Insect Biodiversity At Mangrove Ecosystem

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Abstract : A lot of attention being paid to the study of biodiversity has led to increasing interest in assessing the diversity of insects because this group dominates terrestrial and freshwater ecosystems and are valuable indicators of the healthof these ecosystems. Presence of insects in the mangrove ecosystem is of importance because they feed, reproduce on plants and help in pollination. Certain level of natural damage caused by pest insects is of ecological significance in mangrove ecosystem. Study of insect biodiversity is useful in managing the forest resources. The study area selected for this research project is a private land owned by Godrej & Boyce Mfg.Co.Ltd located along the Eastern Express Highway at Vikhroli, Mumbai. This land is covered with mangrove forest. Total eleven sites were selected randomly so as to cover maximum area of mangrove forest. At each site, during low tide, different insects were observed and photographed. Photo-essay of these insects was prepared. Diversity index, evenness index and dominance index was calculated. As per the results, Shannon index is 0.4, Simphon's diversity index is 0.93 and evenness index is 0.1. Species richness index is 1.94**.** The result shows that the study location being in the industrial area of Mumbai, the insect diversity is less but there is a natural balance of damage and reproduction. The present research paper highlights the need of conservation of floral and faunal biodiversity to preserve the natural balance of the ecosystem.

Key words **:** Mangrove ecosystem, Insect biodiversity, diversity index, evenness index, dominance index, Godrej Company

Introduction

Mangrove conservation is very important as they are extremely productive ecosystems. Because mangroves occupy the intertidal zone, they interact strongly with aquatic, inshore, upstream and terrestrial ecosystems and in this way mangroves help to support a diverse flora and fauna of marine, freshwater and terrestrial species (Donald J. Macintosh and Elizabeth C. Ashton, 2002). Mangrove species diversity is well known for the larger animals and plants, but poorly known for micro-organisms and insects. Study of its insect biodiversity can help in determining its potential productivity and in better management of mangroves. Insects can be either harmful like pest insects which are to be managed or beneficial like honeybees which can be helpful in gaining economical productivity. They play a very important role in ecology of mangrove ecosystem. Insects, can be either permanent residents or temporary visitors of mangrove environment (Macintosh & Ashton 2002). Hence they provide linkage between mangrove ecosystem and other ecosystems. There are herbivores that feed on leaves, flowers, seeds or mangrove propagules; detritivores that eat dead wood or decaying leaves; more general foragers and predators. Some insects play crucial roles as pollinators and all in turn represent a major food source for predators. Study of insects is done to maintain an indigenous plant in a healthy state under local conditions. One needs to know what level of natural damage is normal. Insects are rarely severely damaging to a healthy host but respond rapidly to declining resistance. Significant changes may well indicate stress from pollution or deteriorating soil or water regime, perhaps in time to take corrective action. Measures of species diversity are important, as their stability over (long) periods of time are frequently seen as indicators of the well-being of ecological systems.

In studies related to mangrove insect biodiversity, numerous butterfly and moth species have been undertaken. Termites are an important component of the fauna but little is known about them. They burrow inside the trunks and branches of mangrove trees and maybe very important in breaking down dead wood. Ants are often abundant in the mangrove tree canopy suggesting their ecological significance but again not much is known about ants. Mosquitoes are often incredibly numerous and the degree of abundance is exceptional (Macne, 1968). They are often a nuisance because of their biting of humans but also because they can be vectors of diseases such as malaria and yellow fever (Macintosh & Ashton 2002). This has often been a reason for mangroves to be regarded as wastelands. For this resource to be conserved and managed much more research is needed.

Mangroves at Godrej

Although Mangroves along the Mumbai coastline are vanishing, a stretch of 1,750 acres of mangroves preserved by the Godrej Company continues to flourish. The vast mangroves of Pirojshanagar include over 16 species of mangroves and their sub-varieties. The Soonabai Pirojsha Godrej Marine Ecology Centre and Mangrove Interpretation Center works towards caring for these mangroves. The center

also conducts programmes for mangrove preservation like regular monitoring to keep a check on miscreants and protecting rare species of fauna, raising nurseries and through artificial regeneration.

Study Area: The study area selected for this research project is a private land owned by Godrej & Boyce Mfg.Co.Ltd located along the Eastern Express Highway at Vikhroli, Mumbai. This land is covered with mangrove forest that is being maintained by The Godrej for the past 65 years. The Western bank of the Thane Creek is the single largest mangrove belt in Mumbai. A substantial tract of mangrove land is adjoining the Godrej & Boyce township, Pirojshanagar, in Vikhroli a suburb of Mumbai..

Materials and methods

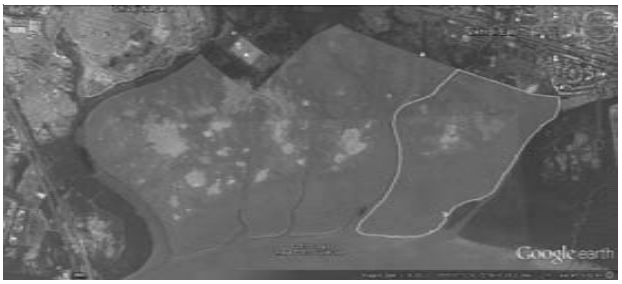
Mapping: GIS mapping of mangroves near Godrej area was studied and 11 locations were decided for field work to carry out the study at the periphery of mangrove patches.

Field visits: field visits were taken every day for 11 days (one day for 11Location) in summer season, at the time of low tide.

Data collection: Data collection was done by taking the photographs of insects and noting down on which plant which insect was observed.

Identification: Identification was done by using Google images and field guides such as insect in colour by N.D.Riley .GPS Location

North	East	South	West
$19^{0}06'52.31s"N$	$19^{0}5'08.00s"N$	$19^{0}03'34.44s"N$	$19^{0}05'23.05s"N$
$72^{0}56'32.71s"E$	$72^{0}57'27.57s"E$	$72^{0}56'27.78s"E$	$72^{0}55'46.94s"E$



Result and discussion

Table1: Insect diversity

Insects / Site	1	2	3	4	5	6	7	8	9	10	11	n_i
Pseudococcidae(Mealy bugs)	8	3		5	10	20	5	8	5	15	5	**84**
Attacephalotes(Leaf cutter ant)	7	6		5	5	5	5	15	8	6		**62**
Luciliasericata (Metallic fly)	1							4		3		**8**
Muscadomestica(Housefly)	1			1			1	1	1	1	2	**8**
Adisegipty(Dengue mosquito)	5			4	15			3			2	**29**
Lasiusniger (Common blackants)	2			5								**7**
Camponotouspennysylvanicus (Black carpenter ant)		1				1					1	**3**
Apisindica(honey bee)		4		6			10		5	2		**27**
Xylocopaviolacea(Carpenter bee)		1		1								**2**
Hymnoptychissordid (Pneumatophore moth)								1	7	10		**18**
Cicadellaviridis(hopper bug)		1	1									**2**

Anisoptera (Dragonfly)		4		2			4		1		3	**14**
Diptera(Dipterian fly spp 1)				1		1		2				**4**
Diptera(Dipterian fly spp 2)							1	2			1	**4**
Diptera(Dipterian fly spp 3)								1	1			**2**
Diptera(Dipterian fly spp 4)											1	**1**
Diptera(Dipterian fly spp 5)											1	**1**
Gryllidae(Cricket)				1								**1**
Eristalinussyrphidae (Hoverfly)					1					1	1	**3**
Nabissp(Damsel bug)					1							**1**
Micropezidae(Ichneumon wasp)					1							**1**
Harmoniaaxyridis (Ladybird beetle)						1					1	**2**
Pseudomyrmexferrugine (Pagoda ant)	1	1		1		1	1				1	**6**
Formica (Wood ants)						5						**5**
Euremahecabe(Small grass yellow butterfly)							1	1				**2**
Phalantaphalanta (Common leopard butterfly)							1					**1**
Tabanidae (Horsefly)							2	1				**3**
Colotisamata(Small Salmonarab)				15							10	**25**
1. Eggs												
2. Caterpillar	10											**10**
3. Adult	4						1		1		5	**11**
Aphisfabae(Red aphids)										3		**3**
Xylosandruscrassiusculus	1							1		1		**3**
(Wood boaring beetle)												
Aleurocanthuswoglumi(Blackfly)										45		**45**
Eumenesfraternus (Potter wasp)											1	**1**
Lymantria (Tussock moth pupa)								1				**1**
Mantodea(Praying mantis)											1	**1**
Danauschrysippus (Plain tiger butterfly)							1					**1**
Chrysomelidaebruchinae									2			**2**

Table 2 : Diversity indices

Insect / Site	n_i	Pi= n_i/N	ln Pi	H= $\Sigma pi*lnpi$	D= $\Sigma(pi)^2$	E= H/logS	D=s/N
Pseudococcidae(Mealy bugs)	84	0.2	1.6	0.125	0.04		
Attacephalotes(Leaf cutter ant)	62	0.15	1.89	0.079365079	0.0225		
Luciliasericata (Metallic fly)	8	0.019	3.96	0.00479798	0.000361		
Muscadomestica(Housefly)	8	0.019	3.96	0.00479798	0.000361		
Adisegipty(Dengue mosquito)	29	0.07	2.65	0.026415094	0.0049		
Lasiusniger (Common blackants)	7	0.017	4.07	0.004176904	0.000289		
Camponotouspennysylvanicus (Black carpenter ant)	3	0.007	4.96	0.00141129	0.000049		
Apisindica(honey bee)	27	0.066	2.71	0.024354244	0.004356		
Xylocopaviolacea(Carpenter bee)	2	0.004	5.29	0.000926276	0.00002401		
Hymnoptychissordid (Pneumatophore moth)	18	0.04	3.21	0.012461059	0.0016		
Cicadellaviridis(hopper bug)	2	0.0049	5.29	0.000926276	0.00002401		
Anisoptera (Dragonfly)	14	0.034	3.38	0.010059172	0.001156		
Diptera(Dipterian fly spp 1)	4	0.0098	4.62	0.002121212	0.00009604		
Diptera(Dipterian fly spp 2)	4	0.0098	4.62	0.002121212	0.00009604		
Diptera(Dipterian fly spp 3)	2	0.0049	5.29	0.000926276	0.00002401		
Diptera(Dipterian fly spp 4)	1	0.0024	6.03	0.00039801	0.00000576		
Diptera(Dipterian fly spp 5)	1	0.0024	6.03	0.00039801	0.00000576		
Gryllidae(Cricket)	1	0.0024	6.03	0.00039801	0.00000576		
Eristalinussyrphidae (Hoverfly)	3	0.007	4.96	0.00141129	0.000049		
Nabissp(Damsel bug)	1	0.0024	6.03	0.00039801	0.00000576		
Micropezidae(Ichneumon wasp)	1	0.0024	6.03	0.00039801	0.00000576		
Harmoniaaxyridis (Ladybird beetle)	2	0.0049	5.29	0.000926276	0.00002401		
Pseudomyrmexferrugine (Pagoda ant)	6	0.014	4.26	0.003286385	0.000196		
Formica (Wood ants)	5	0.012	4.42	0.002714932	0.000144		
Euremahecabe (Small grass yellow butterfly)	2	0.0049	5.29	0.000926276	0.00002401		
Phalantaphalanta (Common leopard butterfly)	1	0.0024	6.03	0.00039801	0.00000576		
Tabanidae (Horsefly)	3	0.007	4.96	0.00141129	0.000049		
Colotisamata(Small Salmonarab) 1. Eggs	25	0.061	2.79	0.021863799	0.003721		
2. Caterpillar	10	0.024	3.72	0.006451613	0.000576		
3. Adult	11	0.027	3.61	0.007479224	0.000729		
Aphisfabae(Red aphids)	3	0.007	4.96	0.00141129	0.000049		
Xylosandruscrassiusculus (Wood boaringbeetle)	3	0.007	4.96	0.00141129	0.000049		

Aleurocanthuswoglumi(Blackfly)	45	0.11	2.2	0.05	0.0121		
Eumenesfraternus (Potter wasp)	1	0.0024	6.03	0.00039801	0.00000576		
Lymantria (Tussock moth pupa)	1	0.0024	6.03	0.00039801	0.00000576		
Mantodea(Praying mantis)	1	0.0049	5.29	0.000926276	0.00002401		
Danauschrysippus (Plain tiger butterfly)	1	0.0024	6.03	0.00039801	0.00000576		
Chrysomelidaebruchinae	2	0.0049	5.29	0.000926276	0.00002401		
	N=405			**H= 0.40**	**D= 0.93**	**E=0.1**	**d=1.94**

Discussions:

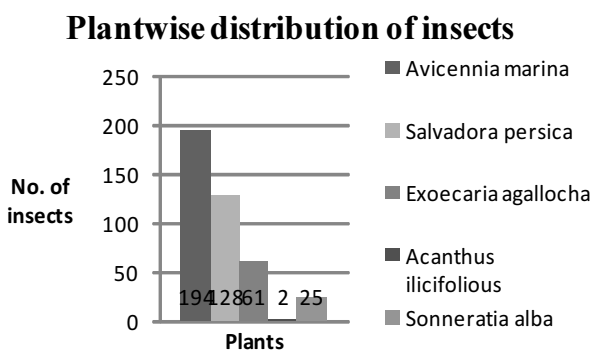
1. Shannon index (H) is a measure of diversity of community. According to the calculations, Shannon index is equal to 0.4. This shows that insect community is less diverse. During field visits, similar types of insects were found at each location.

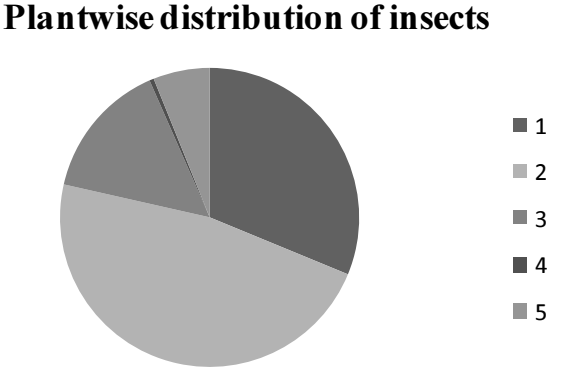
2. Simpson's dominance index (D) provides measure of diversity which takes into account both richness and evenness. Simpson's Index (D) is an index of dominance whose maximum value is one which is obtained in case of single species dominating a given area. Near zero values are obtained when numerous species are present (no dominance). Here, Relative abundance of Mealy bugs is 0.2 (which is maximum) followed by that of leaf cutter. For most of the species relative abundance is less than 0.05. This shows that mealy bugs were dominant and most of the trees are infested by it.

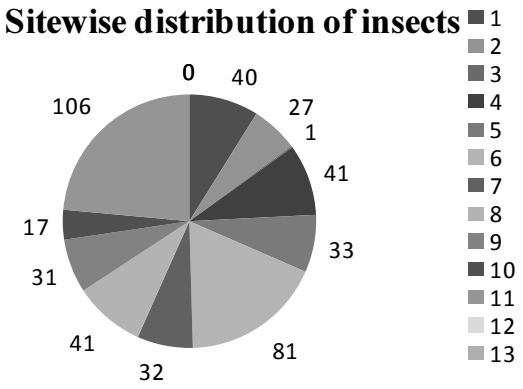
3. Eveness index (E) provides information about distribution i. e. whether the distribution is patchy or even. It is a measure of relative abundance of the different species making up the richness of an area. According to the results that are obtained, evenness index is equal to 0.1.

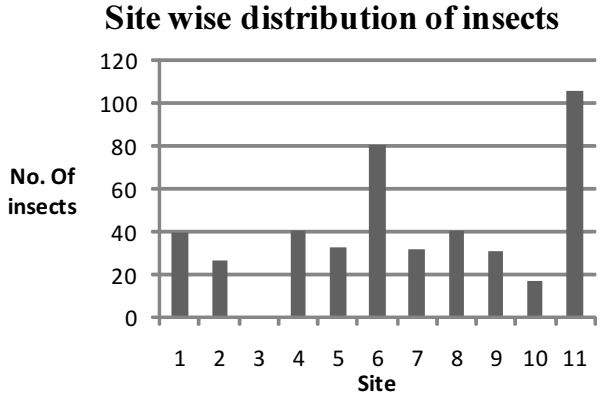
   This shows that distribution is not even. At one site (site 3), there was not a single insect. While at station 10 there were maximum population of insects. Here, black citrus flies (45 in number) were maximum in numbers which were not found previously on any station.

4. Species richness index (d) shows high diversity of species. Richness is a measure of different kind of organisms present in a particular area. Species richness is found to be 1.94. That means, species are rich in diversity. Many pest insects were found in this mangrove ecosystem. Mealy bugs were the most dominant species. At one sites (Canal site) almost whole plant of apple mangrove was affected by mealy bug. There were many bumble bees, honey bees and dipterian flies which are required for pollination. Most affected plant was *Salvadora persica.*









Conclusion

113 species of insects were recorded from Muthupet mangroves. Insects belonging to 11 families of Lepidoptera and 14 families of Coleoptera were dominant (Rahaman, 2002) Season in which these observations are taken is not stated in the research paper. Dominance of Lepidopterans was also observed in Pichavaram mangroves, Cuddalore District, Tamil Nadu (Senthil, 1992).

Most abundant insects in the salt marsh are the Dipteraand Homoptera, Coleoptera, Orthoptera, Lepidoptera, Hemiptera, Hymenoptera, and Odonata respectively.

According to the species richness index, the diversity is also good. However, Mangrove ecosystem of Godrej Company is protected from human interference in naturally maintained ecosystem. This mangrove ecosystem has pest species as well as beneficial species. Therefore we can say that there is a natural balance of damage and reproduction. But being in the industrial area of Godrej, there are chances of pollution. Also, there are dumping grounds in Kanjurmarg area which are nearer to jetty area (site showing least insect number). This may be the cause of water pollution which ultimately pollutes the soil and affects growth of insect species.

We sampled the area for the period of less than one month during summer season.We feel that our visits were less as compared to those required for insect diversity studies. Rainy season is considered as best season for insect study.Therefore there is a possibility of getting more diversity of insect if the study is done during the monsoon season and study time is increased.

Insect diversity in mangrove ecosystem is difficult to undertake because of the marshy conditions as well as there are several reasons for getting low insect biodiversity.

Only few insects have been able to invade habitats characterized by high salinities or tidal influences (Merrit and Cummins 1996), both of which are typical of salt marshes. Two common explanations include inability to deal with the high osmoregulatory stress and competition with other invertebrates.

Suggestions and recommendations

Following things can be done to protect biodiversity:

1. Amateurs can help also by telling non-entomologists how important it is to conserve insect habitats throughout the landscape.
2. Nature Trails can be arranged specially for showing insect biodiversity.
3. Further study needed to be done on insect biodiversity for a longer period of time.

Acknowledgement

I am extremely thankful to Mr. Hemant Karkhanis, my guide and mentor at Godrej Mangrove Centre and Godrej group for providing me this opportunity of working with them. I would like to express my deepest gratitude to my advisor, Dr. Sanjay Joshi, Faculty, Dept of Environmental Science, K. J. Somaiya College of Science and Commerce, Vidyavihar, Mumbai, for his excellent guidance, caring, patience, and providing me with an excellent atmosphere for doing research.

I would also like to thank Dr. Sugandha Shetye,Course Co-ordinator, Dept of Environmental Science, K. J. Somaiya College of Science and Commerce, Vidyavihar, Mumbai and Dr. Elizabeth Abba, Faculty, Dept of Environmental Science, K. J. Somaiya College of Science and Commerce, Vidyavihar, Mumbai, for guiding me for the past several years and helping me to develop my background knowledge in the subject of biodiversity. I would never have been able to complete my dissertation without help and support from my friends and from my family.

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