	Dr. Smita Krishnan



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

DEPARTMENT OF ZOOLOGY
STUDENT ENTOMOLOGY PROJECT REPORT
(2016 – 17)

Sr. No.	Roll. No.	Name	Topic	Guiding Teacher
1	342, 10, 213, 336, 341, 345	Khyati Patel, Kristan Dhodi, Shivam Arora, Shraddha Agrawal, Simran Mascarenhas, Vinsea Singh	Study of LC 50 of cucurminoids and allicin on <i>Daphnia pulex</i>	Dr. Smita Krishnan & Mr. Conrad Cabral
2	217, 220, 222, 227, 229, 236	George Jacob, Keertana Venkatesh, Keya Matthew, Apurva Phale, Kunal Reshamwala, Chandrika Varma	Determining the change in Maggot mass and temperature associated with Pork kept in different environmental conditions	Dr. Smita Krishnan & Mr. Conrad Cabral
3	133, 136, 138, 140, 143, 337, 338	Svetlana Dcosta, Neha Jain, Mary Stephen, Neeti Rathi, Hisham Shaikh, Sindhuja Bheesette, Karan Deshpande	Individual and interactive effect of <i>Azadirachta indica</i> and Copper sulphate on Chironomous species	Dr. Smita Krishnan & Mr. Conrad Cabral
4	224, 225, 340, 343, 04, 234	Subrata Mishra, Shalini Mukherjee, Jacqueline Varkey, Pearl Pires, Chiselle Varella, Priscilla Shetty	Insecticidal properties of liquid chemical versus home remedies and its effect against german cockroaches	Dr. Smita Krishnan & Mr. Conrad Cabral
5	21, 14, 344, 66, 20, 9, 17, 16	Sean Dsouza, Athira Rajan, Subarna Ray, Sumaiya Quereshi, Komal Tade, Sweta Carvalho, Hussainbee Shaikh, Marishia Rodrigues	Insect diversity, activity and succession on different carrion types	Dr. Smita Krishnan & Mr. Conrad Cabral
6	12, 13, 19, 11, 18, 15	Brandon Dsouza, Harshini Jhala, Harshit Singh, Prinson Dsilva, Shivira Shukla, Udit Nair	Comparison of the effectiveness of the household substances in being an alternative to chemical pesticides	Dr. Smita Krishnan & Mr. Conrad Cabral



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.




ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

DEPARTMENT OF ZOOLOGY
STUDENT ENTOMOLOGY PROJECT REPORT
(2015-16)

Sr. No.	Roll. No.	Name	Topic	Guiding Teacher
1	126, 176	Kyle Myers, Neha Kapadia	Antioxidant activity of marine algae collected from Okha	Dr. Madhuri Hambarde
2	16, 12, 13, 11, 23, 24	Thomsina Dsouza, Alston Fernandes, Duhita Naware, Ronita Sequiera, Helen Sathiya	Effect of stress (heat and cold shock) on goldfish	Dr. Madhuri Hambarde
3	10,27, 314, 325, 326	Aaron Crasto, Michelle Andrews, Aparna Sunderesh, Niddhi Salian and Rebecca Samuel	Serum protein profiling for diabetes mellitus	Dr. Madhuri Hambarde
4	317, 17, 324, 319, 315	Ankita Das, Evan Nazerath, Iqbal Bhalla, Ryan Rodrigues and Vinni Jain	Associative learning in transgenic zebrafish (Daniorerio)	Dr. Smita Krishanan
5	322, 22,25, 7, 21, 20	Harshad Parekar, Mcbern Rodrigues, Marcus Tobias, Niyati Koli, Sumer Rao and Joel Pinto	Effect of incubation on weight of eggs, eggshell thickness and its calcium content	Dr. Sujata Deshpande
6	32,9,14, 316, 19, 26	Amanda Caerio, Louann Colaco, Namita Iyer, Parmeshwari Chandak, Shanelle Pereira and Sharon Fernandes	Effect of hypergravity on eukaryotes: Chironomous larvae	Conrad Cabral
7	18, 8, 318, 321, 320	Gretel Pereira, Karen Lobo, Jisha Hannie, Gautami Mankhame and Ganeshri	Effect of salt stress on biota in freshwater	Dr. Madhuri Hambarde



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

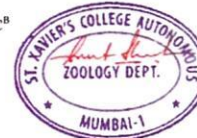
Sr. No.	Roll. No.	Name	Topic	Guiding Teacher
8	322	Harshad Parekar	Antioxidant properties of some brown algae	Dr. Madhuri Hambarde
9	126	Neha Kapadia	Antioxidant properties of red algae	Dr. Madhuri Hambarde
10	176	Kyle Myers	Antioxidant properties of green algae	Dr. Madhuri Hambarde

A comparative study: Flesh fly egg laying or breeding site preferences on differently treated meat pieces

Cardoza. S.; Joseph. M.; Nulkar. S.; Krishnan. S^A., Cabral. C^B

^AAssoc. Prof. & Head of Department of Zoology

^BAsst. Prof. of Department of Zoology



Abstract: Flesh flies from the family Sarcophagidae are carrion-breeding flies. Protection from predators and parasitoids is a very important criteria when it comes to choose a location for breeding and laying eggs. Hence, they search for an environment that is safe and nutritious enough for their offsprings. In forensic entomology, these dipterans play an important role. Natural orifices, body fur and exposed wounds are preferable locations but it depends upon various factors such as the degree of decomposition or the presence of other carrion feeding organisms. We first exposed pieces of pig meat to obtain our sets of adult flesh flies. The next step, was to check the egg laying food preference with differently treated meat pieces which were exposed to a set of flies at a time. It was observed that the flesh flies preferred the boiled/ cooked meat over the rest.

Introduction:

Forensic entomology is the study of insects and other arthropods in criminal investigation. Insects or arthropods are found in a decomposing organisms or carrion. These insects can be used to estimate the time of death i.e., time interval between death and corpse discovery, also called post-mortem index (PMI), location and movement of the corpse and cause of death and probable suspects at the death scene. The first recorded incident where insects were used in a criminal investigation was in 13th-century China as described in Sung Tzu's book called - The washing away of wrongs. When a farmer was found murdered in a field with a sharp weapon, all the suspects were told to place their sickles on the ground. Only one sickle attracted blow flies the first to reach on the trace amount of blood hidden to the naked eye on the sickle which resulted in the confession by the murderer. The first application of forensic entomology in a modern court house was in 18th-century France where entomological data was admitted as proof for acquitting the current occupants of the residence from where the skeletonized remains of a toddler were found.

As soon as death occurs, cells start dying and enzymes start digesting the cells inside out in a process called autolysis and hence the body starts decomposing. Bacteria present in the gastrointestinal tract start destroying the soft tissue producing liquids and gases like hydrogen sulphide, carbon dioxide, methane, ammonia, sulphur dioxide and hydrogen. The volatile molecules escaping from the decomposing body attract insect. (Joseph I *et al*; 2011 & Amendt J *et al*; 2004)

Application of Forensic Entomology for investigations other than death Food Infestation Cases: Food production facilities where Integrated Pest Management procedures are not followed can be quite an attraction for pests. Cases involving the contamination of food products with insect debris call for the involvement of a forensic entomologist to investigate and provide support. Presence of Drugs: An analysis of the bodies, faeces and dead skins of insects feeding on carrion and cadavers helps forensic entomologist determine the presence and type of drugs or poison in the body. Flesh flies coming from the family Sarcophagidae are carrion feeders and consider it to be a protective and nutritious environment for their offsprings. Flesh flies have a life cycle of 15 days showing complete metamorphosis and are larviparous where the eggs incubate and hatch in the female's body. Larvae feed for approximately four days, depending on environmental conditions and the species. After completing the larval stage of the life cycle, flesh flies pupate, which is a dormant stage of little or no movement. Most species emerge as adults within 12 to 15 days. Some pupae might remain dormant for several weeks and hatch after several weeks. the pupae colour (Red to black) can tell how old it is.

In this experiment carried out the aim was to look for flesh flies egg laying presence on different treated meats. Considering the different types of treated pork pieces as different conditions of crime. The analysis of the same is discussed below.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Material and methods:

Experimental setup to obtain adult flies:

Two fresh raw pork pieces (~250 g) were kept enclosed in a rat cage at St. Xavier's College, Mumbai for 15 days. The location was chosen such that no pests like mice, stray animals or scavengers disrupted the experimental setup. It was an open air location and kept away from direct sunlight and so as to avoid rapid desiccation of the meat pieces. The cage was covered with a paper at one end leaving one end open for flies to enter and get access to the meat. This cage was placed on top of a tray filled with soil and some was spread around the tray. It is seen that the 3rd instar larvae pupate in the soil, hence the above facilitated easy collection of the pupae. These pupae were collected in flasks and provided with powdered sugar as a food source.

Experimental setup with the adults flies obtained:

Etherisation was done so as to transfer the flies from the flask to the experimental box. A card board box with two holes made at opposite sides of the box. On each hole a transparent glass was attached in which a piece of treated meat was placed. A boiled meat piece at ~120°C for 10 min, meat piece burnt for 20 min, drugged (coated with powdered aspirin) and a meat piece wrapped with three ply melt blown were placed in each glass. The box was covered with colourless cellophane so as to observe the movement of flies. This also prevented the escape of flies.

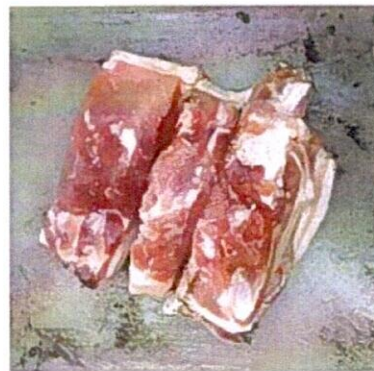
Two sets of flies were released. Each set consisted of 10 flies and two runs were carried out, each lasted for a total of 45 minutes. Observations were terminated after 45 mins after which the flies were set free.

Results:

Two days after setting up the experiment, no infestation was visible. On the third day, there were 1st instar larvae seen under the meat as well as between two meat pieces. In the next few days the larval instar development was observed. It was also observed that the pieces of meat seemed to ooze body fluids. The exposed surface of the meat had marginally desiccated. The observed results are as follows:




Experimental setup



Day 1



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65



1st instar larvae on day
03



2nd instar larvae after
few days



3rd instar larvae



Pupae on the 10th day



Emerged out Adult
flesh flies

Among the 10 flies released in each set, 8 flies went towards the different meat pieces as shown below in the tables.

SET 01

Type of treatment to the meat	No. of Flesh flies preferring the treated meat
Burnt	1
Drugged	1
Wrapped	2
Boiled	4



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



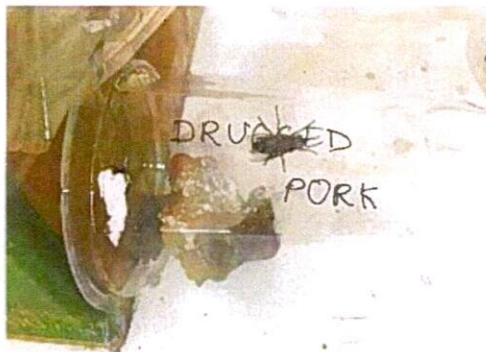
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



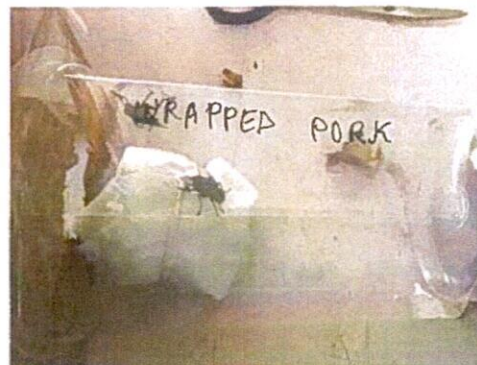
Experimental setup



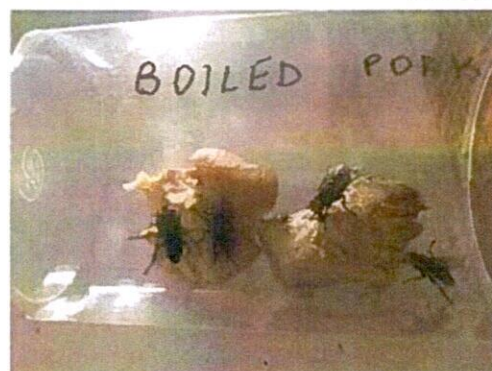
Burnt meat piece



Drugged meat piece



Wrapped meat piece



Boiled meat piece



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

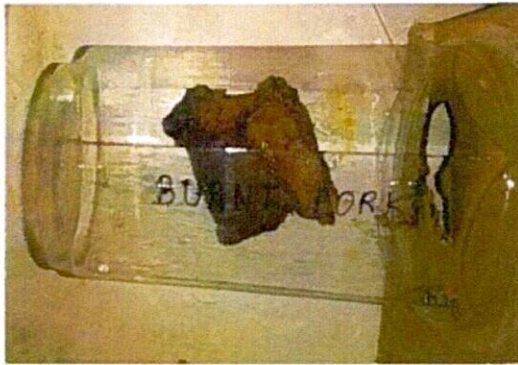
Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

SET 02

Type of treatment to the meat	No. of Flesh flies preferring the treated meat
Burnt	2
Drugged	1
Wrapped	2
Boiled	3



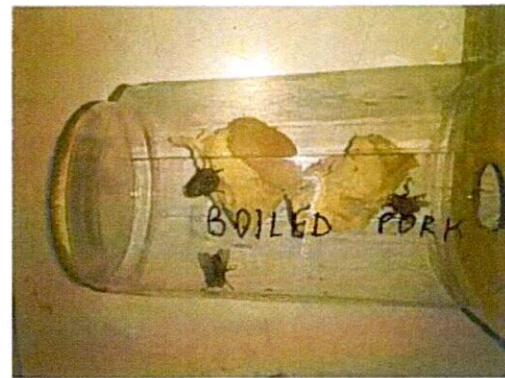
Burnt meat piece



Drugged meat piece



Wrapped meat piece



Boiled meat piece



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Discussions :

All the meat treatments were in correlation with simulation of possible disposal methods of a body. This experiment was carried out assuming all the flies were mated and their preferences were pertaining to their requirement to oviposit. Amongst the four categories of treated meat the one that attracted the maximum flies was boiled meat. Boiling of meat loosens the muscles fibres and results in breakdown of the connective tissues. From literature it is known that flies prefer nectars which are amino acid - sugar base over completely sugar based ones. (Baker, 1977). This is an indicative of the relative amino acid deficient nature of insect's dietary aspects. Hence in both sets, maximum number of flies were attracted to the cooked meat. Age and sex dependent nutritional choices are also seen in flesh flies and is assumed to be in correspondence with their ovarian cycles. (Nakagawa A. *et al* 1994). Thereby this preference of easily digestible meat is ideal. The raw wrapped meat had the next most number of flies attracted to it. The wrapped meat was a simulation of bodies being disposed off in body bags and rucksacks. The number of flies showed that despite heavy wrapping the odour is not contained and can attract enough flies to facilitate a plausible forensic entomological investigation. The meat coated with Aspirin was a simulation of drug overdoses. It was one of the treatment that had minimal number of flies. A possible explanation for this could be that the Aspirin coating would have altered the meat's surface chemical composition and hindered in spreading of odour. Roasted meat was used to show the attraction of flies to burnt bodies. Since the meat was roasted on open flame with approximate temperature of ~1900°C. The meat was of neither nutritional value nor was it a good substrate for laying and harbouring larvae due to extreme desiccation. These earlier speculations were analysed with the experiment. Further studies can be done with larger data sets, more sample sizes and variations to yield conclusive results about the above discussed data.

Acknowledgements:

This work was greatly supported by the teaching and non-teaching staff of the Department of Zoology at St. Xavier's college, Mumbai.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.




ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

References:

- Ameen, M., & Huq, M. (1973). Filth inhabiting flies of Dacca city. *Journal Of Natural History*, 7(6), 633-652. doi: 10.1080/00222937300770541
- Amendt, J., Richards, C. S., Campobasso, C. P., Zehner, R., & Hall, M. J. (2011). Forensic entomology: Applications and limitations. *Forensic Science, Medicine, and Pathology*, 7(4), 379-392. doi:10.1007/s12024-010-9209-2
- Archer, M., & Elgar, M. (2003). Female breeding-site preferences and larval feeding strategies of carrion-breeding Calliphoridae and Sarcophagidae (Diptera): a quantitative analysis. *Australian Journal Of Zoology*, 51(2), 165. doi: 10.1071/zo02067
- Joseph, I., Mathew, D., Sathyan, P., & Vargheese, G. (2011). The use of insects in forensic investigations: An overview on the scope of forensic entomology. *Journal of Forensic Dental Sciences*, 3(2), 89. doi:10.4103/0975-1475.92154
- Nakagawa A, Iwama A, Mizukami A. Age-dependent changes related to reproductive development in the odor preference of blowflies, *Phormia regina*, and flesh flies, *Boettcherisca peregrina*. *Zoolog Sci*. 1994 Oct;11(5) 725-730. PMID: 7765858
- H Baker, I Baker, 1977 Intraspecific Constancy of Floral Nectar Amino Acid Complements



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Green Synthesis and characterization of Silver Nanoparticles using leaf extract of *Nicotiana tabacum* L.

Jason Coutinho*, Jasmine Pereira, Sandra Pereira, Ena Shaikh, Varun Rawal,
Joshua Rajan
Department of Zoology, St. Xavier's College, Mumbai

*Corresponding Authors email: jason.coutinho@xaviers.edu.in

Abstract

Green synthesis of nanoparticles from plant extracts has captured the attention of many researchers. This method of synthesis is preferred as it is economical, sustainable and eco friendly. The metal nanoparticles synthesized using this method is highly effective in combating different microbes, parasites and pests. In this study we have enumerated the benefits of selecting *Nicotiana tabacum* to synthesize nanoparticles as it is commercially available and a well known biological pesticide. It was observed that the leaf extract of tobacco delivers fast and convenient method for synthesis of silver nanoparticles. Also the study defines a pH at which the silver nanoparticles are synthesized best using tobacco extract. The size of the nanoparticles at that pH has also been evaluated.

Keywords: silver nanoparticle, green synthesis, tobacco, leaf extract.

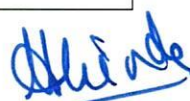
Introduction

One can define nanoparticle as any particle falling within the range of 1 to 100 nm. Nanoparticles are intermediates between isolated molecules and bulk material, their specialty being that they show properties differing from both. Nanotechnology is a multi-disciplinary science that can be defined as the design, production, characterization and the application of devices, structures and systems by controlling shape and size at a nanometric scale.^[1] Potential benefits of nanomaterials along with their study, characterization and applications are well recognized and have been described in scientific literature. Some scientist even believe that it will soon become a billion dollar industry in the upcoming years.^[2] Some well studied nanomaterials are Carbon Nanotubes, Nanorods, Nanoprisms, Nanoclusters, Nanofibres and Nanoparticles of noble metals such as silver and gold. Silver nanoparticles are important materials that have been and are still being studied extensively.

Silver nanoparticles can be synthesized by various physical and chemical methods. Wet chemical synthesis methods like the citric acid reduction methods can be accurately scaled for large scale synthesis of silver nanoparticles of required shape and size through optimization of shape and size^[2]. However these wet chemical methods use highly toxic chemicals, for eg; sodium borohydride (NaBH₄) for reduction which are harmful to the environment and may get adsorbed onto the surface of the synthesized silver nanoparticles. Many synthetic capping agents like polyvinyl alcohol, poly (methacrylic acid), poly (methyl methacrylate), dodecanethiol are used. Not only is this process expensive but sometimes also makes the synthesized nanoparticles unsuitable for biomedical applications. Physical methods on the other hand are extremely expensive and are not economically feasible for large scale



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

production. Due to this there is a need to develop environment friendly and cost effective methods for synthesis of silver nanoparticles^{[3][2][4]}.

Nanoparticles of various noble metals, especially silver have been synthesized using bacteria, fungi, yeast and aqueous plant extracts^{[3][4]}. Silver nanoparticles have been effectively synthesized from aqueous extracts of plant parts such as leaves, petals, roots, latex, rhizomes, fruits and even from marine algae and seaweed^{[5][2]}. Silver nanoparticles synthesized from aqueous plant extract of coconut husk have shown potent larvicidal activity against the larvae of the malarial mosquito *Anopheles stephansi* and the larvae of the filarial mosquito *Culex quinquefasciatus* (originally named *C. fatigans*)^[6].

Green synthesis of silver nanoparticles involves the reduction of the salt of the noble metals, here it being Silver nitrate AgNO_3 which is brought about by the different phytochemical constituents present in aqueous plant solution. The aqueous leaf extract *Nicotiana tabacum* was used as the reducing and capping agent for the synthesis of silver nanoparticles. The variety of phytochemicals present in the aqueous extract, particularly the phenols and flavanoids are believed to be the main reducing agents owing to their antioxidant properties^[4]. Tobacco also yields a potent biological pesticide called nicotine. Since the phytochemicals also act as capping agents and determine the antimicrobial or larvicidal activity of a nanoparticle, the tobacco leaf was chosen as a suitable reducing and capping agent.^{[2][4][1]} In this study we aimed to successfully synthesize stable silver nanoparticles and characterize them.

Methodology

The chemicals used in the experiment were of analytical grade. Deionized water was used to prepare buffers and aqueous solutions.

Dried tobacco leaves were obtained from a reliable source. It was dried in a hot air oven for 24 hours and crushed in a mortar and pestle. The resulting powder was sieved through a mesh of 0.105mm. The powder was stored in an airtight container for further use. 1% plant extract was prepared by boiling the appropriate amount of tobacco powder in deionized water. The decoction was filtered through No. 1 Whatman paper. All experiments were conducted in triplicates and the graphs are illustrative of the each experimental set. Silver nanoparticles were synthesized using the tobacco extract and 1mM silver nitrate (AgNO_3) solution in a ratio of 5:1 (v/v). AgNO_3 was dissolved in buffers ranging from 8.6 to 9.2 with increments of 0.2 pH units. The reaction mixture was exposed to UV light at 365nm for 30 minutes^[4]. Spectrum readings were taken for each of the reaction mixtures in a UV-Spectrophotometer at zero time and at the end of 30 minutes of exposure. After the analysis was completed, 0.1M NaCl was added in equal amounts to the reaction mixtures and centrifuged. Milky white precipitate that formed a pellet or settled at the bottom of the reaction tube when spun at 13000 rpm at the end of centrifugation was indicative of unreacted silver ions (non-completion of the reaction). If the precipitate did not settle, the reaction was considered complete^[4].

Characterization of AgNP's was done with the help of UV-VIS spectrophotometer Bio-Spec-1700 (Shimadzu Corporation, Kyoto, Japan). Further analysis was conducted using a Nanoparticle Tracking Analysis at the Institute of Science, Mumbai.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

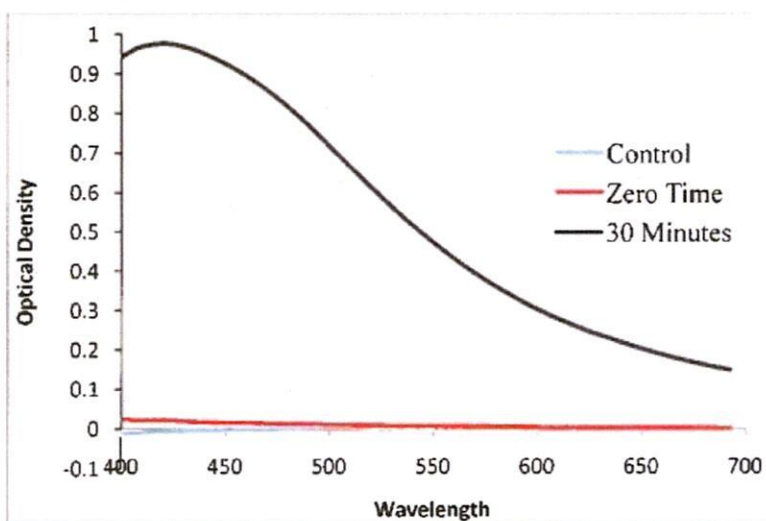

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



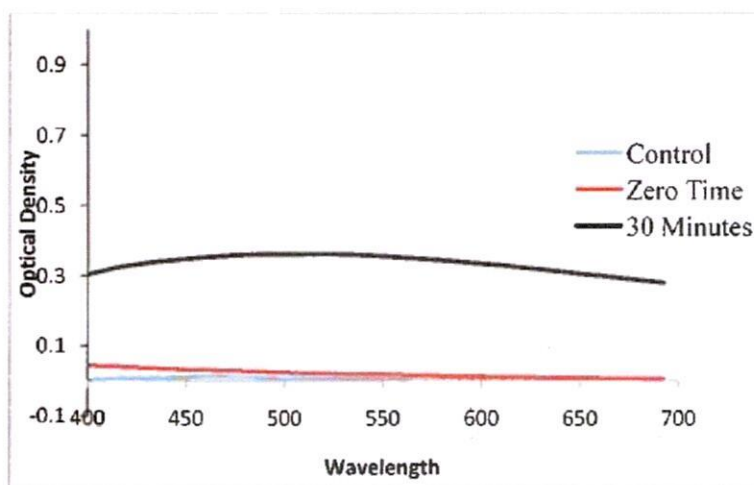
Results

Optimal pH for synthesis of Silver Nanoparticles using Tobacco leaf extract:

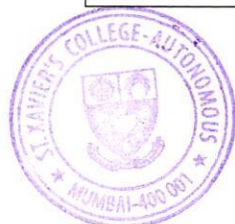
In the present study, leaf extract of tobacco was used to synthesize silver nanoparticles. Addition of AgNO_3 to the extract resulted in the browning of the extract solution during the 30 minutes exposure period [7]. The range of pH for the synthesis of silver nanoparticles ranged between 8.6 units to 9.2 units. Graphs represent optical density of aliquots taken at 30 minutes interval (0 to 30 minutes) in the range of 400nm to 700nm [4]. The color change was observed during the 30 minutes exposure to UV light. The data reveals maximum wavelength to be 422 nm at pH 8.6 with optical density 0.98. Hence pH 8.6 is considered to be optimal for green synthesis of nanoparticles using tobacco leaf extract.



Graph for pH 8.6 (Absorption Spectrum) at the end of 30 minutes UV exposure

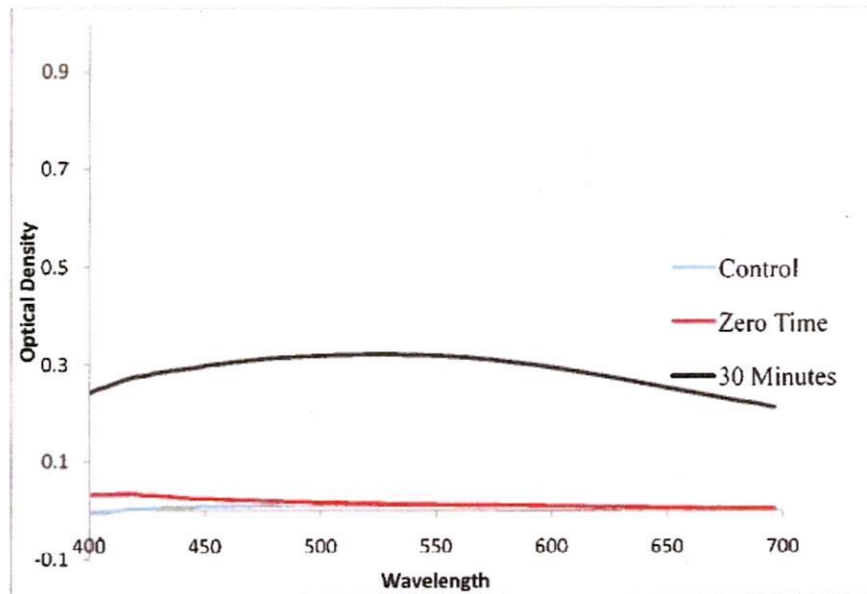


Graph for pH 8.8 (Absorption Spectrum) at the end of 30 minutes UV exposure

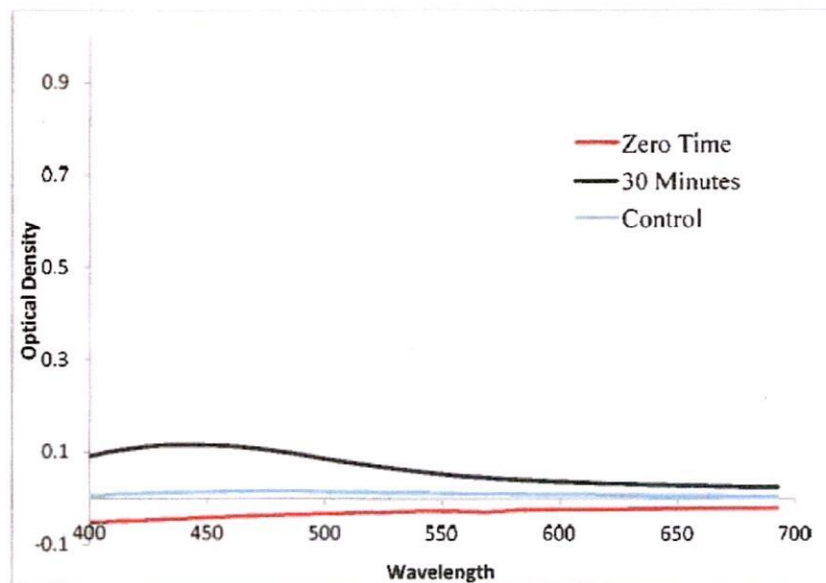




ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Graph for pH 9.0 (Absorption Spectrum) at the end of 30 minutes UV exposure



Graph for pH 9.2 (Absorption Spectrum) at the end of 30 minutes UV exposure

Nanoparticle Tracking Analysis:

According to the results obtained from the analysis performed on the nanoparticles, the mean is 22nm and mode is 17nm. The average standard deviation of the nanoparticles is recorded



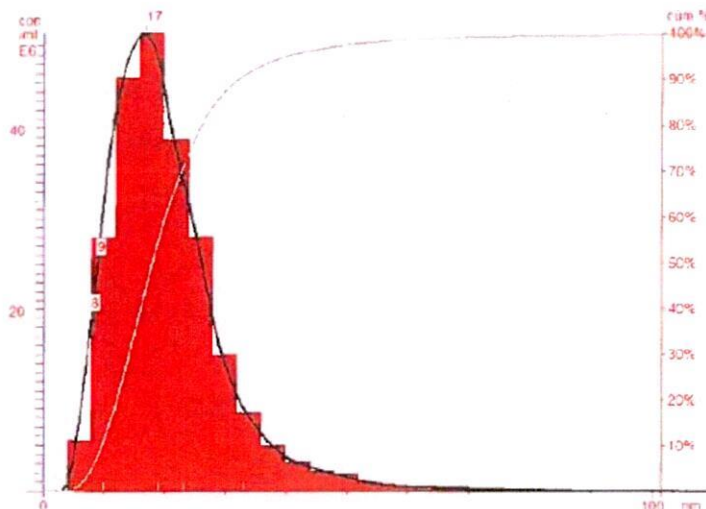
NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

to be 15nm. Hence the particle size ranges between 22 ± 15 nm. (i.e.: size ranges between 7nm to 37 nm)



Nanoparticle Tracking Analysis data of Particle Size vs Concentration

Discussion

Silver Nanoparticles have gained considerable interest because of their unique properties and proven applicability in diverse areas such as medicine, catalysis, biotechnology, bioenergy, electronics, optics, etc. These nanoparticles have significant inhibitory effects against microbial pathogen^[8]. Recently both academic and industrial research has explored the possibility of using AgNP's as an anticancer therapeutic agent due to the conventional side effects of chemo therapy and radiation therapy. The development of AgNP's as anti-angiogenic molecules is one of the most interesting approaches for cancer treatment and other angiogenesis related disease; poor delivery and problem of drug resistance^[9].

Tobacco contains alkaline nicotine and phenolic compounds which serve as an excellent source of reducing agent^[9]. The antioxidative activity of phenolic compounds is mainly due to their redox property, which plays an important role in absorbing and neutralizing free radicals, quenching singlet and triplet oxygen or decomposing peroxides. Several reports have conclusively shown close relationship between total phenolic contents and antioxidative capacity. The antioxidant activity is the result of a combination of different compounds having synergistic and antagonistic effect^[10]. Tobacco has a total of 25 phenolic compounds which were analyzed using high performance liquid chromatography-ultraviolet/mass spectrometry (HPLC-UV/MS)^[11]. We exploited this resource to synthesize silver nanoparticles using bottom up approach. In producing nanoparticles using plant extracts, the extract is simply mixed with a solution of the metal salt. Phenolic acids have been reported to possess hydroxyl and carbonyl groups which can bind to metals. They inactivate ions through chelation, and their chelating ability is likely related to the high nucleophilic characteristics of their aromatic rings. Therefore, these possess high antioxidant activity, thus giving us

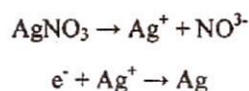


NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



nanoparticles. The nature of the plant extract, its concentration, the concentration of the metal salt, pH, temperature and contact time, all play a significant role in affecting the rate of production of nanoparticles [12]. While the chemical methods of synthesizing metallic nanoparticles involves the use of titration with NaOH, our approach is more efficient than the others, as using a buffered solution helps in maintaining a constant electrolyte concentration across the buffer range investigated. Buffer solutions provide a uniform and stable ionic concentration throughout the period of synthesis. The reduction of Ag^+ ions to Ag^0 by tobacco leaf extract was monitored with the use of UV-VIS spectrophotometer by recording the absorption as a function of time [13]. The phenolic compounds in tobacco act as reducing agents and reduce $AgNO_3$, resulting in the formation of silver nanoparticles. The reaction could be summarized as:



The biosynthesized silver nanoparticles from extracts of plants shows larvicidal and anti-bacterial activity against harmful pests like aphids, hemipterans, larvae of termites, etc.

1. Larvicidal activity:

The larvicidal activity of AgNPs could be due to the denaturation of the sulfur-containing proteins or phosphorous containing compounds like DNA that leads to the denaturation of organelles and enzymes and thus reduces the cellular membrane permeability and reduction in ATP synthesis which finally causes the loss of the cellular function and cell death [14]. They have larvicidal action against vectors of malaria and filariasis and have also been found to be active plasmodium pathogens and carrier cancer cells. Slow release of silver ions via oxidation inside or outside the micro-organisms cell has proved to be highly toxic. Nanoparticles have also shown to have interfered with the replication of DNA and inactivation of proteins [12].

2. Bactericidal activity:

Silver has shown a good bactericidal effect against gram-positive bacteria than negative bacteria [15]. AgNPs synthesized using *Leptadenia reticulata* leaf extract [16] show antioxidant activity at concentration of 500 μ g/ml. This is due to the ability of the radicals to donate hydrogens and easily incorporate electrons; the latter is possible due to the presence of host lipophilic radicals. The ability of AgNPs to control blood sugar levels was evaluated using extracts of *Tephrosia tinctoria* [17] where AgNPs scavenged free radicals, decreased levels of enzymes that catalyze the hydrolysis of complex carbohydrates and increased the consumption rate of glucose. Nanotechnology applications are highly suited for biological molecules because of their unique properties [2].

3. Anti-microbial activity:

Silver nanoparticles synthesized from *Sphaeranthus amaranthoides* showed anti microbial activity against gram positive and gram negative bacteria by destabilizing the outer membrane, blocking bacterial respiration and depleting the intracellular ATP. This eventually leads to denaturation of the bacterial cell wall. Silver nanoparticles synthesized from *Abutilon indicum* leaf extract showed a very high anti bacterial activity on *Staphylococcus aureus*, *Bacillus subtilis*, *Salmonella typhi* and *Escherichia coli* [18].





ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

4. Anticancer activity:

AgNPs synthesized from *Acalypha indica* show 40% cell inhibition against human breast cancer cells while those from *Datura innoxia* showed 50% proliferation in the human breast cancer cell line MCF7. The cytotoxic assays silver nanoparticles of *Chrysanthemum indicum* showed no toxicity towards 3T3 mouse embryo fibroblast cells^[18]

Conclusion

The use of nanoparticles in the medicinal, food, pharmaceutical, and agricultural industries has garnered a great deal of interest, with a focus on development of more convenient methods using green biotechnology tools for production of eco-friendly, nontoxic, and environmentally benign nanoparticles. The synthesized nanoparticles were of 10-30nm in size at pH 8.6. The NTA and UV-vis spectrophotometry were used to determine size and the best pH, showing the highest absorption peak for the maximum synthesis of nanoparticles. All these techniques, it was proved that the pH of plant extract and buffers plays an important role in obtaining the highest absorption peak showing maximum synthesis of nanoparticles. Nanotechnology will provide a more complete knowledge base regarding various factors that influence green synthesis of nanoparticles and the most sophisticated technology that can be used for characterization of the synthesized nanoparticles for its more efficient future applications in biomedical and pharmaceutical industries and this simple procedure has several advantages such as cost-effectiveness, compatibility for medical and pharmaceutical applications as well as large scale commercial production^[19].

Acknowledgements

The authors thank Dr. Smita Krishnan, HOD of the Department of Zoology of St. Xavier's College Mumbai for providing us with the means and facilities to carry out our project. We are most grateful to Dr. Pushpa Sinkar for her invaluable mentoring and guidance that made this project possible. We would also like to thank Dr. Sujatha Deshpande, Dr. Maduri Hambarde, Mr. Conrad Cabral, Mr. Valentine Borges, Dr. Vishwas Sarangdhar, Mrs. Sangeeta Shetty and Mr. Royston Lobo for all the help that they provided throughout the duration of this project. This project would not be possible without the facilities made available to us by Dr. Rajendra Shinde, HOD of the Department of Botany and Central Instrumentation Facility (CIF) at St. Xavier's College Mumbai.

References

1. Jain, S., Hirst, D. G., & Osullivan, J. M. (2012). Gold nanoparticles as novel agents for cancer therapy. *The British Journal of Radiology*, 85(1010), 101-113. doi:10.1259/bjr/59448833
2. Chung, I., Park, I., Seung-Hyun, K., Thiruvengadam, M., & Rajakumar, G. (2016). Plant-Mediated Synthesis of Silver Nanoparticles: Their Characteristic Properties and Therapeutic Applications. *Nanoscale Research Letters*, 11(1). doi:10.1186/s11671-016-1257-4



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.

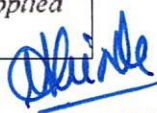


ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

3. Govarthanam, M., Thangasamy, S., Koildhasan, M., Rajiniganth, R., Kuppasamy, S., Lee, K. J., . . . Byung-Taek, O. (2014). Biosynthesis and characterization of silver nanoparticles using panchakavya, an Indian traditional farming formulating agent. *International Journal of Nanomedicine*, 1593. doi:10.2147/ijn.s58932
4. Sinkar, P., Rao, C., Borges, V. J., Lobo, R. A., & Paralkar, S. (2015). Use of *Camellia sinensis* L. leaves in environmentally benign synthesis of silver nanoparticles. *International Journal of Chemistry*, 4(2), 159-169.
5. Tamim, A., Ibrahim, I., & Hashim, S. (2016). Biosynthesis, characterization and antifungal activity of the green silver nanoparticles synthesized by a marine alga *Digenia simplex*. *International Journal of Scientific & Engineering Research*, 7(6), 544-545.
6. Roopan, S. M., R., Madhumitha, G., Rahuman, A., Kamaraj, C., Bharathi, A., & Surendra, T. (2013). Low-cost and eco-friendly phyto-synthesis of silver nanoparticles using *Cocos nucifera* coir extract and its larvicidal activity. *Industrial Crops and Products*, 43, 631-635. doi:10.1016/j.indcrop.2012.08.013
7. Rao, M. L., Bhumi, G., & Savithramma, N. (2013). Green Synthesis of Silver Nanoparticles by *Allamanda cathartica* L. Leaf Extract and Evaluation for Antimicrobial Activity. *International Journal of Pharmaceutical Sciences and Nanotechnology*, 6(4).
8. Iravani, S., Korbekandi, H., Mirmohammadi, S. V., & Zolfarghari, B. (2014). Synthesis of silver nanoparticles: chemical, physical and biological methods. *Research in Pharmaceutical Sciences*, 9(6), 385-406.
9. Zhang, X., Liu, Z., Shen, W., & Gurunathan, S. (2016). Silver Nanoparticles: Synthesis, Characterization, Properties, Applications, and Therapeutic Approaches (B. Yang, Ed.). *International Journal of Molecular Sciences*, 17(9).
10. Subhashini, K., Ramesh, N., & Jeyasankar, A. (2015). Larvicidal activity of silver nanoparticle synthesized by the leaf extracts of *Adhatoda vasica* against *Culex quinquefasciatus* (say) (Diptera: Culicidae). *International Research Journal of Natural and Applied Sciences*, 2(8).
11. Shen, D., Lu, X., Chang, Y., Zhang, J., Zhao, Y., Wang, Y., . . . Zhao, C. (2014). Determination of phenolic compounds in fresh tobacco leaves by high performance liquid chromatography-ultraviolet/mass spectrometry. *Chinese Journal of Chromatography*, 32(1), 40. doi:10.3724/sp.j.1123.2013.08004
12. Mittal, A. K., Chisti, Y., & Banerjee, U. C. (2013). Synthesis of metallic nanoparticles using plant extracts. *Biotechnology Advances*, 31(2), 346-356. doi:10.1016/j.biotechadv.2013.01.003
13. Elemike, E., Onwudiwe, D., Ekennia, A., Sonde, C., & Ehiri, R. (2017). Green Synthesis of Ag/Ag₂O Nanoparticles Using Aqueous Leaf Extract of *Eupatorium odoratum* and Its Antimicrobial and Mosquito Larvicidal Activities. *Molecules*, 22(12), 674. doi:10.3390/molecules22050674
14. K, R. K. (2014). Biosynthesis of Silver Nanoparticles from *Morinda tinctoria* Leaf Extract and their Larvicidal Activity against *Aedes aegypti* Linnaeus 1762. *Journal of Nanomedicine & Nanotechnology*, 05(06). doi:10.4172/2157-7439.1000242
15. Subha, V., Ravindran, E. R., Hariram, J., & Renganathan, S. (2015). Bioreduction of silver nanoparticles from aqueous stem extract of *Catharanthus roseus* and bactericidal effects. *Asian Journal of Pharmaceutical and Clinical Research*, 8(5).
16. Swamy, M. K., Sudipta, K. M., Jayanta, K., & Balasubramanya, S. (2014). The green synthesis, characterization, and evaluation of the biological activities of silver nanoparticles synthesized from *Leptadenia reticulata* leaf extract. *Applied Nanoscience*, 5(1), 73-81. doi:10.1007/s13204-014-0293-6



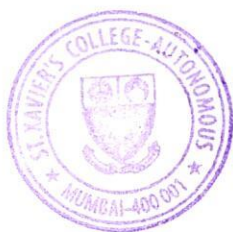
NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.




ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

17. Rajaram, K., Aiswarya, D., & Sureshkumar, P. (2015). Green synthesis of silver nanoparticle using *Tephrosia tinctoria* and its antidiabetic activity. *Materials Letters*, 138, 251-254. doi:10.1016/j.matlet.2014.10.017
18. Firdhouse, M. J., & Lalitha, P. (2015). Biosynthesis of Silver Nanoparticles and Its Applications. *Journal of Nanotechnology*, 2015, 1-18. doi:10.1155/2015/829526
19. Panigrahi, T. (2013). Synthesis and characterization of silver nanoparticles using leaf extract of *Azadirachta indica* (Unpublished master's thesis). Department of life science National Institute of Technology Rourkela-769008, Orissa, India.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.




ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Department of Zoology - List of Field Visits

2019-20	S.Y and T.Y.B.Sc	Dandeli Forest Reserve.
	T.Y.B.Sc	Entomology Trip Regional Fruit Research Station, Vengurla.
2018-19	S.Y and T.Y.B.Sc	Bee keeping unit - Mahabaleshwar, Wai, (Panchghani), Mancher (Gowardhan Cheese Unit) and Mapro industry.
	S.Y and T.Y.B.Sc	Jaldapara N.P, Gorumara and Chilapata Forest Reserves.
2017-18	F.Y.B.Sc.	Badlapur
	S.Y and T.Y.B.Sc	Trip to Gujarat –Gir Forest
	Honours Trip	Khandala – Ornithology & Herpetology Wangini Khagol Mandal – Astrobio
	TYBSc	Entomology Trip to BAIF (Uruli Kanchan) and Mahabaleshwar
2016-17	T.Y.B.Sc (Entomology)	BAIF,Urlikanchan and CBRTI, Pune
	T.Y.B.Sc (Zoology)	Namdapha Tiger Reserve (Arunachal Pradesh) and Dibru-Saikowa (Assam)
	T.Y.B.Sc, S.Y.B.Sc and F.Y.B.Sc	Tadoba- Andhari Tiger Reserve
	Honours Trip	Sky Observation to Neral in collaboration with Khagol Mandal
2015-16	T.Y.B.Sc and S.Y.B.Sc (Zoology)	Islands of the Gulf of Kutch
	T.Y.B.Sc (Entomology)	KKV –Dapoli
	Honours Trip	Field excursion to Khandala and Manor Sky Observation to Neral in collaboration with Khagol Mandal

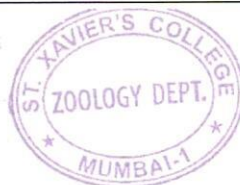


NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



28 MAR 2018


ENTOMOLOGY REPORT

Sericulture, Lac culture and Apiculture at
Urulikanchan and Panchgani

Pradyut Rao
167280
TYBSc – Zoology/Botany



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

The trip began on the 10th of January from Bandra, where we boarded a bus at 6:25 am. After a rather taxing bus ride, we reached BAIF Development Research Foundation (formerly registered as the Bharatiya Agro Industries Foundation), at around 1:30 p.m. We were given a much needed lunch break where we stuffed ourselves with some really good, simple Maharashtrian food. After lunch we were lead into a room where the assistant director himself gave us a brief background about BAIF, highlighting the illustrious history of Urulikanchan and about the ideas and thoughts that eventually blossomed into the present organisation. Albeit the talk was in marathi and a majority of us required the help of our more marathi inclined classmates to understand, it was indeed informative. It is a reputed voluntary organisation which was established in the year 1967 by Dr. Manibhai Desai, one of Mahatma Gandhi's disciples.

This organisation is committed to ensure the provision of a sustainable livelihood to the poor residing in the rural areas through the management of natural resources and livestock development as major income generation activities. One of BAIF's most influential works involve the formation of Self Help Groups (SHGs) for women hailing from a rural background. It started off as a small wriggling thought only to bloom into a fully fledged organisation. It has helped these uneducated and/or exploited rural women to take a stand and make something of themselves. It has played a crucial part in building their self confidence and provided conducive environment for a tight-knit community of strong willed women. This is evident by the fact that the majority of people under employment at BAIF are women who dwarf their male counterparts in numbers.

Once the talk with the Assistant Director was done, we went over to the Central Cattle breeding farm where we witnessed massive, muscular bulls that were surely the cream of the crop, waiting to be milked for semen. Semen is usually collected early in the morning and artificial insemination is done later on. The semen is analysed, purified and stored in liquid nitrogen vessels to keep fresh during transportation. We then headed to the Sericulture unit of BAIF.

SERICULTURE UNIT -

There are 4 natural strains of silk that are usually found, namely; Mulberry silk, Eri silk, Tassar silk and Muga silk. However, BAIF rears and processes only three kinds which are the Mulberry, Tassar and Eri types.


The female silkmoth will lay many tiny eggs on the leaves of a particular plant. On hatching tiny caterpillars begin to emerge out. The caterpillars will begin feeding on the leaves of the plant and grow in size. They complete 4 moults. The caterpillars then spin cocoons around themselves which are made of fine silken threads, inside of which they change into a pupae. The pupae change into moths and exit the cocoons. The cocoon is unwounded and woven into silk. Egg cardboards are used for keeping the collected eggs.

Factors affecting the quality of silk:

- **Water:** The water used in silk reeling plays a vital role. It has been estimated that 100 litres of water is required to produce about one kg of silk from the charkha. The pH of the water should be within 6.8 to 8.4.
- **Cocoon drying:** The primary objective of cocoon drying is to kill the pupae and reduce water content of the fresh cocoons because if this is not done then the moths will emerge out by piercing the cocoon shell and reeling would be useless after this.
- **Temperature:** Temperature plays a vital role on the growth of the silkworms. They are cold-blooded therefore; temperature will have a direct effect on the various physiological activities. Temperature has a direct correlation with the growth of the silkworms; a wide fluctuation will be harmful. Increased temperature during the late instars will accelerate larval growth and shorten larval period. The optimum temperature for normal growth is 20°C and 28°C and the desirable temperature for maximum productivity ranges from 23°C and 28°C.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Bombyx mori silkworms feeding on leaves

Tasar silk –

It is also known as Kosa silk in Sanskrit. Tasar silk is obtained from the larvae of *Antheraea mylitta*. It is more textured than mulberry silk due to the presence of shorter fibres and hence, it is not as durable. These silkworms mainly thrive on Ain and Arjun plants.

Eri silk –

Also known as Endi or Errandi, Eri is a multivoltine silk spun from open-ended cocoons, unlike the other silk varieties. Eri silk is obtained from the silkworm, *Philosamia ricini*. It is a domesticated type. The worms feed mainly on the leaves of the castor plant. It is found in the north-eastern states like Assam as well in the states of Bihar, Karnataka, Meghalaya, Orissa and West Bengal. It is the only domestic variety other than *Bombyx mori*.

Mulberry silk –

Bulk of the commercial silk produced in the world comes from this variety. Mulberry silk is obtained from the silkworm, *Bombyx mori* L. which solely feeds on the leaves of the mulberry plant. These silkworms are completely domesticated and can be easily reared indoors. This type contributes to about 90% of the world's silk production. The cocoons are spun into raw silk fibres. The colour of the silk is pure white and made up of individual long fibres. Silk contains natural protein called sericin and fibroin. Silk fibers from the *Bombyx mori* silkworm have a triangular cross section with rounded corners. The flat surface of the fibrils reflects light at many angles, thus giving silk its natural sheen.

Bombyx mori L. has three different but related races of silkworms; univoltine, bivoltine and multivoltine or polyvoltine. Univoltine races of silkworms produce only one brood of offspring per year. Whereas, multivoltine races have more than two broods of offspring per year. Univoltine species are not suitable for summer and winter rearings as the larvae are weak against unfavourable conditions. Multivoltine larvae are robust and can tolerate fluctuating environmental conditions, making them best suited for tropical climates. Univoltines lay only diapausing eggs (eggs remain dormant) while the multivoltines lay non-diapausing eggs (eggs are not dormant).

There are two types of silk – raw silk and fine silk. In sericulture, silk that contains sericin is called as raw silk. This gummy substance provides some sort of protection during processing. It is usually retained until the yarn stage. It is removed by boiling the silk in water containing soap leaving the end product



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

lustrous and soft. Fine silk is processed silk, having a composition of 40% silk, 30% wool and 30% viscose, giving it a subtle soft touch.

Process of Extraction:

Koshikas or mountages are used to facilitate cocoon formation. The appropriate geometry of a Koshika helps to reduce the loss of the silk thread and to optimise the size of the cocoon. BAIF use of a gunny-cloth moutage over the traditional chandrika. Using Koshikas reduce the time required for harvesting and more cocoons could be harvested per 100 sq. cm. The koshikas are easy to disinfect and easier to store when not in use.



Silkworm Cocoons

Once the cocoons are formed they are dried and stored. The cocoons are dried in direct sunlight from morning to evening until the pupae are killed or steam stifling could be done wherein the cocoons are directly exposed to hot wet steam or hot air conditioning in a chamber of many compartments could be done where each compartment receives different degrees of temperature (multivoltine races need different temperatures). The stored cocoons need good ventilation. The cocoons are sorted for inferior and superior quality ones. Deflossing comes next where the floss i.e. the outer covering of the cocoons, which is unable to reel, is brushed out.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

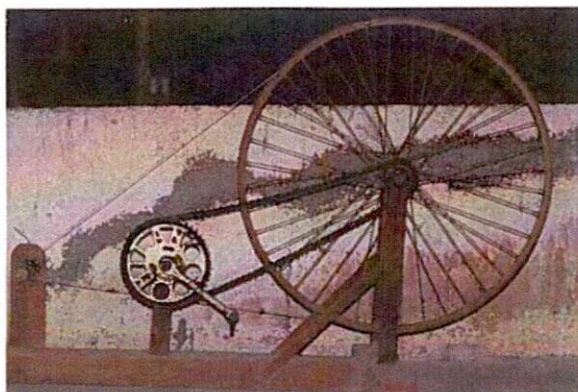
Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Reeling: Reeling involves the unwinding of the silk filaments from individual cocoons.

- Charkha- This primitive spinning apparatus has to be operated by two hands – one drives the wheel and the other adds the cocoons in. One end of the reeling thread is wound onto each wheel, the cocoons are boiled separately.



Charkha at the Sericulture unit, BAIF

- Multi-end reeling machine- This is a semi-automated machine which is used to reel out more than one cocoon at a time. BAIF has another reeling machine which reels only one cocoon at a time. It looks quite similar to a sewing machine. Multi-end reeling machines with improved mechanisms are used nowadays.



A reeling machine in the Sericulture unit of BAIF



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde.
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Quite often the silk threads break while they are being processed, instead of being discarded they are kept aside and re-reeled to form usable threads again. Silk threads are really delicate and break easily, therefore, a single thread of silk is made by twisting the filaments from 4-8 cocoons at once, with a slight twist, in order to create a single strand.

Silk reeled on the small reels are converted into standard size skeins in the re-reeling machines. Re-reeling plays a significant role on the production of quality silk.

The castor seeds from the castor plantation are put into the decorticator to remove their outer shell. The castor seeds that are now without shells are put into an oil expeller for extracting the oil from the decorticated seeds. The oil is then used for medicinal or industrial purposes.

LAC CULTURE –

BAIF was involved in training students from local tribal schools to promote lac cultivation. The farmers discovered lac growing on the Palas trees naturally. Lac is a natural resin of animal origin. It is obtained from the secretions of the lac insect i.e. *Laccifer lacca*. The insect lives as a parasite on the trees. It sucks on the sap of Kusum, Palas, Khair, Babul and Ber. The larvae of the lac insect move out of the mother's cell and feed on the tender twigs. The female lac insect in the meantime will secrete a resinous substance around her body through certain hypodermal glands present on their abdomens. They soon get entirely enclosed in these cells. On coming in contact with air the lac hardens. Once the insect leaves the cell the worker can scrape of these lac cells from the twigs and the processing is done to obtain the finished product which is then used for making seals, polishes, varnishes, coating gramophone records, etc.

We left BAIF by around 4 p.m., got into the bus and headed towards Panchgani. As it is with the usual ghat traveller, hunger is our immortal enemy. We were famished and by the time we reached Panchgani only a few restaurants were open. We hurriedly stuffed ourselves and made our way to our final destination for the night, Ecocamp. We trundled along with our luggages, dropped them into our respective Harvestmen-infested tents and relaxed under the stars. A bonfire was lit and we played around until it was late and we decided to head in to get some shut eye.

A handful of us woke up early the next morning, the 11th of January, to trek up to Table Land. We, along with our professor Dr. Smita Krishnan and with the company of two adorable stray dogs walked a short hike to the top, but boy when we did we were stunned by the beauty of the rising sun eloquently mixing in with an equally splendid plateau that provided us with a natural spectacle. Getting back to EcoCamp we had a fulfilling breakfast and headed to Mahabaleshwar.

Our next stop was Madhuban Honey, Mahabaleshwar. The Directorate of Beekeeping was established at Mahabaleshwar in 1946. The organic honey project is implemented by the Board, branding of Madhuban brand developed by the board and due to which there is a high demand for organic honey. They collect honey from farmers and beekeepers that have been registered with them. They instruct farmers in and around the area that live in the forests to look after the combs containing the bees. Madhuban provides bee boxes to the registered farmers, hence, helping them generate an additional income. They undertake the work of training in beekeeping, supplying bee boxes, provision of technical guidance, supplying bee colonies, distribution of queen bees, capture of colonies and breeding of new colonies, production of honey through nursery colonies, research, processing of honey, sale of honey and wax etc. These farmers maintain the beehives and the bee products that are collected by these farmers like honey, beeswax, etc. is sent to Madhuban. The products obtained in such a manner are then physically and chemically tested in the laboratory for purity as per the quality parameters. The laboratory here has sophisticated equipments for honey testing and processing. After all this done, the finished product is packed in bottles, sealed and put for sale. Madhuban provides self-employment and an additional income source to the farmers turned part-time bee-keepers. It also ensures healthy bee colonies and essential equipment for the processing at reasonable rates.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



A bee-keeper in Madhuban showing the bees

APICULTURE –

A beehive, consists of the following members – the queen bee, a number of drones and numerous sterile female workers. A man-made beehive or the Langstroth hive is used to commercially rear bees on a large scale. It has roof at the very top which is followed by a honey super. Below this is the queen excluder which prevents the queen from entering into the honey chamber. Then comes the brood chamber or box which is at the bottom. It has a number of hive frames where the queen lays her eggs. The hive ends in the bottom board which is fitted on a stand. The bottom board has a small opening which is big enough only for the passage of the worker bees and drones but not the queen.

The queen will lay her eggs in the cells of the brood chamber. Eggs will hatch within a few days. The workers then feed the larvae. Larvae grow in size in these cells. When the time is right the worker bees will cap the cells. Larva spins a cocoon and pupates. The cap is broken and the young bee emerges from its cell.

Madhuban has two species of honeybees – *Apis mellifera* and *Apis cerana indica*.

*Apis mellifera*L. – Also known as the Western honey bee or European honey bee it is the most common species found worldwide. It is threatened under IUCN. Pheromones and dance languages (waggle dance and round dance) are used by the bees to communicate with one another in the hive. This bee was one of the first domesticated insects and is the primary species maintained by bee-keepers. The honey bees swarm in the spring and early summer, when there is an abundance of of blooming flowers from which they can extract pollen and nectar.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Apis cerana indica F. – The Indian honey bee is a subspecies of the Asiatic honey bee. These are relatively non-aggressive and don't exhibit swarming behaviour that often. This species is ideal for beekeeping. It is considered to be similar to *A. mellifera*. It is one of the most important pollinators for coconut palms. They are generally medium sized. They can be easily domesticated. Each hive produces 3-6 kgs of honey per year.



A langstroth hive

HONEY PROCESSING PLANT –

When the time comes to collect the honey from the beehive, the hive is smoked in order to drive the buzzing bees out of it so that honey can be collected with ease. The comb is taken out of the honey super. The combs are then placed upright in a cylindrical honey extractor and with the help of centrifugal force, the spinning of the combs flings the honey out. The extractor extracts the honey from the comb without destroying the combs, hence, the combs can be reused. The honey is then collected from the honey extractor and is then sent for processing. It begins with adding the honey to a hot water bath which is kept at 80°C. From this hot water bath it is passed through a coarse filter. The outer part of the filter has a cold water jacket that lets out cold water as the honey is passing through the filter. From here, the honey is poured into another tank i.e. a fine grain filter at 60°C. After this the honey is pushed into moisture controlling columns which have 18-20% moisture. The finished product is now obtained. It is collected, packed and stored for sale.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Honey Processing Unit at Madhuban

Real vs adulterated honey.

Fake honey has added glucose, dextrose, molasses, sugar syrup, flour, corn syrup, starch, etc. By simply observing the external qualities of the honey we can tell if it is real or not. Real honey is not sticky when rubbed between two fingers. Adulterated honey is sticky due to the added sweeteners. Real honey is highly viscous whereas fake honey is runny and light. The taste of real honey will vanish within a few seconds but that of fake honey will linger due to the additional sweeteners. A mild scent is emitted from pure honey. Fake honey will have no smell or it will be sour smelling. Real honey will caramelize quickly and not froth but fake honey never caramelises and appears bubbly. The real deal will never dissolve in water whereas the adulterated one will dissolve almost immediately.

Products obtained from honey bees:

- **Honey:** Honey is made by the bees by collecting nectar and sweet deposits from various plants and trees in the locality of the hive, modifying and storing it in their combs. It involves the conversion of most of the sucrose in the nectar to fructose and glucose. Raw honey contains impurities like pollen and particles of the hive and it is much darker than refined honey. Honey is used as a natural sweetener, mild laxative and sedative, it has antiseptic properties and is used in Ayurvedic medicines. Madhuban sells Sunflower honey, Ajwain honey and Jamun honey; these are named so depending on which flowers the honey bees feed on. The contents of these will vary and have a number of beneficial properties.
- **Beeswax:** The wax is secreted from the wax glands of the mature worker bees, which are located on their abdomens. They use it to build the walls and the caps of the cells of the combs. During honey harvestation, the wax can be collected and processed to make products such as candles, seals, lipstick ingredients, polishes, crayons, etc.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

- Propolis: It is a resinous mixture collected by the worker bees from particular trees. It has anti-microbial properties. Propolis is used to seal unwanted gaps or open spaces in the hive. It is used in wood finishes and has few medicinal properties.
- Royal Jelly: It is a bee secretion used to nourish the queen larvae and worker larvae (it is fed to the worker and drone larvae only for a few days after which they are fed Beebread). It is only secreted by the young worker bees and the queen bee. It has unsupported claims of health benefits and is hence, marketed for the same.

As we left Madhuban, as though confirming this trip was a special one, the ever elusive Indian giant squirrel or Shekru made a bold appearance and got all of us excited. After this awesome sighting we made our way to Mapro gardens which has become the norm for one who goes to Mahabaleshwar. We gorged on some of their deliciously famous strawberries and cream, stocked up on some lovely fresh winter strawberries and Mapro crushes and headed back to the bus. With our bellies over filled with food, minds teeming with newfound knowledge, we were lulled into a comfortable numbness, only waking up next when we were back in Mumbai.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Ahink
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

BIBLIOGRAPHY –

- www.baif.org.in
- <https://texeresilk.com> > About Silk
- silks.csb.gov.in
- **Silk reeling and testing manual. Chapter 6.** (www.fao.org/docrep/x2099e/x2099e07.htm)
- inserco.org
- **Sericulture | Raw Silk Manufacture (Reeling) | IndiaAgroNet**
- www.madhubanhoney.com
- <https://www.mybeeline.co/en/p/how-can-we-differentiate-100-pure-honey-and-adulterated-honey>
- www.knitrowan.com
- **ADW: Apis mellifera: INFORMATION**



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

2016-17

Namdapha Forest Reserve: Arunachal Pradesh

2016

Educational Visit Report



Karan Deshpande TYBSc (Zoo-Biochemistry)

Simran Mascarenhas TYBSc (Zoo-Biochemistry)



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.

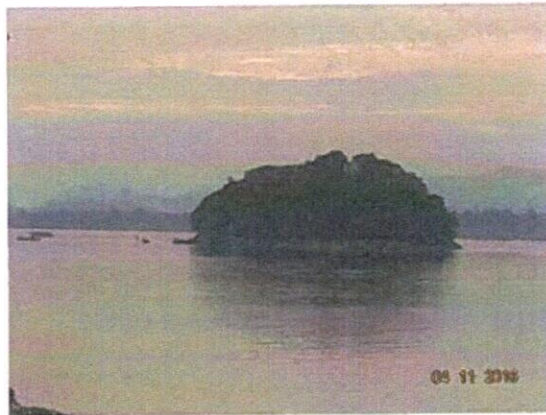


ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

INTRODUCTION

The Department of Zoology, St. Xavier's College organized an educational visit to the Namdapha National Park situated in Arunachal Pradesh for the Third Year students of the year 2016-17. This trip was organized for 11 days. We had booked train tickets to and fro. Our train journey was supposed to be 2 and half days going and coming back. We boarded our train on 2nd November from Bombay to Guwahati, Assam. We were 9 students and 3 staff members going for this trip. We reached Guwahati on 4th morning around 11 am. The same day we had to board another Assam inter state train at 9 30 pm that would take us from Guwahati to Ledo, Assam. On 4th November we had requested the Jesuit house located in Guwahati for a few hours of accommodation and Father concerned was kind enough to be obliged for the same. We stayed at the Jesuit House and freshened up after spending two nights in a train. The same evening we left the Jesuit House to board our train to Ledo. At Ledo Station we were joined by another staff member from the Lifescience Department of St. Xavier's College. It was an overnight journey and we arrived at Ledo on 5th morning. At Ledo station we met our tour guides sent by Mr. Phupla Tsingpo. We had availed Mr. Tsingpo's services for lodging and guiding in Namdapha. Mr. Tsingpo's men met us at the station and drove us across the border of Assam into Arunachal Pradesh to Miao. Miao was the point from where we would go into the Namdapha National Park. We needed clearance documents and permit letter to cross the Assam-Arunachal Pradesh border. Mr. Tsingpo and our Department made sure we had those permits arranged. We reached Miao had at lunch there. After lunch we had to rush to Namdapha as we had to trek about 10 km distance from the drop off point to where we had our lodging inside the National Park. Sunset in north east India takes place around 4 45pm so we had to make as much of ground as we could before it would turn dark. Our trek route was also hit by landslides a month before we got there so we had to travel without carrying our luggage for safety purposes. Our luggage was transported to where we stayed by the help of Elephants arranged by Mr. Tsingpo. It took us about 2 hours to trek to our lodging cabins. Food and refreshments were all arranged for our arrival. It was a hectic day of travelling and we all slept immediately.

Next morning ie 6th November, we woke up early to trek around the forest and hope to spot as many as animals as we could. Our guide Bicki was a very nice person well versed with the forest routes and the animals found there. We called him Bicky bhaiya and he was more than happy to show us around everywhere. We trekked around all day and saw lot of birds which will be talked about later. We heard some baboon calls but couldn't visually spot them in the tree's. We were back by lunch time and then visited a nearby stream before the sun could set at 4 45pm again after which we were not permitted to go



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

out of our facilities. On 7th morning we woke up early to start heading back to our previous drop off point on the same 10km route we took while coming. This time we crossed that route in the day so it was simpler. It took us about 2 hours again. Once again our luggage was transported by the Elephants to the drop off point. From that point we drove back to Miao where we had lunch on the previous days. We were also staying in Miao that day. Miao was a small village in Arunachal Pradesh. After lunch we went to the village Entomological Museum. It was a small place but had very resourceful collection of specimens beyond imagination. We got back to our lodging site once again after that short visit and had the evening to ourselves. Next day 8th November, early morning after breakfast we packed our luggage and head towards Tinsukhia in Assam. From Tinsukhia we were going to go to Dibruh Saikowa, a marine national park. We reached Dibruh Saikowa at lunch time. We took a cruise around the Dibruh Saikowa island to look for dolphins. This was also around lunch time so arrangement for lunch was made on the cruise itself. We did spot a few dolphins if not many. We couldn't really know the specie of dolphins we saw but they were very shy and wouldn't surface very often. That same day we had a train to catch in the evening back to Guwahati.

Mr. Tsingpo and his crew made sure we reached the Tinsukhia Station on time. This was the last time he was going to be with us. We thanked him for all his services and arrangements and making sure our stay was comfortable. We boarded our interstate train back to Guwahati. It was an overnight journey and we reached again on the 9th morning at Guwahati. We stayed once again at the Jesuit house for the day as our train to Bombay was in the evening. We reached the Jesuit house at about 7am and the Father in charge was more than welcoming to us visiting again. We had decided to visit the Umananda island situated on the Brahmaputra river, just a 5 minute ferry ride from Guwahati. We visited Umananda to see the Golden Langur's that reside on that island. Umananda also has a shiva temple that people usually visit it for. Our train back was scheduled for the same day at 5 30pm. We packed our luggage and reached the station once again to board our train back to Bombay. We later found out our train was delayed and rescheduled to board at 9 30pm, so we spent time at the station itself entertaining ourselves for 4 hours. Finally we boarded our train at around 10pm that day. It took us 2 and half days to come back and we had reached Bombay early morning on 12th November around 4am. We were tired and exhausted from a hectic trip but at the same time we had made a million memories and cherished some of the most memorable moments together with our fellow students and staff members.

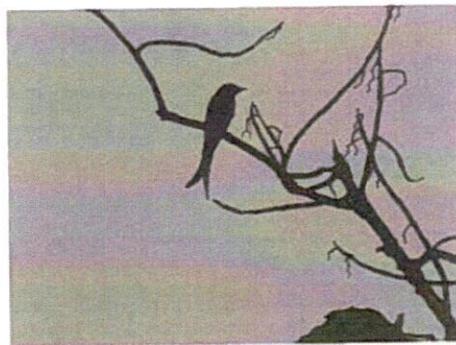


NAAC SSR Cycle 4 (2015-2020):
2_3_1 *Experiential Learning*

Alinda
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Things we Saw

North east has a very unique fauna it represents the transitional zone between the Indian, Indo-Malayan, Indo-Chinese biogeographic regions. It boasts of a rich biological diversity ranging from mammals to birds to insects. From our train journey with binoculars glued to our eyes searching desperately for this amazing and rich bird diversity. Many of us obsessed with birds were extremely happy and satisfied with the plethora of wildlife we got an opportunity to see.

Ranging from mammals, birds, butterflies, insects and even an entomological museum.

Some of the mammals seen were:

We saw different species of **squirrels** .one of the cutest and big squirrel was **Red Giant flying squirrel** at Namdapha national park .

Another mammal seen was the **Hoolock Gibbon** both male and female were seen. This is the only species in primates where there is sexual dimorphism. The males have a **black** coat with horizontal **white** lines on its forehead while the females have brownish coats with the horizontal white lines. They are well known for their shrill call which sounded like ullock.

Golden langurs were lazily sleeping on tree tops. Many of the langurs were affected and killed because of a disease that hit the areas around the Brahmaputra river valley.

Gangetic river dolphins were seen frolicking about.

There was an abundance of birds seen in the north-east.

1. **Asian Openbill** :It is a large wading bird with the colours of grayish or white body with black wings. They were seen along the water bodies during our train journey.

2. **Woolly-necked Stork**: A large wading water bird seen along the way. It has a black body with a white neck giving it a wooly neck like appearance.

3. **Grey backed shrike**: It is found in the north and east. They breed at high altitudes and have a distinct grey back hence the name.

4. **White Wagtail**: A small passerine bird with a constantly wagging tail.

5. **Red headed trogon**: A very highly coloured and attractive bird with the male having a reddish-crimson head



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

6. Many species of hornbills were seen like **Great hornbill** and **Rufous necked hornbill**.

7. Many Barbet species were seen like **Blue-eared barbet**, **lineated barbet**, **jungle barbet**, **blue throated barbet**.

8. Myna species seen were **jungle myna**, **golden crested myna**, **Common hill myna**.

9. Woodpecker species like **greater yellownape**, **black rumped yellow flameback woodpecker**.

Other species included,

Eurasian hobby: small, slim falcon and found in open land, farmland and marshes. It is a bird of prey

Scarlet minivet: small passerine bird with attractive black and red colour

Grey treepie: medium sized member of the crow family with a long tail.

White browed fantail : dark brown upper parts with white spots on the wings

Grey headed Canary : has a square crest with a grey hood and yellow underparts.

Sultan tit : large song bird with yellow crest and dark bill

Slaty bellied: belongs to the warbler family

Common tailorbird: It makes its nest out of leaves sewn together. It belongs to the warbler family

Long tailed sibia, **Pied falconet**, etc were some other species seen.

Experience:


Visiting North east had always been on my bucket list. Being an ideal place for nature lovers this place boast of an amazingly beautiful landscape with Mountains, rivers greenery everywhere and the plethora of wildlife. It has been an amazing journey right from Lokmanya Tilak terminus to Namdapha national park. Learning a lot along the way, making new friends, meeting new people and travelling in the trains from three days at a stretch. This trip has taught me a lot and I have had the opportunity to see so many things. From the hilariously funny hoolock gibbons to the lazily sleeping golden langurs to the shy gangetic dolphins. It will be a memorable trip and a wonderful memory that I would love to cherish.

Acknowledgement:

We would like to thank the department of Zoology especially Smita mam and Conrad sir for organizing this beautiful trip. A thank you to the staff Pushpa mam, Manasi mam along with smita mam and Conrad sir for accompanying us. To Mr. Tsingpo and his team for making our stay memorable and the amazing food he served us. The hot crispybhajiya's with chai and the other amazing things that we ate. To Bicky Bhaiya for patiently accompanying us and showing us the beautiful wildlife of arunachal Pradesh. And to all the other passengers in the train who made our three days of travel memorable and fun.



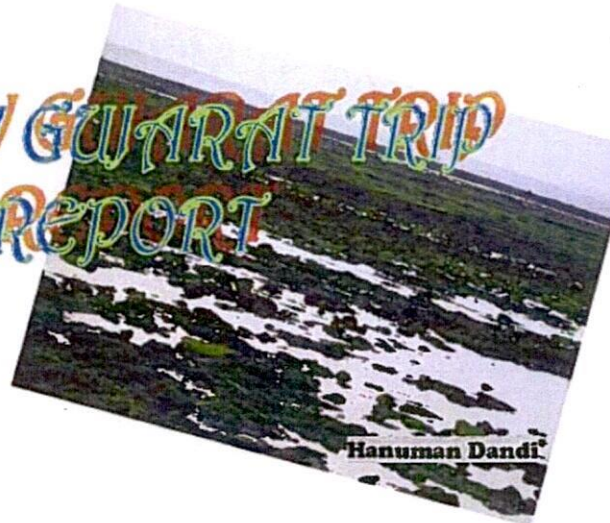
NAAC SSR Cycle 4 (2015-2020):
2_3_1 *Experiential Learning*


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

ZOOLOGY GUJARAT TRIP REPORT



TOPIC : CORALS IN GUJARAT REEF

NAME: SUBARNA RAY

ROLL :104 UID: 142200

CLASS : SYBSC



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

INDEX

Sr No.	Topic/Report	Page No.
1	Acknowledgement	1
2	Report of Hanuman Dandi	2
3	Report of Chusna Islands	4
4	Report of Paga Islands	7
5	Report of Narara Reef	9
6	Bibliography	13



NAAC SSR Cycle 4 (2015-2020):
2_3_1 Experiential Learning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

ACKNOWLEDGEMENT

I would like to thank the zoology department of St Xavier's College, Mumbai for organizing the Educational Trip to explore the marine biodiversity of Gujarat and the teachers for motivating me through the Report. I am thankful to my Class mates for photos used in my photo log. I would like to extend my thanks to the trip organizers of Bedh Dwarka and Jamnagar for this successful Report.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

Date: 26/10/2015

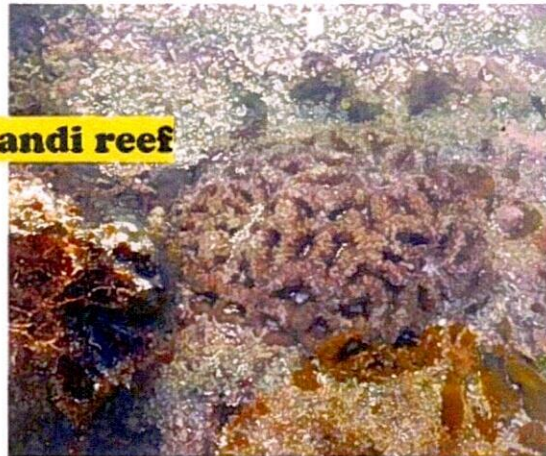
Place : Hanuman Dandi reef

Common name:

Brain Coral

Family: Mussidea

Characteristics:



Spheroid shape and grooved surface which resembles a brain. Found in shallow warm waters. Also called " Flower Animals". They extend their tentacles to catch food and for protection by wrapping over them. The surface is hard and resistant to any damage caused by hurricanes or fishes. Life span of 900 years. They extend their colonies vertically and a height of 1.8 metres.

Other marine organisms include sea slug, sea anemone, oysters , puffer fish, crabs and octopuses were spotted. Pseudo brain corals were sporadic. Hanuman Dandi was a barrier reef with a diverse flora and fauna.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65



Chiton



Brittle Star



Squid (Loligo)



NAAC SSR Cycle 4 (2015-2020):
2_3_1 *Experiential Learning*

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

Date : 27/10/2015

Place : Chusna Islands

(Fringing reef)

Common name :

PseudoBrain coral



Scientific name:

Diploria starigosa

Characteristics:

The symmetrical brain coral forms smooth flat plates or massive hemispherical domes up to 1.8 metres (5 ft 11 in) in diameter. The surface is covered with interlinking convoluted valleys in which the polyps sit in cup-shaped depressions known as corallites.

The ridges separating the valleys are smoothly rounded and do not usually have a groove running along their apex as does the rather similar grooved brain coral

The coral has symbiotic dinoflagellate algae called zooxanthella in its tissues and it is these which give the



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

coral its colour of yellowish or greenish brown, or occasionally blue-grey. Grows on shallow waters and sometimes on muddy stretches of seabed.



Fluorescent green coral



Giant Sea Anemone



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65



Rani Crab

The Chusna Islands comprises of Meetha and Khara chusna. Both the islands linked be a strident reef diversified by mainly sponges and Crabs and aquatic marine organisms. Sponges are essential for the functioning of the coral reef's ecosystem. Algae and corals in coral reefs produce organic material. This is filtered through sponges which convert this organic material into small particles which in turn are absorbed by algae and corals.



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65



The chusna islands

Date : 28/10/2015

Place: Paga Reef

**Comparatively less
biodiversity than**

Common name:

Pillar coral

Scientific name:

Dendrogyra cylindrus



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

2015-16

Characteristics

It is a digitate coral -that is, it resembles fingers (Latin *digites*) or a cluster of cigars, growing up from the sea floor without any secondary branching. It is large and can grow on both flat and sloping surfaces at depths down to 20 m (65 ft), encrusted base from which grow vertical cylindrical, round-ended columns

Habitat

Pillar corals are found in the warmer parts of the Coastline. Within its range, *D. cylindrus* is common in some places, but rare in other seemingly suitable locations.

Octopuses and jellyfishes were dominant and spread across the reef especially near the Dhami point.



Sea Slug



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

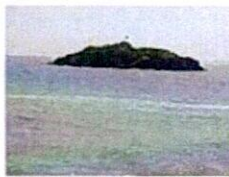
2015-16



Ascidia



Octopus



Paga Island

Date: 30/10/2015

Place: Narara Reef

(Marine National Park)

Common name:

Staghorn Coral

Scientific Name:



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

2015-16

Acropora cervicornis

Characteristics

It is branching, stony coral with cylindrical branches ranging from a few centimetres to over two metres in length and height. The upper limit is defined by wave forces, and the lower limit is controlled by suspended sediments and light availability. The corals are found in shallow waters at moderate temperatures and a diverse varieties of remnants are found here.

The dominant mode of reproduction for staghorn corals is asexual with new colonies forming when branches break off a colony and reattach to the substrate. This life history trait allows rapid population recovery from physical disturbances such as storms. However, it makes recovery from disease or bleaching episodes (where entire colonies or even entire stands are killed) very difficult.

Sexual reproduction is via broadcast spawning of gametes into the water column once each year Individual colonies are both male and female (simultaneous hermaphrodites) and will release millions of gametes. The coral larvae (planula) live in the plankton for several days until finding a suitable area to settle.



Puffer fish

Hinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.





ST. XAVIER'S COLLEGE

(AUTONOMOUS)

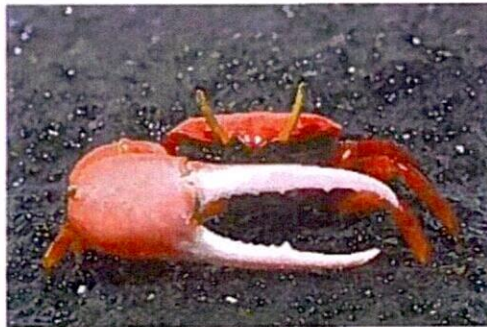
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

2015-16



Sea Caterpillar



Fiddler's Crab

Narara reef located in Jamnagar was a treasure trove of marine biodiversity. The fauna found here include: 70 species of sponges are found. Coral including species of hard coral and of soft coral. Jellyfish, Portuguese man of war and sea anemones are other coelentrates found here. Arthropods include prawns, crabs, lobsters, shrimps and other crustaceans. Molluscs like pearl oysters and sea slugs are present. Octopus which change colour are also



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE


(AUTONOMOUS)

5, Mahapalika Marg, Mumbai - 400 001,
INDIA.

☎ 2262 0661/65

2 2015-16


found. Echinoderms like starfish, sea cucumbers and sea urchins are present. The fishes found are puffer fishes, sea horse, sting ray and mudskippers which are an endangered species. Endangered sea turtles such as green sea turtles, olive ridleys and leatherbacks are seen here. There are three species of sea snakes.



Narara reef(Marine National Park)



NAAC SSR Cycle 4 (2015-2020):
2_3_1_Experiential Learning


PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

2015-16

BIBLIOGRAPHY

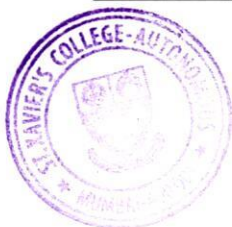
http://www.naturefoundationsxm.org/education/coral_reefs/kinds_of_coral.htm

<http://oceanservice.noaa.gov/facts/threecorals.html>


https://en.wikipedia.org/wiki/Coral_reef/Staghorn_coral/Brain_coral

<https://drive.google.com/drive/folders/0B4rgy9jOHjJTRnhkeTRoZ0drQzg>

https://en.wikipedia.org/wiki/Marine_National_Park,_Gulf_of_Kutch



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

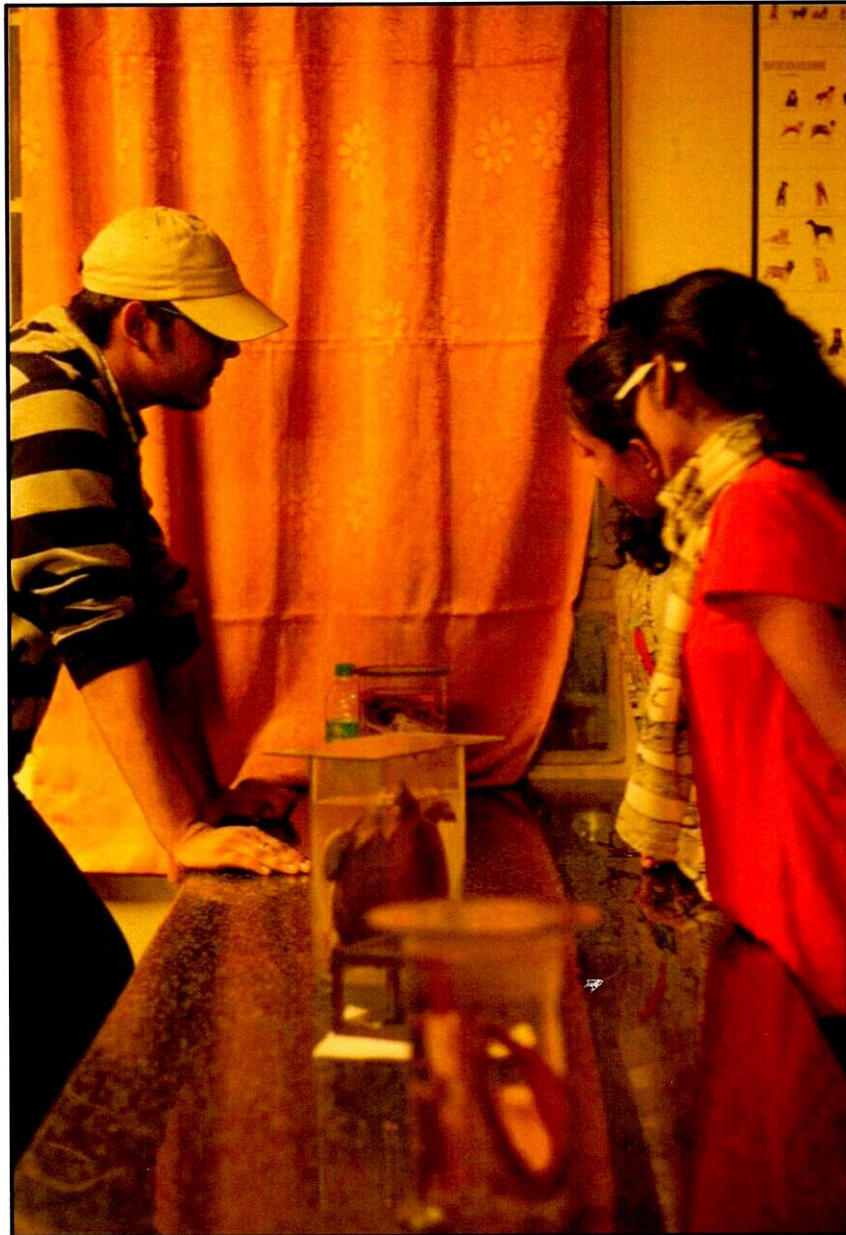

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65

Department of Zoology – Exhibition: Walk of Life

The Department of Zoology organizes an annual Exhibition titled “Walk of Life” which has a different theme every year. Based on the theme, different specimens are exhibited. The exhibition is open to all school and college students.



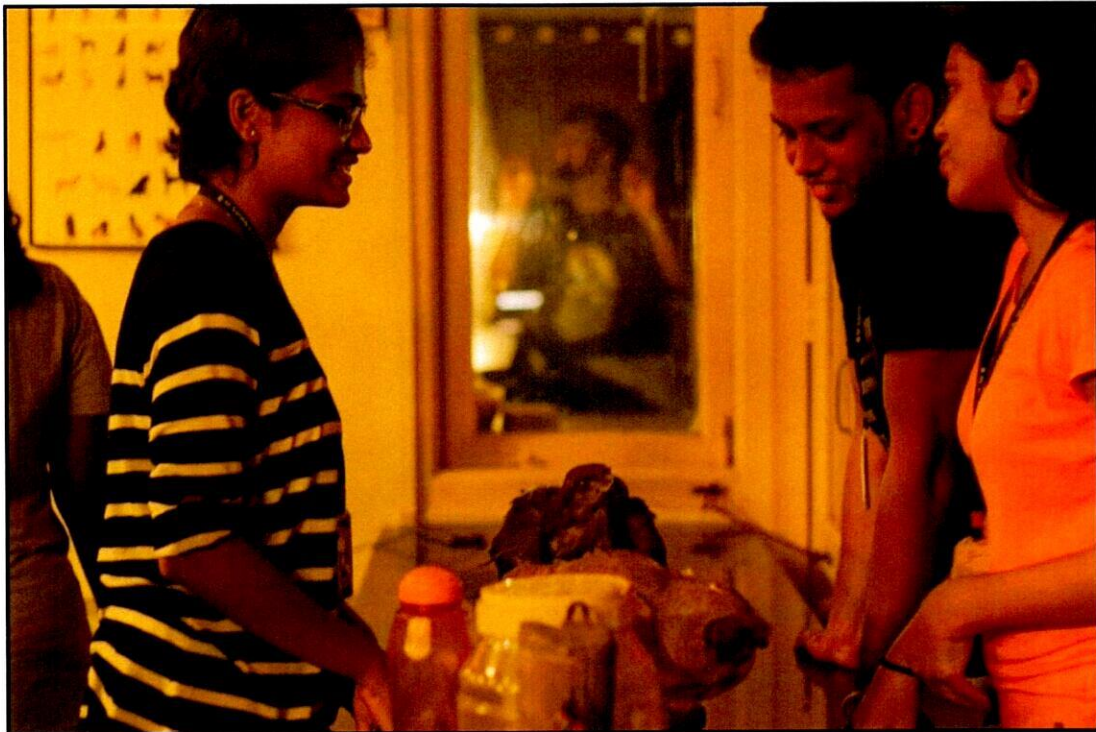
NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Department of Zoology – Exhibition: Walk of Life (2016-17)



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Department of Zoology – Exhibition: Walk of Life (2016-17)



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Department of Zoology – Exhibition: Walk of Life (2016-17)



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Department of Zoology – Exhibition: Walk of Life (2016-17)

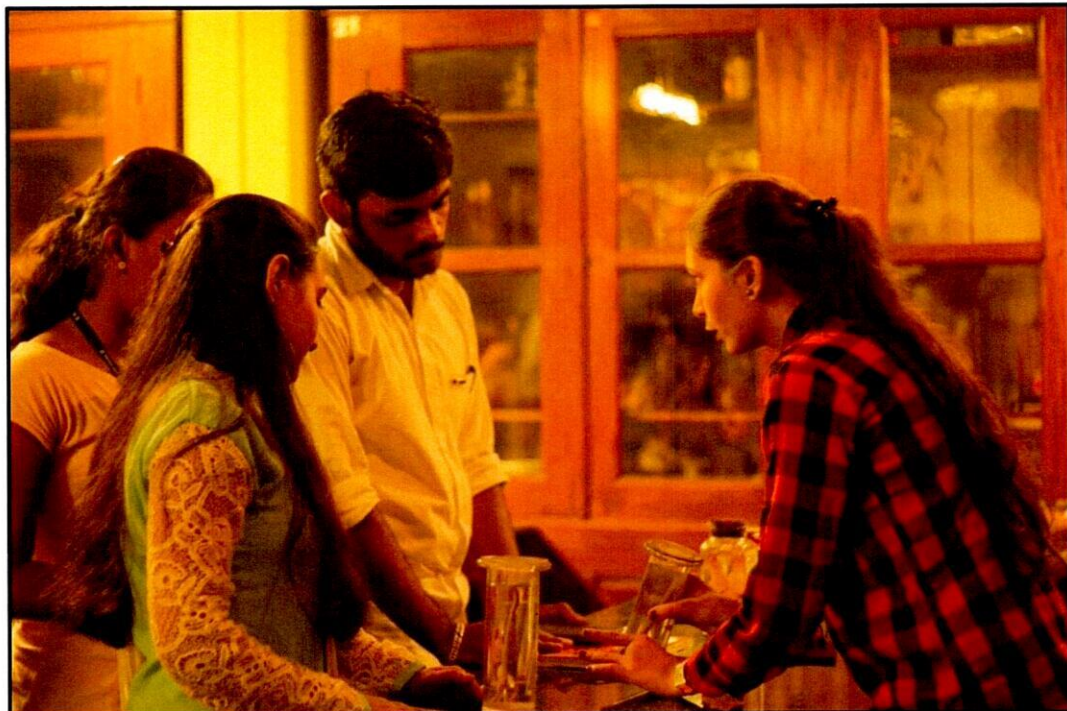
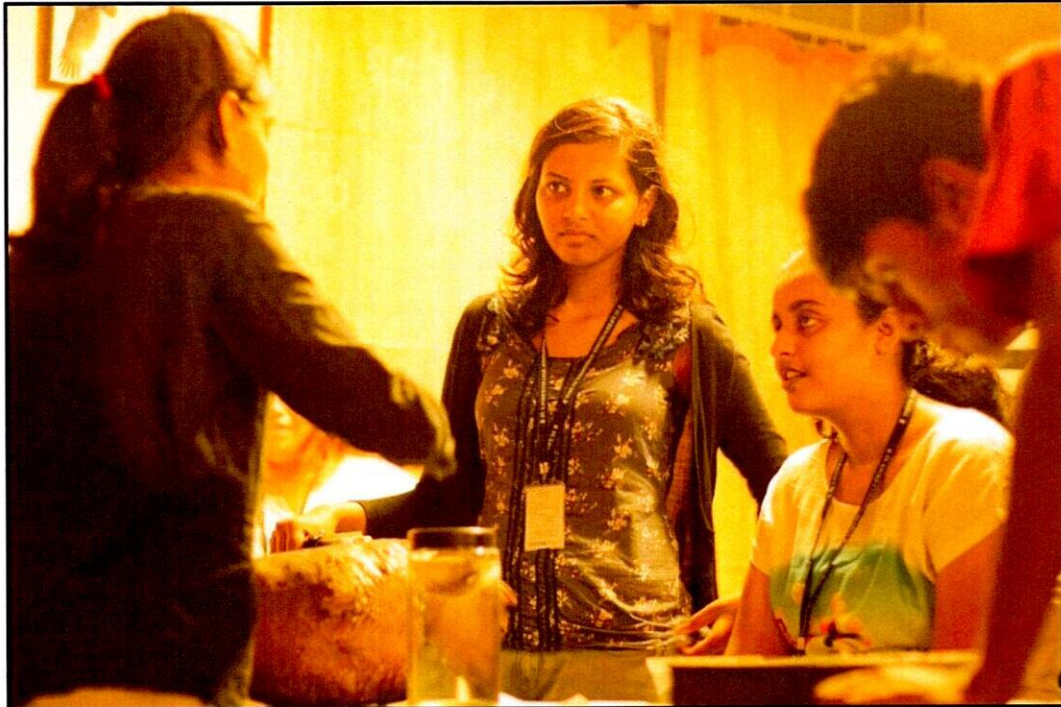


NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Department of Zoology – Exhibition: Walk of Life (2016-17)

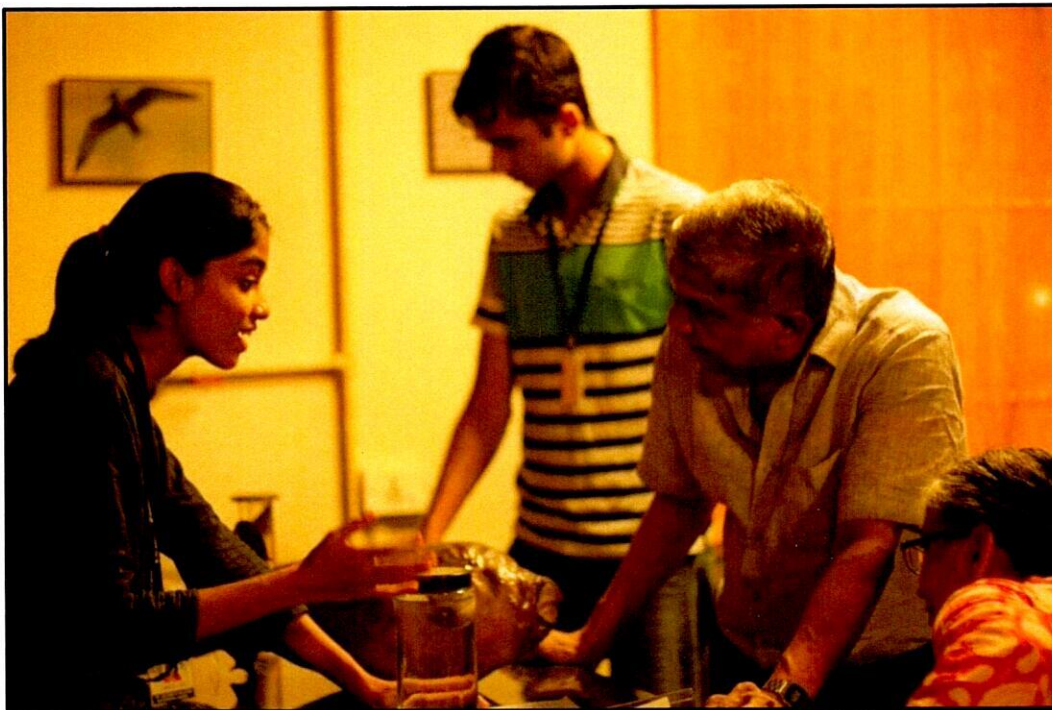


NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Shinde
PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.



ST. XAVIER'S COLLEGE
(AUTONOMOUS)
5, Mahapalika Marg, Mumbai - 400 001,
INDIA.
☎ 2262 0661/65



Department of Zoology – Exhibition: Walk of Life (2016-17)



NAAC SSR Cycle 4 (2015-2020):
2_3_1_ExperientialLearning

Alvinda

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.