Department of Botany,

St Xavier's College (Autonomous), Mumbai

CERTIFICATE

This is to certify that the project on '*Relationship between diversity of birds and habitat type (forest, mangroves and grasslands) in Mumbai with respect to plants found in each habitat*' has been successfully completed by **Mr. Clive Francis D'Costa** of Botany M.Sc. Part II, UIDNo 188307 during the academic year 2019-20

Mr. Alok Gude
Project Guide

Head, Dept of Botany

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MUMBAI - 400 001.

Dissertation

RELATIONSHIP BETWEEN DIVERSITY OF BIRDS AND HABITAT TYPE [FOREST, MANGROOVES, AND GRASSLANDS IN MUMBAI AND ITS SUBURBS] WITH RESPECT TO PLANTS FOUND IN EACH HABITAT .

SUBMITTED BY

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M.Sc. Part II [SEM 4] BOTANY

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[ANGIOSPERM TAXONOMY AND PHYTOCHEMISTRY]

UNDER THE GUIDANCE

OF

PROF. ALOK GUDE

DEPARTMENT OF BOTANY

ST XAVIER'S COLLEGE MUMBAI (AUTONOMOUS)

2019-2020

This is to certify that Mr Clive Francis Dcosta , student of M.Sc. part II semester 4 botany (Angiosperm taxonomy and phytochemistry), St. Xavier's college (Autonomous) with UID 188307 has completed his research project on , RELATIONSHIP BETWEEN DIVERSITY OF BIRDS AND HABITAT TYPE [FOREST, MANGROOVES, AND GRASSLANDS IN MUMBAI AND ITS SUBURBS] WITH RESPECT TO PLANTS FOUND IN EACH HABITAT .

In the academic year of 2019-2020.

Prof. Alok Gude

Project guide and In-charge HOD External examiner

ACKNOWLEDGEMENT

I take this opportunity to thank ST. XAVIERS COLLEGE (AUTONOMOUS) for giving me this opportunity to carry out my work. The constant guidance and encouragement given by all concerned was the driving force for the success and outcome for the thesis in the present form. I am extremely fortunate to receive this throughout the course of my project work and I owe my profound to all of them.

I take this opportunity to express my gratitude to Principal Dr Rajendra Shinde, also would like to thank the Head of the department Prof. Alok Gude who is also my guide for the project, Prof. Saif Khan my co-guide, Dr Rajdeo singh, Dr Vijaya lobo and Dr Manek Mistry for their constant guidance.

Also I would like to thank my father Mr Francis Dcosta, my mother Mrs Cecil Dcosta, my friends Mr Pratik Bavi, Mr Sanjay Paul for their moral support.

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INTRODUCTION

Plants and birds share a special mutual relationship which help them in assisiting each other in food, shelter, reproduction and many more phenomenons .

The habitat types is directly or indirectly responsible to the diversity of birds in each habitat and the plants in each habitat are responsible in attracting the birds directly or indirectly .

This could be by the fruits they produce or the nectar they feed to the birds in return of seed dispersal and pollination .

There are also indirect relationships between plants and birds as in the case of mangroves which we will talk about in details further which are responsible for attracting birds and their diversity in the habitat .

Diversity of birds in each habitat depends on the diversity of plants but in some cases a less diverse plant kingdom may show more diversity of birds , this means individual plants can also be responsible for attracting more types of birds , also the other biotic and environmental factors also needs to be taken in consideration .

These relations needs to be studied so as to understand the decrease in number of individual or species in either kingdoms because the survival of the two kingdoms are inter-related in most cases.

Also planting of non native species can affect the native plant and bird as the can be invasive as well as of no use to the birds at times .

Also some plants act as good and safe shelter for birds, mostly

small sized birds which need protection from other large predatory birds and depleting number of such plants can affect the numbers and diversity of small sized birds and passerines .

Aim : To study the relationship between diversity of birds and habitat type (forest, mangroves, grassland in Mumbai and its suburbs) with respect to plant species in each habitat .

HYPOTHESIS : The diversity of birds is related to diversity of plants in each habitat .....

MATERIALS AND METHODS : Binoculars, field guides, camera, field note book, GPS.

Each of the habitat was explored and possible relationships were noted down, later each of these relationship or inter-dependence were categorized into different types for further simplification.

Photographic evidences could not be taken as no availability of proper camera.

A checklist of bird species was made in each habitat.

Important plants in each habitat were also noted down.

A categorization of types of relationships found were also made in order to further simplify.

Observations :

The forest habitat :

The forest habitat notes a number of direct relationships between plants and birds such as feeding the frugivorous birds with juicy fruits, providing sweet nectar for the nectar feeding birds from the nectaries in the flower, providing shelter for small birds like passerines.

In return the plants can achieve their important life processes like seed dispersal and pollination.

As we move through the forest floor one can identify some patches with no signs of birds where as other patches rich in number of different birds, the obvious reason for this is the plant species in these patches, also considering the fact that in some periods of time these plants may not be flowering or fruiting.

List of some common plants attracting birds by the fruits they produce:

1. **The Moraceae family plants :** plants such as Ficus racemosa, F. hispida, F. bengalensis, F. religiosa attract a number of birds by the fruits the produce. The family

attracts all size and kinds of birds, from large birds like hornbills and orioles to small sized birds like barbetts and flowerpeckers .

2. **Syzygium cumini** : the plant when fruiting attracts a number of birds of all size, it's a large tree and can produces enough fruits for a large flock of birds, the fruits are small in size and are commonly known as jamun.
3. **Mangifera indica** : a very common tree on the forest floor, huge tree which fruits during the summers attracting a lot numbers of frugivorous birds.
4. **Manilkarpa zapota** : commonly known as chikoo or sapota is found commonly on the forest floor , the large pulpy brown fruits attract a lot of birds and mammals .
5. **Annona reticulate** : commonly known as custard apple
6. **Artocarpus heterophyllus** : commonly known as jackfruit , these fruits are large and not penetrable by the beaks of most birds hence when monkeys or other animals bite into it the birds also get an opportunity to consume the juicy pulp .
7. **Carissa congesta** : a medium sized tree but widespread on the forest floor producing small sized fruits commonly known as karvanda .
8. **Michelia champaca** : commonly known as Sonchampa , the fruits as well as flowers attract a large diversity of birds .
9. **Cordia dichotoma** : also known as Sebestan plum produces small jamun size fruits and also is responsible for attracting a lot of birds .

10. **Diospyros melanoxylon :** commonly known as Tendu usually fruits in may or june it belongs to the family Ebenaceae , these chickoo sized fruits are large and fleshy and hence many birds are attracted for the pulp .

11. **Morinda pubescens :** commonly known as Bartondi, eaten by large sized birds like orioles and Asian koels .

List of some common plants that attract birds by providing nectar :

1. **Bombax Cebia :** one of te most dominant trees on the forest floor with huge red flowers, the plant can be easily identified by spines all over the plant body, the flowers are filled with nectar and are visited by all kind of nectar feeding birds, some small birds are also seen puncturing the flowers in order to get to the nectaries since their beaks are too small .

2. **Cebia pentandra :** commonly known as kapok closely related to bombax cebia also produces large flowers filled with nectar similar to that of bombax cebia .

3. **Helicteres Isora :** commonly known as “murund sheng” attracts butterflies and birds like flowerpeckers and sunbirds .

4. **Butea Monosperma :** commonly known as” palash” or “The flameof the forest” produces clusters of attractive red flowers attracting all kinds of birds .

5. **Spathodea Campanulta :** also known as” African tulip” its filled with nectar such that when pressed it squirts out nectar hence also known as “squirt tree” attracting all sizes of birds, en some frugivorous birds like parakeets due to such huge amount of nectar .

6. **Fimiana Colorata :** orangish-red flower, flowering in terminal panicles attracts a lot of birds like orioles and Asian koels .
7. **Erythrina indica :** commonly known as the indian coral tree , the showy red flowers attract a lot of birds like parakeets , orioles etc .
8. **Spathodea campanulata :** indian cork tree these flowers are similar to those of the indian coral tree , large, showy , orangish-red .
9. **Sterculia colorata :**commonly known as the bonfire tree which give out a bunch of juicy orangish flower are responsible for attracting a lot of forest birds.
10. **Thepesia populnea :** Portia tree with large bell shaped flowers attract a lot of birds .

Trees providing shelter and protection to birds : most of the trees with compound leaves and dense crown provide good shelter for birds as well as protection from other predatory birds, these include trees like tamarind , neem , khair etc .

Trees benefited by birds : birds feeding on insects such as white browed flycatchers and tickles blue flycatcher , feed on insects which infests on trees, especially during fruiting seasons when the fruits are ripe or over ripe the attract a lot of insects and pests and hence these birds are important for the overall health of a habitat .

In recent times we seen the depleting numbers of birds , hence it is important to learn about its feeding and shelter dependence and plants such trees as listed above in city roads and gardens in order to tackle the problem .

The mangrove habitat

As we know of the many important uses of mangroves such as protecting the shorelines from damaging storms and hurricane winds, waves, and floods preventing soil erosion by stabilizing sediments with their tangled root systems, maintaining water quality and clarity it also plays a major role in attracting a diversity of birds though in this case the relation is indirect because as we know most of mangroves are viviparous so there are no fruits produced for birds to feed on or nectar filled flowers .

So where does the attraction lies? The answer lies hidden underground in the roots , the roots of mangrove provide hard substrate for the attachment for epiphytic algae like diatoms , blue-green algae , phytoplankton etc .

They also provide both hard and soft habitat for diversity of invertebrate life forms such as snails , barnacles , molluscs , shrimps ,crab etc.

Mangroves produce a large amount of leaf litter which all these small life forms feed on, the leaf litter are quickly decomposed by fungi and bacteria, this decomposed matter is flushed into the estuary by outgoing tides providing food source for shrimps crab and fishes.

These invertebrate life forms which thrive on mangrove ecosystem attract a huge diversity of swamp birds known as waders.

Flamingos which are the majority in any wetland habitat feed on crustaceans, mollusks, seeds, insects, various types of

algae and diatoms through a process called filter feeding wherein they intake whatever happens to be there, while filtering out undesirable parts.

This behaviour is also seen in birds like pied avocets, ibises and some species of ducks like shoveler.

A number of other bird species like storks, spoonbills, ducks, terns, gulls are also attracted to mangroves due to abundance of food in the habitat.

There are three types of mangroves the one with its roots sticking into the ocean are **the red mangroves**, named for their red tinted roots , these are the rizophora species.

As we go little further inland, you will come across **the black mangroves**, these plants grow in very wet soil that is not heavily oxygenated which is why their roots grow upwards into the air, these roots are called pneumatophores.

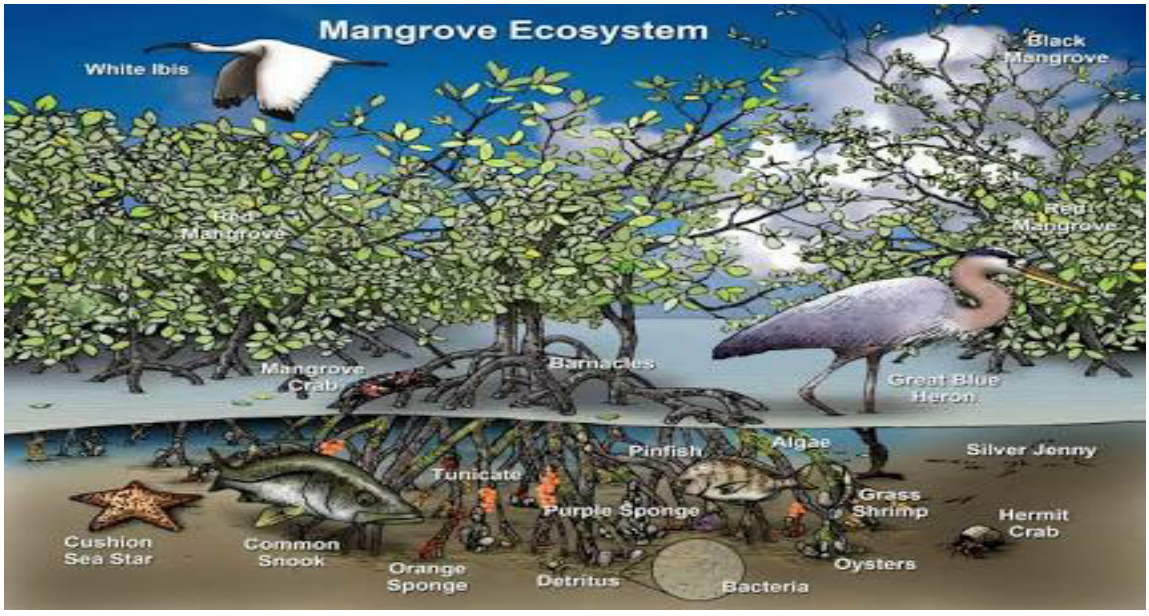
Even further inland one will encounter **the white mangroves**, similar to typical tree when compared to the previous two. Here one will find a god population of wablers and prinias which feed on insects chiefly.

The red mangrove and the black mangrove species are chiefly responsible for attracting all the swamp birds whereas the white mangrove species will attract the birds similar to the one in the forest habitat.

The birds come to Mumbai once the during the winters to avoid the and stay here till late summer till the monsoon arrives, this migration is to avoid the harsh winters from the places the migrate from.

Some of the important plants in the mangrove habitat :

1. **Avicennia marina** : One of the commonest species along the Mumbai coast , it flowers in april and may attracting insects and the insect hunting birds , being a white mangrove it is found further inland .
2. **Avicennia officinalis** : this species differ from marina in having ovate or egg shaped leaves .
3. **Sonneratia caseolaris** : these have cork like pneumatophores or breathing roots , they act as a substrate to many invertebrate life forms and microbes which attract fishes too.
4. **Sonneratia apetala** : this differs from the previous one by the absence of petals as the name suggests .
5. **Rhizophora mucronata** : this small tree up to 4m tall raised higher on adventitious stilt roots generally remains above the high tide mark , these roots act as a substrate for many life forms forming its own small ecosystem chain under i



Invertebrate organisms anchoring on roots of mangrove

The urban habit

In the urban habitat like Mumbai we don't see much of diversity like in its suburbs this is because the trees planted in the city are non-native or the ones planted for beautification purpose and these are of very low value for the insects and birds species and nowadays we see more of such plants being planted all along the streets of the city, a few patches with native trees like *ficus religiosa, azadiraktha indica, mangifera indica* will see rich diversity of birds and insects around it even if its alongside a busy road indicating to the importance of such native trees for our birds and insects also it is believed that because of urbanization we don't see a lot of birds and butterfly species which we used to see before but the root cause for loss of these birds and insect species seem to be the loss or replacement of the trees which they dwell on with the non-native and incompatible ones .

The type of birds affected the most are the frugivorous and the nectar-feeding birds and also the insect feeding birds, as the non-native trees do not attract as many insects as the native ones.

Hence what we get to see in the urban habitat is scavengers like crow and kites, pigeons and some passerines sparrow and mynas.

Also due to patches of mangroves and grassland in some areas attract the birds of those respective habitat.

Numbers of species of plants and birds in each habitat :

habitats	Total number of plant species	Total number of bird species
Forest	1300	274
Mangrove	10	134

Conclusions

1. The diversity of birds in a particular habitat depends on the diversity of the plants in a particular habitat.
2. The highest diversity of plants is seen in the forest habitat and so is the highest diversity of birds, followed by the mangrove, grassland and urban habitats.
3. The previous conclusion indicates that the diversity of birds is thus dependant of the plant kingdom diversity.
4. One will find more number of birds in the mangrove habitat but they are usually a flock of the same species, the diversity on the other hand is more in the forest though one cannot spot them easily due to the thick canopy.
5. A forest habitat cannot be replaced by mere plantations,

replacements should be well planned and close to the previous habitat so that other organism can also disperse to that area.

6. The mangrove habitat is more or less irreplaceable and clearing a mangrove habitat can permanently erase the diversity of the birds in the region.
7. A urban habitats diversity can be increased by planting the right type of trees.

FUTURE SCOPE

Habitat loss, extinctions have been increasing cause of concern in recent times, and hence sustainable development, smart afforestation and reforestation is the increasing need of the hour.

It is very necessary to plant our native trees and endemic plant species rather than exotic show plants.

We need to understand a forest or any other habitat completely, the food-chain the interdependence of the dwellers of the

habitat and many other factors to protect a forest, prevent extinction and habitat loss.

In most cases the existence of plants and birds or other pollinators of insects are interrelated hence to prevent the extinction of one we need to we need to check on the numbers of others.

In many cases the flowers of certain plant species can be pollinated only by a particular species of a insect or bird, in such case the decreasing number of that insect or bird species can cause extinction of that particular plant in the region.

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