

THE GENUS *ORTHOPODOMYIA* THEOBALD IN SOUTHEAST ASIA¹

By

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INTRODUCTION

This paper treats the 7 species of *Orthopodomyia* which occur in the Southeast Asian area. Although it has been largely extracted from a more comprehensive study of the entire genus (Zavortink 1968), several significant changes and additions have been made. These include the following: keys to species have been rewritten and made more artificial; descriptions of the species have been shortened and restricted to characters which are diagnostic or at least characteristic of one or more species; discussions and group descriptions have been modified to pertain only to species found within the Southeast Asian region; descriptions have been corrected, where necessary, to accommodate variations observed during examination of additional specimens; sections on distribution and biology now include more extensive data for the Thailand collections; and a recently described species has been included.

The terminology of the present paper generally conforms to that of Belkin (1962) and the format to that of Bram (1967), Delfinado (1967, 1968), and Knight (1968). An asterisk following the abbreviations used (σ = male, ♀ = female, P = pupa, and L = larva) indicates that all or some portion of that sex or stage is illustrated. Abbreviations used for the references to the literature conform to the World List of Scientific Periodicals, 3rd ed., Academic Press, 1952. Types of the included species which are in the British Museum (Natural History) and the United States National Museum have been studied by me.

In addition to material accumulated by the Southeast Asia Mosquito Project, specimens from the following institutions were examined: Bernice P. Bishop Museum; British Museum (Natural History); Liverpool School of Tropical Medicine; Taiwan Provincial Malaria Research Institute; United States National Museum; University of California at Davis; and, University of California at Los Angeles.

Orthopodomyia is a small genus of container breeding mosquitoes with a nearly world wide distribution. Eight species groups have been recognized (Zavortink 1968), but only one of these, the *albipes* group, occurs in the Oriental region. The *albipes* group is, however, the largest and most diverse in the genus. It is the only group in which sympatry of species is common and it is the group in which the greatest discordance between classifications based on adults and immature stages is found.

Knight and Mattingly (1950) were the first to study this group of mosquitoes. Their *anopheloides* subgroup is nearly coextensive with that portion of the *albipes* group considered in the present paper.

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GENUS *ORTHOPODOMYIA* THEOBALD

Orthopodomysia Theobald 1904, Entomologist 37: 236-237. Type species: *O. albipes* Leicester 1904.

FEMALE. *Head.* Frons narrow, with light decumbent scales; vertex and occiput with numerous narrow decumbent and broad erect scales; decumbent scales light, erect scales dark posteriorly, light or light-tipped anteriorly; dorsolateral, lateral and ventral surfaces with broad flat scales; clypeus small, normally bare; labium slightly swollen apically, dark scaled with light scales usually in a narrow to broad band near or distad of middle, in a dorsal preapical spot, and streaked on ventral surface from or basad of band to or near apex; palpus long, 0.4 to 0.6 length of proboscis, 4 or 5 segmented, dark scaled with 2 or 3 light patches beyond the base; antenna longer than proboscis, pedicel and flagellomere 1 with light scales. *Thorax.* Paratergite moderately broad, bare; mesonotal bristles unusually numerous, strongly developed, and long; scutum largely covered with light and dark scales of various sizes in a complicated and variable pattern; scutellar lobes with long narrow light scales; *apn*, *ppn*, *ppl*, lower *stp*, and upper *mep* bristles present, *pra* bristles present or absent, *sp* and *psp* bristles absent; *apn*, *ppn*, *pst*, *ppl*, *ssp*, *pra*, *stp*, and upper and lower *mep* scales present, *psp* and *pcx* scales absent. *Legs.* Coxae with light and sometimes dark scales; femora, tibiae, and, to a lesser extent, tarsomere 1 with light and dark scales in a complicated pattern of streaks, spots, bands and speckles; fore and mid legs with tarsomere 1 longer than the remaining 4 tarsomeres combined and tarsomere 4 shorter than 5; hind tarsomere 5 all white; claws simple. *Wing.* Dark scaled with conspicuous light patches on costa and other veins, the number and size of light patches, especially at base of costa, exceedingly variable. *Halter.* Scales light or dark. *Abdomen.* Terga dark with light scales in distinct or connected basolateral and apicolateral patches which become smaller on distal segments and in small to moderately large median subdorsal patches on all or more distal segments. *Terminalia.* Segment VIII not retractile; cerci large, compressed.

MALE. Similar to female. *Head.* Proboscis dark with light scales in complete or incomplete band basad of middle; palpus straight, 0.7 to 0.9 length of proboscis, 5 segmented, dark scaled with 4 light patches; antenna subequal to proboscis, strongly plumose, flagellomeres 1 to 4 or 5 with tufts of light scales. *Legs.* Anterior fore and mid claws large and unidentate, posterior fore and mid claws and hind claws simple. *Abdomen.* Usually more extensively light scaled than in female. *Terminalia.* Tergum VIII with distinct lobe on posterior margin; tergum IX not strongly sclerotized, without lobes, usually with fine setae; basimere well developed, long conical, without apical or basal lobes; basal mesal lobe with 6-8 terete apical bristles, the more ventral usually finer and more strongly curved; distimere simple, with numerous setae and usually 1 simple terminal appendage; phallosome simple; aedeagus large, varied in shape, sclerotization, and dentition; paraproct with 2-5 apical teeth; cercal setae fine, 1-6.

PUPA. *Cephalothorax.* Hairs 6, 7-C close together; 8, 9-C relatively close together, far caudad of trumpet, and in line perpendicular to middorsal ridge. *Trumpet.* Widely spaced; moderate in length; tracheoid portion absent; meatus without slit. *Abdomen.* Hair 1-I strongly developed and strongly dendritic; hair 1-II generally well developed and with many branches; hair 9-II-VIII cephalad of caudolateral angle of segment, on II-VI small and single, on VII moderately to strongly developed and 7-13b, on VIII strongly developed and usually 11-16b (9-19). *Terminal Segments.* Hairs 1-IX, X absent. *Paddle.* Longer than broad; without spicules; hair 1-P present, small, usually branched; 2-P absent.

LARVA. *Head.* Slightly to distinctly broader than long; mental plate well developed, usually with 8-13 teeth on each side; integument without ornamentation. *Antenna.* Short to moderately long, smooth; hair 1-A in basal 0.3-0.5, moderately developed, and usually 4-9b. *Thorax.* Deep red or purple epidermal pigment usually present; 1 pair of conspicuous tracheal dilations present. *Abdomen.* Mature fourth instar larva with large sclerotized plates on segments VII and VIII; hair 6-I, II strongly developed and multiple, 6-III, V, VI very long and single, 6-IV shorter and usually double; comb scales in 2 rows, those of posterior row larger; siphon moderately long to quite long, pecten absent; only hair 1-S well developed, placed in basal 0.3-0.5; anal saddle complete, margin without spicules; 1-X small to moderately developed, 2-X very strongly developed and multiple, 3-X long and single; ventral brush well developed, usually with 7 pairs of hairs.

DISTRIBUTION. The Oriental *albipes* group of the genus *Orthopodomyia* is found from India, southern China, and southern Japan, south to Ceylon, the Malay Archipelago, and northeastern Australia.

TAXONOMIC DISCUSSION. The *albipes* group of *Orthopodomyia* contains 10 species. Seven of these, *albipes* Leicester, *andamanensis* Barraud, *anopheloides* (Giles), *lanyuensis* Lien, *madrensis* Baisas, *siamensis* Zavortink and *wilsoni* Macdonald, are found within the Southeast Asian area. The 3 exotic species are *flavicosta* Barraud and *flavithorax* Barraud from coastal southwestern India and Ceylon and *papuensis* Zavortink from Ceram and New Guinea.

The 10 species of the *albipes* group fall into 4 subgroups. All 4 of these, the *albipes*, *anopheloides*, *flavicosta*, and *wilsoni* subgroups, occur in the Southeast Asian region and the monotypic *albipes* and *wilsoni* subgroups are restricted to it.

Adults of all species treated in this paper are very similar and those of each species are quite variable, particularly in ornamentation of the proboscis, wing, abdomen, and hind leg. Consequently, specific identification is frequently difficult or impossible. The male terminalia of most species are distinct, but the differences between them are not of sufficient magnitude to make identification easy. The immature stages show the greatest divergence and the species and subgroups are defined largely on the basis of differences in these stages. Unfortunately, the variation in the chaetotaxy of both the pupa and larva for several of the species is so great that identification, even to subgroup, is often not simple. Despite the difficulties encountered in identifying any single stage, specific determinations are quite reliable when made from a combination of larval, pupal, and adult characters.

BIOLOGY. The immature stages of species in the *albipes* group occur in water which accumulates in bamboo stumps, bamboo internodes, rot cavities in trees, and artificial containers. Adults are rarely encountered in the field. Females of 2 species, *albipes* and *andamanensis*, are known to bite man.

KEYS TO THE SOUTHEAST ASIAN SPECIES

ADULTS

- | | | |
|-------|---|--------------------------|
| 1. | <i>Pra</i> usually with 1 bristle; <i>ssp</i> scale patch forked
or angled (Fig. 1a) | 2 |
| | <i>Pra</i> without bristles; <i>ssp</i> scale patch simple
(Figs. 1b, 2b). | 3 |
| 2(1). | Joint between hind tarsomeres 1 and 2 without
a broad white ring | <i>madrensis</i> (p. 6) |
| | Joint between hind tarsomeres 1 and 2 with a
broad white ring | <i>lanyuensis</i> (p. 8) |

PUPAE

1. Trumpet nearly cylindrical 2
Trumpet not cylindrical 3
- 2(1). Hair 5-C strongly developed, usually 5, 6b(3-8);
hair 2-II-IV thickened (Fig. 9) *siamensis* (p. 9)
Hair 5-C moderately developed, usually single
or double (1-3b); hair 2-II-IV fine (Fig. 9) *wilsoni* (p. 11)
- 3(1). Trumpet broadening to nearly maximum width
in basal portion, remainder almost parallel
sided (Fig. 10) *albipes* (p. 12)
Trumpet broadening gradually from base to apex 4
- 4(3). Hair 5-VI usually single or double and long,
extending nearly to or beyond alveolus of
hair 4-VIII (Fig. 11) *madrensis* (p. 6)
lanyuensis (p. 8)
Hair 5-VI usually 3-7b(2-8) and short, extending
nearly to or slightly beyond alveolus of hair
4-VII, longer in hairy forms 5
- 5(4). Hair 1-III usually 12-14b(10-17); hair 9-C usu-
ally 2, 3b(2-5) (Fig. 10) *andamanensis* (p. 14)
Hair 1-III usually 5-7b(3-11); hair 9-C usually
single (single, double) (Fig. 11) *anopheloides* (p. 16)

FOURTH STAGE LARVAE

1. Branches of hair 6-I, II usually at least as stout
as 6-III; hair 1-M, T single and short, sub-
equal in length to 3-M or 2-T, and posterior
comb scales expanded at apex and with 5-7
elongate spines 2
Branches of hair 6-I, II finer than 6-III; hair
1-M, T branched and/or long, much exceeding
3-M or 2-T, and/or posterior comb scales
narrow at apex and with a single elongate spine 3
- 2(1). Branches of 6-I, II tapering to a fine apex and
barbed from near base to near apex; segment
VI of mature larva with dorsal sclerotized
plate *siamensis* (p. 9)
Branches of 6-I, II coarse to near apex and
barbed only in basal portion (Fig. 3); seg-
ment VI of mature larva without a sclero-
tized plate *madrensis* (p. 6)
lanyuensis (p. 8)
- 3(1). Posterior comb scales narrow at apex and
with only 1 spine of fringe elongated (Figs.
4, 6); sclerotized body parts exclusive of
siphon largely straw-colored to tan 4
Posterior comb scales expanded at apex and
with fan-like fringe of several elongate
spines (Figs. 7, 8); sclerotized body parts
exclusive of siphon largely brown to dark brown 5

- 4(3). Elongate spine of posterior comb scales usually very long; siphon long and thin, index usually 7.0-12.0 (Fig. 6) *wilsoni* (p. 11)
 Elongate spine of posterior comb scales shorter; siphon broader, index usually 4.0-6.0 (3.6-7.5) (Fig. 4) *albipes* (p. 12)
- 5(3). Hair 6-I usually 9,10b(7-10); hair 6-II usually 9-11b(7-12) *andamanensis* (p. 14)
 Hair 6-I usually 5-8b; hair 6-II usually 4-8b (Fig. 7) *anopheloides* (p. 16)

DESCRIPTIONS OF THE SUBGROUPS AND SPECIES

FLAVICOSTA SUBGROUP

PUPA. *Trumpet*. Varied. *Abdomen*. Hair 1-II strongly developed, long and usually with 9-20 mostly simple branches, some much finer than others, arising from the base; 5-V, VI usually long, extending to or beyond alveolus of hair 4 of second following segment; 5-VI usually single (single, double).

LARVA. *Thorax*. Hair 1-M, T single, short, usually subequal in length to 3-M and 2-T. *Abdomen*. Hair 6-I, II with branches as stout as or stouter than 6-III, form varied; posterior comb scales expanded at apex and usually with 5-7 large spines.

DISTRIBUTION. Species in this subgroup are found in southwestern India, Ceylon, peninsular Thailand, Luzon, and Lanyu.

TAXONOMIC DISCUSSION. As currently interpreted, the *flavicosta* subgroup contains the 5 species *flavicosta*, *flavithorax*, *lanyuensis*, *madrensis*, and *siamensis*. Only the last 3 of these occur in the Southeast Asian region.

O. lanyuensis and *madrensis* are very similar to each other in all stages. *O. siamensis* is quite distinct from them, but is largely indistinguishable in the adult stage from *andamanensis* and *anopheloides*, 2 Southeast Asian species in the *anopheloides* subgroup.

The *flavicosta* subgroup is probably the oldest in the *albipes* group. The species, except for *madrensis* and *lanyuensis*, are relatively well marked and all have very limited, relictual distributions in areas characterized by extremely heavy precipitation. Additional species undoubtedly exist on biological islands in and around the periphery of the Southeast Asian area.

BIOLOGY. Larvae and pupae are usually found in tree-holes. Habits of the adults are unknown.

ORTHOPODOMYIA MADRENSIS BAISAS

(Figures 1a, 3, 11)

Orthopodomyia madrensis Baisas 1946, Mon. Bull. Bur. Hlth. Philipp., Manila 22:41 (♂*, ♀, P*, L*); Knight & Mattingly 1950, Proc. ent. Soc. Wash. 52:17 (♂, ♀, L); Delfinado 1966, Mem. Amer. ent. Inst. 7:68 (♂, ♀, P, L); Zavortink 1968, Contr. Amer. ent. Inst. 3(2):122 (♂*, ♀, P*, L*).

FEMALE. (Figure 1a) *Head*. Dorsolateral scales yellow; labial light scales white to yellow, band near middle, preapical spot sometimes completed ventrally, and sometimes with additional light scales in dorsal streak basad of middle band; palpus 0.42 length of proboscis, light scales white to

yellow, in 2 patches beyond the base. *Thorax*. *Pra* usually with 1 bristle; pleural scales largely pure white; *ssp* scale patch well developed, a moderately long forked or angled row (upper extension erroneously called hypostigial scales by Zavortink (1968)). *Legs*. Fore and mid tarsomeres 2 and 3 usually light scaled at both ends; hind tarsomere 1 dark scaled at apex; hind tarsomere 2 with at most a few light scales at base, broadly white ringed at apex; hind tarsomere 3 entirely white or with dark patch or ring; hind tarsomere 4 all white. *Wing*. Vein Sc without presectoral light patch; 1A dark at base. *Abdomen*. Light scales white or rarely yellowish; terga sometimes with additional light scales in weak narrow basal band or middorsal basal patch; sternum II or sterna II and III light scaled, III-V or IV, V light scaled with median lateral dark patch, VI-VIII dark scaled with light basolateral patch and sometimes light median streak.

MALE. *Head*. Proboscis with additional light scales in broad preapical band, usually in ventral streak joining 2 bands and sometimes scattered dorsally; palpus 0.77 length of proboscis. *Abdomen*. Generally as in female. *Terminalia*. (Fig. 3) Tergum VIII lobe with apex emarginate and serrate; basimere with strong sinuous bristles distad of basal mesal lobe; basal mesal lobe with 7 or 8 more or less equally developed stout bristles; aedeagus weakly sclerotized, more or less irregularly oval in dorsal aspect, with a pair of nearly contiguous to widely separated ventral teeth about 0.55-0.67 distance from base and without a conspicuous projection between or below ventral parameres.

PUPA. (Fig. 11) *Cephalothorax*. Hair 1-C moderately developed, single or double; 2-C moderately developed, usually 2, 3b(2-4); 3-C strongly to very strongly developed, usually 4-6b(3-8); 4, 5-C very strongly developed, usually 3, 4b(2-4); 7-C very strongly developed, usually double (1-3b); 8-C moderately to strongly developed, single; 9-C moderately to strongly developed, usually double or single (1-3b). *Trumpet*. Largely dark brown, gradually widening from base. *Abdomen*. Hair 2-II slightly thickened, mesad of 5-II; 2-III, IV fine; 1-III usually 4-6b; 5-IV usually 3b(2, 3); 5-V usually double (single, double); 5-VI usually single.

LARVA. (Fig. 3) *Head*. Integument largely tan to brown; hair 13-C moderately developed, usually 3-5b. *Antenna*. Short. *Abdomen*. Hair 6-I, II 4, 5b(3-5), with branches coarse to near apex and barbed only in basal portion; 1-III moderately long, single; 1-V long, single; 1-VI shorter than 4-VI; segment VI without sclerotized plate; siphon index usually 3.8-6.6; hair 1-S located 0.44-0.53 from base of siphon and usually 8-11b(6-13).

TYPE DATA. *Orthopodomyia madrensis* Baisas, holotype male with associated larval and pupal skins (TH1B-4) lost; type locality: Llavac, Laguna, Luzon (Sunico), PHILIPPINES.

DISTRIBUTION. Specimens examined: PHILIPPINES, Luzon, 22 males, 15 females, 25 pupae, 43 larvae, 19 rearings. Records from literature: PHILIPPINES, Luzon (Baisas 1946, Delfinado 1966, Zavortink 1968).

TAXONOMIC DISCUSSION. *O. madrensis* and *lanyuensis*, a species only recently described by Lien, are presently considered to be very closely related. The two are distinguished from each other only in the adult stage and are easily separated from all other species by having the subspiracular scale patch forked or angled and a single bristle on the prelar knob. *O. madrensis* is distinguished from *lanyuensis* by lacking a large white ring over the joint between hind tarsomeres 1 and 2. The male terminalia of both species are unusual in having all the apical setae of the basal mesal lobe more or less equally developed and strong. Pupae of *madrensis* and *lanyuensis* have no unique characters; they are separated from the other species by the combination of a long, single or double hair 5-VI and the trumpet broadening gradually from the base. The larvae of both species have abdominal hair 6-I, II peculiarly developed; each branch is stout nearly to its apex and barbed only near its base. This character alone sets them apart from all other *Orthopodomyia* larvae.

O. madrensis is not distinct from the other members of the *albipes* group, including *lanyuensis*, in ornamentation of the proboscis, base of the costa, or abdominal sterna, as thought by Baisas (1946: 41), Knight & Mattingly (1950: 6, 19), and Lien (1968: 6). The light scaling of the proboscis is frequently white rather than yellow and is subject to the same variation in extent as in the other species. The basal portion of the costa varies from completely dark scaled through distinct light basal, prehumeral and humeral patches to completely light scaled. Only abdominal sterna II and III are light scaled. As mentioned above, the number of white hind tarsomeres is variable in this species.

O. madrensis is apparently endemic to the island of *Luzon* in the Philippines.

BIOLOGY. This species breeds in rot holes in trees and treeferns; it is frequently associated with *anopheloides* in those habitats. Nothing is known of the habits of the adults.

ORTHOPODOMYIA LANYUENSIS LIEN

Orthopodomyia lanyuensis Lien 1968, Trop. Med. 10: 4 (♂*, ♀, P*, L*).

FEMALE. *Head.* Dorsolateral scales yellow; labial light scales cream-colored, band near middle, preapical spot weakly complete ventrally; palpus 0.44 length of proboscis, light scales white to yellow, in 2 patches beyond the base. *Thorax.* *Pra* with 1 bristle; pleural scales largely pure white; *ssp* scale patch well developed, a moderately long forked row. *Legs.* Fore and mid tarsomeres 2 and 3 light at both ends; hind tarsomere 1 with broad apical white ring, hind tarsomeres 2 and 3 conspicuously white ringed at both ends, hind tarsomere 4 all white. *Wing.* Vein Sc without presectoral light patch; 1A dark at base. *Abdomen.* Light scales white to yellowish; distal terga with additional light scales in basal bands; sternum II largely light scaled, III-VIII dark scaled with light basal band and basolateral patch which becomes smaller on distal segments.

MALE. *Head.* Proboscis with additional light scales in large preapical patch; palpus 0.85 length of proboscis. *Abdomen.* Terga with conspicuous basal bands. *Terminalia.* (Probably indistinguishable from *madrensis*.) Tergum VIII lobe with apex rounded and serrate; basimere with strong sinuous bristles distad of basal mesal lobe; basal mesal lobe with 8 or 9 more or less equally developed stout bristles; aedeagus weakly sclerotized, more or less irregularly oval in dorsal aspect, with a pair of slightly separated ventral teeth about 0.58-0.60 distance from base, and without a conspicuous projection between or below ventral parameres.

PUPA and LARVA. Apparently indistinguishable from *madrensis*.

TYPE DATA. *Orthopodomyia lanyuensis* Lien, holotype male with associated larval and pupal skins (78400.6) in Taiwan Provincial Malaria Research Institute; type locality: south of Hongtou, *Lanyu* (Chen), TAIWAN.

DISTRIBUTION. Specimens examined: TAIWAN, *Lanyu*, 1 male, 1 female, 2 pupae, 2 larvae, 2 rearings. Records from the literature: TAIWAN, *Lanyu* (Lien 1968).

TAXONOMIC DISCUSSION. *O. lanyuensis*, only recently described by Lien, is very similar to, and perhaps conspecific with, *madrensis*. The 2 are distinguishable only as adults, and then only by characters which are known to be extremely variable in *Orthopodomyia* species of the *albipes* group. The ways by which adults, male terminalia, pupae, and larvae of *lanyuensis* and *madrensis* are separated from the other species in Southeast Asia are found in the taxonomic discussion of *madrensis*. *O. lanyuensis* differs from *madrensis* by having a large white ring over the joint between hind tarsomeres 1 and 2. Since *lanyuensis* differs from *madrensis* by having a different type of

leg banding, rather than just in the number of white hind tarsomeres, I am considering it to be a distinct species.

The pupae of *lanyuensis* which I have seen have a slightly greater number of branches in several hairs, including hair 5-VI which is double,³ than any specimens of *madrensis*. I believe these differences, rather than being specific, are the result of hairiness in these individual pupae. Hairy larval forms are unknown.

O. lanyuensis is presently known only from *Lanyu*, a small island east of the southern end of Taiwan. *O. madrensis* occurs about 250 miles further south on *Luzon*.

BIOLOGY. The immature stages are found in tree-holes. Habits of the adults are unknown.

ORTHOPODOMYSIA SIAMENSIS ZAVORTINK

(Figures 5, 9)

Orthopodomysia siamensis Zavortink 1968, Contr. Amer. ent. Inst. 3(2): 126 (♂*, ♀, P*, L*).

FEMALE. *Head.* Dorsolateral scales brown anteriorly, white or yellow posteriorly; labial light scales cream-colored, band distad of middle; palpus 0.42 length of proboscis, light scales white, in 2 patches beyond the base. *Thorax.* *Pra* bristles absent; pleural scales largely white to cream-colored or yellow-tinged; *ssp* scale patch well developed, a simple short to moderately long row. *Legs.* Fore and mid tarsomeres 2 and 3 usually light scaled at both ends; hind tarsomere 1 white scaled at apex, hind tarsomere 2 with at most a very narrow white ring at base, broadly white ringed at apex, hind tarsomere 3 entirely white or less commonly with dark patch or ring distad of middle, hind tarsomere 4 entirely white. *Wing.* Vein Sc without presectoral light patch; 1A usually dark at base. *Abdomen.* Light scales white or white and yellow; additional light scales sometimes in basal bands on distal terga; sterna II-VIII dark scaled with basolateral light patch which becomes smaller on distal segments.

MALE. *Head.* Proboscis with additional light scales in dorsal and ventral preapical patches or a broad preapical band which extends further basally on ventral surface; palpus 0.82 length of proboscis. *Abdomen.* As in female. *Terminalia.* (Fig. 5) Tergum VIII lobe with apex rounded or emarginate and with or without teeth; basimere without strong specialized bristles distad of basal mesal lobe; basal mesal lobe with 4 or 5 stout bristles and 1 or 2 finer ones; aedeagus strongly sclerotized, shape in dorsal aspect variable, but never pyriform and always broadest in apical half, with a pair of nearly contiguous ventral teeth about 0.50-0.55 distance from base, and without a conspicuous projection between or below ventral parameres.

PUPA. (Fig. 9) *Cephalothorax.* Hairs 1, 2-C strongly developed, usually 6, 7b(5-8); 3-C strongly developed, usually 7-9b(4-10); 4, 5-C strongly developed, usually 5, 6b(3-8); 7-C strongly developed, double; 8-C strongly developed, usually 6, 7b(3-8); 9-C strongly developed, 3-5b. *Trumpet.* Largely light brown, nearly cylindrical. *Abdomen.* Hair 2-II-IV thickened, 2-II laterad of 5-II; 1-III usually 5, 6b(5-7); 5-IV double; 5-V, VI single.

LARVA. (Fig. 5) *Head.* Integument largely tan to light brown; hair 13-C moderately strong, usually 8, 9b(8-11). *Antenna.* Moderately long.

³ In one paratype in SEAMP collection hair 5-VI is single on one side, double on the other (B. de M.).

Abdomen. Hair 6-I, II 6, 7b with branches tapering to a fine apex and barbed from near base to near apex; 1-III long, single; 1-V very long, double; 1-VI shorter than 4-VI; segment VI with dorsal sclerotized plate; siphon index usually 6.4-7.8 (6.4-10.1); hair 1-S located 0.41-0.49 from base of siphon and usually 6-8b(5-8).

TYPE DATA. *Orthopodomyia siamensis* Zavortink, holotype male with associated larval and pupal skins (TG 102-30) in U.S. National Museum; type locality: Muang, Trang, THAILAND.

DISTRIBUTION. Specimens examined: THAILAND, *Nakhon Si Thammarat, Narathiwat, Phangnga, Ranong, Trang*, 14 males, 8 females, 20 pupae, 58 larvae, 21 rearings. Records from the literature: THAILAND, *Narathiwat, Trang* (Zavortink 1968).

TAXONOMIC DISCUSSION. The adult of this species differs from *madrensis* and *lanyuensis*, the other Southeast Asian members of the *flavica* subgroup, by not having a forked or angled subspiracular scale patch or a bristle on the prealar knob. It is, however, apparently indistinguishable from *andamanensis* and many specimens of *anopheloides*, Southeast Asian species of the *anopheloides* subgroup. The male terminalia are differentiated from those of all other species by the shape of the aedeagus. The pupa has hair 2-II-IV thickened and thorn-like. In the larva the branches of hair 6-I, II are stout, yet taper to a fine apex and are barbed throughout. Abdominal segment VI of the mature larva bears a dorsal sclerotized plate; while this plate is commonly found in *Orthopodomyia* larvae of other groups, *siamensis* is the only species in the *albipes* group to have it developed.

Hind tarsomere 3 of the adult is entirely white scaled or has a dark patch or ring beyond the middle. Ornamentation of the base of the costal vein is almost as variable in this species as in *madrensis*. Hairy forms of the larva and pupa are not yet known.

O. siamensis is a relictual species restricted, as far as is known, to peninsular Thailand. Despite the extreme similarity with members of the *anopheloides* subgroup in the adult stage, the species seems to be quite removed from all others.

BIOLOGY. The immature stages have been collected in rot holes in trees, stumps, roots and in bamboo stumps. When found in the latter habitat, they may be associated with *albipes*. All known adults are reared and nothing is known about their behavior.

WILSONI SUBGROUP

PUPA. *Trumpet.* Largely dark brown, cylindrical. *Abdomen.* Hair 1-II moderately developed, moderately long, dendritic or with 1 or more stalks from which 18-34 fine branches arise; 5-V, VI long, usually extending to near alveolus of hair 4 of second following segment; 5-VI usually double (1-3b).

LARVA. *Thorax.* Hair 1-M, T 1-5b, moderately long to long, subequal in length to or much longer than 3-M and 2-T. *Abdomen.* Hair 6-I, II with branches finer than 6-III, tapering to fine apex and barbed from near base to near apex; posterior comb scales narrow at apex and with a single long, strong spine.

TAXONOMIC DISCUSSION. The monotypic *wilsoni* subgroup, known only from the Malay Peninsula, is well differentiated from the other subgroups in all stages. The immature stages are normally found in bamboo internodes.

ORTHOPODOMYIA WILSONI MACDONALD

(Figures 1b, c, g, 6, 9)

Orthopodomyia wilsoni Macdonald 1958, Proc. R. ent. Soc. Lond. (B) 27: 121 (♂*, ♀, P*, L*); Zavortink 1968, Contr. Amer. ent. Inst. 3(2): 130 (♂*, ♀, P*, L*).

FEMALE. (Figs. 1b, c, g) *Head.* Dorsolateral scales brown anteriorly, yellowish posteriorly; labial light scales cream-colored, band about 0.75 distance from base; palpus 0.42 length of proboscis, light scales white, in 2 patches beyond the base. *Thorax.* *Pra* bristles absent; pleural scales largely cream-colored to yellow; *ssp* scale patch weakly developed, a simple usually short row. *Legs.* Fore and mid tarsomeres 2 and 3 entirely dark scaled or light scaled only at base; hind tarsomere 1 light or dark scaled at apex, hind tarsomere 2 conspicuously white ringed at both ends, hind tarsomere 3 usually like 2, but sometimes entirely white scaled, hind tarsomere 4 all white. *Wing.* Vein Sc without presectoral light patch; 1A dark at base. *Abdomen.* Light scales white or more frequently yellow or golden; additional light scales usually in large to very large basal middorsal patch on tergum II or terga II and III, and sometimes scattered basally or in narrow basal band on remaining terga; sterna II-VII dark scaled with basolateral light patch which becomes smaller on distal segments.

MALE. *Head.* Proboscis with additional light scales in preapical dorsal patch or oblique band; palpus 0.84 length of proboscis. *Abdomen.* Terga more frequently and broadly banded and subdorsal median light patches larger. *Terminalia.* (Fig. 6) Tergum VIII lobe with apex truncate or emarginate and serrate; basimere without strong, elongate specialized bristles distad of basal mesal lobe; basal mesal lobe with 4 stout bristles and 1 finer; aedeagus moderately sclerotized, pyriform in dorsal aspect, with a pair of separated ventral teeth near apex, and without a conspicuous projection between or below ventral parameres.

PUPA. (Fig. 9) *Cephalothorax.* Hairs 1-5-C moderately developed, 1-3 usually single or double (1-3b), hair 4 usually single (1-4b), hair 5 usually single or double (1-3b); 7-C very strongly developed, usually double (2, 3b); 8, 9-C moderately developed, usually single (single, double). *Abdomen.* Hair 2-II-IV fine, 2-II mesad of 5-II; 1-III usually 5, 6b(4-7); 5-IV usually 3, 4b; 5-V usually 2, 3b.

LARVA. (Fig. 6) *Head.* Integument largely straw-colored to tan; hair 13-C moderately strong, usually with 6, 7b(5-8). *Antenna.* Moderately long. *Abdomen.* Hair 6-I 7, 8b, 6-II usually 5-7b(5-8); 1-III moderately long, usually 2, 3b(1-3); 1-V very long, single; 1-VI equal to or longer than 4-VI; segment VI without sclerotized plate; siphon index usually 7.0-12.0; hair 1-S located 0.30-0.37 from base of siphon and usually 8-10b(6-10).

TYPE DATA. *Orthopodomyia wilsoni* Macdonald, holotype male with associated larval and pupal skins (0348/4) in British Museum; type locality: Ulu Gombak Forest Reserve, *Selangor* (Macdonald), MALAYSIA.

DISTRIBUTION. Specimens examined: MALAYSIA, *Selangor*, 10 males, 7 females, 14 pupae, 14 larvae, 14 rearings. THAILAND, *Nakhon Si Thammarat*, *Phangnga*, *Ranong*, 2 males, 2 females, 3 pupae, 21 larvae, 3 rearings. Records from the literature: MALAYSIA, *Selangor* (Macdonald 1958). THAILAND (Zavortink 1968).

TAXONOMIC DISCUSSION. *O. wilsoni* is one of the most distinctive of the Southeast Asian species. The adult has a poorly developed subspiracular scale patch and an unusually large basal light patch on abdominal tergum II or terga II and III. In addition, the abdominal light scaling is more golden or yellow in *wilsoni* than in any other species. The adult is also distinct from all others except *lanyuensis* in banding of the hind tarsomeres. The terminalia

of the male differ from those of *albipes*, the only other Southeast Asian species with a distinctly pyriform aedeagus, by lacking strong, elongate specialized bristles on the basimere distad of the basal mesal lobe. The pupa has a dark cylindrical trumpet and cephalothoracic setae 1-6, 8, 9 relatively weakly developed, short and few branched. The shape of the larval comb scales is unlike that of any other species. The larva also differs from all others except *siamensis* by having a long thin siphon.

Most adults of *wilsoni* have conspicuous, subequal white bands at both ends of hind tarsomeres 2 and 3. I have seen a single reared specimen from the Isthmus of Kra which has hind tarsomere 3 entirely white scaled on both legs. The form of larval hairs 1-M, T, I-IV and 13-T, II-V is quite variable; these hairs may be long and relatively few branched to short and relatively many branched. Hairy forms are unknown for the pupa.

O. wilsoni is apparently a relictual species; it has no close relatives, but its affinities probably lie with *albipes*.

BIOLOGY. The immature stages occur in cracked or punctured bamboo internodes. There is one reared record of larvae having been collected in the concave top of the fungus *Polystictus xanthopus*. Although Macdonald (1958) did not recover this species from the same internodes as *albipes* in Malaysia, the two species are frequently associated in collections from peninsular Thailand. Habits of the adults are largely unknown, but a male has been collected resting on vegetation in a forest. Resting adults of both *anopheloides* and *andamanensis* were also taken at the same time and place.

ALBIPES SUBGROUP

PUPA. *Trumpet.* Largely brown to dark brown, broad, attaining maximum width in basal 0.33. *Abdomen.* Hair 1-II moderately developed, short, usually with a central stalk from which 19-35 very fine dendritic or forked branches arise, sometimes without stalk and with as few as 2 simple branches; 5-V, VI long, extending to alveolus of hair 4 of second following segment; 5-VI usually double (2-5b).

LARVA. *Thorax.* Hair 1-M, T 1-4b, usually long, much exceeding 3-M and 2-T. *Abdomen.* Hair 6-I, II with branches finer than 6-III, tapering to fine apex and barbed from near base to near apex; posterior comb scales narrow at apex and with a single strong but relatively short spine.

TAXONOMIC DISCUSSION. The *albipes* subgroup consists of a single species found from eastern India to northern Borneo. The subgroup is quite well marked in all stages. Bamboo internodes are the preferred breeding sites.

ORTHOPODOMYIA ALBIPES LEICESTER

(Figures 1d, 2, 4, 10)

Orthopodomyia albipes Leicester 1904, *In* Theobald, *Entomologist* 37:237 (♂, ♀); Barraud 1934, *Fauna Brit. India, Diptera* 5: 102 (♂, ♀, L); Knight & Mattingly 1950, *Proc. ent. Soc. Wash.* 52: 16 (♂*, ♀, P*, L*); Zavortink 1968, *Contr. Amer. ent. Inst.* 3(2): 133 (♂*, ♀, P*, L*).

FEMALE. (Figs. 1d, 2) *Head.* Dorsolateral scales brown anteriorly, white posteriorly; labial light scales white, band at about middle; palpus 0.58 length of proboscis, light scales white, in 3 patches beyond the base. *Thorax.* *Pra* bristles absent; pleural scales largely white, sometimes cream-colored; *ssp* scale patch well developed, a simple moderately long row. *Legs.* Fore and mid tarsomeres 2 and 3 usually light scaled at base only; hind tarsomere

1 dark scaled at apex, hind tarsomere 2 usually with more extensive white scaling at base than at apex (at least on outer surface), hind tarsomere 3 entirely white or rarely with dark patch basad of middle, hind tarsomere 4 entirely white. *Wing*. Vein Sc often with presectoral light patch; 1A white scaled at base. *Abdomen*. Light scales white or rarely some yellow; terga with additional light scales sometimes scattered basally or in basal bands; sternum II mostly light scaled, III-VII dark scaled with light scales in basolateral patch which becomes smaller on distal segments, in midventral apical patch on segments II or III-V or VI, and sometimes in narrow basal band.

MALE. *Head*. Proboscis with additional light scales in preapical band which extends further basally along ventral surface; palpus 0.75 length of proboscis. *Abdomen*. As for female. *Terminalia*. (Fig. 4) Tergum VIII lobe with apex rounded or truncate and serrate; basimere with moderately to strongly developed elongate curved or sinuous bristles distad of basal mesal lobe; basal mesal lobe with 4 or 5 stout bristles and 1 or 2 finer ones; aedeagus moderately sclerotized, pyriform in dorsal aspect, with a pair of separated ventral teeth near apex and without a conspicuous projection between or below ventral parameres.

PUPA. (Fig. 10) *Cephalothorax*. Hair 1-C moderately developed, usually 2-4b(2-5); 2-C strongly developed, usually 2, 3b(1-3); 3-C very strongly developed, usually 4-6b(4-9); 4-C strongly developed, usually 3, 4b(2-4); 5-C very strongly developed, usually 4, 5b(3-6); 7-C very strongly developed, usually 3, 4b(3-5); 8, 9-C moderately developed, 8 usually single or double, 9 usually single. *Abdomen*. Hair 2-II-IV fine, 2-II mesad of 5-II; 1-III usually 6-8b(4-8); 5-IV usually 3-5b; 5-V usually 3b(2-4).

LARVA. (Fig. 4) *Head*. Integument largely straw-colored; hair 13-C moderately developed, usually 4-6b. *Antenna*. Moderately long. *Abdomen*. Hair 6-I, II 5-7b; 1-III long, usually 2, 3b(1-4); 1-V very long, usually single (single, double); 1-VI equal to or longer than 4-VI; segment VI without sclerotized plate; siphon index usually 4.0-6.0(3.6-7.5); hair 1-S located 0.32-0.40 from base of siphon and usually 9-11b(6-14).

TYPE DATA. *Orthopodomyia albipes* Leicester, lectotype male with terminalia slide in British Museum; type locality: Kuala Lumpur, *Selangor*, MALAYSIA.

DISTRIBUTION. Specimens examined: INDIA, *Bihar*, 1 male, 1 female. MALAYSIA, *Kedah, Kelantan, Pahang, Perak, Selangor*, 246 males, 294 females, 266 pupae, 384 larvae, 265 rearings. EAST MALAYSIA, *Sabah, Sarawak*, 2 males, 3 females. SINGAPORE, 1 larva. THAILAND, *Chiang Mai, Kanchanaburi, Lampang, Nakhon Ratchasima, Nakhon Si Thammarat, Narathiwat, Phangnga, Ranong, Surat Thani, Tak*, 87 males, 66 females, 147 pupae, 372 larvae, 142 rearings. Records from the literature: INDIA, Darjeeling District (Barraud 1934). MALAYSIA, *Perak* (Edwards 1928), *Sabah* (Zavortink 1968), *Sarawak* (Barraud 1934), *Selangor* (Leicester 1904, Macdonald 1958). THAILAND, *Kanchanaburi, Ranong* (Zavortink 1968). VIET NAM (Borel 1930).

TAXONOMIC DISCUSSION. *O. albipes*, like the other bamboo inter-node-breeding species, *wilsoni*, is also one of the most differentiated in Southeast Asia. The adult is distinctive in having hind tarsomere 2 usually more extensively light scaled basally than apically and in possessing a midventral apical light patch on abdominal sterna II or III to V or VI. Segment 4 of the palpus of the female is elongated in *albipes*. In all but a very few specimens, the added length separates the light scales at the apex of the segment from those at the base, so that the palpus has 3 light patches beyond the base instead of the 2 found in all other species. The male terminalia are characterized by the combination of a pyriform aedeagus and strong, elongate specialized bristles on the basimere distad of the basal mesal lobe. The pupa is easily separated from the other species by the shape of the trumpet. The larva differs from other species in shape of the comb scales and, to a lesser extent, in shape of the siphon.

I have seen specimens of *albipes* from West Malaysia and Thailand which have a conspicuous white ring at both ends of hind tarsomere 2. In other respects, including larval and pupal characters, these individuals are typical *albipes*. Hind tarsomere 3, normally entirely white, sometimes has a dark patch basad of the middle. The distimere of the male terminalia frequently bears 2 claws. Larval hairs 1-M, T, III, IV and 13-T, II-V are quite variable in length and number of branches. Hairy forms of the pupa are unknown.

O. albipes is one of the more widely distributed Southeast Asian species. Although it has no close relatives, it is probably derived from the same phyllad as *wilsoni*.

BIOLOGY. This species breeds in cracked or perforated bamboo internodes and, less frequently, bamboo stumps. It is sometimes associated with *wilsoni* in bamboo internodes and has been taken with *siamensis* in bamboo stumps. The immatures are encountered far more frequently than those of the other Southeast Asian species. Females are known to bite man (Macdonald 1958: 124).

ANOPHELOIDES SUBGROUP

PUPA. *Trumpet.* Largely brown to dark brown, broadening gradually from base. *Abdomen.* Hair 1-II moderately to strongly developed, moderately long to long, and with 8-35 mostly simple branches, some much finer than others, arising at base; 5-V, VI short, extending to alveolus of hair 4 of first following segment, in non-hairy forms, but long, extending to alveolus of hair 4 of second following segment, in hairy forms; 5-VI usually 3-7b(2-8).

LARVA. *Thorax.* Hair 1-M, T 1-4b, long to very long, much surpassing 3-M and 2-T. *Abdomen.* Hair 6-I, II with branches finer than 6-III, tapering to a fine apex and barbed from near base to near apex; posterior comb scales expanded at apex and with fan-like fringe of several elongate spines.

DISTRIBUTION. Species of this subgroup are found from India, southern China, and southern Japan, south to Ceylon, *Java*, and northern *Queensland*.

TAXONOMIC DISCUSSION. The *anopheloides* subgroup consists of the 3 species *andamanensis*, *anopheloides*, and *papuensis*. Only the first 2 of these occur in the Southeast Asian area.

O. andamanensis and *anopheloides* are very similar to each other in all stages and often cannot be separated. The male terminalia and immature stages of the pair are well differentiated from the other species in the Southeast Asian area, but the adults are frequently indistinguishable from those of *siamensis*, a species in the *flavicosta* subgroup.

The *anopheloides* subgroup is undoubtedly the most recent in the *albipes* group. The species are poorly marked and widespread.

BIOLOGY. The preimaginal stages of species in this subgroup are commonly found in tree-holes, bamboo stumps, and artificial containers. Adults have been collected resting on tree trunks and forest vegetation. Females of *andamanensis* apparently bite man.

ORTHOPODOMYIA ANDAMANENSIS BARRAUD

(Figures 1f, 8, 10)

Orthopodomyia anopheloides var. *andamanensis* Barraud 1934, Fauna Brit. India, Diptera 5: 102 (♂, ♀).

Orthopodomyia andamanensis Barraud: Knight & Mattingly 1950, Proc. ent. Soc. Wash. 52: 15 (♂*, ♀, P*, L*); Zavortink 1968, Contr. Amer. ent. Inst. 3(2): 141 (♂*, ♀, P*, L*).

FEMALE. (Fig. 1f) *Head.* Dorsolateral scales brown anteriorly, white posteriorly; labial light scales usually white, band at or distad of middle or sometimes absent, preapical patch sometimes either absent or completed ventrally, and sometimes with additional light scales scattered near base; palpus 0.43 length of proboscis, light scales white, in 2 patches beyond the base. *Thorax.* *Pra* bristles absent; pleural scales largely white or cream-colored; *ssp* scale patch well developed, a simple moderately long row. *Legs.* Fore tarsomeres 2 and 3 entirely dark scaled or light scaled at base or at both ends, mid tarsomeres 2 and 3 light scaled at both ends; hind tarsomere 1 usually white scaled at apex, hind tarsomere 2 with at most a narrow basal white ring and with a narrow to moderately broad white ring at apex, hind tarsomere 3 entirely white or rarely with subbasal dark patch or ring, hind tarsomere 4 all white. *Wing.* Vein Sc without presectoral light patch; 1A sometimes white scaled at base. *Abdomen.* Light scales white or cream-colored, rarely yellowish; sometimes terga with additional light scales scattered basally or in basal bands; sterna II-VII dark scaled with basolateral light patch which becomes smaller on distal segments.

MALE. *Head.* Proboscis with additional light scales in a moderately broad to broad preapical band which extends farther basally along ventral surface; palpus 0.80 length of proboscis. *Abdomen.* Terga and sterna sometimes with light basal bands. *Terminalia.* (Fig. 8) Tergum VIII lobe emarginate or truncate, serrate; basimere without strong specialized bristles distad of basal mesal lobe; basal mesal lobe with 4 or 5 stout bristles and 1-3 finer ones; aedeagus weakly sclerotized, approximately fusiform in dorsal aspect, without ventral teeth, but with a basal projection extending conspicuously ventrad below ventral parameres.

PUPA. (Fig. 10) The hairs in the hairy form have more branches (in italics in the following description) and are generally more strongly developed than in the non-hairy form. *Cephalothorax.* Hair 1-C moderately developed, usually 2, 3b, up to 5b; 2, 3-C moderately developed, usually 3-5b(2-6), up to 10b; 4-C moderately to strongly developed, usually 2-4b, up to 8b; 5-C strongly to very strongly developed, 2, 3b, up to 6b, 7-C very strongly developed, 2, 3b, up to 6b; 8, 9-C moderately to strongly developed, usually 2, 3b(2-5), up to 8b. *Abdomen.* Hair 1-II moderately developed, usually 16-25b, up to 35b, 2-II-IV fine, 2-II mesad of 5-II; 1-III usually 12-14b(10-17); 5-IV 5, 6b, up to 8b; 5-V usually 4, 5b(4-6), up to 7b; 5-VI usually 6, 7b(4-8).

LARVA. (Fig. 8) *Head.* Integument brown to dark brown; 13-C moderately developed, 4-6b(4-7). *Antenna.* Short. *Abdomen.* Hair 6-I usually 9, 10b(7-10), 6-II usually 9-11b(7-12); 1-III, V very long, single; 1-VI shorter than 4-VI; segment VI without sclerotized plate; siphon index usually 4.0-5.6; hair 1-S located 0.37-0.50 from base of siphon and usually 11, 12b(10-14).

TYPE DATA. *Orthopodomyia anopheloides* var. *andamanensis* Barraud lectotype male with terminalia slide in British Museum; type locality: ANDAMAN ISLANDS (Covell).

DISTRIBUTION. Specimens examined: ANDAMAN ISLANDS, 1 male, 1 female. INDONESIA, *Java*, 6 males, 10 females, 1 pupa; *Kalimantan*, 2 males, 1 female, 1 pupa, 1 larva, 1 rearing; *Sumatra*, 5 males, 7 females, 1 pupa, 1 larva. MALAYSIA, *Perak*, *Selangor*, 5 males, 8 females, 8 pupae, 8 larvae, 8 rearings. PHILIPPINES, *Palawan*, 1 male, 1 female, 2 pupae, 2 larvae, 2 rearings. SINGAPORE, 2 males, 1 female, 1 pupa, 1 larva. THAILAND, *Chanthaburi*, *Chiang Mai*, *Chiang Rai*, *Khon Kaen*, *Lampang*, *Nakhon Nayok*, *Nakhon Ratchasima*, *Ranong*, *Tak*, *Trang*, 35 males, 15 females, 7 pupae, 15 larvae, 6 rearings. VIET NAM, 1 male, 1 female. Records from the literature: ANDAMAN ISLANDS (Barraud 1934). INDIA, *Darjeeling* District (Barraud 1934). INDONESIA, *Celebes* (Knight & Mattingly 1950), *Java*, *Kalimantan* (Bonne-Wepster 1954), *Sumatra* (Brug & Bonne-Wepster 1947). MALAYSIA, *Perak* (as *albipes*, Leicester 1908), *Selangor* (Macdonald 1958). PHILIPPINES, *Palawan* (Knight & Mattingly 1950).

SINGAPORE (Barraud 1934). THAILAND, *Chiang Mai, Chiang Rai, Khon Kaen, Nakhon Nayok, Nakhon Ratchasima* (Zavortink 1968), *Lampang* (Thurman 1959). VIET NAM (Zavortink 1968).

TAXONOMIC DISCUSSION. The adult of *andamanensis* is apparently indistinguishable from that of *siamensis*. It differs from the majority of those of *anopheloides* by having hind tarsomeres 3 and 4 entirely white scaled. From those rare specimens of *anopheloides* with hind tarsomeres 3 and 4 entirely white scaled, it sometimes differs by having a narrower white ring at the apex of hind tarsomere 2. The aedeagus of the male terminalia of both *andamanensis* and *anopheloides* is quite different from that of the other species. It lacks ventral teeth but has a basal projection between or below the ventral parameres. In *andamanensis* this basal projection is usually directed more ventrally than in *anopheloides*. Non-hairy pupae of *andamanensis* and *anopheloides* differ from other Southeast Asian species by having hair 5-VI short and multiple. The pupa of *andamanensis* is separated from that of *anopheloides* by having a greater number of branches in hairs 1-III and 9-C. Larvae of the 2 species have characteristically shaped posterior comb scales, long thoracic hair 1-M, T, and branches of abdominal hair 6-I, II finer than hair 6-III. The larva of *andamanensis* usually has a greater number of branches in hair 6-I, II than *anopheloides*.

I have seen 3 male specimens from Thailand that have a dark ring in the basal portion of hind tarsomere 3; they agree with *andamanensis* in all other characters and are probably that species. Hairy forms are known for the pupa only.

O. andamanensis and *anopheloides* are very similar in all stages, are sympatric over a broad area and are found in the same breeding sites. It is possible that further study will show them to be only forms of a single species.

O. andamanensis occurs from east India to *Java, Celebes* and *Palawan*. I have not seen the material upon which the *Celebes* record is based. It is possible that the species there is the closely related *papuensis* rather than *andamanensis*.

BIOLOGY. The immature stages of *andamanensis* have been taken from tree-holes, bamboo stumps, and artificial containers; they are often associated with those of *anopheloides*. Females of the *Celebes* population are known to bite man (Knight & Mattingly 1960: 16). Adults are sometimes taken resting in the forest; such collections frequently contain *anopheloides* also.

ORTHOPODOMYIA ANOPHELOIDES (GILES)

(Figures 1e, 7, 11, 12)

Mansonia anopheloides Giles 1903, *In Wyville Thomson, J. trop. Med.* 6: 315 (♂, ♀*, L).

Orthopodomyia albipes var. *nigritarsis* Leicester 1908, *Cul. Malaya* :177 (♂, ♀); Edwards 1913, *Bull. ent. Res.* 4: 239 (synonymy).

Orthopodomyia maculata Theobald 1910, *Rec. Indian Mus.* 4: 29 (♂); Edwards 1913, *Bull. ent. Res.* 4:239 (synonymy); Barraud 1934, *Fauna Brit. India, Diptera* 5: 101 (A, L; as variety of *anopheloides*); Knight & Mattingly 1950, *Proc. ent. Soc. Wash.* 52: 9 (♂*, P, L; as subspecies of *anopheloides*); Thurman 1959, *Univ. Md. Agric. Exp. Sta. Bull. Pacif. Sci. Congr.* 9:55 (as variety of *anopheloides*); Zavortink 1968, *Contr. Amer. ent. Inst.* 3(2): 146 (synonymy).

Orthopodomyia maculipes Theobald 1910, *Mon. Cul.* 5:470 (♀*); Barraud, 1934, *Fauna Brit. India, Diptera* 5: 101 (A, L; as variety of *anopheloides*); Knight & Mattingly 1950, *Proc. ent. Soc. Wash.* 52: 10 (♂*, ♀, P*, L; elevated to specific rank); Zavortink 1968, *Contr. Amer. ent. Inst.* 3(2): 146 (synonymy).

- Orthopodomyia manganus* Baisas 1946, Mon. Bull. Bur. Hlth. Philipp., Manila 22: 35 (σ^* , φ , P*, L*); Knight & Mattingly 1950, Proc. ent. Soc. Wash. 52: 7 (synonymy).
- Orthopodomyia (Orthopodomyia) nipponica* LaCasse & Yamaguti 1948, Mosq. Fauna Japan and Korea 2: 264 (σ^* , φ^* , P*, L*); Knight & Mattingly 1950, Proc. ent. Soc. Wash. 52: 7 (synonymy).
- Orthopodomyia (Orthopodomyia) lemmonae* Thurman 1959, Univ. Md. Agric. Exp. Sta. Bull. A-100: 58 (L*); Zavortink 1968, Contr. Amer. ent. Inst. 3(2): 147 (synonymy).
- Orthopodomyia anopheloides* (Giles): Edwards 1913, Bull. ent. Res. 4: 239 (taxonomy); Barraud 1927, Indian J. med. Res. 14: 527 (σ^* , φ); Barraud 1932, Indian J. med. Res. 19: 1014 (P*, L*); Barraud 1934, Fauna Brit. India, Diptera 5: 98 (σ , φ^* , P*, L*); Knight & Mattingly 1950, Proc. ent. Soc. Wash. 52: 7 (σ^* , φ , P*, L); Delfinado 1966, Mem. Amer. ent. Inst. 7: 66 (σ^* , φ , P*, L*); Zavortink 1968, Contr. Amer. ent. Inst. 3(2):146 (σ^* , φ^* , P*, L*).
- Orthopodomyia mcgregori* of Knight & Chamberlain 1948, Proc. helm. Soc. Wash. 15: 10 (P*; misidentification); Knight & Mattingly 1950, Proc. ent. Soc. Wash. 52: 13 (σ , P, L; misidentification).

FEMALE. (Fig. 1e) *Head.* Dorsolateral scales brown anteriorly, white posteriorly; labial light scales usually white, band at or distad of middle or sometimes absent, preapical patch sometimes either absent or completed ventrally, and sometimes with additional light scales scattered near base; palpus 0.48 length of proboscis, light scales white, in 2 patches beyond the base. *Thorax.* *Pra* bristles absent; pleural scales largely white or cream-colored, rarely yellow-tinged; *ssp* scale patch well developed, a simple moderately long row. *Legs.* Fore and mid tarsomeres 2 and 3 usually light scaled at both ends; hind tarsomere 1 usually white scaled at apex, sometimes with broad white ring, hind tarsomere 2 dark or light scaled basally and with a moderately broad to very broad apical white ring, hind tarsomeres 3 and 4 rarely all white, more commonly 3 or 3 and 4 with dark patch or ring distad of middle. *Wing.* Vein Sc without presectoral light patch; 1A sometimes white scaled at base. *Abdomen.* Light scales white or cream-colored, rarely yellowish; sometimes terga with additional light scales scattered basally or in basal band; sterna II-VII dark scaled with light scales in basolateral patch which becomes smaller on distal segments and sometimes in basal band.

MALE. *Head.* Proboscis with additional light scales in preapical dorsal patch or narrow to broad band which extends further basally along ventral surface; palpus 0.78 length of proboscis. *Abdomen.* Terga and sterna more frequently and extensively banded than in female. *Terminalia.* (Fig. 7) Tergum VIII lobe emarginate or truncate and usually serrate; basimere usually without strong specialized bristles distad of basal mesal lobe; basal mesal lobe with 4-6 stout bristles and 1-3 finer ones; aedeagus weakly to moderately sclerotized, approximately fusiform in dorsal aspect, without ventral teeth, but with a basal projection extending conspicuously cephalad between ventral parameres.

PUPA. (Fig. 11) As in *andamanensis* the hairs in the hairy form have more branches (in italics in the following description) and are generally more strongly developed than in the non-hairy form. *Cephalothorax.* Hair 1-C moderately developed, 2-3b, *up to 4b*; 2-C moderately developed, 1-3b, *up to 7b*; 3-C moderately developed, 3-5b, *up to 10b*; 4-C moderately to very strongly developed, 2, 3b, *up to 6b*; 5-C very strongly developed, 2-3b, *up to 6b*; 7-C very strongly developed, usually double, *up to 6b*; 8, 9-C moderately to strongly developed, usually single (single, double), 1-3b. *Abdomen.* Hair 1-II moderately developed, usually 12-19b (8-23), *up to 34b*; 2-II fine and mesad of 5-II; 2-III, IV fine; 1-III usually 5-7b(3-11); 5-IV 3, 4b, *up to 8b*; 5-V usually 3-4b(2-4), *up to 7b*; 5-VI usually 3-5b(2-6).

LARVA. (Figs. 7, 12) *Head.* Integument largely brown to dark brown; hair 13-C moderately developed, 4-6b(4-7). *Antenna.* Short. *Abdomen.* Hair 6-I usually 5-8b, 6-II usually 4-8b; 1-III, V very long and single in non-hairy form, long and double in hairy form; 1-VI shorter than 4-VI in non-hairy form, equal to or longer than 4-VI in hairy form, segment VI without sclerotized plate; siphon index usually 3.5-4.8(3.2-6.4); hair 1-S located 0.36-0.50 from base of siphon and usually 10-12b(9-13).

TYPE DATA. *Mansonia anopheloides* Giles, lectotype male with terminalia slide in British Museum; type locality: Dehra Dun, Uttar Pradesh, INDIA. *Orthopodomyia albipes* var. *nigritarsis* Leicester, lectotype female (76) in the British Museum; type locality: Pangkor Laut, Perak (Daniels), MALAYSIA. *Orthopodomyia maculata* Theobald, holotype male in Indian Museum; type locality: Maddathurai, Travancore (Annandale), INDIA. *Orthopodomyia maculipes* Theobald, lectotype female in British Museum; type locality: ANDAMAN ISLANDS (Lowis and White). *Orthopodomyia manganus* Baisas, holotype male with associated larval and pupal skins (THIII-5) lost; type locality: Llavac, Laguna, Luzon (Sunico), PHILIPPINES. *Orthopodomyia* (*Orthopodomyia*) *nipponica* LaCasse & Yamaguti, lectotype female with associated pupal skin in U.S. National Museum; type locality: Kyoto, Honshu, JAPAN. *Orthopodomyia* (*Orthopodomyia*) *lemmonae* Thurman, holotype larva (M398-1) in U.S. National Museum; type locality: Doi Chom Cheng of Doi Sutep Range, Chiang Mai (Thurman), THAILAND.

DISTRIBUTION. Specimens examined: ANDAMAN ISLANDS, 4 females. CEYLON, 4 males, 8 females. CHINA, Chekiang, 1 male, 1 female. INDIA, Assam, Himachal Pradesh, Mysore, Uttar Pradesh, 5 males, 7 females, 5 pupae, 19 larvae, 8 rearing. INDONESIA, Java, 1 male, 1 female, 2 pupae, 5 larvae; Sumatra, 4 males, 1 female, 2 pupae. JAPAN, Honshu, 13 males, 5 females, 2 pupae, 22 larvae, 2 rearings. MALAYSIA, Perak, Selangor, 13 males, 11 females, 19 pupae, 20 larvae, 19 rearings. EAST MALAYSIA, Sabah, 9 males, 8 females, 13 pupae, 13 larvae, 14 rearings. NEPAL, 1 larva. PAKISTAN, East Pakistan, 1 larva. PHILIPPINES, Leyte, Luzon, Mindoro, Negros, Palawan, 29 males, 25 females, 23 pupae, 56 larvae, 25 rearings. RYUKYU ISLANDS, Iriomote Island, Ishigaki Island, Okinawa, 30 males, 35 females, 28 pupae, 49 larvae, 28 rearings. SINGAPORE, 3 males, 2 females, 1 pupa, 7 larvae. TAIWAN, 5 males, 11 females, 11 larvae. THAILAND, Chanthaburi, Chiang Mai, Kanchanaburi, Khon Kaen, Nakhon Nayok, Nakhon Ratchasima, Nakhon Si Thammarat, Phangnga, Prachuap Khiri Khan, Ranong, Surat Thani, Tak, Trang, 61 males, 58 females, 52 pupae, 156 larvae, 49 rearings. VIETNAM, 5 males, 3 females, 3 pupae, 12 larvae, 3 rearings. Records from the literature: ANDAMAN ISLANDS (as *maculipes*, Theobald 1910b). CEYLON (as *maculata*, Theobald 1910b). CHINA, Chekiang (Wu 1936), Hainan (as *maculata*, Chu 1957), Hunan (Chang 1957), Yunnan (Chow 1949). INDIA, Assam, Eastern Himalayas, North Bengal, South Bombay, Western Himalayas (Barraud 1927), Malabar, North Kanara (Barraud 1932), Travancore (as *maculata*, Theobald 1910a), United Provinces (Giles 1903). INDONESIA, Java (as *maculata*, Barraud 1934), Kalimantan (as *maculipes*, Haga 1924), Sumatra (as *maculipes*, Brug & Edwards 1931). JAPAN, Honshu (as *nipponica*, LaCasse & Yamaguti 1948). MALAYSIA, Perak (as *nigritarsis*, Leicester 1908), Sabah (Zavortink 1968), Selangor (partly as *andamanensis* and *maculipes*, Macdonald 1958). NEPAL, PAKISTAN, East Pakistan (Zavortink 1968). PHILIPPINES, Leyte, Negros, Mindoro (Zavortink 1968), Luzon (as *manganus*, Baisas 1946), Palawan (as *mcgregori*, Knight & Chamberlain 1948 and as *maculipes*, Knight & Mattingly 1950). RYUKYU ISLANDS, Iriomote, Ishigaki (Bohart 1959), Okinawa (Gentry 1957). SINGAPORE (as *maculipes*, Edwards 1926). TAIWAN (Chow 1950). THAILAND, Chanthaburi, Khon Kaen, Nakhon Nayok, Nakhon Ratchasima, Trang (Zavortink 1968), Chiang Mai (partly as *lemmonae* and *maculata*, Thurman 1959), Nakhon Si Thammarat (as *maculipes*, Edwards 1928).

TAXONOMIC DISCUSSION. *O. anopheloides* and *andamanensis* are a pair of very similar species. The characters which separate them from the other Southeast Asian species are discussed under *andamanensis*. The adult of *anopheloides* is told from that of *andamanensis* by the usual presence of a dark patch or ring distad of the middle of hind tarsomere 3 or hind tarsomeres 3 and 4 and by the usually broader apical white ring on hind tarsomere 2. Male terminalia of *anopheloides* usually have the basal projection of the aedeagus directed more cephalad than in *andamanensis*. The pupa of *anopheloides* differs from that of *andamanensis* by having fewer branches in hairs 1-III and 9-C. The larva of *anopheloides* is distinguished from that of *andamanensis* by having fewer branches in hair 6-I, II.

O. anopheloides is the most variable and widespread of the Southeast Asian species of *Orthopodomyia*. As a result, it has several synonyms. Leicester was apparently unaware of Giles' earlier description when he proposed *nigratarsis* in 1908. *O. maculata* Theobald, 1910a and *maculipes* Theobald, 1910b were based on specimens with different types of leg banding. *O. manganus* Baisas, 1946 and *nipponica* LaCasse & Yamaguti, 1948 were considered to be distinct from *anopheloides* largely on the basis of markings of the proboscis. *O. lemmonae* Thurman, 1959 was based on young fourth instar larvae of the hairy form. Large series of *anopheloides* with associated larval and pupal skins are now available from many parts of the range of the species; study of these series has indicated that only one variable species is involved.

While most adults of *anopheloides* have a dark patch or ring on hind tarsomeres 3 and 4, a few have a patch or ring on only hind tarsomere 3, and even fewer have hind tarsomeres 3 and 4 entirely white scaled. The chaetotaxy of both the larva and pupa of this species is very variable; hairy forms, individuals in which many of the setae are elongate, thickened and more highly branched, are known for both stages.

O. anopheloides is the dominant species of *Orthopodomyia* in the Oriental region. It is found throughout nearly the entire Southeast Asian region.

BIOLOGY. The immature stages of *anopheloides* have been found in tree-holes, bamboo stumps, artificial containers and rock-holes. Adults have been found resting on tree trunks and in vegetation. The aquatic stages may occur with those of *andamanensis* and *madrensis* and adults may rest in the same areas as those of *wilsoni* and *andamanensis*.

HYBRIDS

ANOPHELOIDES X ALBIPES

(Figure 12)

I have seen 4 males with associated larval and pupal skins from northern Thailand, *Chiang Rai*, that I think are hybrids between *anopheloides* and *albipes*. The adults resemble *albipes*, but differ from that species and all other *Orthopodomyia* by having a patch of scales on each side of the clypeus. The larvae and pupae are also similar to *albipes*, but have some less conspicuous features of *anopheloides*. The aedeagus of the male terminalia (Fig. 12) is more or less intermediate between that of *anopheloides* and *albipes*.

NOMEN DUBIUM

ORTHOPODOMYIA MCGREGORI (BANKS)

Kerteszia mcgregori Banks 1909, Philipp. J. Sci. 4: 548 (σ); Edwards 1932, In Wytsman, Genera Insect., fasc. 194: 108 (reduced to synonymy with *albipes*); Baisas 1946, Mon. Bull. Bur. Hlth. Philipp., Manila 22: 34, 35 (suggested leaving status uncertain until topotypic material was available); Knight & Chamberlain 1948, Proc. helm. Soc. Wash. 15: 10 (resurrected from synonymy with *albipes*); Zavortink 1968, Contr. Amer. ent. Inst. 3(2): 154 (changed to status of *nomen dubium*).

TYPE DATA. *Kerteszia mcgregori* Banks, holotype male destroyed; type locality: *Basilan Island* (Mcgregor), PHILIPPINES.

TAXONOMIC DISCUSSION. I am following Baisas (1946: 34, 35) in considering *mcgregori* to be a *nomen dubium*. Although Banks' description of *mcgregori* is unusually detailed for descriptions of that time, it remains uncertain to what taxon the name applies. However, the species is not *albipes*, as thought by Edwards (1932: 108). The *mcgregori* of Knight & Chamberlain (1948: 10) and Knight & Mattingly (1950: 13) is *anopheloides*.

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Fig. 1

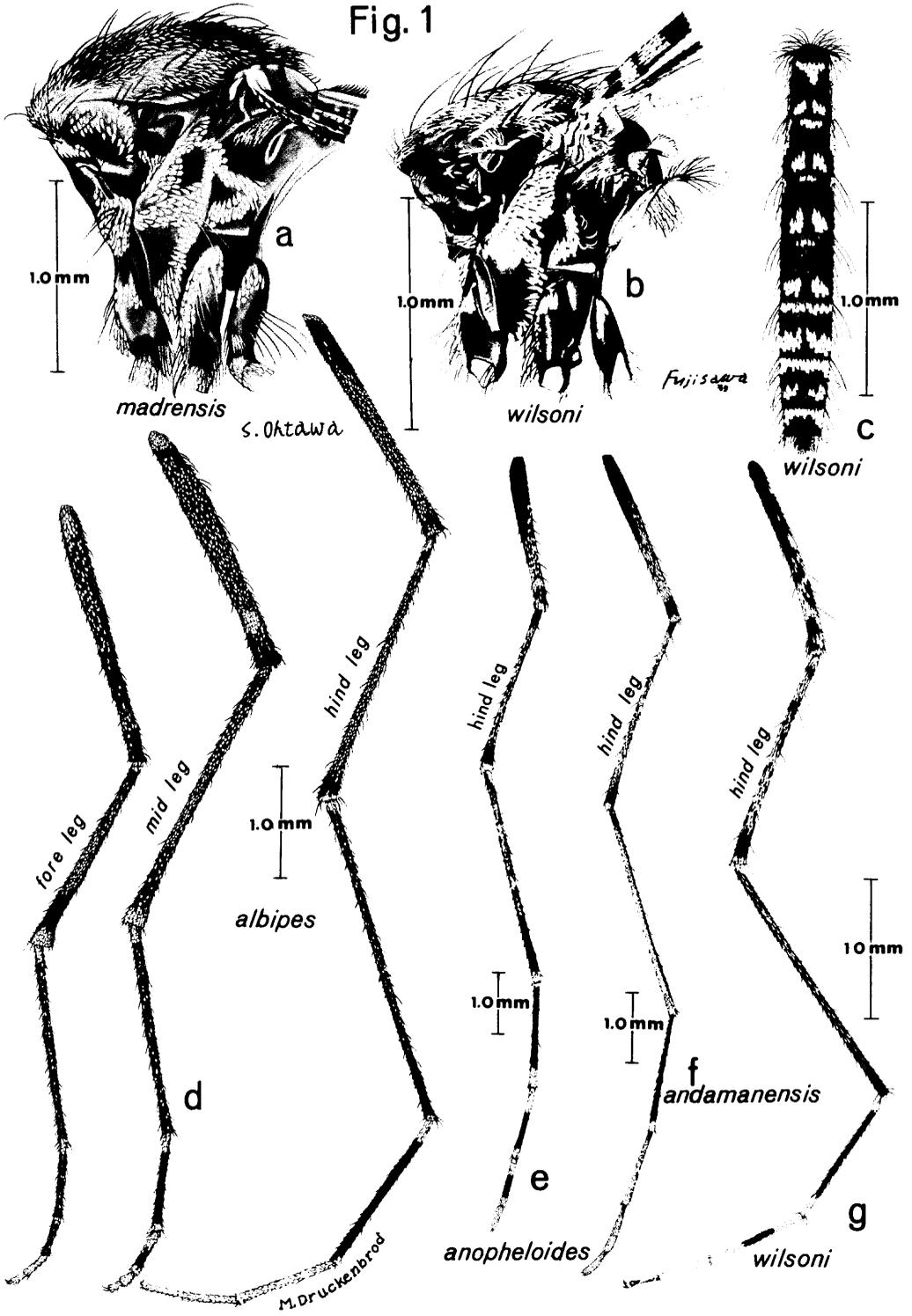


Fig. 2

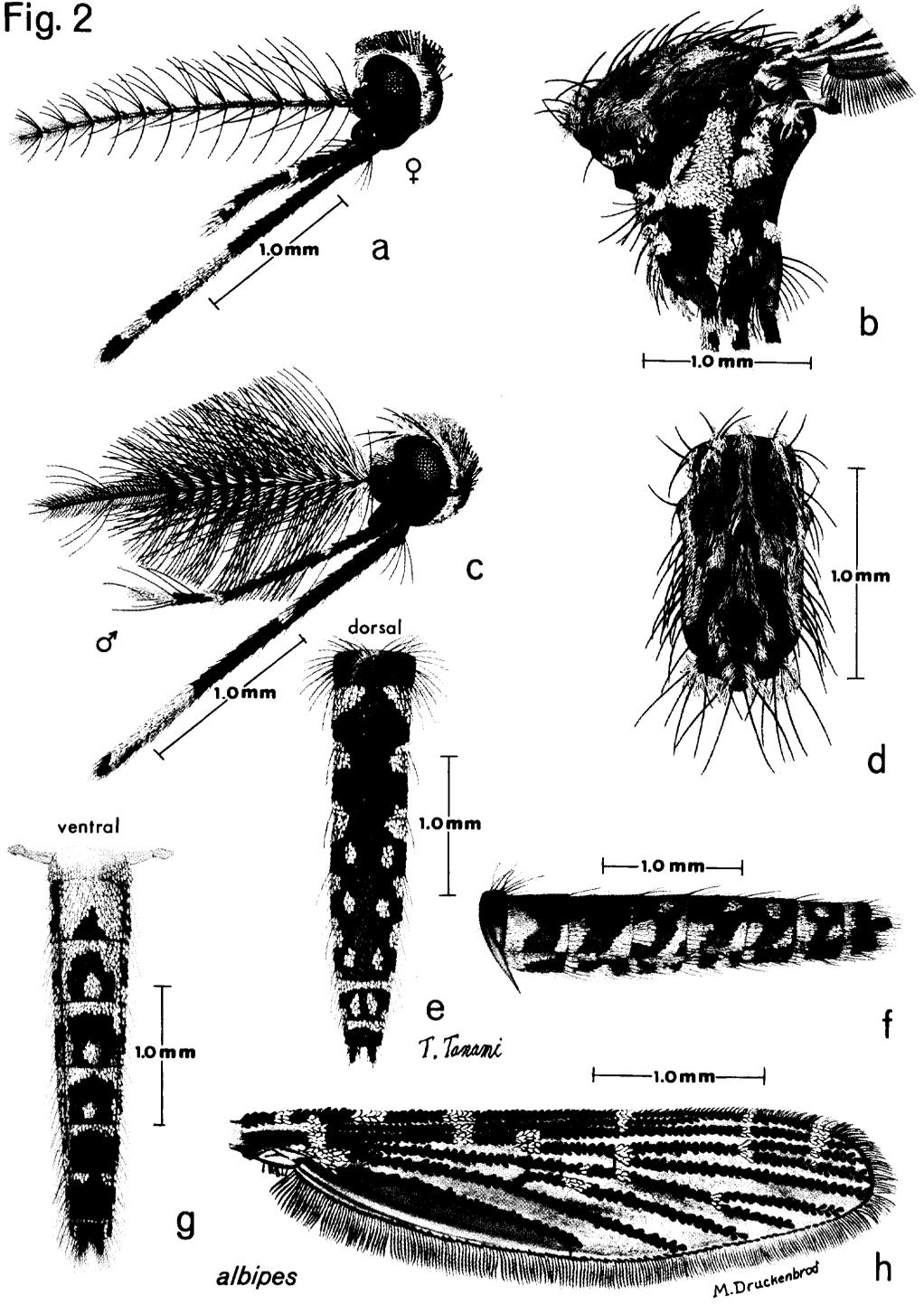
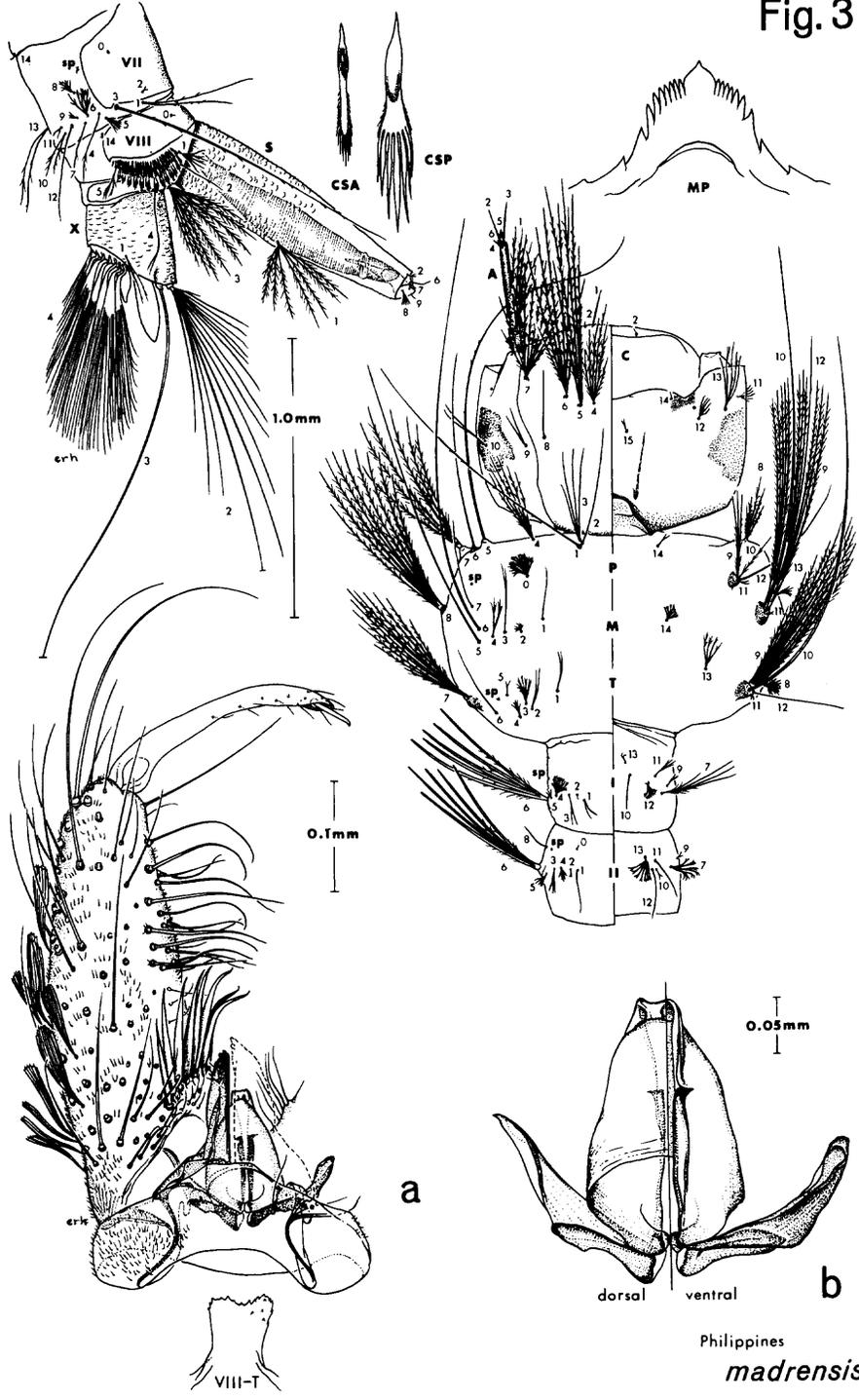


Fig. 3



Philippines
madrensis

Fig. 4

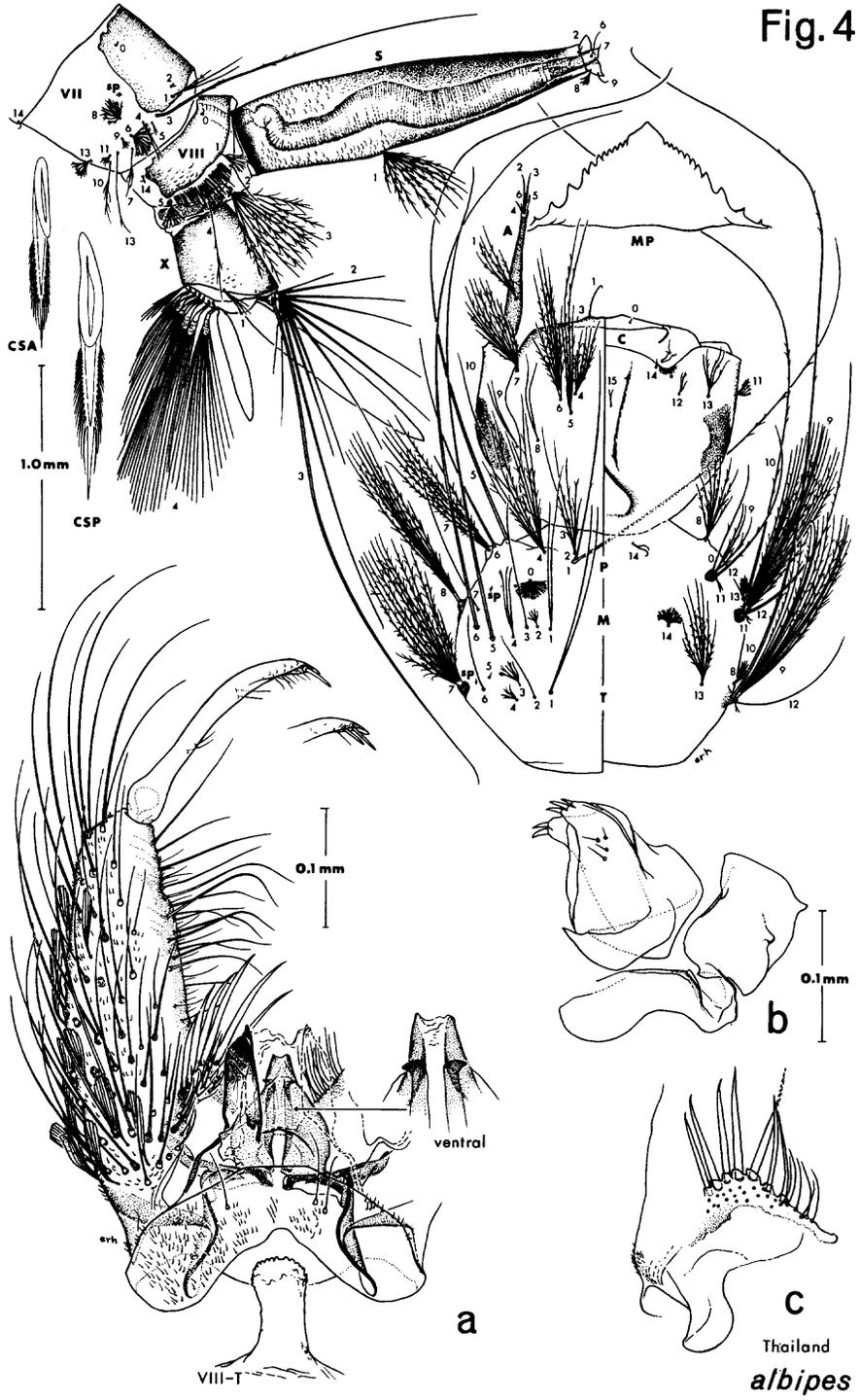


Fig. 5

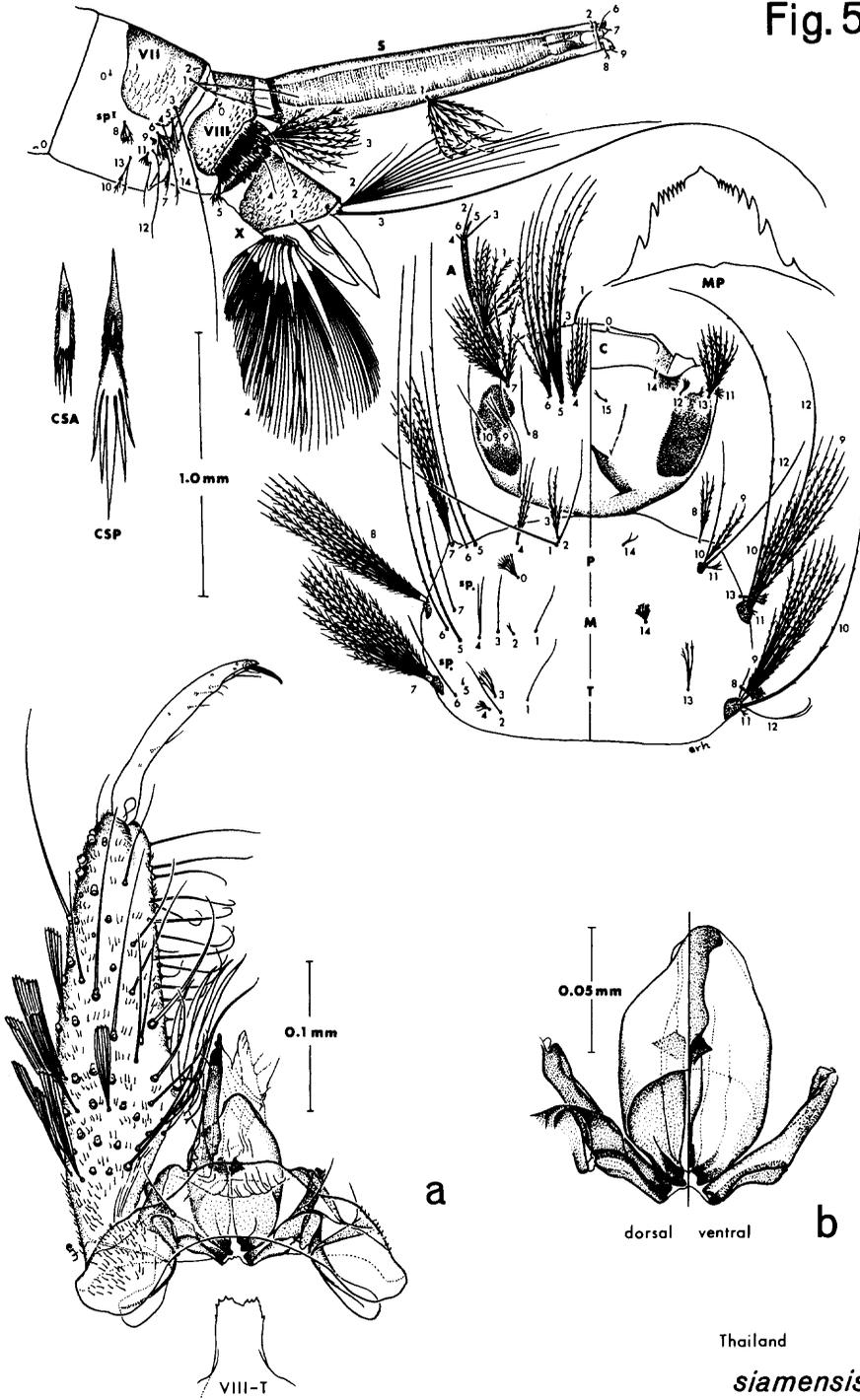


Fig.6

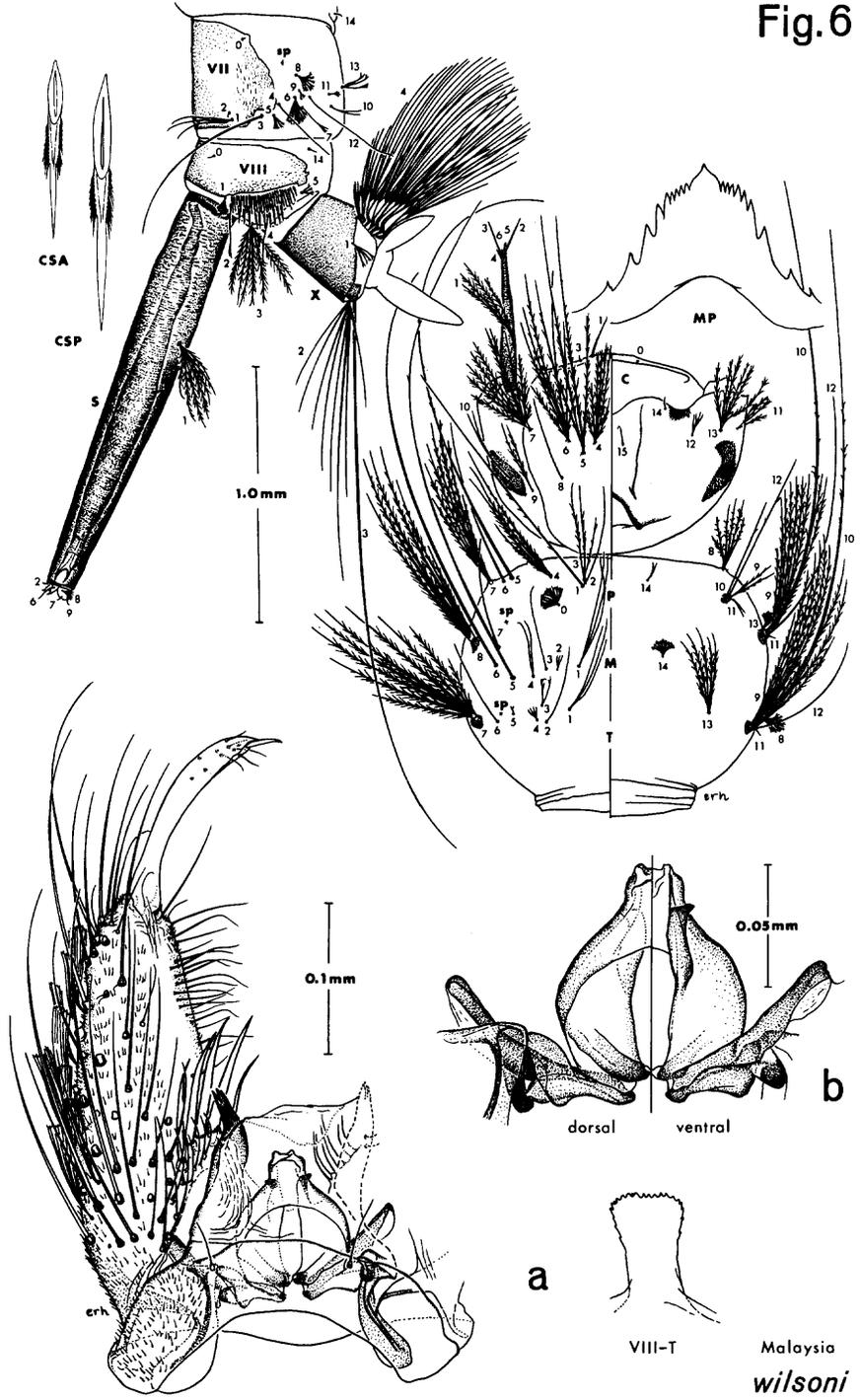


Fig. 7

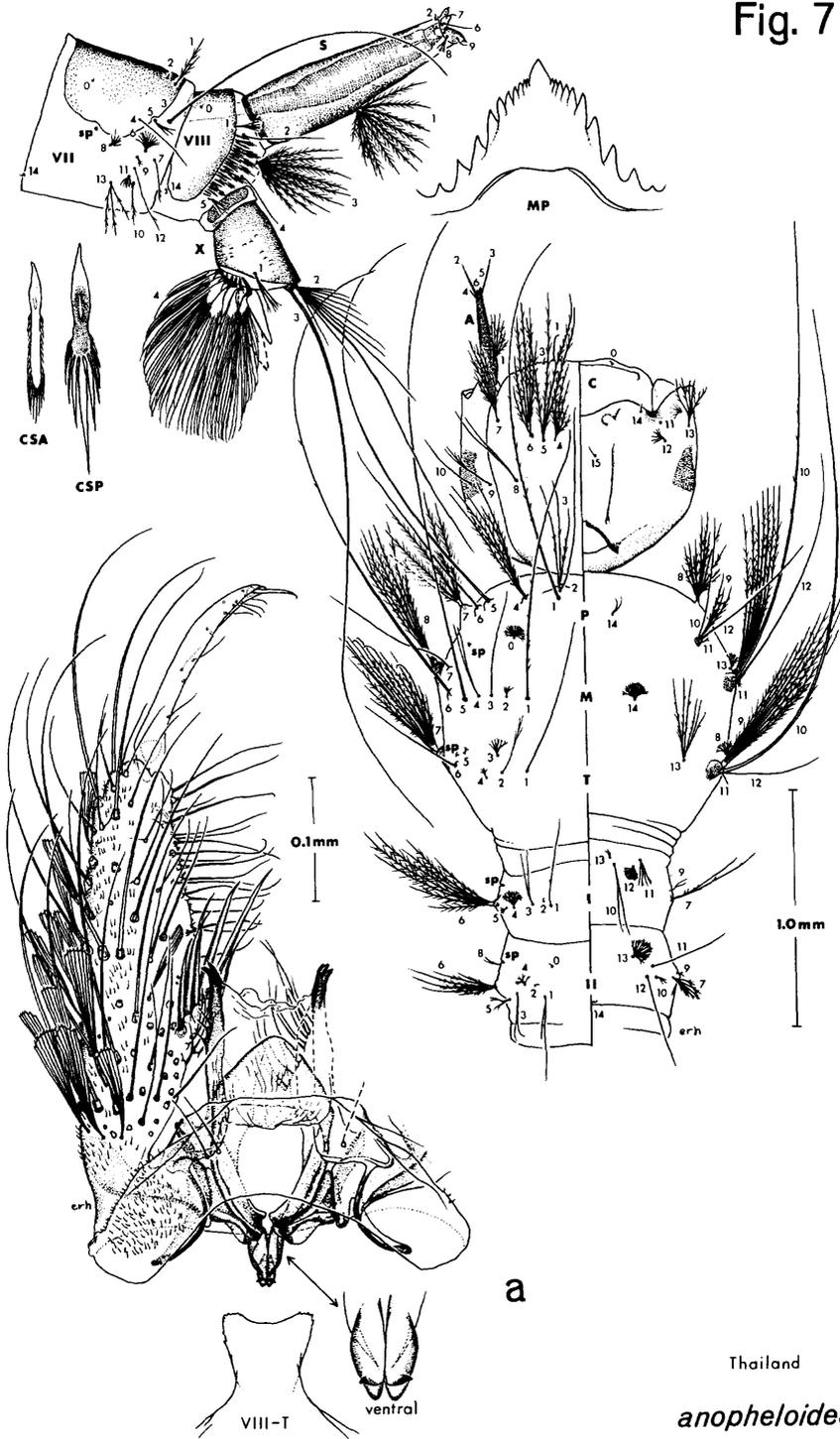


Fig.8

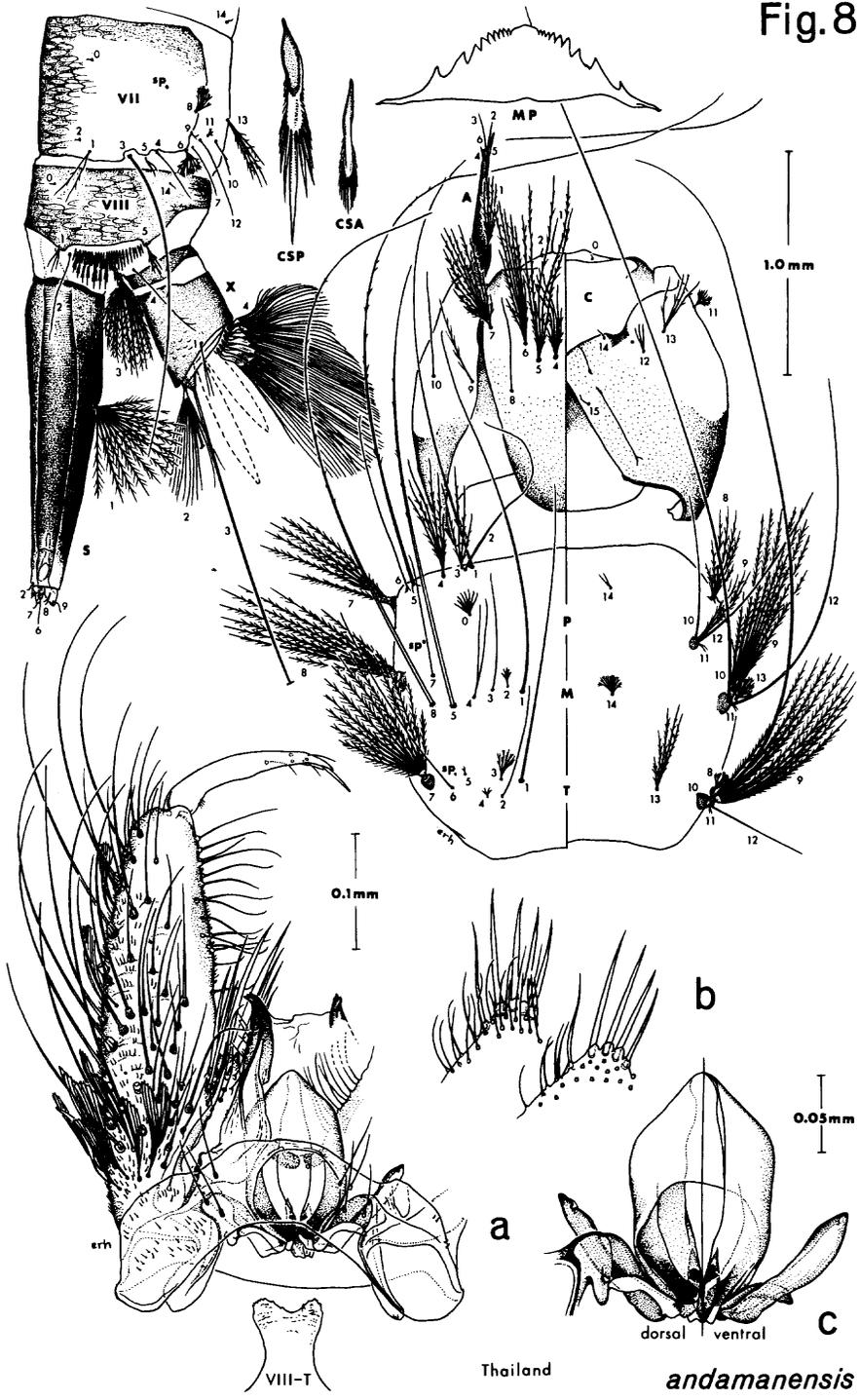
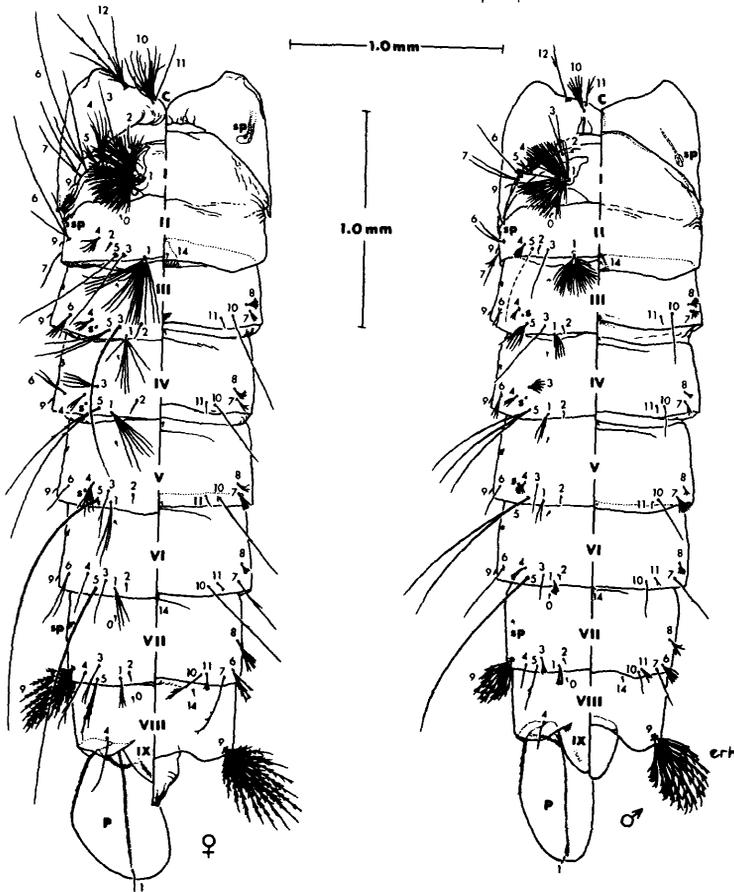
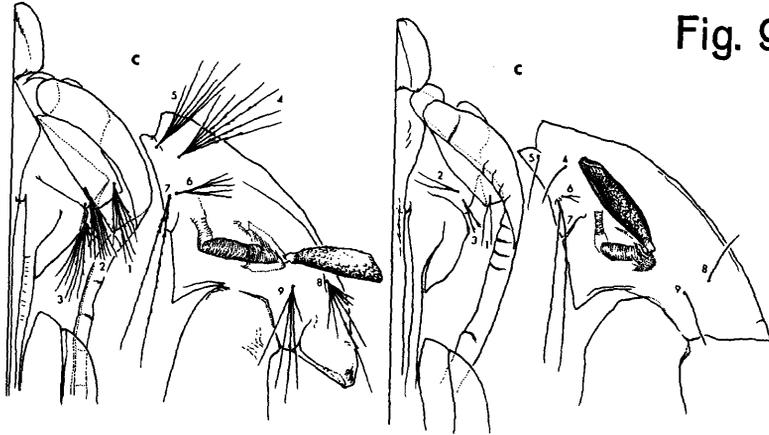


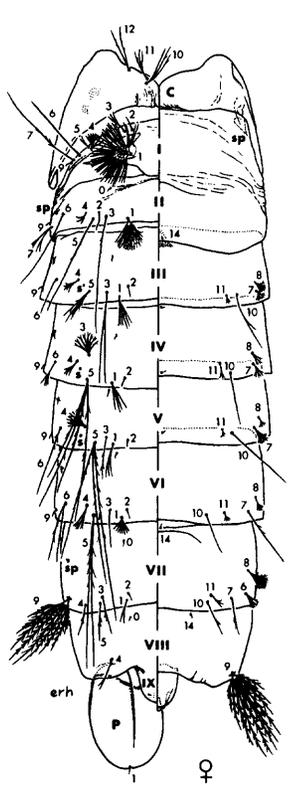
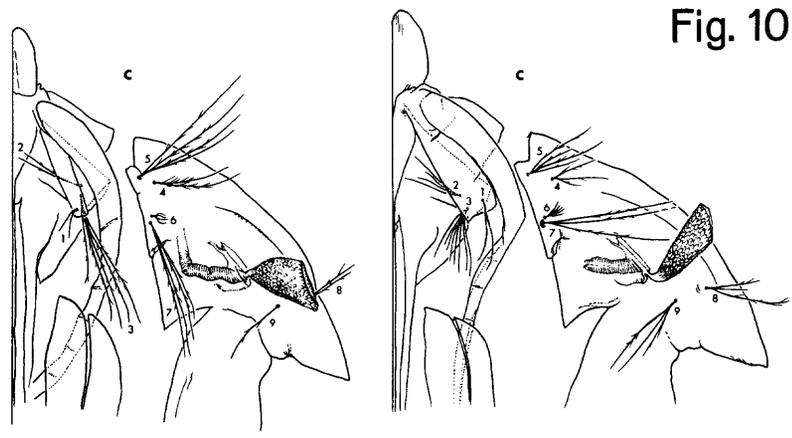
Fig. 9



Thailand
siamensis

Malaysia
wilsoni

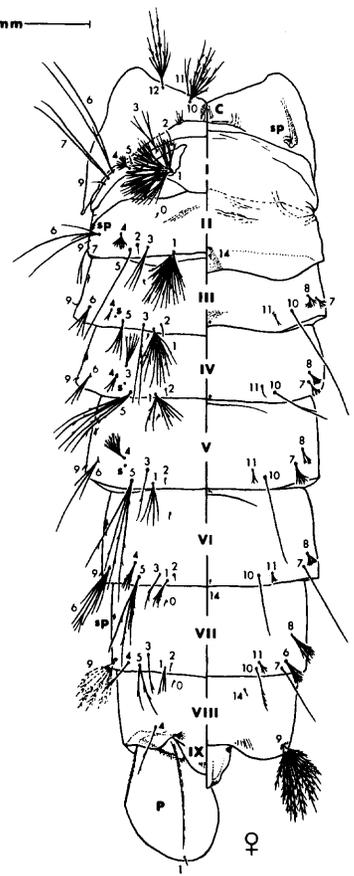
Fig. 10



Thailand
albipes

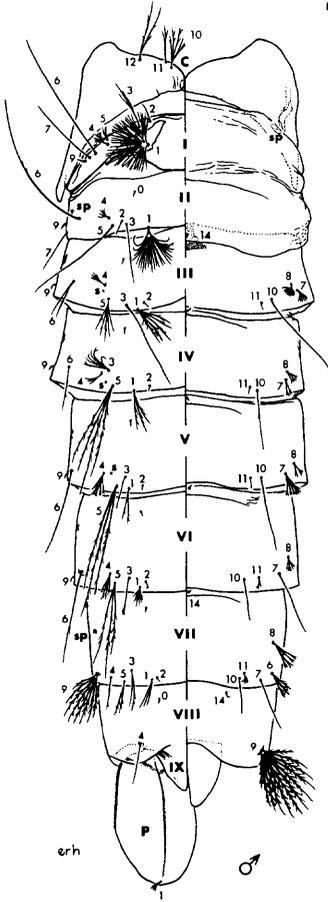
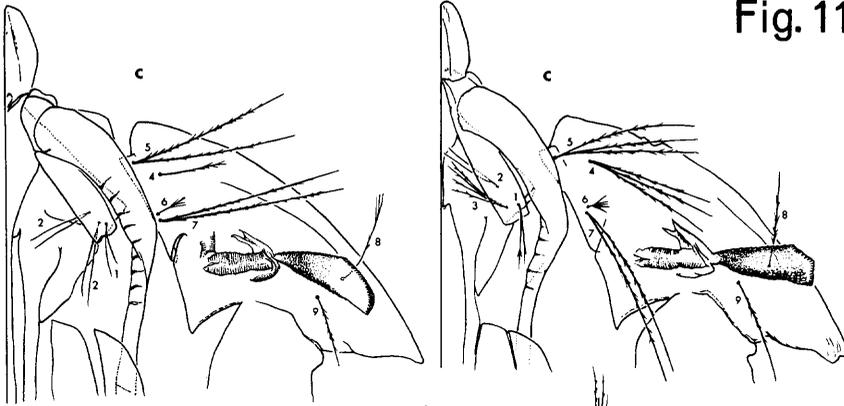
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1.0 mm



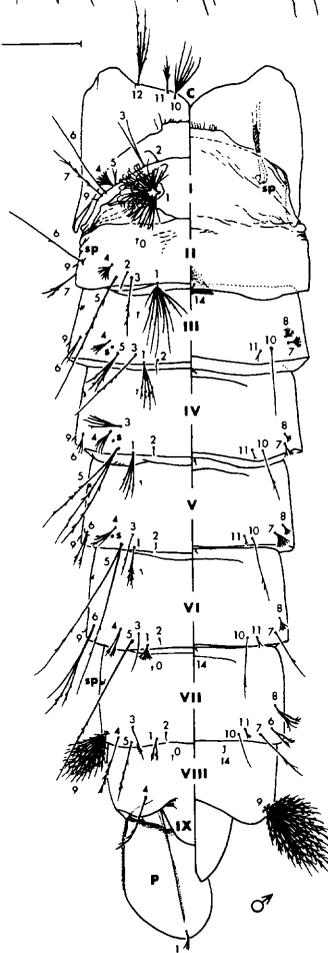
Philippines
andamanensis

Fig. 11



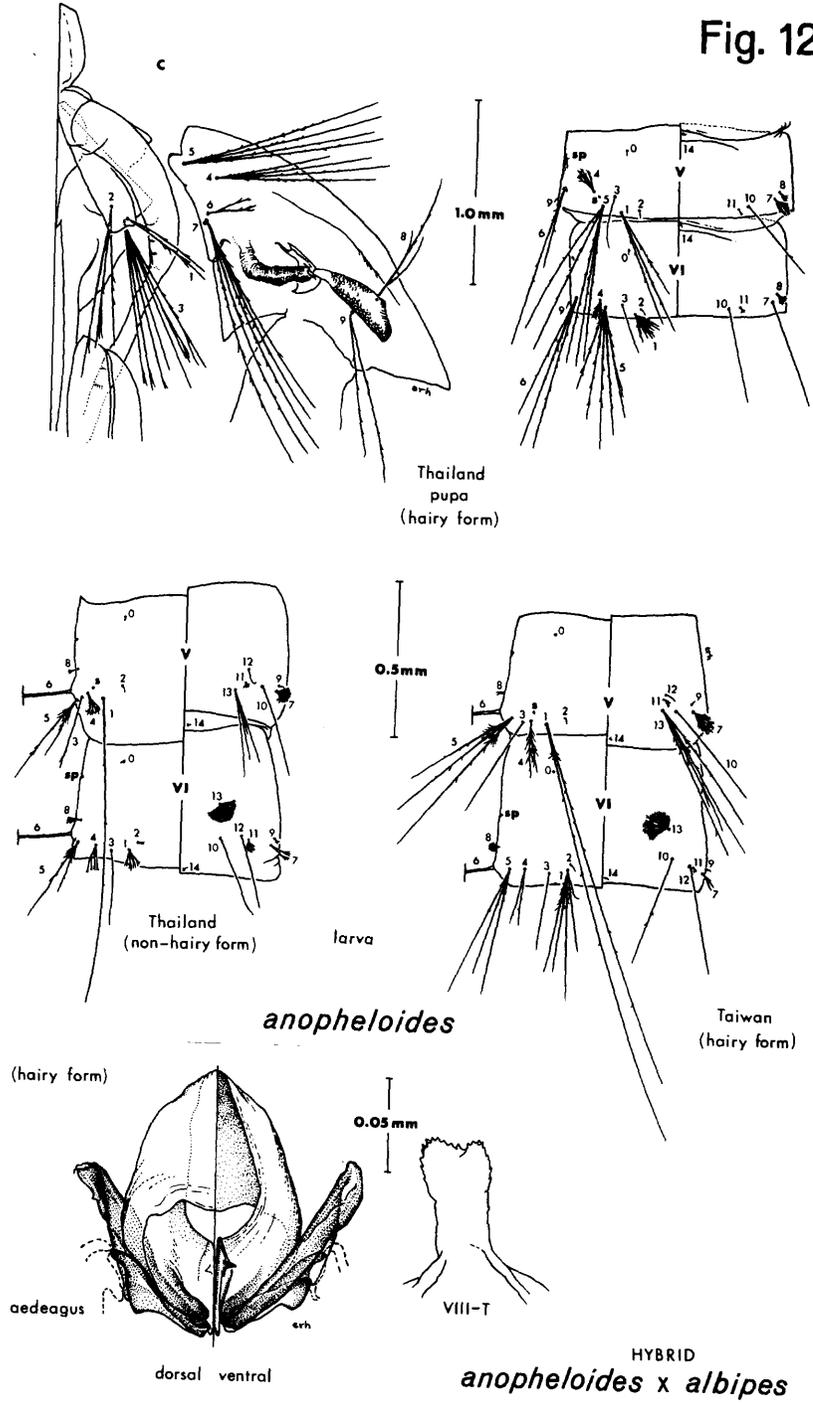
Thailand
anopheloides

1.0mm



Philippines
madrensis

Fig. 12



INDEX

Names of valid taxa included in the present study are in roman type. Synonyms, valid extralimital species, misidentifications and *nomina dubia* are in italic type. Italic numerals are used for the principal text reference, roman numerals for secondary text references, and roman numerals in parentheses for figures.

albipes Leicester	3, 4, 5, 6, 10, 12, 13, 14, 19, 20 (1, 2, 4, 10)
albipes group	1, 3, 6, 8
albipes subgroup	3, 12
andamanensis Barraud	3, 4, 5, 6, 10, 12, 14, 16, 17, 19 (1, 8, 10)
anopheloides (Giles)	3, 4, 5, 6, 8, 10, 12, 14, 16, 17, 18, 19, 20 (1, 7, 11, 12)
anopheloides subgroup	3, 6, 10, 14
anopheloides subgroup of Knight & Mattingly	1
anopheloides x albipes	19 (12)
flavicosta Barraud	3, 6
flavicosta subgroup	3, 6, 14
flavithorax Barraud	3, 6
lanyuensis Lien	3, 4, 5, 6, 7, 8, 9, 10, 11
<i>lemmonae</i> Thurman	17, 18, 19
<i>maculata</i> Theobald	16, 18, 19
<i>maculipes</i> Theobald	16, 18, 19
madrensis Baisas	3, 4, 5, 6, 7, 8, 9, 10, 19 (1, 3, 11)
<i>manganus</i> Baisas	17, 18, 19
<i>mcgregori</i> (Banks) nomen dubium	20
<i>mcgregori</i> of authors	17
<i>nigritarsis</i> Leicester	16, 18, 19
<i>nipponica</i> LaCasse & Yamaguti	17, 18, 19
papuensis Zavortink	3, 14, 16
siamensis Zavortink	3, 4, 5, 6, 9, 10, 14, 16 (5, 9)
wilsoni Macdonald	3, 4, 5, 6, 11, 12, 13, 14, 19 (1, 6, 9)
wilsoni subgroup	3, 10