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STUDIES ON THE MOSQUITO FAUNA INHABITING SHORELINE HABITATS OF ORISSA COAST (CULICIDAE : DIPTERA)

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INTRODUCTION

Mosquito fauna known from the world comprises 3,500 species that are tradionally classified in to three subfamilies *viz*. Anophelinae, Culicinae and Toxorhynchitinae under the family Culicidae of the Order Diptera. (Insecta). Taxanomic 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 born 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 (Fig. 1). 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 "Hexadeltaic Region" or the "Gift of Six Rivers". In addition, the largest brackish water lake of India, the Chilika is located between 85^{0}20' E and 19^{0}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 55 mosquito species under 12 genera, 17 subgenera and 3 tribes occurring in Puri and Khurda 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.

MATERIALS AND METHODS

Two coastal districts of Orissa *i.e.*, Khurda and Puri have been chosen for collection of mosquito samples. The Khurda and Puri districts are located 20º 40'N and 85º 35'E and 19º 45'N and 85º 50'E respectively. Samples of adults and immature stages of mosquitos were collected from twelve villages around the Chilika Lake covering the two districts which represent diversified habitats. Random samplings were made during the period from January 2006 to September 2007 from different localities of Balugaon, Chhedapadar, Bidharpur, Pratap, Totapada villages in Khurda District and Alipara, Giqala, Sipakuda, Rambhartya Island, Ashram, Altunga, Beleswarpatna villages in Puri District (Fig. 1).

Mosquitoes were collected by employing simple standard techniques from indoor and outdoor habitats and from cattle sheds. Samples were also collected

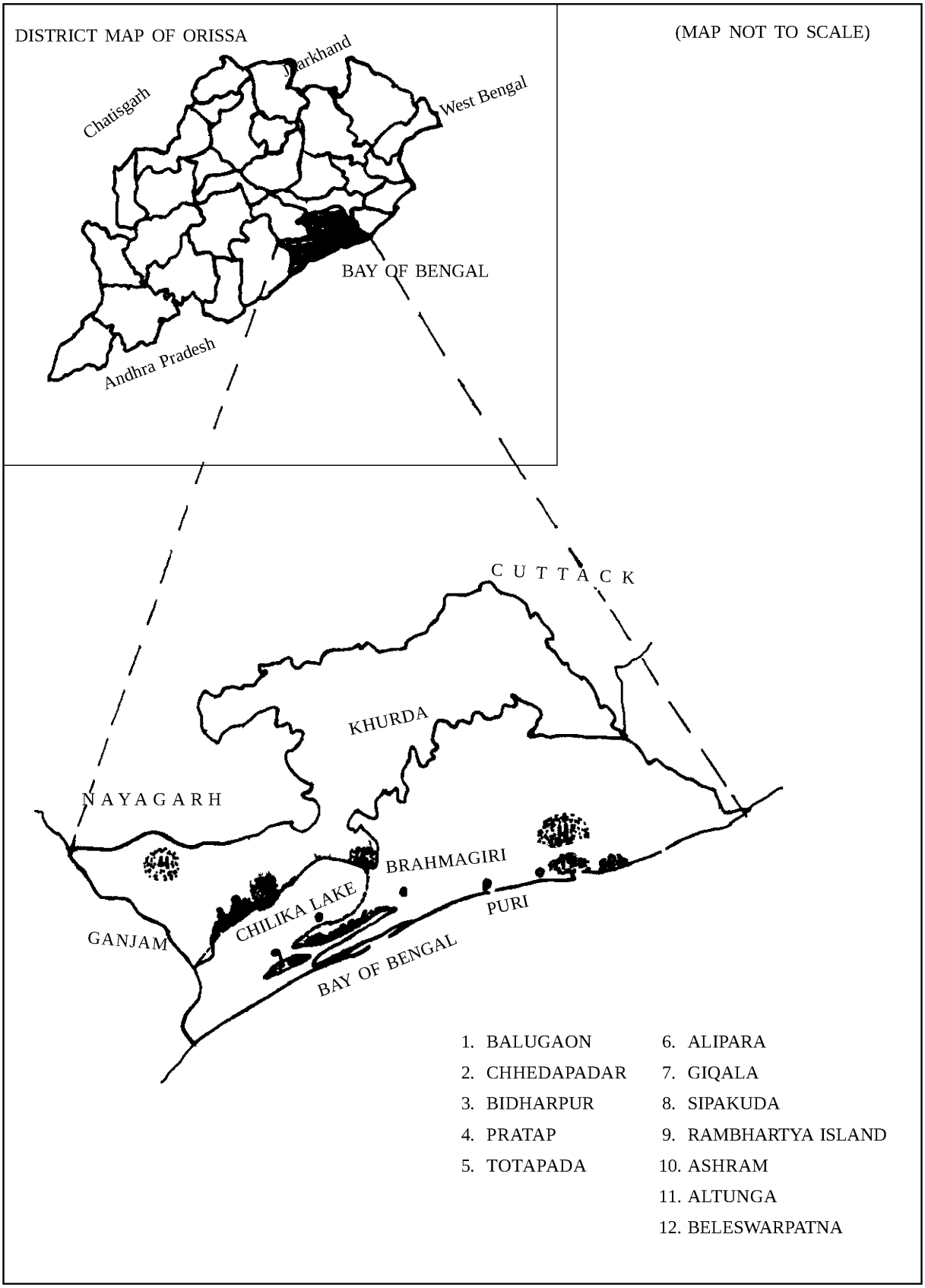

Fig. 1. Map of Orissa showing Collection sites in the Puri and Khurda district (2006-07)

during dawn and dusk while mosquitoes maximize their frequency of taking blood meal from the hosts. Mosquito repellant spray was used to paralyze the specimens. The knocked down specimens were collected by picking with the help of fine forceps and transfer them to the collection tubes to avoid breaking of legs. Suction tube was also used to collect the live mosquitoes. Resting adult mosquitoes were collected from the shrubs around the cattle sheds and human dwellings, paddy fields, and near by forest areas. Over 2000 examples of adults and immature stages of mosquitos have been collected by employing the above techniques during the survey period. Adults of male and female mosquitos and their immature stages were identified using standard literatures and the keys provided by Christopher, 1933; Barraud, 1934 and Rao, 1984. In this study 22 species of mosquitoes belonging to 7 genera were identified from the south coastal Orissa. The diagnostic characters of all the species listed here are based on the key characters of adult females. Identified specimens were registered and deposited at the museum of Zoological Survey of India, Gopalpur, Orissa.

EXTERNAL FEATURES OF A MOSQUITO

The body of the mosquito is divided in to head, thorax, and abdomen (Fig. 2). The head (Fig. 3) contains compound eyes and proboscis. The proboscis is the piercing mouthparts used to "suck" blood from the victim. The mosquito's head is mostly formed of the compound eye. Each eye (Fig. 3) is made up of many tiny lenses forming a compound eye which allows for a broad field of vision. The thorax (Fig. 4) has one pair of wings (Fig. 7) and halteres. The abdomen (Fig. 5) or gut is capable of expanding as it ingests the prey's blood. The markings present on the thorax and abdomen are useful for the identification of the species. The length of mosquitoes varies in species but is rarely greater than 16 mm and weighs up to 2.5 mg. Mosquitoes are able to continuously fly for 1 to 4 hours at a speed of 1-2 kmph and travel up to 10 km in a night. Most species are nocturnal or crepuscular (dawn or evening) feeders. During the heat of the day most mosquitoes rest in a cool place and wait for the evening. The pathogens are transmitted to victims while sucking the blood.

TAXONOMIC LIST OF MOSQUITO SPECIES RECORDED FROM THE ORISSA COAST

Family CULICIDAE

Genus ***Anopheles***

Subgenus ***Cellia***

Subgenus ***Anopheles***

1. ***Anopheles (Anophilis) aitkenii*** James

1903. *Anopheles aitkenii* James, In : Theobald, *Monogr. Cul.*, **3** : 22.

Diagnostic characters : palpi equal to the proboscis, completely dark and scales small in size; costa and subcosta are completely dark including vein 1 (R1); prescuttelar space of thorax without setae; pale ring absent at the termination of tarsi.

Distribution : In India, widely prevalent in Andaman Islands, Andhra Pradesh, Assam, Bihar, Karnataka, Kerala, Maharashtra, Manipur, Meghalaya, Orissa, Punjab, Sikkim, Tamil Nadu, Uttar Pradesh and West Bengal.

Remarks : Breeds in a variety of places such as small pools and seepages, in the jungle tea garden drains which are shaded by tea plants, swamps, marshes, channels, river, rock pools, streams heavily shaded with trees, wells etc. Recorded from Mayurbhanj, Keonjhar and Koraput of Orissa.

2. ***Anopheles (Anopheles) nigerimus*** Giles*

1900. *Anopheles nigerimus* Giles. *Handbook* : 162. (as variety of *hyrcanus*).

Diagnostic characters : Four banded palpi (tip of the palpi pale); Pale area on costa and subcosta including vein 1 (R1) is less than 4, pale scale on inner costa and fringe spot on vein 5.2 (Cu2), basal dark mark on wing vein 5 (Cu) long (0.4 multiplied by length of Cu stem).

Material Examined : 3 exs. (F), Pratap, Khurda Distt., 24.i.2006 Coll. : S. Dash; 3 exs. (F) from Sipakuda, Beleswarpatna Dist. Puri, 26.i.2006, Coll. : S. Dash.

Distribution : In India, occurs in all mainlands except Himachal Pradesh.

Remarks : Breeds in standing water with good aquatic vegetation.Recorded from all over Orissa especially from coastal Orissa.

3. ***Anopheles (Anopheles) sinensis*** Wiedemann

1828. *Anopheles sinensis* Wiedemann, *Aussereurop Zweifl Insekt.*, **1** : 547.

Diagnostic characters : Pale area on costa and subcosta including vein 1 (R1) is less than 4; four banded palpi (tip of the palpi pale); size of pale bands on hind tarsomeres very small.

Distribution : In India recorded from Assam, Delhi, Manipur, Meghalaya, Mizoram, Orissa, Punjab and Tamil Nadu.

Remarks : Mainly breeds in the rice fields. Recorded from all over Orissa but especially from Koraput District.

Subgenus ***Cellia***

4. ***Anopheles (Cellia) aconitus*** Donitz*

1902. *Anopheles aconitus*, Donitz, *Z. Hyg. Infektkrankh*, **41** : 70.

Diagnostic characters : Intervening dark band on the palpi very small (in most of the specimens dark band absent); more than 4 Pale area on costa and subcosta including vein 1 (R1); speckling in fore and hind legs are absent; Hind tarsomeres 5, 4, and 3 are dark; Tip of hind tarsomere and bands on legs are black.

Material Examined : 2 exs. (F) from Altunga, Puri Distt. 24.i.2006; 1 ex (F) from Tangi,. Khurda Distt., 27.i.2006. Coll. : S. Dash.

Distribution : Distributed all over India including Andaman Islands and Lakshadweep except Haryana, Himachal Pradesh, Jammu and Kashmir, Punjab, Rajsthan.

Remarks : Species breeds in clean-water tanks with grassy edges, ponds, streams, water drains, river bed pools and rice fields (at least 45 cm long). Reported from the coastal plains of Orissa.

5. ***Anopheles (Cellia) annularis*** Van der Wulp*

1884. *Anopheles annularis* Van der Wulp. *Notes Leyden Mus.*, **6** : 249.

Diagnostic characters : Apical pale band of palpi nearly equal to the pre-apical dark band; area at the bifurcation of wing vein 5 (Cu) dark; more than 3 pale area on costa and subcosta including vein 1 (R1); speckling in fore and hind legs absent; tarsomeres 5, 4 and 3 of hind leg completely pale.

Material Examined : 2 females (adult). Chhedapadar,. Khurda Distt., 23.i.2006, Coll. : S. Dash; 4 exs (F)., Alipada and Altunga of Puri Distt., 27.i.2006, Coll. : S. Dash.

Distribution : In India, very commonly found in coastal Orissa, Bihar, Maharahtra, Punjab and West Bengal.

Remarks : Mixed dwellings during day. Also found at outdoor in small numbers. Reported from Singhbhum, Chilika lake area, Puri, Keonjhar, Koraput of Orissa.

6. ***Anopheles (Cellia) culicifacies*** Giles*

1901. *Anopheles culicifacies* Giles, *Entomologist's mon. Mag.*, **37** : 198.

Diagnostic characters : Apical pale band nearly equal to the preapical dark band of palpi; more than 3 Pale area on costa and subcosta including vein 1 (R1); Fringe spot on vein 3 (R4 + 5) absent; speckling in fore and hind legs absent; hind tarsomeres 5, 4 and 3 are dark; bands on fore tarsomeres absent;.

Materials Examined : 2 exs. (F). Bidharpur, Khurda Distt., 23.i.2006, Coll. : S. Dash; 1 ex. (F) from Giqala of Puri Distt., 27 .i. 2006, Coll. : S. Dash.

Distribution : In India recorded throughout the country except Andaman & Nicobar Islands.

Remarks : It rests in cattle sheds and houses during the day. Also collected from straw, mud cakes *etc.*, near stables and from dense vegetation under the bushes and tree holes. Reported from Balangir, Balighara, Baruva, Bhadrak, Chatikona, Cuttack, Ganjam, Jeypore, Kesinga, Phulbani and Sambalpur in Orissa.

7. ***Anopheles (Cellia) fluviatilis*** James

1902. *Anopheles fluviatilis* James, *Scient. Mem Med. Sanit. Depts. India*, **2** : 31.

Diagnostic characters : Apical pale band nearly equal to the pre-apical dark band of palpi; wing with 4 or more dark spots on costa, involving costa and vein R, wing vein 3 (R4 + 5) and inner costa mostly pale and inner costa dark: speckling in legs absent; bands on fore tarsomeres absent.

Distribution : In India, occurs in all main lands.

Remarks : More percentage of adults rest at human habitats than cattle sheds in day time. The species also rests outdoors. Reported from Jeypore, Koraput, Mayurbhanj of Orissa.

8. ***Anopheles (Cellia) jeyporiensis*** James

1902. *Anopheles jeyporiensis* James, *Scient. Mem. Med. Sanit. Depts. India*, **2** : 32.

Diagnostic characters : Pre-apical dark band ¼ or 1/5 of the apical pale band of palpi; Wing with 4 or more dark spots on costa, involving costa and vein R, distance of the anterior forked cell from the base of the costa compared to that of posterior forked cell is small; speckling in legs absent; hind tarsomeres 5, 4 and 3 are dark; small bands on fore tarsomeres.

Distribution : In India, found from Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Goa, Karnataka, Kerala, Madhya Pradesh, Mahrashtra, Manipur, Meghalaya, Mizoram, Orissa, Rajasthan, Sikkim, Tamil Nadu, Uttar Pradesh, Uttarakhand and West Bengal.

Remarks : Adults found largely in cattle sheds as well as inside houses. Found at altitudes from 2000 to 6000m. Reported from Jeypore hills of Orissa after which the species has been named.

9. ***Anopheles (Cellia) karwari*** (James)

1903. *Anopheles karwari* (James), In : Theobald. *Monogr. Cul.*, **3** : 102.

Diagnostic characters : Palpi with 4 pale-scaled bands. Wing with 4 or more dark spots on costa, involving costa and vein R, wing never all dark; only hindtarsomeres 5 and part of 4 pale-scaled.

Distribution : This species is recorded in India including Andaman & Nicobar Islands, Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Tamil Nadu,

Goa, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Mizoram, Orissa, Rajasthan, Tripura, Uttar Pradesh, Uttarakhand, West Bengal.

Remarks : Reported all over Orissa . Breeds mainly in seepage. Not regarded as vector of Malaria.

10. ***Anopheles (Cellia) maculatus*** Theobald*

1901. *Anopheles maculatus* Theobald, *Monogr. Cul.*, **1** : 171.

Diagnostic characters : Apical pale band of palpi nearly equal to the subapical pale band; more than 4 Pale area on costa and subcosta including vein 1 (R1); speckling in fore and hind legs are present; hind tarsomeres 5 and part of 4 are only pale; dark band at 4th tarsomere of hind leg are present; scales on 6 and 7 tergites are with broad golden scales.

Material Examined : 3 exs. (F), Totapada, Pratap Khurda Distt., 28.i.2006 Coll. : S. Dash.

Distribution : In India, occurs in all main lands.

Remarks : Prefers bright sunlit places for breeding and shade has a deleterious effect in breeging Breeding is more pronounced in pre- and post monsoon months. Recorded all over Orissa.

11. ***Anopheles (Cellia) majidi*** Young and Majid

1928. *Anopheles majidi* Young and Majid, *Indian. J. med. Res.*, **16** : 169.

Diagnostic characters : Apical and sub-apical pale band equal and separated by a small or same sized dark band intervening dark band of palpi; more than 4 Pale area on costa and subcosta including vein 1 (R1); speckling in fore and hind legs are absent; Hind leg tarsomeres 5, 4, and 3 are dark; tip of hind tarsomere pale and bands present on legs.

Distribution : In India it is found in Arunachal Pradesh, Assam, Goa, Karnataka, Kerala, Meghalaya, Mizoram, Orissa, Tamil Nadu, Tripura and West Bengal.

Remarks : Breeds in grassy slow-running streams, breeding also recorded from open drains in tea gardens and fallow rice fields. Reported from Koraput, Orissa.

12. ***Anopheles (Cellia) minimus*** Theobald

1901. *Anopheles minimus* Theobald, *Monogr. Cul.*, **1** : 186.

Diagnostic characters : Apical and sub-apical pale band equal and separated by a small or same sized dark band intervening dark band of palpi; wing with 4 or more dark spots on costa, involving costa and vein R, inner costa interrupted; speckling in legs absent; Hind leg tarsomeres 5, 4, and 3 are dark; tip of hind tarsomere black and bands on legs absent.

Distribution : In India, widely prevalent in Arunachal Pradesh, Assam, Madhya Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura. It has sporadic distribution in Andhra Pradesh, Bihar, Karnatak, Kerala, Orissa, Tamil Nadu, in the foothills of Uttar Pradesh and West Bengal.

Remarks : Breeds in burrow pits, rice fields and seepages. The species prefers shady places. Reported from all over Orissa.

13. ***Anopheles (Cellia) moghulensis*** Christophers

1924. *Anopheles moghulensis* Christophers, *Indian J. Med. Res.*, **12** : 296.

Diagnostic characters : Apical pale band nearly equal to the pre-apical dark band of palpi; pre-apical dark band ¼ or 1/5 of the apical pale band; wing with 4 or more dark spots on costa, involving costa and vein R; speckling in legs absent; hind tarsomeres 5, 4 and 3 are dark; bands on fore tarsomeres are small.

Distribution : In India recorded from Andhra Pradesh, Bihar, Jammu & Kashmir, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu.

Remarks : Rests in human dwellings and occasionally in cattle sheds. Reported all over Orissa.

14. ***Anopheles (Cellia) pallidus*** Theobald

1901. *Anopheles fuliginosus var.* Theobald. *Monogr. Cul.*, **1** : 134.

Diagnostic characters : Apical pale band of palpi nearly equal to the pre-apical dark band; wing with 4 or more dark spots on costa, involving costa and vein R, pale area at the bifurcation of wing vein 5 (Cu); speckling in legs absent; hind leg tarsomeres 5, 4 and 3 completely pale; apex of hind tarsomere1 without any pale band.

Distribution : Found throughout India.

Remarks : Mixed dwellings. Reported all over Orissa.

15. ***Anopheles (Cellia) ramsayii*** Covell

1931. *Anopheles pseudojamesi*, Strickland and Choudhury. *Anoph. Larvae*, suppl., : 25(L.).

Diagnostic characters : Apical pale band of palpi nearly equal to the pre apical dark band Wing with 4 or more dark spots on costa, involving costa and vein R, Dark and inner costa interrupted speckling in legs present; hind tarsomeres 5, 4 and 3 completely pale.

Distribution : In India the distribution restricted to Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Goa, Maharashtra, Meghalaya, Orissa and West Bengal.

Remarks : Breeds in rainwater pools, tanks and swamps. Adults rest in houses and cattle sheds. Reported from Orissa coastal plains.

16. ***Anopheles (Cellia) splendidus*** Koidzumi*

1920. *Anopheles splendidus* Koidzumi, *Daiwan. Kenkyujo Hokoku*, **8** : 23.

Diagnostic characters : Apical pale band of palpi nearly equal to the sub apical pale band; more than 3 Pale area on costa and subcosta including vein 1 (R1); speckling in fore and hind legs are present; Hind tarsomeres 5, 4 and 3 completely pale.

Material examined : 2 exs. (F), Giqala, Puri Distt., 24.iii.2007 Coll. : S. Dash; 1 ex (F) from Chhedapadar, Khurda Dist., 28.iii. 2007, Coll. : S. Dash.

Distribution : In the south eastern parts of India

Remarks : Breeds in riverbed pool, slow-moving stream, human dwelling, cattle shed. Recorded from the coastal and southern hills of Orissa.

17. ***Anopheles(Cellia) subpictus*** Grassi*

1899. *Anopheles subpictus* Grassi,. *Rc. R. Accad. Lincei,* **8** : 101.

Diagnostic characters : Apical pale band nearly equal to the preapical dark band; more than 3 pale area on costa and subcosta including vein 1 (R1); speckling in fore and hind legs are absent; Hind leg tarsomeres 5,4, and 3 are dark; Band on foreleg tarsomeres are broad.

Material Examined : 25 exs (F) Chhedapadar, Bidharpur, Totapada, Pratap, Balugaon, Tangi of Khurda Distt. 24.i.2006 Coll. : S. Dash; 37 exs. (F) Alipada, Giqala, Sipakuda, Beleswarpatna, Altunga of Puri Distt., 25- 27.i. 2006, Coll. : S. Dash.

Distribution : Found throughout India.

Remarks : Breeds in stagnant waters, clear or turbid waters, water with or without vegetation, shaded or slightly shaded places, wells, burrow pits, channels, lake margins, ponds, tanks, ground pools, fallow and freshly flooded rice fields, cement cisterns, tree-holes, fresh or brackish waters.Recorded all over Orissa.

18. ***Anopheles (Cellia) sergentii*** (Theobald)

1907. *Pyretophorus sergentii* Theobald, *Monogr. Cul.*, **4** : 68.

Diagnostic characters : Apical pale band nearly equal to the pre-apical dark band of palpi; pre-apical dark band ¼ or 1/5 of the apical pale band; wing with 4 or more dark spots on costa, presence of fringe spot on vein 3 (R4 + 5)nvolving costa and vein R; speckling in legs absent; hind tarsomeres 5, 4 and 3 are dark; bands on fore tarsomeres absent.

Distribution : In India, recorded from Jabalpur (Madhya Pradesh) and Koraput (Orissa).

Remarks : Rests in human dwellings and cattle sheds but sometimes in underground aqueducts.

19. ***Anopheles (Cellia) tessellates*** Theobald

1901. *Anopheles tessellates* Theobald, *Monogr. Cul.*, **1** : 175.

Diagnostic characters : Wing with 4 or more dark spots on costa, involving costa and vein R, speckling in legs present; Narrow banding in hind tarsomeres.

Distribution : In India, recorded from Andaman and Nicobar Islands, Andhra Pradesh., Assam, Bihar, Goa, Gujurat, Karnataka, Kerala, Lakshadweep, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Nagaland, Orissa, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh., Uttarakhand, West Bengal.

Remarks : Reported all over Orissa, Occurring in mixed dwellings, cattle sheds and outdoors, rest particularly on the lower part of the walls.

20. ***Anopheles (Cellia) theobaldi*** Giles*

1901. *Anopheles theobaldi* Giles, *Entomologist's. Mon. mag.*, **37** : 198.

Diagnostic characters : More than 4 pale area on costa and subcosta including vein 1 (R1); speckling in fore and hind legs are present; Apical pale band of palpi nearly equal to the sub apical pale band; Hind tarsomeres only 5 and part of 4 pale; The dark band at 4^{th} tarsomere of hind leg is absent.

Material Examined : 3 exs. (F) from Sipakuda, Altunga, Puri Distt., 24.i.2006, Coll. : S. Dash; 3 exs. (F) from Chhedapadar, Bidharpur, Pratap, Khurda Distt., 27.i.2006. Coll : S. Dash.

Distribution : Found all over India but concentrated mainly in central and western part of peninsula.

Remarks : Forest species and basically a stream breeder, also breeds in ponds, tanks, rice fields and riverbed pools. Reporeted all over Orissa.

21. ***Anopheles (Cellia) vagus*** Donitz*

1902. *Anopheles vagus* Donitz. *Z. Hyg. Infektkrankh.*, **41** : 80.

Diagnostic characters : Pre-apical dark band ¼ or $^1/_5$ of the apical pale band of palpi.; more than 3 pale area on costa and subcosta including vein 1 (R1); speckling in fore and hind legs are absent; Hind tarsomeres 5, 4, and 3 are dark; Band on fore tarsomeres are broad.

Material Examined : 10 exs. (F) from Chhedapadar, Bidharpur, Totapada, Pratap, Balugaon, Tangi of Khurda Distt. 24.i.2006 and 25.ii.2007 Coll. : S. Dash; 20 exs. (F) Alipada, Giqala, Sipakuda, Beleswarpatna, Altunga of Puri Distt., 27.i.2006, Coll. : S. Dash.

Distribution : In India, found throughout the country except Delhi, Himachal Pradesh, and Punjab.

Remarks : Adults rest indoors in cattle sheds and mixed dwellings. Cattle sheds are regarded more attractive. However, outdoor resting is limited. Reported from all over Orissa.

22. ***Anopheles (Cellia) varuna*** Iyengar*

1924. *Anopheles varuna* Iyengar, *Indian J. med. Res.*, **12** : 24.

Diagnostic characters : Proboscis generally dark, sometime half of it is yellow; apical and sub-apical pale band equal and separated by same sized dark band intervening dark band of palpi; more than 4 Pale area on costa and subcosta including vein 1 (R1); inner costa of wing is dark; fringe spot absent on vein 6 (Anal); vein 5.1 (Cu 1) with two dark areas;speckling in fore and hind legs are absent; Hind tarsomeres 5, 4, and 3 are dark; Tip of hind tarsomere and bands on legs are black.

Material Examined : 2 exs. (F) from Altunga, Puri Distt. 24.i.2006 Coll. : S. Dash. : 1ex (F) from Tangi, Khurda Distt., 27.i.2006 Coll : S. Dash.

Distribution : Distributed all over India including Andaman Islands, Lakshadweep, except Himachal Pradesh, Haryana, Jammu and Kashmir. Punjab, Rajsthan.

Remarks : Breeds profusely in freshwater tanks, ponds, rice fields, drains, irrigation channels, wells etc., with algal and other aquatic vegetation. Reported from Jeypore hills, Orissa.

Subfamily TOXORHYNCHITINAE

Genus ***Toxorhynchites*** Theobald

Sugenus ***Toxorhynchites*** Theobald

23. ***Toxorhynchites (Toxorhynchites) splendens*** (Wiedemann)

1819. *Culex splendens* Wiedemann, *Zool. Mag. keil*, **1** : 2.

Diagnostic characters : A small dark brown species with bright blue scales on head and pleurae, a line of flat scales in front of wing, and lateral pale spots on abdomen. Wing about 1.6 mm.

Distribution : Cosmopolitan.

Remarks : Breeds in tree holes, bamboo, and fallen log. Recorded through out Orissa.

Genus ***Aedes*** Meigen

Subgenus ***Aedimorphus*** Theobald

24. ***Aedes (Aedimorphus) caecus*** (Theobald)

1901. *Culex caecus* Theobald, *Monogr. Cul.*, **1** : 413.

Diagnostic Characters : Anterior surface of mid-femur dark brown, without speckling of pale scales.

Distribution : In northern coastal area of Orissa, Andaman Island and West Bengal.

Remarks : It breeds in Ground pool, earthen pots etc. Reported from Bhiterkanika, Orissa.

Subgenus ***Cancraedes*** Edwards

25. ***Aedes (Cancraedes) cancricomes*** Edwards

1922. *Aedes (Cancraedes) cancricomes* Edwards, *Indian J. med. Res.*, **10** : 272.

Diagnostic Characters : Scutellar scales all flat; abdomen with lateral basal creamy-white triangular patches on II-VII.

Distribution : In India Andhra Pradesh, Orissa and Andaman Island.

Remarks : It breeds in tree holes, crab holes, swamp pool.Reported from Bhitterkanika, Orissa.

Subgenus ***Diceromyia*** Theobald

26. ***Aedes (Diceromyia) iyengari*** Edwards

1923. *Aedes (D) iyengari* Edwards, *Bull. ent. Res.*, **14** : 4.

Diagnostic Characters : Head with white stripe either side of middle line; abdomen with some round white admedian spots on dorsum.

Distribution : Found throughout India.

Remarks : It breeds in tree holes, rock pool etc. Reported from Bhiterkanika coastal area of Orissa.

Subgenus ***Stegomyia*** Theobald

27. ***Aedes (Stegomyia) albopictus*** (Skuse)*

1895. *Culex albopictus* Skuse, *Indian Mus. Notes*, (1894) **3** : 20.

Diagnostic characters : Black species, with snow-white markings and white basal bands on tarsi, palpi, a narrow silvery-white median line running nearly whole length of mesonotum, scutellar scales flat and snow-white on all lobes, wide white tarsal bands on 4th hind tarsal segment, line of flat silvery scales on border of mesonotum in front of wing root, white scales on pleurae in irregular patches, white transverse bands on abdomen at bases of segment.

Material examined : 6 exs. (F), Beleswarpatna, Altunga, Puri Dist., 2.iii.2007, Coll. : S. Dash; Bidharpur and Pratap, Khurda Distt:, 25.ii.2007, Coll. : S. Dash.

Distribution : Found throughout India.

Remarks : It breeds in tree holes, bamboo, leaf axils. Only rarely in artificial receptacles or rock-pools. Recorded widely from all parts of Orissa.

28. ***Aedes (Stegomyia) imitator*** (Leicester)

1908. *Stegomyia imitator* Leicester, *Cul. Malaya*, **1** : 89.

Diagnostic characters : Palpi slender, upturned, without distinct hair-tufts; black species, with conspicuous snow-white ornamentation. mesonotum with several white patches; mid-femur with a median white spot on anterior surface.

Distribution : Found throughout India.

Remarks : It breeds in tree hole, bamboo, forest floor etc. Recorded widely throughout the country.

29. ***Aedes (Stegomyia) novalbopictus*** Barraud

1931. *Aedes (Stegomyia) novalbopictus* Barraud, *Indian. J. med. Res.*, **19** : 224.

Diagnostic characters : Palpi slender, upturned, without distinct hair-tufts; black species, with conspicuous snow-white ornamentation. Abdomen with silvery basal bands on dorsum.

Distribution : Found throughout India.

Remarks : It breeds in tree holes, bamboo, human landing.Reported from almost all states of India.

30. ***Aedes (Stegomyia) vittatus*** (Bigot)*

1861. *Culex vittatus* Bigot, *Annls. Soc. ent. Fr.* (4), **1** : 227.

Diagnostic characters : Black species, with snow-white markings; proboscis with scattered yellow scaling ;mesonotum marked with 4-6 small white spots; femora with preapical white rings, and white basal bands on tarsi, all tibiae with white rings.

Material examined : 10 exx. (F), Alipada, Giqala, Beleswarpatna, Puri Dist., 10.vi.2007, Coll. : S. Dash; Tangi, Khurda Distt., 08.vi.2007, Coll. : S. Dash.

Distribution : Found throughout India.

Remarks : It breeds in tree hole, bamboo, leaf axils. Rock pools etc. Recorded through out the coastal belt of Orissa.

31. ***Aedes (Stegomyia) w-albus*** (Theobald)

1905. *Stegomyia w-albus* (Theobald) *Annl. hist. nat. Mus. natn. hung.*, **3** : 74.

Diagnostic characters : Palpi slender, upturned, without distinct hair-tufts; black species, with conspicuous snow-white ornamentation ; mesonotum with several white patches; mid-tarsi with a median white spot on anterior surface;.

Distribution : Found throughout India.

Remarks : Breeds in tree hole, bamboo, forest floor etc. Reported widely throughout the country.

Genus ***Aedeomyia*** Theobald

Sub genus ***Aedeomyia*** Theobald*

1901. *Aedeomyia* Theobald, Mono.Cul. ii, p. 218.

Diagnostic characters : The material has been identified only till genus level. It is a small mosquito with comparatively short legs, ornamented with a dense covering of white, black and yellow scales, tufts of suberect scales at tip and hind femora.

Material examined : 3 females (adult) Balugaon, Distt. Khurda, 07.vi.07, Coll : S. Dash,

Distribution : Found throughout India.

Remark : Breeds in Pond with vegetation, Canal with algae.

Genus ***Armigeres*** Theobald

Sub Genus ***Armigeres*** Theobald

32. ***Armigeres (Armigeres) subalbatus*** (Coquilett)*

1898. *Armigeres subalbatus* (Coquilett), *Proc. U.S. Nat. Mus.*, xxi, p. 302.

Diagnostic characters : Palpi of female about 1/2 length of proboscis; pale margin of Mesonotum usually yellowish; Abdominal sternites III-VI with wide apical black bands.

Material Examined : 7 exs. (F), Kushbhadra Muhan, Puri Distt., 23.i.2006, Coll. : S. Dash.

Distribution : Through out India including Andaman Islands.

Remarks : Resting on vegetations, coconut shell, bamboo, septic tank. Recorded from all over Orissa.

33. ***Armigeres (Armigeres)*** theobaldi*

1934. *Armigeres theobaldi* Barraud, *Fauna Br. India*, Dipt., **5** : 319 (n.name for *apicalis* Theobald).

Diagnostic characters : Abdominal tergites with median apical yellow markings; lateral white patches, not visible dorsally; venter white scaled.

Material examined : 10 exs. (F) collected from Giqala, Puri Distt., 24.i.2006 Coll. : S. Dash.

Distribution : In India it is restricted only to Orissa.

Remarks : It breeds in bamboo stalk. Recorded all over Orissa.

Genus ***Culex*** Linnaeus

Sub-Genus ***Culex*** Linnaeus

34. ***Culex (Culex) bitaeniorhynchus*** Giles

1901. *Culex bitaeniorhynchus* Giles, *J. Bombay nat. Hist. Soc.*,**13** : 607.

Diagnostic characters : Proboscis and tarsi with pale rings (tarsal rings sometimes faint); no lower mesepimeral bristle; wings speckled with scales, which are usually numerous.

Distribution : Found throughout India.

Remarks : Breeds in Irrigation canal, ponds, ground pool, paddy field, slow-moving stream with algae. Recorded from all over Orissa especially from Bhitarkanika and Jeypore Hills.

35. ***Culex (Culex) cornutus*** Edwards

1922. *Culex cornutus* Edwards, *Indian. J. med. Res.*, **10** : 283.

Diagnostic characters : Proboscis and tarsi with pale rings (tarsal rings sometimes faint); no lower mesepimeral bristle; abdominal tergites with distinct apical pale markings.

Distribution : Found throughout India.

Remarks : The adults rest on the vegetations. Recorded from all over Orissa especially from Jeypore Hills.

36. ***Culex (Culex) fuscocephalus*** Theobald

1906. *Culex fuscocephalus* Theobald, *Monogr. Cul.*, **4** : 420.

Diagnostic characters : Proboscis without pale ring; tarsi entirely dark; lower mesepimeral bristle present. Abdomen unbanded.

Distribution : Found throughout India.

Remarks : Breeds in ground pool and Paddy field. Adults rest in human dwelling, landing on human and cattle. Recorded from all over Orissa especially from Bhitarkanika and Jeypore Hills.

37. ***Culex (Culex) gelidus*** Theobald

1901. *Culex gelidus* Theobald, *Monogr. Cul.*, **2** : 20.

Diagnostic characters : Proboscis and tarsi with pale rings (tarsal rings sometimes faint); no lower mesepimeral bristle; wings without unusually broad scales; tibiae not lined.

Distribution : Found throughout India.

Remarks : Breeds mainly in ground pools, having much weeds, marshy tracks, cement tanks. Adults rest mainly in cow sheds. Recorded from all over Orissa.

38. ***Culex (Culex) mimulus*** Edwards

1915. *Culex mimulus* Edwards, *Bull. ent. Res.*, **5** : 284.

Diagnostic characters : Proboscis and tarsi with pale rings (tarsal rings sometimes faint); no lower mesepimeral bristle; wings with three pale spots on costa (including one at tip); pale spot at middle of wing usually extending over vein1.

Distribution : All over India, mainly concentrated in Uttar Pradesh, Uttarakhand and Assam.

Remarks : Breeds in rainwater pool, ponds, stream, and riverbed pool with algae. Adults rest on vegetation. Recorded from all over Orissa, especially from Jeypore Hills.

39. ***Culex (Culex) quiquefasciatus*** Say*

1823. *Culex quiquefasciatus* Say *J. Acad, nat. Sci. Philad.*, **3** : 10.

Diagnostic characters : Integument of thoracic pleuron without dark stripe; scutal integument yellowish or pale brown.

Material Examined : 50 exs (F) collected from Balugaon, Totapada Khurda Distt., 27.i.2007, Coll. : S. Dash.

Distribution : Cosmopolitan in Distribution.

Remarks : Commonly occurring throughout Orissa mostly found in human dwelling, cattle sheds.

40. ***Culex (Culex) sinensis*** Theobald

1903. *Culex sininsis* Theobald, *Monogr. Cul.*, **3** : 180.

Diagnostic characters : Proboscis and tarsi with pale rings (tarsal rings sometimes faint); no lower mesepimeral bristle; abdominal tergites apically banded; mesonotal scales pale ochreous.

Distribution : Cosmopolitan in Distribution.

Remarks : Inhabiting the pond bank. Common in Coastal Orissa.

41. ***Culex (Culex) sitiens*** Wiedemann

1828. *Culex sitiens* Wiedemann *Aussereurop Zweifl. Insekt*, **1** : 542.

Diagnostic characters : Proboscis and tarsi with pale rings (tarsal rings sometimes faint); no lower mesepimeral bristle; femora speckled with pale scales, especially anterior surface of mid-femur.

Distribution : Cosmopolitan in Distribution.

Remarks : Breeds in swamp pool, Coir retting pit. Adults rest in vegetation, Crab hole. Common in coastal areas of Orissa.

42. ***Culex (Culec) tritaeniorhynchus*** Giles

1901. *Culex tritaeniorhynchus* Giles, *J. Bombay nat. Hist. Soc.*, **13** : 606.

Diagnostic characters : Proboscis and tarsi with pale rings (tarsal rings sometimes faint); no lower mesepimeral bristle; mesonotal scales uniformly dark brown.

Distribution : Cosmopolitan in Distribution.

Remarks : Breeds in irrigation canal, pond, ground pool, paddy fields. Commonly found throughout Orissa.

43. ***Culex (Culex) vishnui*** Theobald*

1901. *Culex vishnui* Theobald, *Monogr. Cul.*, **1** : 355.

Diagnostic characters : Very common small brown mosquito, with a pale band on the proboscis. Mesonotum with light and dark scales mixed in varying proportions, sometimes forming an indefinite pattern, but at least with light scales round front margin.

Material Examined : 11 exs. (Females) collected from Balugaon, Khurda Distt., 28.i.2006 and 19.i.2006 Coll. : S. Dash.

Distribution : Found throughout India.

Remarks : It breeds in ground pools, rice fields, salt marshes etc. Recorded from rice fields, ponds and cement tanks in many localities of Orissa.

44. ***Culex (Culex) whitei*** Barraud

1923. *Culex whitei* Barraud, Indian. *J. med. Res.*, **11** : 508.

Diagnostic characters : Very common small brown mosquito, with a pale band on the proboscis. Mesonotum with light and dark scales mixed in varying proportions, sometimes forming an indefinite pattern, but at least with light scales round front margin.

Distribution : It is mainly found in the north-eastern region of India though it is cosmopolitan in habit.

Remarks : It breeds in ground pools. Recorded From shorelines of Orissa.

45. ***Culex (Culex) whitmorei*** (Giles)

1904. *Taeniorhynchus whitmorei* Giles *J. trop. Med.*, **7** : 367.

Diagnostic characters : Proboscis and tarsi with pale rings (tarsal rings sometimes faint); no lower mesepimeral bristle; wings with broad scales on veins 1.3, and 5; mid an hind tibiae with pale lines.

Distribution : In India, occurs in all main lands.

Remarks : It breeds in ground pool, cement tank. Adults rested in vegetation. Recorded mainly from hilly areas of Orissa.

Genus ***Ficalbia*** Theobald

Subgenus ***Ficalbia***

46. ***Ficalbia (Ficalbia) minima*** (Theobald)

1901. *Uranotaenia minima* Theobald, *Monogr. Cul.*, **2** : 262.

Diagnostic characters : Tarsi with narrow pale rings, most distinct on hind legs; dorsum of abdomen with transverse pale bands.

Distribution : In India recorded from West Bengal, Orissa, Assam, North-eastern states and Kerala.

Remarks : Breeds in irrigation canal, pond with floating vegetation. Resting in pond bank, vegetation. Recorded from the coastal parts of Orissa.

Genus ***Coquilletidia*** Dyar

Subgenus ***Coquilletidia*** Dyar*

1905. *Coquilletidia* Dyar, *Proc. ent. Soc. Wash.*, **7** : 47.

Diagnostic characters : These are yellowish brown mosquitoes of moderate size. The general structure is very much as in *Aedes* but there are no post spiracular bristles. Distinct from *Culex* in absence of pulvilli, wing-scales narrow and lanceolate, pleurae with only a few small patches of scales.

Materials examined : 3 exs. (F), Pratap, Totapada Distt. Khurda, 08.vi.2007, Coll. : S. Dash.

Distribution : Found throughout India.

Remarks : Rests on the floating vegetation in pond. Found in the coastal region of Orissa. Found all over Orissa.

Genus ***Heizmannia*** Ludlow

Subgenus ***Heizmannia*** Edwards

47. ***Heizmannia (Heizmannia) chandi*** Edwards

1922. *Heizmannia (H) chandi* Edwards, *Indian. J. med. Res.*, **10** : 291.

Diagnostic characters : Postnotum having small bunch of hairs; outstanding plume-scales on veins 2.1 and 2.2 linear.

Distribution : In India it occurs only in type locality (Bhiterkanika and Singhbhum, Orissa).

Remark : Breeds in tree hole and bamboo.Endemic species from Orissa.

Genus ***Mansonia*** Blanchard

Subgenus ***Mansonioides*** Theobald

48. ***Mansonia (Manasonioides) annulifera*** (Theobald)*

1901. *Panoplites annulifera* Theobald, *Monogr. Cul.*, **2** : 183.

Diagnostic characters : Mesonotum marked with distinct round spots of white scales, Yellowish brown; mesonotum marked with 4 (or more) distinct round white spots; rather broad white scales on mid-lobe of scutellum; Abdomen : lateral chitinous hooks on tergite VIII widely and evenly spaced, much as in *indiana*, but less curved.

Material examined : 12 exs. (F) collected from Alipada, Giqala, Sipakuda, Beleswarpatna, Puri Dist. : 08.vi.07 Coll. : S. Dash.

Distribution : Found throughout India.

Remarks : Breeds in irrigation canal Pond with floating vegetation, Light trap, and human landing. Found all over Orissa.

49. ***Mansonia (Manasonioides) dives*** (Scheiner)*

1881. *Culex longipalpis* van der Wulp, *Bijd. Fauna Mid Sumatra, Dipt.*, **4** : 9.

Diagnostic characters : Mesonotum not having so much distinct spots, Brownish-black; mesonotum marked with 2 (or 3) round white spots; scales on mid-lobe of scutellum narrow. Abdomen : Chitinous hooks on tergite VIII much as in *M. uniformis*, bur there is a more pronounced gap between the lateral and median series.

Material examined : 12 exs. (F) collected from Alipada, Sipakuda, Puri Dist.; 09.vi.2007, Coll. : S. Dash.

Distribution : Distributed throughout North-East India.

Remarks : Found in human settlements and houses. Reported from coastal Orissa.

50. ***Mansonia (Manasonioides) indiana*** Edwards*

1930. *Mansonia (Man.) indiana* Edwards, *Bull. ent. Res.*, **21** : 541.

Diagnostic characters : Mesonotum not having so much distinct spots; Mesonotum dark brown, not marked with greenish stripes; some white scales, tending to form indistinct spots or patches, in some specimens; Abdomen : Chitinous hooks on tergite VIII of female widely spaced and curved, without a definite gap between these and the median teeth.

Material examined : 10 exs (F) collected from Sipakuda, Puri Dist.,11.vi.2007, Coll. : S. Dash; Totapada, Khurda Dist., 08.vi.2007, Coll. : S. Dash.

Distribution : Found throughout India.

Remarks : Habitated mostly in human dwelling areas. Reported from coastal Orissa.

51. ***Mansonia (Manasonioides) uniformis*** (Theobald)*

1901. *Panoplites uniformis* Theobald, *Monogr. Cul.*, **2** : 180.

Diagnostic characters : Mesonotum not having so much distinct spots; Mesonotum marked with a pair of sublateral greenish stripes on a brown ground; markings on tarsi as in annulifera but with yellowish tinge not snow-white; Abdomen : Lateral chitinous hooks on tergite VIII curved and slightly separated from median series.

Material examined : 7 exs. (F) collected from Alipada, Giqala, Sipakuda, Beleswarpatna, Altunga Puri Dist. 11.vi.2007, Coll. : S. Dash; Totapada, Tangi, Khurda Dist., 08.vi.2007, Coll. : S. Dash.

Distribution : Found throughout India.

Remarks : Breeds in irrigation canal, pond with vegetation, Cattle shed, human dwelling. Recorded all over Orissa.

Genus ***Ochlerotatus*** Lynch Arribalzaga

Subgenus ***Finalaya*** Theobald

52. ***Ochlerotatus (Finalaya) niveus*** (Ludlow)

1903. *Stegomyia niveus* Ludlow, *Monogr. Cul.*, **3** : 139.

Diagnostic characters : Segment VIII narrow and completely retractile; cerci long and narrow and projecting from ring of segment VII; one or two lower mesepimeral bristles usually present.

Distribution : In Eastern India, Andaman Island.

Remarks : Breeds in tree holes and found mostly in human dwelling. Recorded from Coastal Orissa.

Sub genus ***Rhinoskusea*** Edwards

53. ***Ochlerotatus (Rhinoskusea) longirostris*** (Leicester)

1908. *Ficalbia longirostris* Leicester, *Cul. Malaya*, : 228.

Diagnostic characters : Segment VIII narrow and completely retractile; cerci long and narrow and projecting from ring of segment VII; one or two lower mesepimeral bristles usually present.

Distribution : Andaman Island.

Remarks : Resting in Crab holes. Recorded from Coastal Orissa.

54. ***Ochlerotatus(Rhinoskusea) portonovoensis*** Tewari and Hiriyan

1996. *Ochlerotatus (Rhinoskusea) portonovoensis* Tewari and Hiriyan, *J. Am. Mosq. Control Assoc.*, **12** : 720.

Diagnostic characters : Segment VIII narrow and completely retractile; cerci long and narrow and projecting from ring of segment VII; one or two lower mesepimeral bristles usually present.

Distribution : North Eastern India.

Remarks : Crab holes, swamp pool, tree holes. Recorded from Coastal Orissa.

Genus ***Uranotaenia*** Lynch Arribalzaga

Subgenus ***Pseudoficalbia*** Theobald

55. ***Uranotaenia (Pseudoficalbia) atra*** Theobald

1905. *Uranotaenia atra* Theobald, *Ann. Mus. Nat. Hung.*, iii, p. 114.

Diagnostic characters : Hind tarsi entirely dark; lateral apical markings on abdominal tergites, no median pale markings on dorsum.

Distribution : In mainland of India as well as in Andaman Island.

Remarks : Breeds in ground pool, crab holes and root base. Recorded from Coastal Orissa.

DISCUSSION

The present study deals with 55 species of mosquitoes under 12 genera reported from coastal Orissa. Out of which over 2000 specimens 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 over all 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 *Armegeres* 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, Armegeres subalbatus, Manasonia annulifera, Manasonia indiana, Manasonia longipalpis, Mansonia uniformis, Aedes vittatus, Aedes albopictus, Coquillettidia*. The district wise species composition of *Mansonioides* shows that it (which species) is dominant in coastal areas like Puri district (Hazra and Dash, 1998). Although *M. uniformis, M. annulifera and M. indiana* have been found through out the districts but *M. longipalpis* is exclusively found in coastal belts. Diversity of mosquito fauna of Puri and Khurda Districts of Orissa are shown in Table-1 and 2 respectively.

To measure the species diversity of the mosquito species of the two districts, Shanon diversity index has been used. The shanon diversity index (H) is the index that is commonly used to characterize species diversity in a community (Stiling, 2002).

Hs= Pi ln Pi.

Pi- Total number of species

ln- Log in

The value of Shanons index has been depicted in the table-3. The value of Shanon diversity index for real communities is often found to fall between 1.5 and 3.5 (Stiling, 2002). From the present investigation it is clear that the mosquito species diversity (H) in the Khurda District was significantly higher than the diversity in the mosquito community of Puri District (Fig. 10).

The TMHD (Per Ten men hour Density) for both the districts, mosquito species has been calculated and is summarized in Table-3. The present findings show highest value for *Anopheles subpictus* (46.87) followed by the *Armigeres (A) subalbatus* (36.25) (Fig.11).

The well recognized malaria vectors *Anopheles culcifacies, An. annularis* are represented by less than 1%. The *Anopheles culcifacies* and *An. annularis* represent 0.15% and 0.3% respectively in the total sample. The species of *Man. indiana* and *Man. longipalpis* have not been reported earlier but are now recorded from the areas of Chilika Lake.

Filarial vector diversity of the coastal districts is very low than that of the diversity of culicine mosquitoes (Hazra and Dash, 1998) but the recent study shows the increase in diversity of filarial vector in the same districts. The low rate of diversity has been shown by Shanons index in Puri District. Seven *Anopheles* species e.g. *An. barbirostris, An. fluviatilis, An. jamesii,*

Table-1 : Diversity of mosquito fauna of Puri District (2006-07).

Sl. No.	Species	No.	Percentage
1.	*An aconitus*	3	0.28%
	An annularis	4	0.38%
	An culcifafacies	0	0
	An maculates	1	0.09%
	An nigerimus	2	0.18%
	An splendidus	0	0
	An subpictus	197	18.86%
	An theobaldi	3	0.28%
	An vagus	92	8.81%
	An varuna	1	0.09%
2.	*Cx. quinquefasciatus*	184	17.62%
	Cx. vishnui gp.	124	11.87%
3.	*Am. subalbatus*	176	16.85%
	Am. Theobaldi	63	6.03%
4.	*Mn. annulifera*	46	4.4%
	Mn. indiana	5	0.47%
	Mn. longipalpis	3	0.28%
	Mn. Uniformis	81	7.75%
5.	*Ad. Aedeimyia*	0	0
	Ad. albopictus	3	0.28%
	Ad. Vitattus	56	5.36%
6.	*Coquillettidia*	0	0
	Total	1044	

An. jeyporiensis, An. karwari, An. philippinensis, An. sundaicus found in the previous studies (Covell and Singh, 1942) are not found during the present study. The disappearance of the species *An. sundaicus* also detected during the Chilika fauna study by Dash *et al.* (2000).

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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Table-2 : Diversity of mosquito fauna of Khurda District (2006-07).

Sl. No.	Species	No.	Percentage
1.	*An. aconitus*	3	0.31%
	An. annularis	2	0.21%
	An. culcifafacies	3	0.31%
	An. maculates	2	0.21%
	An. nigerimus	4	0.41%
	An. splendidus	3	0.31%
	An. subpictus	253	26.63%
	An. theobaldi	3	0.31%
	An. vagus	108	11.36%
	An. varuna	2	0.21%
2.	*Cx. quinquefasciatus*	166	17.47%
	Cx. vishnui gp.	76	8.00%
3.	*Am. subalbatus*	172	18.10%
	Am. Theobaldi	69	7.26%
4.	*Mn. annulifera*	2	0.21%
	Mn. indiana	10	1.05%
	Mn. longipalpis	0	0
	Mn. Uniformis	19	2.00%
5.	*Ad. aedeimyia*	3	0.31%
	Ad. albopictus	3	0.31%
	Ad. Vitattus	44	4.63%
6.	*Coquillettidia*	3	0.31%
	Total	950	

Table-3 : 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.	*Anopheles*	***An. aconitus***	3	0.62
		An. annularis	3	0.62
		An. culcifafacies	3	0.31
		An. maculates	3	0.31
		An. nigerimus	6	0.62
		An. splendidus	3	0.31
		An. subpictus	450	46.87
		An. theobaldi	6	0.62
		An. vagus	200	20.83
		An. Varuna	3	0.31
2.	*Culex*	***Cx. quinquefasciatus***	350	36.45
		Cx. vishnui gp.	200	20.83
3.	*Armegeres*	***Am. subalbatus***	348	36.25
		Am. Theobaldi	132	13.75
4.	*Manasonia*	***Mn. uniformis***	100	10.41
		Mn. annulifera	48	1.56
		Mn. Indiana	15	5
		Mn. longipalpis	3	0.31
5.	*Aedomyia*		3	0.31
6.	*Aedes*	***Ad. albopictus***	6	0.31
		Ad. Vitattus	100	10.41
7.	*Coquilettidia*		3	0.31

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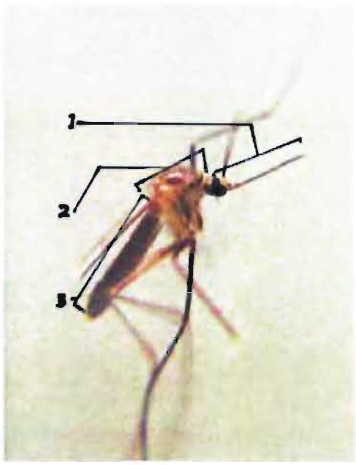

Fig. 2. An Adult Female Mosquito (1-Head, 2-Thorax, 3-Abdomen).

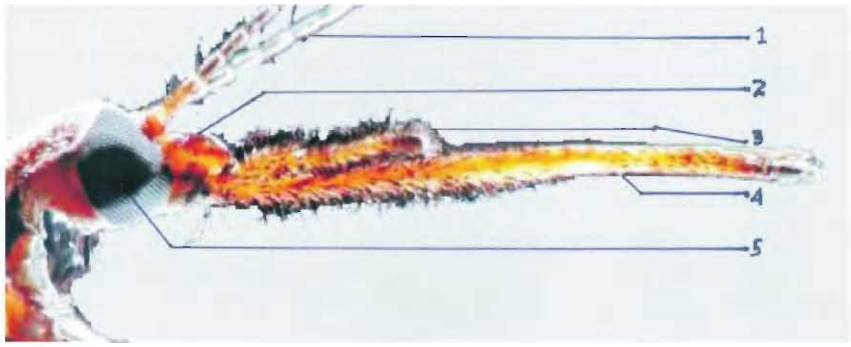

Fig. 3. Head of Adult Female Mosquito (1-Antennae, 2-Clyppeus, 3-Palps, 4-Proboscis, 5-Eye).

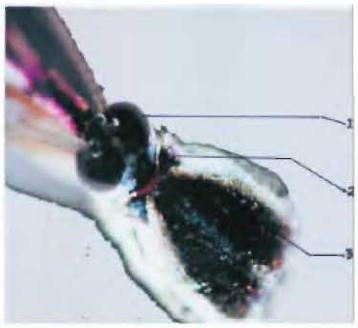

Fig. 4. Thorax of Adult Female Mosquito (1-Head, 2-Antepronotum, 3-Scutum).

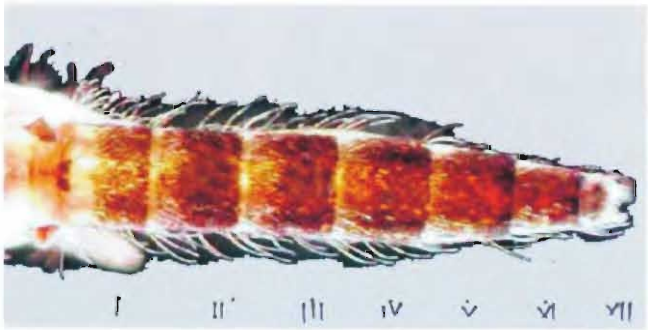

Fig. 5. Abdomen of Adult Female Mosquito.

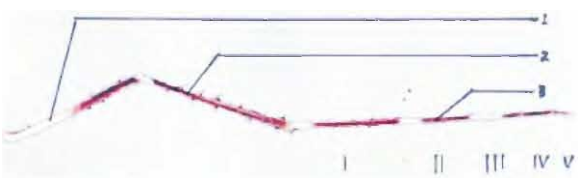

Fig. 6. Hind Leg of Adult Female Mosquito (1-Femur, 2-Tibia, 3-Tarsa).

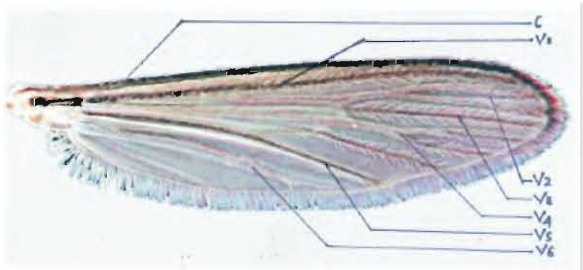

Fig. 7. Wing of Adult Female Mosquito (C-Costa, V-Vein).

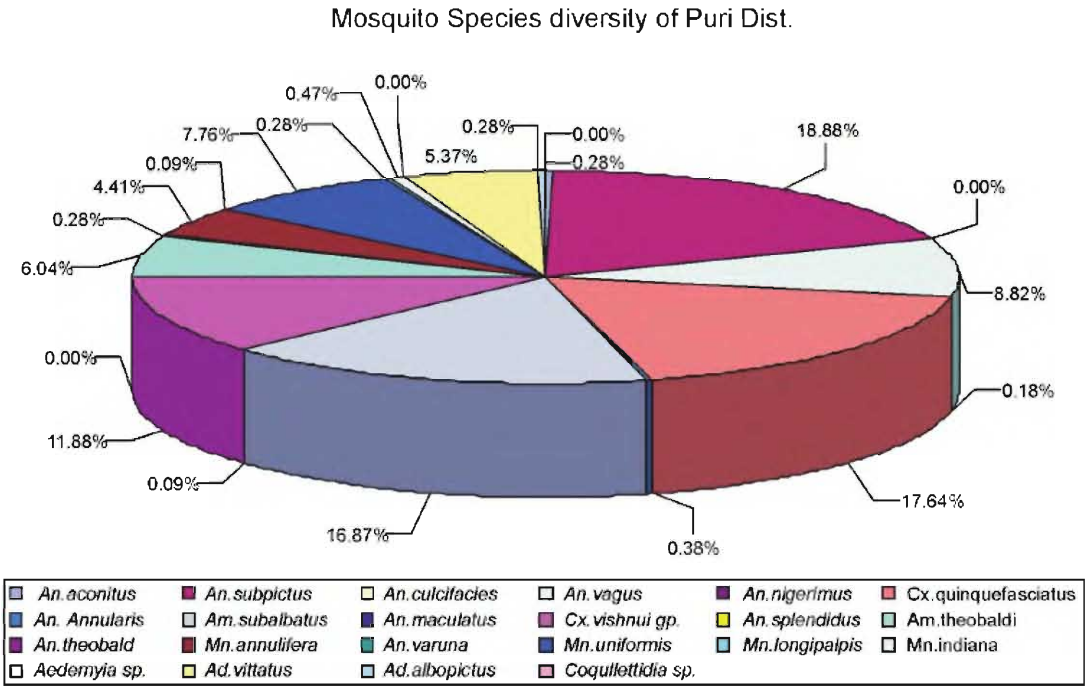

Fig. 8. Mosquito species Diversity of Puri District (2006-07).

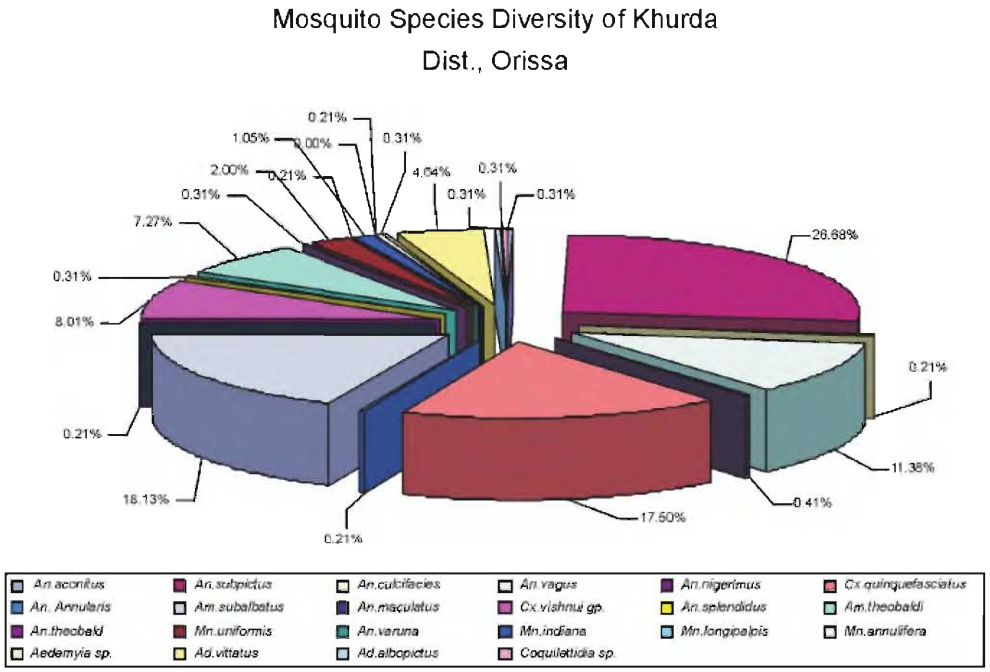

Fig. 9. Mosquito Species Diversity of Khurda District (2006-07).

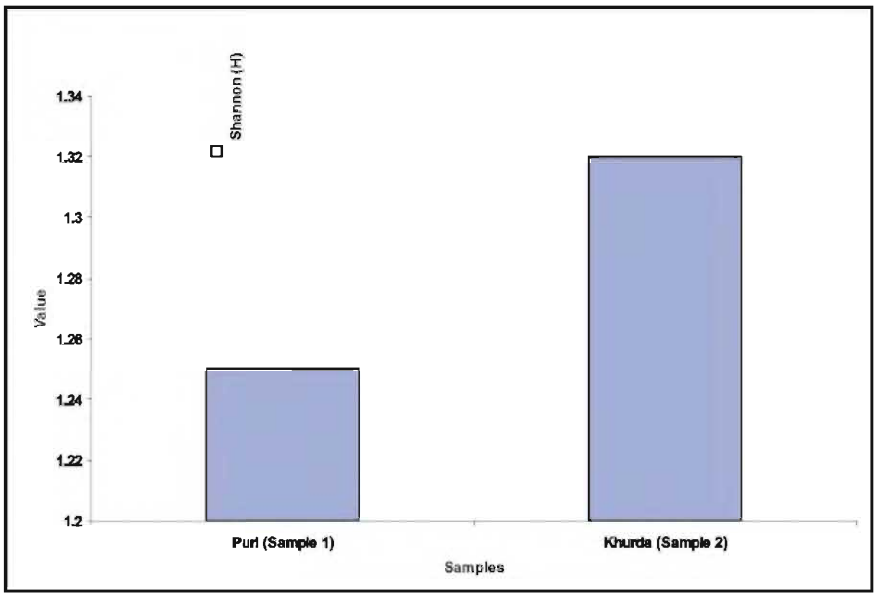

Fig. 10. Shannon mosquito species diversity in the Khurda and Puri districts of Orissa (2006-07).

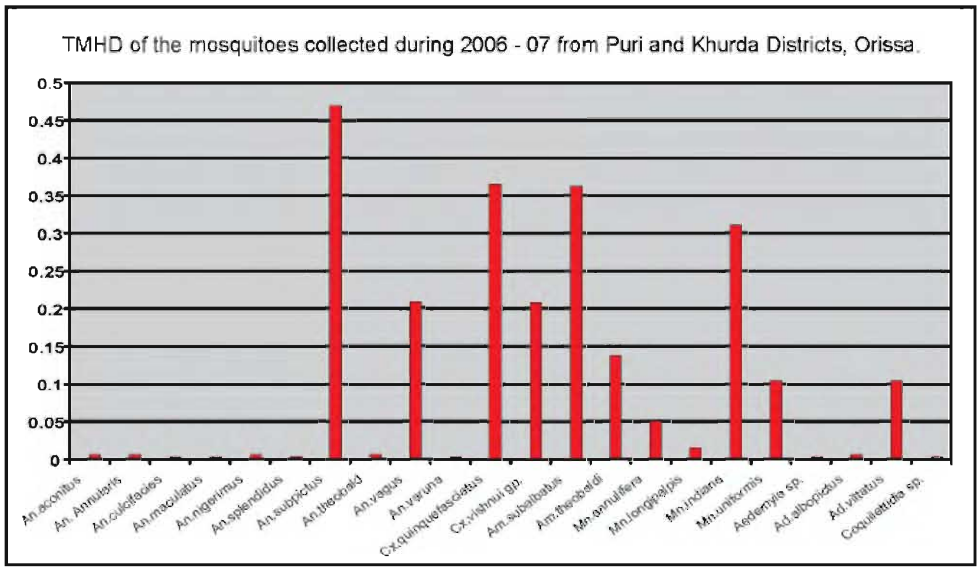

Fig. 11. Per Ten Men Hour Density of the mosquitoes collected from the surroundings of Chilika Lake (2006-07).