Indian Journal of Entomology, 81(4): 000-000 (2019) DoI No.:

MOSQUITOES FROM SENAPATI DISTRICT, MANIPUR

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ABSTRACT

The diversity studies of mosquitoes from Senapati district of Manipur is very scanty. Hence, mosquito larvae and pupae were collected from seven study sites during the two field visits in March 2019. The sites included sewage drains, river (Barak river) and common water canals and reared in the laboratory till adults emerged and identification of the larvae, pupae and adults were done using appropriate keys. These observations reveal the presence of *Culex (Culex) quiquefasciatus* Say, *Culex (Culex) mimeticus* Noe and *Culiseta* (*Culiseta*) *niveitaeniata* (Theobald, 1907). The characteristic of *Culex mimeticus* is the banded wings while the *Culiseta*is characterized by presence of ventral subcostal setae (remigium) and that of the *Culex (Culex) quiquefasciatus* is diagnosed by the male genital features.

Keywords: Karong, Senapati, Manipur, mosquitoes, field surveys, sewage drains, river, water canals, new records, *Culex*, *Culiseta*,

The faunistic study on the mosquito of Senapati District of Manipur is scanty. The area is located in fairly higher altitude obviously cooler all year round. Previous surveys in the north east India revealed nine species of *Anopheles* (Covell, 1927; 1931; Barraud, 1933;Puri, 1936), and this became 16 (Mortimer, 1946), and in 1983, it reached 23 (Malhotra et al., 1983). Rajput and Singh (1990) reported 99 species of mosquitoes from Manipur. More recent reports indicate the presence of 55 species of mosquitoes under ten genera. Of the 17 *Anopheles* spp., three species are new records from Manipur, and four species of culicines are also new records. There are 111 new records of mosquitoes from Manipur (Dutta et al., 2005).

Senapati district is located between 93^{0}29' to 94^{0}15', E, 24^{0}37' to 25^{0}37' N, bound on the south by Imphal East and West Districts, on the East by Ukhrul district, on the west by Tamenglong district and on the north by Phek district of Nagaland. As per the Census 2011, the total population is 1,56,513. The total geographical area is 3271 sq. km with a population density of 87/ km^2. This district was earlier known as Manipur North district which came into existence with effect from 14th November, 1969 with it'sheadquarter at Karong. The geomorphology is medium to high altitudes (1061 to 1788 m) (Central ground water board, 2013). The present study focuses on the different habitats of Senapati District for studying the mosquito diversity.

MATERIALS AND METHODS

Larval stages of mosquito were collected from eight breeding ground of Karong bridge, Barak river and Senapati Bazar during two collection surveys done during March 2019. The sites included sewage drains, river (Barak river) and common water canals. the exact positions with GPS readings were: 1-25^{0}30`74.35, 94$^0$04`47.64, 2-25^{0}30`73.35, 94$^0$04`48.04, 3-25^{0}30`71.76, 94$^0$04`42.71, 5-25^{0}30`57.95, 94$^0$04`21.07, 6-25^{0}30`41.72, 94$^0$04`18.48, 7-25^{0}30`42.60, 94$^0$04`03.79, 8-25^{0}27`52.24, 94$^0$02`61.09, 9-25^{0}27`36.69, 94$^0$02`49.74 (Senapati bazar near SBI Bank). The immature larval and pupal stages were reared with locally available fish foods in beakers till the emergence of adults in the laboratory and identification of the species done from larvae, pupae and adults of both the male and female individuals. The larvae and pupa were killed in ethyl alcohol while the adults were killed by incubating in -20^{0}C for 10 min. The larvae and pupae were identified without permanent preparations while the adults were identified after making permanent slides. The Optscope compound microscope was used to studyalong with the keys and photographs taken with a 5-megapixel camera attached to the microscope. The taxonomic keys followed were of Harbach (1985), Walter and Harbach (1996), Tyagi et al., (2015) and Dobrotworsky (1971).

RESULTS AND DISCUSSION

The water sample of the Barak river was analyzed for parameters viz., pH, EC (Electrical Conductivity), TDS (Total Dissolved Solids), Free CO_2, DO (Dissolved Oxygen), alkalinity, hardness, presence of calcium, magnesium, and chloride. Three species viz., *Culex (Culex) quiquefasciatus* Say, *Culex (Culex) mimeticus* Noeand *Culiseta* (*Culiseta*) *niveitaeniata* (Theobald, 1907) are observed new records. *Culex mimeticus* is distinct with banded wings while the *Culiseta* in the presence of ventral subcostal setae (remigium) and that of the *Culex (Culex) quiquefasciatus* with its male genitalia. Polluted as compared to the Barak river, Senapati Bazar (7^{th}-8^{th} of the location sites) was observed harboring *C. quinquefasciatus*.

There is report of occurrence of *Culex* spp. in more polluted water (Noori et al., 2015), which also observed that combination of NO_3 and PO_4, or NH_4 and PO_4 nutrients in the container favours mosquito development and shortens pupation time. The fairly clean drinkable water of the Barak river nurtured species like *Culiseta* (*Culiseta*) *niveitaeniata* and *Culex (Culex) mimeticus* in the pit duck out after sand pulled up-spots (collection spots-1-3, 4-6). Each of the spots were at least 30 m apart indicating their spatial distribution.

The morphological characters of species and their ecology are discussed below:

Culex quiniquefasciatus (Fig. 1A-F): *Culex* with ventral brush with all setae borne on grid, siphon with 1-3 lateral setae, Other setae in single or double row, if no lateral seta, then all setae are in 2 posterolateral rows, seta 13-T of thorax distinctly shorter than seta 12-T, Seta 1-III, IV of abdomen usually single (dorsally), seta 1-X usually single, seta 1-C unpigmented, sides smooth, mentum that is characteristics of the *Culex* and male genitalia with pointed dorsal arm and nearly parallel; ventral arm were leaf shape (broad and long) (Dehghan et al., 2016).

Culex quinquefasciatus is a member of globally distributed *Cx. Pipiens* species complex. Additionally, the *pipiens* species complex has many related species, ecotypes and hybrids which are situated in geographical introgression zones on multiple continents (Farajollahi et al., 2011). *Culex quinquefasciatus* was first described in 1823 by Thomas Say from a specimen collected along the Mississippi River in the southern United States. At that time, a number of similar species around the world like *Cx.fatigans* (Wiedemann, 1828) from the Old-World tropics were used synonymous to *Cx. quinquefasciatus* (Stone, 1956). Females of *Cx. pipiens* and *Cx. Quinquefasciatus* are morphologically in distinguishable and hybrid zones for the two species are well documented. Owing to this, *Cx. quinquefasciatus* is designated as a subspecies of *Cx. Pipiens* with the name *Cx. pipiensquinquefasciatus* (Barr, 1957). *Culex pipiens* and *Cx. Quinquefasciatus* are distinct and sympatric

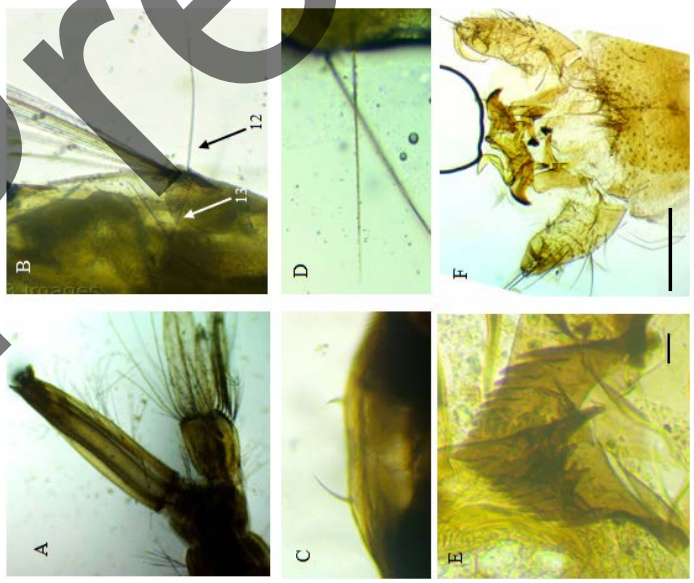

Fig. 1. *Cx. quiniquefasciatus:* A. Siphon and respiratory tubes of larva, B. Seta 12^{th} and 13^{th} of the thorax region, C. Seta 1-C, D. Seta 1 III, IV of abdomen usually single, E. Mentum with teeth (bar represents 10 µm). and F. Male genitalia. Bar represents 1 ml.

(Cornel, 2003), with clear genetic difference (Smith and Fonseca, 2004) which led to the elevation of *Cx. Quinquefasciatus* to a species status.

Culex (*Culex*) *mimeticus*Noe (Fig. 2A-I): Siphon longer, more or less cylindrical, siphon without spines on distal 0.5 of ventral surface, comb scales with strong median apical spine, seta 1-S strong, 2-3 times as long as diameter of the siphon at point of attachment, length at least 5 times width at base, distal pecten spines with 2-5 denticles of different sizes arising proximally, seta 7-I single, comb scales spine like with pointed apex, with or without fringe at sides, seta 4-P single, comb with more than 25 scales, antenna dark brown at base and in distal part, spiculate except ventrally and apically; 1-A inserted at apical 0.39-0. 46 of shaft, with 22-24 strongly barbed branches, extending beyond apex of shaft; gonostylar typical of the *Culex*, wing with pale spots on at least 2 areas of costa and 1 area of other veins.The subgenus *Culex* of *Culex* L. represents a highly successful group of mosquitoes (Walter and Harbach, 1996) and 26 species had been recorded from India (Tyagi et al., 2015). According to Tyagi et al., (2015) up to 2014, the *Culicini* in India were of two genera with 85 species as against four genera and 796 species in the world.

Culiseta (*Culiseta*) *niveitaeniata* (Theobald, 1907) (Fig. 3A-M): Larva moderate with tapering siphon and incomplete sclerotized saddle, head large antenna short, about l/2 length of head, with sparse, minute spiculation; hair 1-A inserted about at middle of shaft, with 6 slightly plumose branches, comb of about 40 scales, hair 1-S inserted at base, plumose; pecten with 12 spines followed by an even row of 12- 15 hairs extending to near apex of siphon anal segment completely ringed by saddle; ventral brush consisting of 15 tufts l-3 of which precratal, 1 may be inserted in the saddle; anal papillae slender, tapering, more than twice as long as saddle (Fig. 4 E), pupa moderate. Respiratory trumpets about 2 l/2 times as long as pinna. Hair 8-C single; 9-C single or 2-branched, Hairs 1, 5-IV-VII single; 5-IV-VI very long, on VII shorter and weaker; l-IV-V as long as 5, shorter and weaker on VI, VII; 6-I-VI single. Paddle oval, with posterior margin spiculated; hair 1-P 2 branches; proboscis somewhat curved downward at the distal end; the dorsal view of head had pattern with yellow setae, ventral subcostal setae (remigium); wing membrane with darker patches in regions of cross-veins and base of fork cells; veins with narrow dark scales; cross-veins r-m and m-cu closely approximated.

Dobrotworsky (1971) reported occurrence of the *Culiseta*larvae from mountainous (mountainous areas-1600- 3658 masl), cool, high altitude regions as the habitat in the present study. Karong is mountainous with the altitude of 1766 m (Central ground water board, 2013) and generally cold throughout the year (17^{0}C). Distribution of specimens according to Dobrotworsky (1971): India, Punjab, Kasauli 3 males, 4 females; AImma, Kausani 1 female, 4 rearings. Taiwan 6 males, 5 females, 6 rearings. Records from literature: India, Punjab, Dehra Dun, Murree, Theog on Hindustan-Tibet

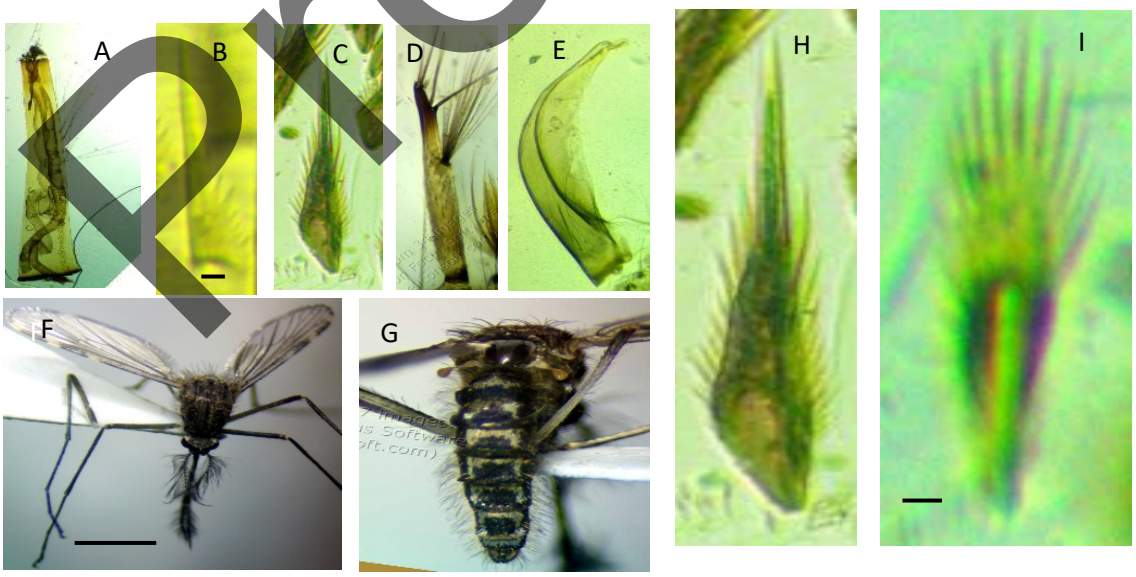

Fig. 2. Cx. mimeticus A. Siphon of a larva, B. Pecten scale of the larva, C. Comb scale of the larva, D. Antenna of larva, E. Gonostyle of male (bar represents 10 µm), F. Frontal view of the male, G. Dorsal view of the abdominal region of the male (bar represents 1 ml).

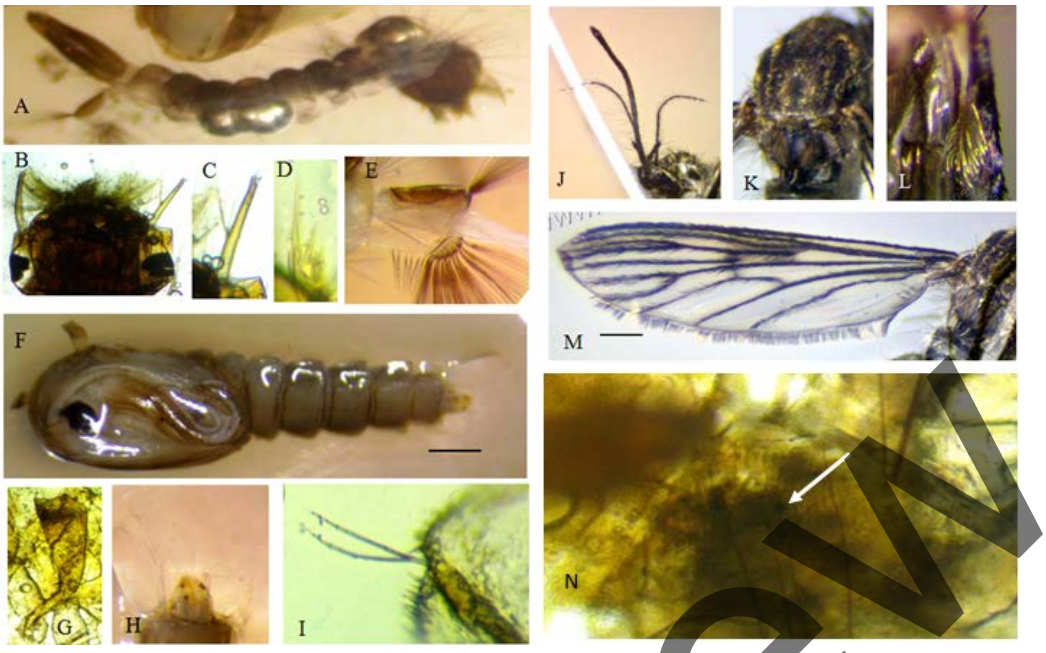

Fig. 3. Culiseta (Culiseta) niveitaeniata. A. Larva, B. Head region, C. Antenna, D. Pecten spine, E. Saddle with ventral setae, F. Pupa, G. Trumpet of the pupa, H. Apical setae of the paddle, I. Hair 1-P 2 branches, J. Mouth part of the female adult, K. Dorsal view of the head of female, L. Setae on the ventral costa region, M. Dorsal view of wings (bar represents 1 mm), N. Comb spines of the larvae (bar represents 10µm).

road 2.439 m; Uttar Pradesh, Naini Tal, Muktesar. Tibet, Yatung, near Sikkim border 3.658 m. (Barraud, 1934). China, North East, Central and South (Maslov 1967).

Tyagi et al., (2015) reported three species from India i.e., *Culiseta* (*Allotheobaldia*) *longiareolata* (Macquart, 1838) *C.*(*C.*) *alaskaensisindica* (Edwards, 1920) and *C.* (*C.*) *niveitaeniata* (Theobald, 1907). Till now the species had not been reported from Manipur. According Dobrotworsky (1965) *Culiseta* evolved in the tropics and subsequently spread to the northern and southern temperate regions, being progressively displaced by later evolving elements. There is no doubt that mosquitoes from tropical groups have dispersed to southern Australia and Tasmania and become adapted to cold climatic conditions. The number of the comb scale reported to be single but in the preset study shows the triangular arrangement of the scales (Fig. 3N).

ACKNOWLEDGEMENTS

The authors thank the Principal and HOD, P. G. Department of Zoology, D M College of Science, Imphal for providing laboratory facilities. The authors acknowledge Kim Gangte for bringing mosquito larvae to the laboratory. The authors thank the Ministry of Science and Technology, Department of Biotechnology, GOI for the financial assistance under No. BT/IN/Indo-US/ Foldscope/39/2015 dt. 20/03/2018.

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(Manuscript Received: September, 2019; Revised: November, 2019;
Accepted: November, 2019; Online Published: November, 2019)