

Investigation on the Mosquito Fauna of Shoreline Habitats of Orissa Coast, India

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Abstract: Mosquito faunatic studies were carried out in selected coastal villages of Odisha. Two thousand mosquitoes belonging to 22 species under 6 genera were collected from twelve villages of Puri and Khurda Districts of Orissa. The present investigation deciphered the dominance of Culicine mosquito species (65.59%) in the coastal districts of Orissa. The study proved the dominance of *Anopheles subpictus* comprising 22.73% of all mosquito population studied and about 65.6% of the overall Anophelines fauna followed by *Anopheles vagus* which is dominated by 10.03%. *Culex quinquefasciatus* Say and the *C. vishnui* Theobald group are the common *Culicines* comprising 17.55% and 10.03% respectively. The species of *Armegeres* group are also equally prevalent as the Genus *Culex*. Shannon diversity index of the mosquito species of the two districts has been studied. Khurda District was significantly higher than the diversity in the mosquito community of Puri District of Odisha, India. The changes in mosquito fauna observed from the Orissa coastal area and Chilika Lake are due to the major ecological changes, extensive use of insecticides and development in agricultural practices, industrial development, natural calamities like severe cyclones, after effects of tsunami.

Keywords: Shoreline; Culicine; Shannon diversity index; Diversity

Introduction

Mosquito fauna known from the world comprises 3,500 species that are traditionally classified into three subfamilies viz. Anophelinae, Culicinae and Toxorhynchitinae under the family Culicidae of the Order Diptera (Insecta). Taxonomic studies of the mosquito fauna of Indian subcontinent were extensively studied by Barraud (1934), Christophers (1933) and their monumental works led to Nagpal and Sharma (1995) updating 320 species of mosquitoes in 37 genera so far reported from India. The mosquito fauna of Orissa state was studied by Fry (1912), Nagpal and Sharma (1983), Dash et al. (2000). However, Rajavel et al. (2005 a, b) has reported recently 74 species belonging to 12 genera and 20 subgenera from Jeypore Hill tracks of Orissa and 43 species belonging to 21 subgenera and 13 genera from mangroves of Bhiterkanika. Keeping in view of the prevalence of mosquito borne diseases in Orissa, an attempt has been made here to document the diversity of mosquitoes inhabiting the shoreline habitats of South Orissa coast.

The state of Orissa, the south eastern coastal state of India, is located between 17.49' N and 22.34' N and 81.27' E and 87.29' E. It is bounded by the Bay of Bengal on the north east; Madhya Pradesh on the west and Andhra Pradesh on the south. The land area of the state covers 155,707 sq. kms, with a coast line of over 450 kms. On the basis of physiographical characteristics, the state has been divided into five major morphological regions viz. the Orissa Coastal Plain in the east, the Middle Mountainous and highlands, the Central plateaus, the Western rolling uplands and the major flood plains. The coastal belt of the state extends from the River Subarnarekha near West Bengal border in the north to the River Rushikulya in the south near the border of Andhra Pradesh. Several deltas of varied sizes and shapes are formed by the major rivers of Orissa, such as the Subarnarekha, the Budhabalanga, the Baitarani, the Brahmani, the Mahanadi, and the Rushikulya. Therefore, the coastal plain of Orissa is also known as "Hex deltaic Region" or the "Gift of Six Rivers". In addition, the largest brackish water lake of Asia, the

Chilika is located between 85°20' E and 19°40' N, and is connected to the Bay of Bengal by a narrow channel 32 km long. These extensive river systems and the lakes are home of diverse faunal groups such as mosquitoes that are adapted to survive in varied habitats like ponds, puddles, tree holes, swamps and salt marshes.

A taxonomic account of 22 species under 6 genera were actually collected and studied from twelve villages of Puri and Khurda Districts from 55 mosquito species under 12 genera, 17 subgenera and 3 tribes occurring coastal districts of Orissa is presented in this study along with some observations on their ecology and distribution. The species of mosquitoes which are actually collected in the present survey marked with asterisk.

1 Materials and Methods

1.1 Topography

The state of Orissa is located on the East coast of India in between 17° 48' and 22° 34' North latitude and 81° 24' and 87° 29' East longitude. Puri and Khurda are two districts on south coast of Orissa comprises of. The two coastal Districts has following latitudes and longitudes ; Puri 19° 48' N, 85° 52' E, Khurda, 20° 11' N, 85° 40' E.

1.2 Sample Collection

Random sampling made during the period from January 2006 to September 2007 from different localities of coastal Villages located in two coastal districts (Figure I). Mosquitoes were collected by employing simple standard techniques from indoor and outdoor habitats of the human habitations and also from cattle sheds. Samples were also collected during dawn and dusk while mosquitoes suck blood from their host. Biting collections were made during dawn and dusk. Pyrethrum spray was done for total mosquito collection from human dwellings. The knocked down specimens were collected over a white cloths sprayed in the room by picking with the help of a fine forceps and transferred to the collection tubes to avoid breaking of legs. Suction tube was also used to collect the live mosquitoes from and outdoor resting mosquitoes. Resting adult mosquitoes were collected from the shrubs around the cattle sheds and human dwellings, paddy fields, and nearby forest areas. The mosquito samples were identified by using the keys developed of Christophers 1933, Barraud, 1934, Rao, 1984 and Nagpal.

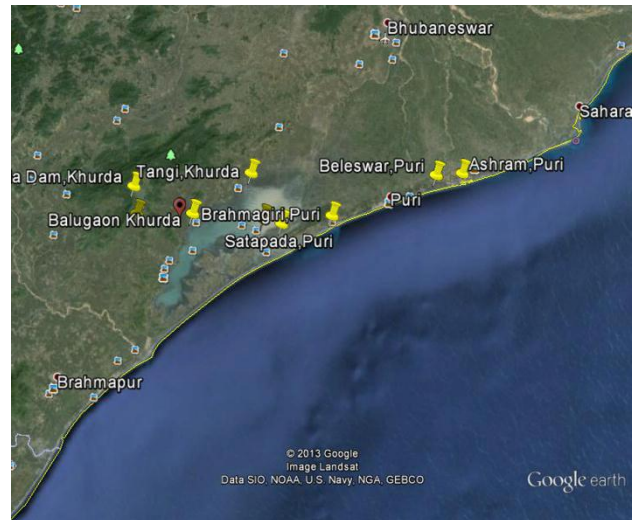


Figure I Collection sites, Puri and Khurda District, Odisha, India

1.3 Data analysis

Species diversity is represented through species richness (S), Shannon index (H) and Shannon evenness (Es). The Shannon index is given by $H = -\sum p_i \ln p_i$, where p_i is the proportion of individuals found in the i^{th} species and \ln denotes the natural logarithm. Another way to assess diversity was by performing the SHE analysis values like S=Species richness, H=Shannon index diversity, and E=evenness (Buzas & Hayek, 1996 and Hayek & Buzas, 1997, 1998). The MHD (Man hour density) of the mosquito fauna of two coastal districts were also been calculated.

1.4 List of mosquito species recorded from the orissa coast

1. *Anopheles (Anophilis) aitkenii* James
2. *Anopheles (Anopheles) nigerimus* Giles*
3. *Anopheles (Anopheles) sinensis* Wiedemann
4. *Anopheles (Cellia) aconitus* Donitz*
5. *Anopheles (Cellia) annularis* Van der Wulp*
6. *Anopheles (Cellia) culicifacies* Giles*
7. *Anopheles (Cellia) fluviatilis* James
8. *Anopheles (Cellia) jeyporiensis* James
9. *Anopheles (Cellia) karwari* (James)
10. *Anopheles (Cellia) maculatus* Theobald*
11. *Anopheles (Cellia) majidi* Young and Majid

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| 12. <i>Anopheles (Cellia) minimus</i> Theobald | 44. <i>Culex (Culex) whitei</i> Barraud |
| 13. <i>Anopheles (Cellia) moghulensis</i> Christophers | 45. <i>Culex (Culex) whitmorei</i> (Giles) |
| 14. <i>Anopheles (Cellia) pallidus</i> Theobald | 46. <i>Ficalbia (Ficalbia) minima</i> (Theobald) |
| 15. <i>Anopheles (Cellia) ramsayii</i> Covell | 47. <i>Heizmannia (Heizmannia) chandi</i> Edwards |
| 16. <i>Anopheles (Cellia) splendidus</i> Koidzumi* | 48. <i>Mansonia (Manasonioides) annulifera</i> (Theobald) * |
| 17. <i>Anopheles (Cellia) subpictus</i> Grassi* | 49. <i>Mansonia (Manasonioides) dives</i> (Scheiner) * |
| 19. <i>Anopheles (Cellia) tessellates</i> , Theobald | 50. <i>Mansonia (Manasonioides) indiana</i> Edwards* |
| 20. <i>Anopheles (Cellia) theobaldi</i> Giles* | 51. <i>Mansonia (Manasonioides) uniformis</i> (Theobald) * |
| 21. <i>Anopheles (Cellia) vagus</i> Donitz* | 52. <i>Ochlerotatus (Finalaya) niveus</i> (Ludlow) |
| 22. <i>Anopheles (Cellia) varuna</i> , Iyengar* | 53. <i>Ochlerotatus (Rhinoskusea) longirostris</i> (Leicester) |
| 23. <i>Toxorhynchites (Toxorhynchites) splendens</i> (Wiedemann) | 54. <i>Ochlerotatus (Rhinoskusea) portonovoensis</i> (Tewari and Hiriyani) |
| 24. <i>Aedes (Aedimorphus) caecus</i> (Theobald) | 55. <i>Uranotaenia (Pseudoficalbia) atra</i> Theobald |
| 25. <i>Aedes (Cancraedes) cancricomus</i> Edwards | |
| 26. <i>Aedes (Diceromyia) iyengari</i> Edwards | |
| 27. <i>Aedes (Stegomyia) albopictus</i> (Skuse)* | |
| 28. <i>Aedes (Stegomyia) imitator</i> (Leicester) | |
| 29. <i>Aedes (Stegomyia) novalbopictus</i> Barraud | |
| 30. <i>Aedes (Stegomyia) vittatus</i> (Bigot) * | |
| 31. <i>Aedes (Stegomyia) w-albus</i> (Theobald) | |
| 32. <i>Armigeres(Armigeres) subalbatus</i> (Coquillett) * | |
| 33. <i>Armigeres (Armigeres) theobaldi</i> * | |
| 34. <i>Culex (Culex) bitaeniorhynchus</i> Giles | |
| 35. <i>Culex (Culex) cornutus</i> Edwards | |
| 36. <i>Culex (Culex) fuscocephalus</i> Theobald | |
| 37. <i>Culex (Culex) gelidus</i> Theobald | |
| 38. <i>Culex (Culex) mimulus</i> Edwards | |
| 39. <i>Culex (Culex) quiquefasciatus</i> Say* | |
| 40. <i>Culex (Culex) sinensis</i> Theobald | |
| 41. <i>Culex (Culex) sitiens</i> Wiedemann | |
| 42. <i>Culex (Culex) tritaeniorhynchus</i> Giles | |
| 43. <i>Culex (Culex) vishnui</i> Theobald* | |

2 Results and Discussions

The present study deals with 57 species of mosquitoes under 12 genera earlier reported from coastal Orissa out of which over 2000 mosquitoes belonging to 22 species under 6 genera were actually collected and studied from twelve villages of Puri and Khurda Districts of Orissa. The study proved the dominance of Culicine mosquito species (65.59%) in the coastal districts of Orissa Rao (1984) remarked that among the Indian *Anopheline* fauna, *Anopheles subpictus* Grassi complex is predominant along the coast. The present studies also proved the dominance of *Anopheles subpictus*, comprising 22.73% of all mosquito population studied and about 65.6% of the overall *Anophelines* fauna. The second species *Anopheles vagus* is dominated by 10.03%. The species of *C. quinquefasciatus* Say and the *C. vishnui* Theobald group are the common *Culicines* comprising 17.55% and 10.03% respectively. The species of *Armigeres* group are also equally prevalent as the Genus *Culex*.

The other species recorded in this study are *Anopheles maculates*, *Anopheles splendidus*, *Anopheles theobaldi*, *Anopheles acconitus*, *Anopheles nigerimus*, *Armigeres subalbatus*, *Manasonia annulifera*, *Manasonia indiana*, *Manasonia longipalpis*, *Mansonia uniformis*, *Aedes vittatus*, *Aedes albopictus*, *Coquillettia*. The district wise species composition of *Manasonioides*

Table1 Per ten men hour density (TMHD) of the mosquitoes collected from the surroundings of Chilika Lake during 2006-07

Sl. No.	Genus	Species	No.	TMHD
1.	<i>Anopheles</i>	<i>An. aconitus</i>	3	0.62
		<i>An. annularis</i>	3	0.62
		<i>An. culcifafacies</i>	3	0.31
		<i>An. maculates</i>	3	0.31
		<i>An. nigerimus</i>	6	0.62
		<i>An. splendidus</i>	3	0.31
		<i>An. subpictus</i>	450	46.87
		<i>An. theobaldi</i>	6	0.62
		<i>An. vagus</i>	200	20.83
		<i>An. Varuna</i>	3	0.31
2.	<i>Culex</i>	<i>Cx. quinquefasciatus</i>	350	36.45
		<i>Cx. vishnui gp.</i>	200	20.83
3.	<i>Armegeres</i>	<i>Am. subalbatus</i>	348	36.25
		<i>Am. Theobaldi</i>	132	13.75
4.	<i>Manasonia</i>	<i>Mn. uniformis</i>	100	10.41
		<i>Mn. annulifera</i>	48	1.56
		<i>Mn. Indiana</i>	15	5
		<i>Mn. longipalpis</i>	3	0.31
5.	<i>Aedomyia</i>		3	0.31
6.	<i>Aedes</i>	<i>Ad. albopictus</i>	6	0.31
		<i>Ad. Vitattus</i>	100	10.41
7.	<i>Coquilettidia</i>		3	0.31

The changes in mosquito fauna observed from the Orissa coastal area and Chilika lake may be associated with the major ecological changes, extensive use of insecticides and development in agricultural practices, industrial development, natural calamities like severe cyclones, after effects of tsunami etc.

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