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Div. Insects
U. S. Nat. Mus.

NOTES ON SOME INDIAN MOSQUITOES OF THE SUBGENUS *STEGOMYIA*, WITH DESCRIPTIONS OF NEW SPECIES.

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[Received for publication, March 6, 1931.]

It has recently been found that, up to now, several Indian species of *Aedes* (*Stegomyia*) have been confused with *albopictus* (Skuse). One of these appears to be *Aedes* (*S.*) *pseudalbopictus* described by Borel from Cochin China, two others appear to be new and are described below. These three species resemble *Aedes* (*S.*) *albopictus* very closely indeed, differing chiefly in the structure of the male genitalia. At present it has not been possible to correlate the females with the males of these different species, but later it may be possible to do so by a close study of the larvæ, and by breeding series of adults from single females.

The identity of *Aedes* (*S.*) *albopictus* is of some medical importance as it has been shown experimentally to be capable of transmitting both dengue fever and yellow fever (Simmons and others, 1930) (Dinger and others, 1929).

Some notes are given on this species below, and on *Aedes* (*S.*) *flavopictus* Yam. The latter, which also resembles *Aedes* (*S.*) *albopictus* very closely, was originally described from Japan, but has been recorded from India by me previously.

Another species of the same subgenus which resembles *Aedes* (*S.*) *annandalei* Theo. and *Aedes* (*S.*) *mediopunctatus* Theo. very closely in markings, but differing remarkably in the structure of the male hypopygium, is described also under the name *Aedes* (*S.*) *puri*, after Dr. I. M. Puri, who collected the specimens in North Bengal.

Camera lucida drawings, all to the same scale, are reproduced on the accompanying plate (Plate XI), illustrating the structure of the male genitalia of the six species dealt with in this paper. It should be noted that the drawings have been made from stained preparations, and from separate parts

mounted flat after dissection of the hypopygium. The different parts cannot be seen to advantage, nor the corresponding structures in different species properly compared, unless the preparations are mounted in this way. I am much indebted to Mohamed Yusaf, Laboratory Assistant, for the trouble he has taken in making several hundreds of careful preparations for me.

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

Systematic references:—

Culex albopictus Skuse, 1894, *Ind. Mus. Notes*, **3**, No. 5, p. 20. (♀ described from Bengal).

Stegomyia scutellaris (Walk.), Theobald, 1901, *Mon. Cul.*, **1**, pp. 298-300. (♂ and ♀, fig. 91, ♂ unguis. Plate XIV, adult ♀).

Stegomyia scutellaris (Walk.), Leicester, 1908. *Cul. Malaya*, pp. 86-87. (♂ and ♀.)

Stegomyia albopicta (Skuse), Edwards, 1917. *Bull. Ent. Res.*, **7**, pp. 209-210. (Fig. ♂ hypop.).

Stegomyia albopicta (Skuse), Barraud, 1923, *Ind. Jour. Med. Res.*, **10**, pp. 779-780. (♂ and ♀, ♂ hypop.: Plate XLIII, fig. 3, XLV, fig. 15, XLVII, fig. 23, LIV, figs. 1-6.)

Aedes (Stegomyia) albopictus (Skuse), Brug, 1924, *Vereen. tot Bev. d. Geneesk. Wetens. in Ned. Ind.*, pp. 41-43, (♂ and ♀, Figs. markings thorax and abdomen).

Stegomyia albopicta (Skuse), Borel, 1928. *Arch. des Inst. Pasteur d'Indochine*, No. 7, pp. 83-85, (♂ and ♀, larva Plate III, figs. ♂ hypop. larva).

The name *scutellaris* Walker (*Culex*) was wrongly applied to this species by Theobald and Leicester. This name is now treated as a synonym of *Aedes (S.) variegatus* Doleschall (*Culex*).

♂ : in the specimens I have examined the palpi are longer than the proboscis by about half the length of the apical segment. This character may be variable as in Leicester's description it is mentioned that the palpi are longer than the proboscis by the length of the terminal segment.

♂ hypopygium: 9th tergite (Fig. 1) strongly produced in the middle into a blunt point (differing from all other Indian species in the group in this respect), a pair of well developed sublateral hairy lobes; coxite (side-piece) about 3 times the length of the greatest width (when separated and mounted flat); basal plaque on inner surface of coxite (Fig. 11) with stem of moderate length and width, apical part flattened (when mounted separately) carrying some blade-like processes on the ventral (sternal) side, several of which are long and curved, there are also a number of hairs with bent tips; style (clasper) (Fig. 13) comparatively rather short, of fairly even width throughout, and with the appendage arising very near the rounded tip.

Distribution (checked by examination of male genitalia):—

LOWER BURMA. Tenasserim, 10–12. 1. 1922 (*Sharma*).

UPPER BURMA. Lashio, 23–24. viii. 1913 (*T. B. Fletcher*).

ANDAMAN ISLANDS. vii. 1926 (*G. Covell*).

ASSAM. Gauhati, ix. 1928 (*Sobha Ram* coll.); Shillong, vi. and viii. 1922 (*Barraud*); Haflong and Dibrugarh, viii. 1922 (*Barraud*).

BENGAL (NORTH). Tirrihana and Marianbarrie Tea Estates, and Sukna, viii. 1928 (*Puri*); Tindharia (Darjeeling Rwy.), viii. 1928 (*Sobha Ram* coll.).

BENGAL (EAST). Chittagong, viii. 1922 (*Barraud*).

ORISSA. Uluburu, Keonjhar State, 26. ix. 1928 (*Senior White*).

BIHAR. Pusa, 178 specimens examined from the collection of the Agricultural Research Institute. Occurs throughout the year but more abundantly during the rainy season.

PUNJAB. Karnal, viii. 1930 (*Barraud*).

WESTERN HIMALAYAS. Kasauli, vi. 1923 and vii. 1924 (*Barraud*).

DELHI PROVINCE. Delhi (specimens in the M. S. I. collection).

KONKAN. Bombay Harbour, Elephanta Island, 6. vii. 1921 (*Barraud*). Trombay, vii. 1921 (*Barraud*), Hog Island, 9. vii. 1921 (*Barraud*).

BOMBAY DECCAN. Belgaum, 1. viii. 1921 (*Barraud*), Nagargali, 13. viii. 1921 (*Barraud*).

MALABAR. Coorg, vi. 1927 (*J. D. Baily*), Malabar Coast, 1915 (*Khazan Chand*).

MADRAS. Nilgiri Hills, ix. 1915 (*Khazan Chand*), Anamali Hills, 4–8. viii. 1928 (*Shaffi*).

CEYLON. Suduganga Estate, Matale, 5. v. 1919 (*Senior White*).

***Aedes (Stegomyia) pseudalbopictus* Borel.**

Stegomyia pseudalbopictus Borel, 1928. *Arch. des Inst. Pasteur d'Indochine*, No. 7, pp. 85–87. (♂ and ♀ larva. Plate IV, figs. ♂ hypop. larva).

There do not appear to be any constant differences in markings by which the males of this species may be distinguished from those of *Aedes (S.) albo-pictus*, but there are very marked differences in the structure of the genitalia. The palpi are longer than the proboscis by rather more than half the length of the apical segment.

♂ hypopygium: 9th tergite (Fig. 2) nearly flat in the middle, a pair of large sublateral hairy lobes; coxite from 3.2 to 3.4 times the length of the greatest width (when separated and mounted flat); basal plaque on inner surface of coxite (Fig. 7) unusually long and narrow with one strong spine-like process and numerous hairs distal to it, several of which, at the apex, are clubbed; style (Fig. 16) comparatively long and slender, appendage stout and arising some distance from the tip which is pointed.

Distribution.—Type locality, Terres Rouges, Cochin China, larvæ in bamboo stumps during rainy season.

Males have been examined from the following places in India:—

BENGAL (NORTH). Marianbarrie Tea Estate, near Sukna, viii. 1928 (*Puri*), Sukna, viii. 1928 (*Puri*).

BOMBAY DECCAN. Nagargali, 13. viii. 1921 (*Barraud*).

***Aedes (Stegomyia) flavopictus* Yam.**

Aedes flavopictus Yamada, 1921. *Annotationes Zoologicae Japonenses*, **10**, Article 6, pp. 52–54. (♂ and ♀, Fig. ♂ hypop.).

Stegomyia flavopicta Yam., Barraud, *Ind. Jour. Med. Res.*, **11**, 1923, pp. 225–6. (♂ and ♀, Plate XIX, figs. ♂ hypop.).

As stated in the original description and in my paper quoted above this species may be distinguished from *Aedes (S.) albopictus* by the colour of the mesonotal markings, which, except for the median silvery stripe, are yellowish. I find however that in many specimens the yellowish tinge is very faint or even wanting, possibly due to fading, and it is therefore almost impossible to distinguish these from *albopictus*. The males may however be easily separated by examination of the genitalia. The palpi are comparatively shorter than in *albopictus* being only very slightly longer than the proboscis.

♂ hypopygium: 9th tergite (Fig. 3) moderately wide, the middle part produced into a rounded lobe, sublateral lobes not well developed and with few hairs; basal plaque on inner surface of coxite (Fig. 9) with narrow stem and wide apical part carrying flattened, slightly clubbed, processes on the sternal aspect, and hairs all about the same length; style (Fig. 14) very similar to that of *Aedes (S.) albopictus*, but both this and the appendage rather longer, the latter arises a short distance from the tip of the style.

Distribution.—Type locality, Shiba, Tokyo, Japan, 20. iv. 1916 (*Yamada*); also occurs in Honshu and Hokkaido, Japan, and Korea.

Males have been examined from the following places in India:—

ASSAM. Shillong, 5,000 ft. vi. 1922 (*Barraud*).

WESTERN HIMALAYAS. Murree, 7,000 ft. 1922 (*Gill*), Kasauli and Krol Mountain, near Solon, 6,000 to 7,000 ft. commonly breeding in tree-holes during the monsoon (*Barraud*).

MALABAR. Coorg, Mercara, vi. 1927 (*J. D. Baily*).

***Aedes (Stegomyia) novalbopictus* sp. n.**

I have been unable to discover any constant differences in markings between this species and *Aedes (S.) albopictus*, and the published descriptions of the latter (quoted under that species above) would appear to apply equally well to this species also, except in certain structural points mentioned below.

♂: the palpi are only about the length of the proboscis, but may be very slightly longer or shorter than that organ.

♂ hypopygium: 9th tergite (Fig. 5) with the middle part forming a wide slightly rounded lobe, with sometimes a very small rounded projection in the centre of the apical margin (when the tergite is separated and mounted flat this projection is not usually seen); sublateral hairy lobes fairly well developed; basal plaque on inner surface of coxite (Fig. 8) with broad stem, numerous hairs of varying lengths, many with bent tips, arising from the apex, and a row of slender flattened spines along the sternal side, these spines often appear sharply pointed but are actually slightly expanded just below the tips; style (Fig. 18) moderately long and of even width throughout, the appendage arising very near the tip.

Distribution.—Type male from Pusa, Bihar, 27. vii. 1916 (S. K. S.) now in the Malaria Survey of India collection, Kasauli. Out of 188 males of '*albopictus*' examined from the collection of the Agricultural Research Institute, Pusa, 10 proved to be the new species here described. Particulars of the other males which have been examined are as follows:—

BIHAR. Pusa, 16. ii. 1908 (*H. N. S.*), 14. iii. 1913 (*H. N. S.*), 8. iv. 1913 (*Md. S.*), 10. vii. 1913 (*Md. S.*), 2. vii. 1914 (*Md. S.*), 15. iv. 1921 (*Shaffi*), 26. v. 1921 (*Shafi*). Pusa, bred from tree-hole material, ii. 1931 (*Barraud*).

ORISSA. Ranchi, 21. viii. 1922 (*T. B. Fletcher*).

WESTERN HIMALAYAS (Foothills). Koti, near Kasauli, bred from tree-hole material, iii. 1931 (*Barraud*).

KONKAN. Bombay Harbour, Elephanta Island and Trombay, vii. 1921 (*Barraud*).

BOMBAY DECCAN. Belgaum, 1. viii. 1921 (*Barraud*).

***Aedes (Stegomyia) subalbopictus* sp. n.**

The male of this species resembles that sex of *Aedes (S.) albopictus* very closely in the ornamentation of the head, thorax, and legs, but differs (in the only specimen known) in having the dorsum of the abdomen entirely dark without any indication of basal silvery bands, there are small basal lateral silvery patches on the tergites. The palpi are about the same length as the proboscis.

♂ hypopygium: this shows a number of differences in structure from that of *Aedes (S.) albopictus*. Ninth tergite (Fig. 4) with the middle part forming a wide curved lobe, sublateral lobes small, not projecting, each with about 4 hairs; coxite rather more than 3 times the length of the greatest width; basal plaque on inner surface of coxite (Fig. 10) with a long moderately broad stem, the apex carrying a number of slightly curved blade-like processes and hairs, the majority of which have hooked tips, the hairs and processes all about the same length; style (Fig. 15) unusually long, the tip pointed, the appendage arising some little distance from it.

Type male (unique) in the Malaria Survey of India collection, Kasauli, from Belgaum, Bombay Deccan, viii. 1921 (*Barraud*).

***Aedes (Stegomyia) purii* sp. n.**

Only two specimens of this species are known, both males and in poor condition. As far as can be seen they resemble *Aedes* (S.) *annandalei* Theo., and *Aedes* (S.) *mediopunctatus* Theo., very closely in ornamentation. It is not possible to say whether they differ from one or both of these species in the markings of the mesonotum as both specimens are very much denuded of scales. A description is given below but it should be noted that this description would equally apply to poor specimens of *Aedes* (S.) *annandalei*, except as regards the structure of the hypopygium. This in several respects is remarkably different from that of any other Indian species.

♂: *head* mainly flat scaled, a collection of dark upright scales on nape, a triangular patch of white scales in the middle of vertex in front, continued between eyes, black scales surrounding the white patch, white scales forming lateral patches, black scales at sides followed by white scales again low down; white scales on inner side of torus and beneath, antennal plumes dark brown; palpi a little longer than proboscis with two conspicuous white rings, one near the base and one in middle of long segment, some white scales at bases of last two segments chiefly beneath; proboscis black. *Thorax*: mesonotum and scutellum in both specimens nearly completely denuded, some flat white scales remain over wing roots and some flat black scales on posterior part of disc, a few rather narrow white scales on front margin; flat white scales on lateral lobes of scutellum, broad black flat scales on mid lobe; flat white scales on anterior pronotal lobes and on lower part of posterior pronotal lobes (upper part bare or denuded); broad flat white scales forming a patch between anterior spiracle and wing root, another large patch on upper part of mesepimeron. *Wings* as usual in the subgenus, with dark brown scales on veins. *Legs*: fore femur dark anteriorly, pale posteriorly on basal half, mid femur dark anteriorly with some pale scales at tip, 1.0 white spot, dark posteriorly except ventrally where it is narrowly pale on basal half or rather more, hind femur entirely pale on rather more than basal half, white scales forming knee spot; tibiae brownish-black; fore tarsi dark except for a narrow white ring at base of segment 1, mid tarsi similarly marked but with a few pale scales at base of segment 2 also, hind tarsi with wider white rings at bases of segments 1 and 2, segment 3 dark, 4 mainly white except for a narrow black ring at tip, 5 dark. *Abdomen*: partially denuded in both specimens, dorsum apparently mainly brownish-black with lateral basal white patches, indications of narrow basal white bands in one specimen, sternites black with basal white bands.

♂ hypopygium: 9th tergite (Fig. 6) very narrow and concave in the middle, sublateral lobes small, each with about 3 hairs; basal plaque on inner surface of coxite (Fig. 12) unusually long with very numerous hairs and 3 strong

harpago-like processes near base; style (Fig. 17) of moderate length and width, rather swollen towards apex and tapering sharply to tip, appendage long and stout, arising some distance from tip of style.

Two co-type ♂♂ in the Malaria Survey of India collection, from Marianbarrie Tea Estate, near Sukna, North Bengal, caught in jungle, viii. 1928 (Dr. I. M. Puri).

REFERENCES.

- SIMMONS, J. S., ST. JOHN, J. H., and REYNOLDS, F. H. K. (1930). Transmission of dengue fever by *Ædes albopictus* Skuse. *Phil. Jour. Sci.*, **41**, pp. 215-231. 12 refs. 1 plate, 1 fig., 2 charts. (Reviewed in *Trop. Dis. Bull.*, **27**, p. 552, 1930.)
- DINGER, J. E., SCHUFFNER, W. A. P., SNIJDERS, E. P., and SWELLEN-GREBEL, N. H. (1929). Yellow fever research in Holland (3rd communication). *Nederl. Tijdschr. v. Geneesk.*, pp. 5982-5991. 1 plan, 2 figs. (Reviewed in *Trop. Dis. Bull.*, **27**, p. 486, 1930.)

EXPLANATION OF PLATE XI.

Camera lucida drawings, all to the same scale, illustrating parts of the hypopygia of six species of *Aedes* (*Stegomyia*); drawings made from stained preparations of separate parts mounted flat.

- Fig. 1. *Aedes* (*Stegomyia*) *albopictus* (Skuse). Ninth tergite.
 " 2. " " *pseudalbopictus* Borel. Ninth tergite.
 " 3. " " *flavopictus* Yam. Ninth tergite.
 " 4. " " *subalbopictus* sp. n. Ninth tergite.
 " 5. " " *novalbopictus* sp. n. Ninth tergite.
 " 6. " " *purii* sp. n. Ninth tergite.
 " 7. " " *pseudalbopictus* Borel. Basal plaque from anal surface of coxite.
 " 8. " " *novalbopictus* sp. n. Basal plaque from anal surface of coxite.
 " 9. " " *flavopictus* Yam. Basal plaque from anal surface of coxite.
 " 10. " " *subalbopictus* sp. n. Basal plaque from anal surface of coxite.
 " 11. " " *albopictus* (Skuse). Basal plaque from anal surface of coxite.
 " 12. " " *purii* sp. n. Basal plaque from anal surface of coxite.
 " 13. " " *albopictus* (Skuse). Style and appendage.
 " 14. " " *flavopictus* Yam. Style and appendage.
 " 15. " " *subalbopictus* sp. n. Style and appendage.
 " 16. " " *pseudalbopictus* Borel. Style and appendage.
 " 17. " " *purii* sp. n. Style and appendage.
 " 18. " " *novalbopictus* sp. n. Style and appendage.

PLATE XI.

