

A Redescription of *Aedes (Stegomyia) calceatus* Edwards and
Description of a New Afrotropical Species, *Aedes*
(*Stegomyia*) *ledgeri* (Diptera: Culicidae)¹

by

Yiau-Min Huang
Medical Entomology Project
Smithsonian Institution
Washington, D. C. 20560

ABSTRACT. The adult male and female of *Aedes (Stegomyia) calceatus* Edwards are redescribed and illustrated from Edwards' holotype and the existing paratypes in the British Museum (Natural History) and the United States National Museum. A new species, *Aedes (Stegomyia) ledgeri*, is described and illustrated. Diagnostic characters for separating *ledgeri* from closely allied species are given. The distributions (based on examined specimens) of *ledgeri* and *calceatus* are presented.

INTRODUCTION

This paper is part of a revision of the subgenus *Stegomyia* of *Aedes* in the Afrotropical Region. Its purpose is to redescribe *Aedes (Stegomyia) calceatus* Edwards, describe a new closely related species, *Ae. (Stg.) ledgeri*, and to attempt to clarify certain taxonomic problems involving the nominal species *calceatus*. Because of the medical importance of many species in the subgenus *Stegomyia* and the similarity of this new species with *calceatus*, I believe that *Ae. (Stg.) ledgeri* should be described at this time. Since nothing is known concerning the medical importance of *ledgeri*, it is hoped that this note will stimulate investigations on that subject. To facilitate such work, diagnostic characters are given for separating *ledgeri* from the other morphologically similar species.

This study is based on specimens that have been collected or otherwise acquired by the Medical Entomology Project (MEP), Department of Entomology, Smithsonian Institution [USNM], and specimens that have been borrowed from individuals and institutions mentioned in the acknowledgments at the end of this paper. In the material examined section for each species, unless otherwise designated by an asterisk, the geographic coordinates for the various localities listed under Kenya are those for the nearest populated area or district; geographic coordinates for other countries come from either Mattingly (1952), Muspratt (1956) or from MEP collection records.

¹This work was supported by Research Contract No. DAMD-17-74-C-4086 from the U.S. Army Medical Research and Development Command, Office of the Surgeon General, Fort Detrick, Frederick, MD 21701.

Report Documentation Page

Form Approved
OMB No. 0704-0188

Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

1. REPORT DATE 1981	2. REPORT TYPE	3. DATES COVERED 00-00-1981 to 00-00-1981		
4. TITLE AND SUBTITLE A Redescription of Aedes (Stegomyia) calceatus Edwards and Description of a New Afrotropical Species, Aedes (Stegomyia) ledgeri (Diptera: Culicidae)		5a. CONTRACT NUMBER		
		5b. GRANT NUMBER		
		5c. PROGRAM ELEMENT NUMBER		
6. AUTHOR(S)		5d. PROJECT NUMBER		
		5e. TASK NUMBER		
		5f. WORK UNIT NUMBER		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Smithsonian Institution, Medical Entomology Project, Washington, DC, 20560		8. PERFORMING ORGANIZATION REPORT NUMBER		
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)		10. SPONSOR/MONITOR'S ACRONYM(S)		
		11. SPONSOR/MONITOR'S REPORT NUMBER(S)		
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited				
13. SUPPLEMENTARY NOTES				
14. ABSTRACT see report				
15. SUBJECT TERMS				
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified	Same as Report (SAR)	18. NUMBER OF PAGES 22
				19a. NAME OF RESPONSIBLE PERSON

The terminology used for the morphology of the larva, pupa and adult follows that of Belkin (1962) and Huang (1979).

Aedes (Stegomyia) calceatus Edwards

Figs. 1, 2, 8

Aedes (Stegomyia) calceatus Edwards 1924:197. TYPE: Holotype male, with associated genitalia on a plastic plate labeled "E. Africa/Lindi, 1923/ In coconut palms/Dr. W. E. Haworth/BM 1924-130". Type-locality: Lindi, TANZANIA, 1923, W. E. Haworth [BM].

Descriptions based on holotype and paratypes.

FEMALE. *Head*. Proboscis dark-scaled, without pale scales on ventral surface, about length of forefemur; palpus about 0.25 length of proboscis, with white scales on apical half; torus covered with white scales except on dorsal surface; clypeus bare; occiput with few erect forked scales; a row of broad white scales around eye margins: beginning dorsally at vertex continuing ventrally to gena with narrow to moderately wide bands of broad scales alternating as follows: white, dark, white, dark, white. *Thorax*. Scutum with narrow dark scales and with a distinct, median spot of broad white scales on anterior border, with a median longitudinal stripe of narrow white scales, usually indistinct or incomplete in anterior 0.60-0.66 of scutum, reaching to prescutellar space; prescutellar white lines present, connected or not connected with median longitudinal stripe at anterior margin of prescutellar space; fossal area with a large patch of broad crescent-shaped white scales; posterior dorsocentral white scales present as a line, reaching to posterior 0.4 of scutum; immediately anterad of wing root with a patch of narrow white scales on lateral margin; acrostichal setae absent; dorsocentral setae present; scutellum with broad white scales on all lobes and with a few broad dark scales at apex of midlobe; anterior pronotum with broad white scales; posterior pronotum with a patch of broad white scales and dorsally with a few narrow dark scales; paratergite with broad white scales; postspiracular area without scales; hypostigial area without scales; propleuron, subspiracular area, upper and lower sternopleuron, and upper and lower mesepimeron with a patch of broad white scales; upper sternopleural scale patch not reaching to anterior corner of sternopleuron; upper mesepimeral scale patch connecting with lower mesepimeral scale patch; lower mesepimeron without setae; metameron bare. *Wing*. With dark scales on all veins except for a minute basal spot of white scales on costa; cell R_2 about 2.2 length of vein R_{2+3} . *Halter*. With dark scales. *Legs* (Figs. 1,8). Coxae with patches of white scales; white knee-spot absent on forefemur, present on mid- and hindfemur; forefemur anteriorly with a narrow white longitudinal stripe on ventral surface in basal 0.4-0.5; midfemur with a large white spot on anterior surface about 0.6 from base; hindfemur anteriorly with a broad white longitudinal stripe in basal 0.60-0.63 that widens 0.33 from base; foretibia anteriorly dark, with a basal white band; midtibia anteriorly dark, with a small basal white spot on posterior surface; hindtibia anteriorly dark, with a white longitudinal stripe on ventral surface in basal 0.22-0.25;

foretarsomere 1 with basal 0.16-0.20 white on dorsal surface; foretarsomere 2 with basal 0.4-0.5 white on dorsal surface; midtarsomere 1 with basal 0.25 white on dorsal surface, with a white stripe on posterior surface running entire length of tarsomere; midtarsomere 2 with basal 0.33-0.50 white on dorsal surface, with a white stripe on posterior surface in basal 0.9-1.0; midtarsomere 3 sometimes with posterior surface 0.33 basally white; hindtarsus with a basal white band on tarsomeres 1-3, ratio of length of white band on dorsal surface to length of tarsomere 0.33, 0.40 and 0.33 respectively; hindtarsomere 4 all white except apex on ventral surface; hindtarsomere 5 all dark; fore- and midleg with tarsal claws equal and toothed; hindleg with tarsal claws equal, simple. *Abdomen.* Tergum I with white scales on laterotergite, usually without basomedian white spot; terga II-VII each with a basal white band and a basolateral white spot not connecting with basal white band; sterna III-VII each with a basal white band; segments VIII largely retracted. *Genitalia.* Description based on single dissected specimen. Apical margin of sternum VIII with a median notch and with a conspicuous rounded lateral lobe; insula longer than wide, with minute setae and with 7 larger setae in apical 0.25; apical margin of tergum IX with a well developed lateral lobe, with 5-6 setae; apical margin of postgenital plate without a shallow median notch; cercus short and broad; 3 spermathecae, one larger than other 2.

MALE. Essentially as in female, differing in following sexual characters: *Head.* Palpus 5-segmented, about length of proboscis, predominantly dark, with a white band at base of segments 2-5, those of segments 4,5 dorsally incomplete; segments 4,5 subequal, slender, dorsally curved, with only a few short setae; antenna plumose, shorter than proboscis. *Wing.* Cell R_2 about 1.7 length of vein R_{2+3} . *Legs* (Figs. 1,8). Foretarsomere 1 usually with a white stripe on posterior surface running entire length of tarsomere; midtarsomere 1,2 all white on posterior surface; fore- and midleg with tarsal claws unequal, the smaller one toothed, the larger one simple. *Abdomen.* Tergum I sometimes with a small, basomedian white spot; sternum VIII with basolateral white spots only. *Genitalia* (Fig. 2). Basimere about 2.0 as long as wide (width measured 0.5 from base), scales restricted to dorsolateral, lateral and ventral surfaces, with setae on dorsomesal surface, mesal surface membranous; claspette large, lobed, subtriangular in shape in dorsal aspect, with numerous simple setae and with 3 or 4 somewhat stronger, basally widened setae on apicosternal angle of expanded distal lobe; distimere simple, elongate, about 0.6 length of basimere, with a spiniform process at or near apex and with a few setae in apical 0.6; aedeagus strongly toothed, with lateral teeth much longer and stouter than distal teeth; paraproct with a long sternal arm about 1.0-1.4 length of apical arm, cercal sclerites well developed, usually with 2-5 long setae; apical margin of tergum IX slightly concave medially with 6-12 setae on lateral lobe; sternum IX without setae.

PUPA and LARVA. Not described. Only colony specimens in poor condition available.

DISTRIBUTION (Map 1). Based on the present collection data, *Aedes calceatus* occurs mainly along the coast of Kenya and Tanzania. It is also found in Shamva, Zimbabwe. Worth and De Meillon (1960:240) recorded *calceatus* from Mozambique, and Ribeiro and Ramos (1973:121) recorded *calceatus* from Angola. I have not seen any specimens from either of the latter countries; therefore, these records need confirmation in light of the new species *ledgeri*.

MATERIAL EXAMINED. 81 specimens: 18 males, 17 females, 14 male genitalia, 1 female genitalia, 9 larvae; 11 individual rearings (11 larval).

KENYA. *Coast Region*: Kwale (4° 11' S, 39° 27' E), Apr-July 1951, 2 ♂, 1 ♀, 2 ♂ gen (MEP Acc. 808, 80/39, 80/40) [DVBD]; Diani (4° 19' S, 39° 32' E), 21 May 1951, 1 ♂, 1 ♂ gen (MEP Acc. 808, 80/41) [DVBD]; Shimba Hills, National ex. Achatina Park (*4° 14'-18' S, 39° 22'-23' E), Aug, Dec, 1976, L. P. Lounibos, 2 ♂, 2 ♂ gen (MEP Acc. 788, 79/218, 79/219) [USNM]; Shimba, Mkonokono (? Shimba Forest Reserve, 4° 15' S, 39° 25' E), Dec 1976, 1 ♀ [BM]; Shimba Hills (4° 13' S, 39° 25' E), (snail shell) May 1977, 1 ♀ [identified as *Ae. conchobius* Munstermann, unpublished manuscript name, in BM, listed as *nomen nudum* in Knight (1978:71)]; F2 laboratory colony, University of Notre Dame, Sept 1978, [Parental generation collected as larvae from Kinondo Forest (*4° 18' S, 39° 22' E), May 1977, L. P. Lounibos] (MEP Acc. 788), 5 1p♂ (ND-2,11,21,22,28), 6 1p♀ (ND-1,7,12,20,27,30), 3 ♂ gen (MEP Acc. 788, 79/216, 79/217, 79/235), 9 L (F2) [USNM].

ZIMBABWE (S. Rhodesia). Shamva (17° 20' S, 31° 37' E), Mar 1928, K. S. Leeson, 1 ♀ [BM].

TANZANIA (Tanganyika). Lindi (10° 00' S, 39° 42' E), 1923, Dr. W. E. Haworth: holotype 1 ♂, with male genitalia remounted on a slide (MEP Acc. 828), paratypes 6 ♂, 6 ♀, 4 ♂ gen (MEP Acc. 719, 79/232, 79/233, 79/234, 80/31), 1 ♀ gen (MEP Acc. 719, 80/59) [BM]; paratypes 1 ♂, 1 ♀, 1 ♂ gen (80/58) [USNM].

TAXONOMIC DISCUSSION. Edwards wrote in his original description of *calceatus* regarding the type specimens, "Lindi, 1923; a series reared from larvae found in the water in the leaf-bases of coconut palms (Dr. W. E. Haworth). Type ♂, paratypes 7 ♂, 7 ♀ in the British Museum, presented by the collector." Later, Edwards (1941:142) redescribed and illustrated *calceatus*, and extended its distribution to include Shamva and Bindura, Zimbabwe. I have had the opportunity of examining at the British Museum (Natural History) the holotype male, and 6 males and 6 females all bearing the same data as the holotype that are believed to be part of Edwards' paratypes. I have also examined one male and one female with the same data as the holotype in the United States National Museum. The female is labeled "paratypes" in Edwards' hand.

Aedes calceatus is a member of the *Aegypti* Group, which is distinguished from other groups of the subgenus *Stegomyia* by (1) palpus possessing white scales, (2) scutum with dorsocentral setae present (3) scutum with a patch of broad crescent-shaped white scales on fossal area, (4) subspiracular area with broad white scales, (5) postspiracular area without scales and (6) paratergite with broad white scales. *Aedes calceatus*

can easily be distinguished from all other members of the Aegypti Group by the following combination of characters: (1) midfemur with a large, white spot on anterior surface in basal 0.6 of segment, (2) midtarsomere 1 with a white stripe on posterior surface, running entire length of tarsomere, (3) midtarsomere 2 with a white stripe on posterior surface in basal 0.9-1.0, (4) hindtibia with a white stripe on ventral surface in basal 0.25, (5) hindtarsomere 3 with basal 0.25-0.33 white, (6) hindtarsomere 4 all white except at apex and (7) hindtarsomere 5 entirely dark.

The male genitalia of *calceatus* is easily differentiated from all other species in the Aegypti Group by (1) a large lobed claspette with numerous simple setae and with 3 or 4 somewhat stronger basally widened setae on apicosternal angle of expanded distal lobe, (2) paraprocts with sternal arms at least as long as apical arms, (3) proctiger with cercal sclerites well developed usually with 2-5 long setae, (4) apical margin of tergum IX slightly concave medially and with 6-12 setae on each lateral lobe.

BIONOMICS. The immature stages of *calceatus* have been collected in bamboo pots placed on the ground inside the forest, in Kwale, Kenya, and in snail shells, in Diani, Shimba Hills and Kinondo Forest, Kenya. Presence of larvae in coconut palm crowns at Lindi, Tanzania, was an artifact resulting from deliberate introduction by the local collector (Lester 1927:139,144, Wiseman et al. 1939:27).

Mattingly (1953:31) stated that *Aedes calceatus* had not been reported to bite man. Muspratt (1956:68) reported that in South Africa, several females of this species have been collected biting man in northern Natal (Tongaland) and the western Transvaal; however, Muspratt's *calceatus* is not really *calceatus*, but is the new species *ledgeri*.

MEDICAL IMPORTANCE. Unknown.

Aedes (Stegomyia) ledgeri new species

Figs. 1, 2, 3, 4, 5, 6, 7, 8

This species is named in honor of Dr. John A. Ledger, Head, Department of Medical Entomology, The South African Institute for Medical Research, Johannesburg, South Africa, in recognition and appreciation of his contributions to our knowledge of the mosquito fauna of South Africa.

Aedes (Stegomyia) calceatus of De Meillon and Lavoipierre 1944:56 (L*); De Meillon, Parent, and Black 1945:99 (P*); Hopkins 1952:148 (L*); Mattingly 1953:11 (♂, ♀, taxonomy) (in part); Muspratt 1956:67 (♂*, ♀*, L).

FEMALE. *Head*. Proboscis dark scaled, without pale scales on ventral surface, longer than forefemur; palpus about 0.2 length of proboscis, with white scales on apical half; torus covered with white scales except on dorsal and ventral surfaces; clypeus bare; occiput with few erect forked scales; with a row of broad white scales around eye margins; beginning dorsally at vertex continuing ventrally to gena, with narrow to moderately

wide, bands of broad scales alternating as follows: white, dark, white, dark, white. *Thorax*. Scutum with narrow dark scales and with a distinct median spot of broad white scales on anterior border, with a short median longitudinal stripe of narrow white scales, reaching to prescutellar space, absent in anterior 0.66 of scutum; prescutellar white line well developed, usually connected with median longitudinal stripe at anterior margin of prescutellar space; fossal area with a large patch of broad crescent-shaped white scales; posterior dorsocentral white scales present as a line, reaching to posterior 0.33 of scutum; immediately anterad of wing root with a patch of narrow white scales on lateral margin; acrostichal setae absent; dorsocentral setae present; scutellum with broad white scales on all lobes, sometimes with a few broad dark scales at apex of midlobe; anterior pronotum with broad white scales; posterior pronotum with a patch of broad white scales and dorsally with a few narrow dark scales; paratergite with broad white scales; postspiracular area without scales; hypostigial area without scales; propleuron, subspiracular area, upper and lower sternopleuron, and upper and lower mesepimeron with a patch of broad white scales; upper sternopleural scale patch not reaching to anterior corner of sternopleuron; upper mesepimeral scale patch connecting with lower mesepimeral scale patch; lower mesepimeron without setae; metameron bare. *Wing*. With dark scales on all veins except for a minute basal spot of white scales on costa; cell R₂ about 2.2 length of R₂₊₃. *Halter*. With dark scales. *Legs* (Figs. 1,7,8). Coxae with patches of white scales; white knee-spot absent on forefemur, present on mid- and hindfemur; forefemur anteriorly with a narrow white longitudinal stripe on ventral surface in basal 0.33-0.50; midfemur with a large white spot on anterior surface about 0.6 from base; hindfemur anteriorly with basal 0.25-0.33 white, and with a large white spot about 0.6 from base, sometimes with basal white area connecting with the median white spot on ventral half of anterior surface; foretibia anteriorly dark, with a basal white band; midtibia anteriorly dark, sometimes with a small basal white spot on posterior surface; hindtibia anteriorly dark, with a white longitudinal stripe on ventral surface in basal 0.25; foretarsomere 1 with basal 0.20-0.25 white on dorsal surface, with a white stripe running entire length on posterior surface; foretarsomere 2 with basal 0.33-0.50 white on dorsal surface; midtarsomere 1 with basal 0.20-0.25 white on anterior surface and all white on dorsal and posterior surfaces; midtarsomere 2 with basal 0.33-0.40 white on anterior surface and white in basal 0.9-1.0 on dorsal and posterior surfaces; midtarsomere 3 sometimes with basal 0.33-0.66 white on posterior surface; hindtarsus with a basal white band on tarsomeres 1-3, ratio of length of white band on dorsal surface to length of tarsomere 0.30-0.33, 0.40 and 0.10-0.17 respectively; hindtarsomere 4 all white except at extreme apex; hindtarsomere 5 all dark; fore- and midleg with tarsal claws equal and toothed; hindleg with tarsal claws equal, simple. *Abdomen*. Tergum I with white scales on laterotergite, sometimes with a small basomedian white spot; terga II-VII each with a basal white band and a basolateral white spot not connecting with the basal white band; sterna III-VII each with a basal white band; segment VIII largely retracted. *Genitalia* (Fig. 4). Apical margin of sternum VIII with a median notch and with a conspicuous rounded lateral lobe; insula longer than wide, with minute setae and with 5-7 larger setae in apical 0.25-0.50; apical margin of tergum IX with a well developed lateral lobe, with 2-6 setae;

apical margin of postgenital plate with a shallow median notch; cercus short and broad; 3 spermathecae, one larger than the other 2.

MALE (Fig. 3). Essentially as in the female, differing in the following sexual characters: *Head*. Palpus 5-segmented, slightly shorter than proboscis, predominantly dark, with a white band at base of segments 2-5, those on segments 4,5 dorsally incomplete; segments 4,5 subequal, slender, dorsally curved and with only a few short setae; antenna plumose, shorter than proboscis. *Wing*. Cell R_2 about 2.0 length of vein R_{2+3} . *Legs* (Fig. 7). Fore- and midleg with tarsal claws unequal, the smaller one toothed, the larger one simple. *Abdomen*. Tergum I sometimes with a small basomedian white spot; sternum VIII with basolateral white spots only. *Genitalia* (Figs. 2,5). Basimere about 2.0-2.2 as long as wide (width measured 0.5 from base), scales restricted to dorsolateral, lateral and ventral surfaces, with setae on dorsomesal surface, mesal surface membranous; claspette large, lobed, subtriangular in shape in dorsal aspect, with numerous simple setae and with 2-4 somewhat stronger basally widened setae on apicosternal angle of expanded distal lobe; distimere simple, elongate, about 0.5-0.6 length of basimere, with a spiniform process at apex and with a few setae in apical 0.5; aedeagus strongly toothed, with lateral teeth longer and stouter than distal teeth; paraproct with a short sternal arm about 0.50-0.68 length of apical arm, cercal sclerite present, moderately developed, cercal setae absent; apical margin of tergum IX medially flat and with 3-10 setae on lateral lobe; sternum IX without setae.

PUPA (Fig. 5). *Cephalothorax*. Trumpet about 3.2-3.9 as long as wide (width measured 0.5 from base); setae 1,3-C usually single (1,2), longer than 2-C; 2-C usually double (1,2); 4-C usually single (1,2); 5-C usually with 2 branches (1-3); 6-C single, stout, longer than 7-C; 7-C usually double (1,2); 8-C usually double (1-4); 9-C single; 10-C usually with 3 branches (1-3), caudomesad of 11-C; 11-C single, stout; 12-C usually single (1,2). *Abdomen*. Seta 1-I well developed, with more than 10 dendritic branches; 2-I single; 3-I single, long and barbed; 2-I and 3-I widely separated, distance between their bases about 1.5 of distance between those of 4-I and 5-I; seta 1-II usually with 5 branches (2-7), barbed; 3-II,III usually single (1,2) and barbed, shorter than segment III; 1-III usually with 3 branches (1-4), barbed; 1-IV usually double (1,2); 2-IV,V anteromesad of 1-IV,V respectively; 5-IV-VI usually single (1,2) and barbed, moderately short, not reaching beyond posterior margin of following segment; seta 9-I-VI small, single, simple, sometimes 9-VI forked at tip; 9-VII usually double (1-3) and barbed; 9-VII,VIII much longer and stouter than 9-I-VI; 9-VIII usually with 5 branches (2-7) and barbed. *Paddle*. Oval, about 1.5-1.7 as long as wide; with distinct denticles varying in length on apical 0.90-0.92 of outer margin and on apical 0.38-0.63 of inner margin, absent where midrib meets apical margin; without fringe of very long hair-like spicules; apex rounded; seta 1-P single. Male genital lobe short and broad, much shorter than wide.

LARVA (Fig. 6). *Head*. Antenna short, less than 0.5 length of head, without spicules; seta 1-A inserted in apical 0.5 of shaft, single; inner mouthbrushes apically pectinate; seta 4-C well developed, usually with 7 branches (6-9), base closer to base of 6-C than to base of 5-C, cephalomesad of 6-C; 5-C single, long; 6-C single; 7-C usually double (1,2);

8-10,13-C single; 11-C usually with 3 branches (2,3), barbed; 12-C usually with 4 branches (2-4); 14-C usually with 6 branches (4-8); 15-C usually with 4 branches (2-4); mentum usually with 10,11 (9-12) teeth on each side. *Thorax*. Seta 1-P usually with 4 branches (3,4), barbed; 2-P single; 3-P usually double (2,3); 4-P usually with 4 branches (3,4); 5-P usually with 4 branches (2-4), barbed; 6-P single and barbed; 7-P usually with 3 branches (2,3), barbed; 9-P usually double (1,2); 11-P usually single (1,2); 5,7-M single and barbed; 6-M usually 3-branched (2,3), barbed; 8-M usually with 4 branches (3,4), barbed; 9-M usually 2-branched (2,3), barbed; 10,12-M single, long, stout and barbed; 11-M single, small; 7-T usually with 4 branches (3-5), barbed; 9-T usually 2-branched, barbed; 10,11-T similar to those on mesothorax; 12-T much reduced, single to simple; basal spine of meso- and metapleural setae long, stout, apically pointed. *Abdomen*. Seta 6-I usually with 3 branches (2,4), barbed; 7-I usually double (1,2), barbed; 6-II usually double (2,3), barbed; 7-II usually with 3 branches (2-4), barbed; 6-III-VI usually double, barbed; 1-VII usually with 4 branches (2-4), barbed; 2-VII usually with 3 branches (1-3); 2-VIII distant from 1-VIII; 1,5-VIII usually with 4,5 branches (2-6), barbed; 3-VIII usually with 6 branches (4,7), barbed; 2,4-VIII single; comb of VIII with 8 (6-10) scales in a row, each scale with free portion widened at base and sharply pointed at apex and with fine denticles basal of apical spine; anal segment with saddle incomplete, marginal spicules very small and inconspicuous; seta 1-X usually with 3 branches (2-4), barbed, short; 2-X usually 2-branched (2,3); 3-X single; ventral brush with 4 pairs of setae on grid, each seta usually 2-branched, sometimes 4b,c,d-X with 3,4 branches; no precratal tufts; anal papillae about 1.8-3.0 length of saddle, sausage-like. *Siphon*. About 1.5-2.0 as long as wide 0.5 from base, acus absent; with usually 14 (9-18) pecten teeth, evenly spaced, or sometimes with apical tooth widely separated from remainder, each tooth usually with 1,2 basal denticles (1-3); seta 1-S with 3-5 branches, barbed, usually inserted beyond apical tooth and beyond middle of siphon.

TYPE DATA. Holotype male (SA 30-43, MEP Acc. 806) with associated larval and pupal skins, and genitalia on slide (MEP Acc. 806, 80/68), Makonde, Sibasa, *Transvaal*, SOUTH AFRICA, collected from eggs in bamboo pot placed in a tree, 2 m above ground level, partially shaded, elevation 606 m, 6 Feb 1980, Y. M. Huang [USNM 76851]. Allotype female (SA 30-46, MEP Acc. 806) with associated larval and pupal skins on slide, same data as holotype [USNM]. Paratypes: 11 males, 2 females as follows, (MEP Acc. 806): 1 1p♂ (SA 30-42), 1 1p♂ (SA 30-44), 1 1p♂ (SA 30-45), 1 1p♂ (SA 30-48), 1 1p♂ (SA 30-49), 1 1p♂ (SA 30-54) with tarsal claws mounted on slide, 1 1p♂ (SA 30-57) [USNM]; 1 1p♂ (SA 30-40) and 1 1p♀ (SA 30-52) [SAIM]; 1 1p♂ (SA 30-41) and 1 1p♂ (SA 30-56) [NITD]; 1 1p♂ (SA 30-47) and 1 1p♀ (SA 30-53) with tarsal claws mounted on slide [BM]; same data as holotype.

DISTRIBUTION (Map 1). *Aedes ledgeri* is apparently a common species in East and South Africa. In Kenya, it occurs from the coast region (Kilifi, Gede, Ganda and Witu) to the inland Nairobi area such as Langata Forest. It has also been collected in Morogoro, Tanzania, in Livingstone, Zambia and in Francistown, Botswana. In South Africa, it occurs from the northern, the eastern and the western Transvaal, and from northern Natal.

MATERIAL EXAMINED. 459 specimens: 90 males, 91 females, 47 male genitalia, 7 female genitalia, 2 male tarsal claws, 3 female tarsal claws; 118 individual rearings (101 larval, 17 pupal).

BOTSWANA (Bechuanaland). Francistown (21° 13' S, 27° 30' E), 1954, J. Muspratt, 1 ♂, 1 ♂ gen (MEP Acc. 802, 80/37) [SAIM].

KENYA. *Nairobi Area*: Langata Forest (1° 20' S, 36° 47' E), June 1945, E. C. C. Van Someren, 1 ♂ [BM]. *Coast Region*: Ganda (3° 13' S, 40° 04' E), 19-26 Jan 1950, 1 ♂, 3 ♀ [DVBD]; same data except 1951, 2 ♀ [DVBD]; same data except Feb-Mar 1951, 2 ♀ [DVBD]; Malindi, June 1953, 2 ♂, 2 ♀, 1 ♂ gen (MEP Acc. 808, 80/72) [DVBD]; Gede (3° 18' S, 40° 01' E), Apr-May 1951, 1 ♂, 4 ♀, 1 ♂ gen (MEP Acc. 808, 80/73) [DVBD]; Witu (2° 23' S, 40° 26' E), Kenya Coast, 1953, 2 ♀ [DVBD]; Kilifi District: Rabai Village, 6 Sept 1976, L. P. Lounibos, 2 ♀ [BM]; Rabai (*3° 58' S, 39° 32' E), 21-24 May 1977, L. P. Lounibos, (MEP Acc. 635): 8 p♂ (Kenya 1-101,102,104,105,107,109,111,116), 5 lp♀ (Kenya 1-2,7,8,9,10), 1 p♀ (Kenya 1-114), 8 ♂ gen (79/220, 79/221, 79/224, 79/225, 80/53, 80/54, 80/55, 80/56) [USNM]; same data, 3 lp♂ (Kenya 2-2,5,6), 4 lp♀ (Kenya 2-1,8,9,11), 2 ♂ gen (79/222, 79/226) [USNM]; same data, 4 lp♂ (Kenya 4-1,7,9,18), 3 lp♀ (Kenya 4-2,4,12), 4 ♂ gen (79/223, 79/228, 79/229, 79/230) [USNM]; same data, 2 lp♂ (Kenya 5-2,6), 2 p♂ (Kenya 5-101,102), 15 lp♀ (Kenya 5-1,5,8,10,11,12,14,16,17,18,19,20,22,24,25), 4 ♂ gen (79/209, 79/210, 79/231, 80/57), 2 ♀ gen (79/211, 79/212) [USNM]; same data, 3 lp♂ (Kenya 10-4,5,8), 3 lp♀ (Kenya 10-1,2,9), 3 ♂ gen (79/213, 79/214, 79/215) [USNM].

SOUTH AFRICA. *Transvaal*: Thabazimbi District (24° 07' S, 26° 01' E), 1953, J. Muspratt, 3 ♂, 3 ♀, 3 ♂ gen (MEP Acc. 802, 80/35, 80/36, 80/38) [SAIM]; same data, 1 ♂, 1 ♂ gen (MEP Acc. 724, 80/74) [IERT]; same data, 2 ♀ [BM]; Bushbuck Ridge (23° S, 31° E), May 1968, B. M. McIntosh, 7 ♂, 5 ♀, 2 ♂ gen (MEP Acc. 801, 80/32, 80/33) [NIV]; Newington, May 1968, B. M. McIntosh, 4 ♀ [NIV]; Sibasa, Makonde (22° 48' S, 30° 32' E), 31 Jan-6 Feb 1980, Y. M. Huang, (MEP Acc. 806); 4 lp♂ (SA 10-40,41,44,45), 2 lp♀ (SA 10-42,43), 1 ♂ gen (80/67) [USNM]; same data, 8 lp♂ (SA 30-42,43,44,45,48,49,54,57), 1 lp♀ (SA 30-46), 1 ♂ gen (80/68), 1 ♂ claws, 1 ♀ claws [USNM]; same data, 1 lp♂ (SA 30-40), 1 lp♀ (SA 30-52) [SAIM], 2 lp♂ (SA 30-41,56) [NITD], 1 lp♂ (SA 30-47), 1 lp♀ (SA 30-53) [BM]; same data except 29 Feb 1980, D. L. Theron, 4 lp♂ (SA 76-19,22,23,25), 2 lp♀ (SA 76-23,24), 4 ♂ gen (80/15, 80/16, 80/17, 80/18), 1 ♀ gen (80/21), 1 ♀ claws [USNM]. *Natal*: Ishongwe (Shongwe, Tongaland) (27° S, 31° E), 1952, J. Muspratt, 1 ♀ [SAIM]; Ndumu (26° S, 32° 16' E): 1956, Paterson, 1 ♀ [NIV]; same data except date unspecified, B. M. McIntosh, 1 ♂, 1 ♀, [NIV]; same data except Dec 1970, B. M. McIntosh, 1 ♂, 2 ♀, [NIV]; Jozini, Makanes Drift (27° 01' S, 32° 16' E), 12-26 Feb 1980, Y. M. Huang, (MEP Acc. 806), 2 lp♂ (SA 59-40,41), 3 lp♀ (SA 59-42,43,44), 1 ♂ gen (80/69), 1 ♀ gen (80/70) [USNM]; same data, 16 lp♂ (SA 111-10,11,12,13,14,15,16,17,18,19,20,21,25,26,32,44), 6 p♂ (SA 111-100,102,103,104,107,108), 8 lp♀ (SA 111-22,23,24,34,38,39,47,74), 6 ♂ gen (80/23, 80/24, 80/27, 80/28, 80/29, 80/30), 2 ♀ gen (80/25, 80/26) [USNM]; same data except 19 Mar 1980, E. J. Jansen, 2 lp♂ (SA 80-12,15), 1 lp♀ (SA 80-13), 2 ♂ gen (80/19, 80/20), 1 ♀ gen (80/22), 1 ♂ claws, 1 ♀ claws [USNM].

TANZANIA (Tanganyika). Mor'ogoro (6° 50' S, 37° 47' E), 17 Apr 1961, 1 ♂ (P10), 1 ♂ gen (MEP Acc. 808, 80/71) [DVBD].

ZAMBIA (N. Rhodesia). Livingstone (17° 50' S, 25° 49' E), 1942, J. Muspratt, 1 ♂, 2 ♀ [BM]; same data except 2-21 Jan 1943, J. Muspratt, 1 ♂, 2 ♀, 1 ♂ gen (MEP Acc. 802, 80/34) [SAIM]; same data except 1946, G. G. Robinson, 1 ♀ [BM].

TAXONOMIC DISCUSSION. *Aedes ledgeri* is a member of the Aegypti Group of *Stegomyia*. The adult male and female are morphologically very similar to those of *calceatus*, *contiguus* Edwards, *langata* Van Someren and *poweri* (Theobald); all these species share the following derived characters: (1) scutellum with broad white scales on all lobes, (2) white knee-spot absent on forefemur, present on mid- and hindfemur, (3) midfemur with a large, white spot on anterior surface, (4) hindtibia with a white stripe at or near base, (5) hindtarsomere 4 all white except at extreme apex and (6) hindtarsomere 5 entirely dark. The adults of *Ae. ledgeri* and *calceatus* differ from those of *contiguus*, *langata* and *poweri* in that midtarsomere 1 is white its entire length on the posterior surface and midtarsomere 2 is white in the basal 0.9 or more on the posterior surface. The adults of *ledgeri* are extremely similar to those of *calceatus*, but can easily be distinguished from *calceatus* in that hindtarsomere 3 of *ledgeri* is 0.17 or less basally white. In *calceatus*, hindtarsomere 3 is 0.25 or more basally white.

The male genitalia of *ledgeri* is similar to that of *calceatus*, but can easily be distinguished from the latter by the paraproct with its rather short sternal arm, which is about 0.68 or less the length of the apical arm, and by the absence of cercal setae. In males of *calceatus* the paraproct has a long sternal arm, as long as or longer than the apical arm, and the proctiger bears 2-5 long cercal setae.

The larva of *ledgeri* is like that of *calceatus*, but can be distinguished from that of *calceatus* by the comb scales with their free portion widened at base and sharply pointed at apex, and with fine denticles on basal portion of apical spine. The free portion of the comb scale in *calceatus* (Fig. 2) is rather slender, basally with nearly parallel sides, is usually longer than the attached portion and lacks fine denticles on the basal portion of the apical spine. The pupa of *ledgeri* is indistinguishable from that of *calceatus*.

Aedes ledgeri shows the greatest morphological similarity in both adult, male and female genitalia, and immatures to *calceatus*. Based on the previously mentioned shared derived characters, I am considering *ledgeri* a sister species of *calceatus*.

BIONOMICS. The eggs of *ledgeri* have been collected in bamboo pots placed in trees, about 1.5-2.0 m above ground level, in Makonde, Makanes Drift and Jozini, South Africa. The larvae of this species have been collected in a tree hole (fig tree), 2 m above ground level in Makanes Drift, South Africa. The immature stages of *ledgeri* were also found in

bamboo pots in Newington, Bushbuck Ridge, South Africa, in Mor'ogoro, Tanzania, in Rabai village, Kilifi District, Kenya, and in tree holes in Ganda, Gede, Langata Forest, Kenya. The eggs of this species were collected in blackened tin cans placed on the ground and 18.2 m high in the forest, in Rabai, Kilifi District, Kenya. In Zambia, the larvae of this species were found in tree holes and tin cans in Livingstone (see Muspratt 1945:14,15).

Two female specimens of *ledgeri* from Witu, Kenya coast, Kenya, were taken biting man. In South Africa, the females of this species also have been reported biting man (see Muspratt 1956:68).

MEDICAL IMPORTANCE. Unknown.

ACKNOWLEDGMENTS

I wish to express my sincere appreciation to Dr. Ronald A. Ward, Dr. Michael E. Faran, and Mr. E. L. Peyton for critically reviewing this manuscript and for their valuable comments.

I am most grateful to Drs. P. F. Mattingly, G. B. White and A. J. Shelley, Department of Entomology, British Museum (Natural History), London, for the loan of the type-specimens of *Aedes (Stegomyia) calceatus* Edwards and *Aedes (Stegomyia) contiguus* Edwards and other material in the British Museum; and to the following for the loan of the specimens used in this study; Drs. J. Mouchet and A. Rickenbach, Services Scientifiques Centraux de l'O.R.S.T.O.M., Bondy, France; Dr. J. M. D. Roberts and Mrs. Phoebe A. O. Josiah, Division of Vector-Borne Diseases, Ministry of Health, Nairobi, Kenya; Dr. J. A. Ledger, Department of Medical Entomology, The South African Institute for Medical Research, Johannesburg, South Africa; and Dr. B. M. McIntosh, National Institute for Virology, Johannesburg, South Africa. I sincerely thank Dr. L. P. Lounibos, University of Florida, Florida Medical Entomology Laboratory, Vero Beach, Florida, for the material from Shimba Hills and F2 Laboratory colony, University of Notre Dame.

I also wish to express my thanks and gratitude to Professor J. Metz, Dr. Botha de Meillon, and Dr. J. A. Ledger of the Department of Medical Entomology, the South African Institute for Medical Research (SAIMR), Johannesburg, and to Dr. C. F. Hansford, National Institute for Tropical Diseases (NITD), Tzaneen, for their cooperation and constant support during the course of my work.

I also wish to express my sincere thanks to Dr. Oliver S. Flint, Jr., Principal Investigator of the Medical Entomology Project, Department of Entomology, Smithsonian Institution, Washington, D. C., to Mrs. Joyce Segerman, Secretary of the Department of Medical Entomology, SAIMR, Johannesburg, for their kindness in making all the arrangements regarding my field work in South Africa; to Mr. S. Henning, SAIMR, and Mr. D. L. Theron, Mr. E. J. Jansen, and Mrs. Hanneljie du Plessis, NITD, for their tireless laboratory and field assistance; also to the many friends and supporters in the various places in South Africa where field studies were conducted.

Special thanks are given to Mr. Young T. Sohn for preparing the drawings; to Mr. T. V. Gaffigan and Miss R. Faitoute for assistance in rearing and preparation of specimens and to Miss S. G. Munro for typing the manuscript for offset printing.

LITERATURE CITED

- Belkin, J. N. 1962. The mosquitoes of the South Pacific (Diptera, Culicidae). Univ. Calif. Press, Berkeley and Los Angeles, 2 vols., 608 and 412 p.
- De Meillon, B. and M. Lavoipierre. 1944. New records and species of biting insects from the Ethiopian region. J. Entomol. Soc. S. Afr. 7:38-67.
- De Meillon, B., M. Parent, and L. O'C. Black. 1945. Descriptions of new larvae and pupae of Ethiopian Culicini. Bull. Entomol. Res. 36: 85-101.
- Edwards, F. W. 1924. Descriptions of two new species of mosquitoes from coconut palms in East Africa. Trans. R. Soc. Trop. Med. Hyg. 18: 197-198.
- _____. 1941. Mosquitoes of the Ethiopian region. III. Culicine adults and pupae. Br. Mus. (Nat. Hist.), London, 499 p.
- Hopkins, G. H. E. 1952. Mosquitoes of the Ethiopian region I.-Larval bionomics of mosquitoes and taxonomy of culicine larvae. 2nd Ed. with notes and addenda by P. F. Mattingly. Br. Mus. (Nat. Hist.), London, 355 p.
- Huang, Y.-M. 1979. Medical entomology studies - XI. The subgenus *Stegomyia* of *Aedes* in the Oriental region with keys to the species (Diptera: Culicidae). Contrib. Am. Entomol. Inst. (Ann Arbor) 15(6): 1-79.
- Knight, K. L. 1978. Supplement to a catalog of the mosquitoes of the world (Diptera: Culicidae). Thomas Say Foundation, Entomol. Soc. Am., Supplement to Volume 6, 107 p.
- Lester, A. R. 1927. The coconut palm. Its potentialities in providing breeding places for mosquitoes. J. Trop. Med. Hyg. 30:137-145.
- Mattingly, P. F. 1952. The sub-genus *Stegomyia* (Diptera: Culicidae) in the Ethiopian Region. I. A preliminary study of the distribution of species occurring in the West African sub-region with notes on taxonomy and bionomics. Bull. Br. Mus. (Nat. Hist.), Entomol. 2:235-304.
- _____. 1953. The sub-genus *Stegomyia* (Diptera: Culicidae) in the Ethiopian region. II. Distribution of species confined to the east and south African sub-region. Bull. Br. Mus. (Nat. Hist.), Entomol. 3:1-65.

- Munstermann, L. E. 1977. Entomological Society of America Program for 25th Annual Meeting, pp. 1-112. [In paper title].
- Muspratt, J. 1945. Observation on the larvae of tree-hole breeding Culicini (Diptera: Culicidae) and two of their parasites. J. Entomol. Soc. S. Afr. 8:13-20.
- _____. 1956. The *Stegomyia* mosquitoes of South Africa and some neighbouring territories. Mem. Entomol. Soc. S. Afr. 4:1-138.
- Ribeiro, H. and H. Da Cunha Ramos. 1973. Research on the mosquitoes of Angola. VIII - The genus *Aedes* Meigen, 1818 (Diptera: Culicidae). Check-list with new records, keys to females and larvae, distribution and taxonomic and bioecological notes. Anais Inst. Hig. Med. Trop. 1:107-138.
- Wiseman, R. H., C. B. Symes, J. C. McMahon and C. Teesdale. 1939. Report on malaria survey of Mombasa. Government Printer, Nairobi, 60 p.
- Worth, C. B. and B. de Meillon. 1960. Culicine mosquitoes (Diptera: Culicidae) recorded from the Province of Moçambique (Portuguese East Africa) and their relationship to arthropod-borne viruses. Anais Inst. Med. trop. 17:231-256.

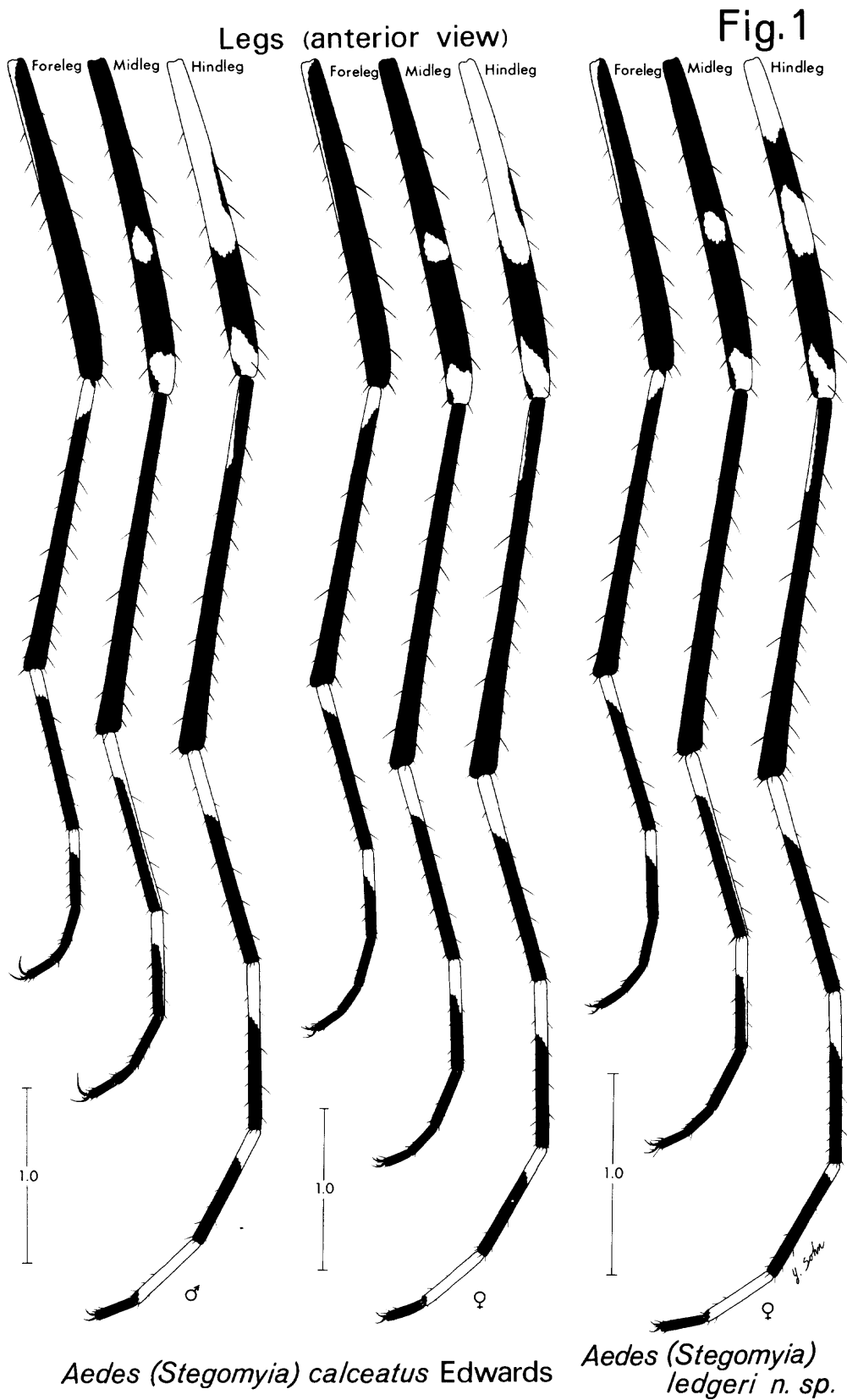
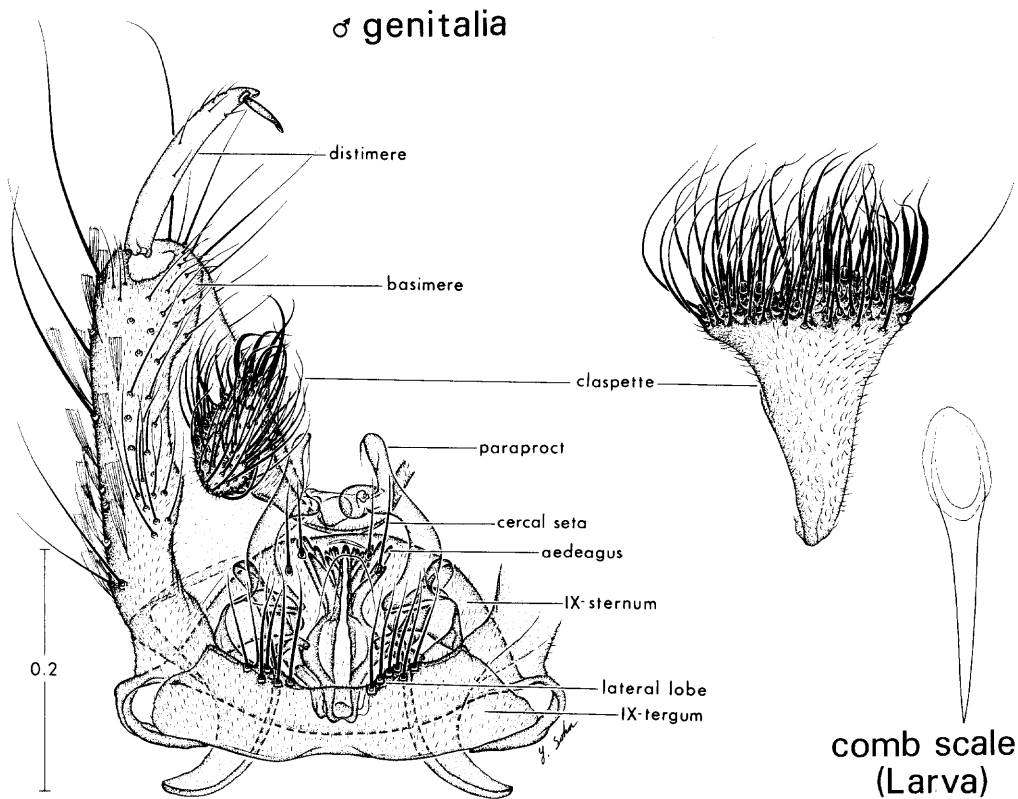
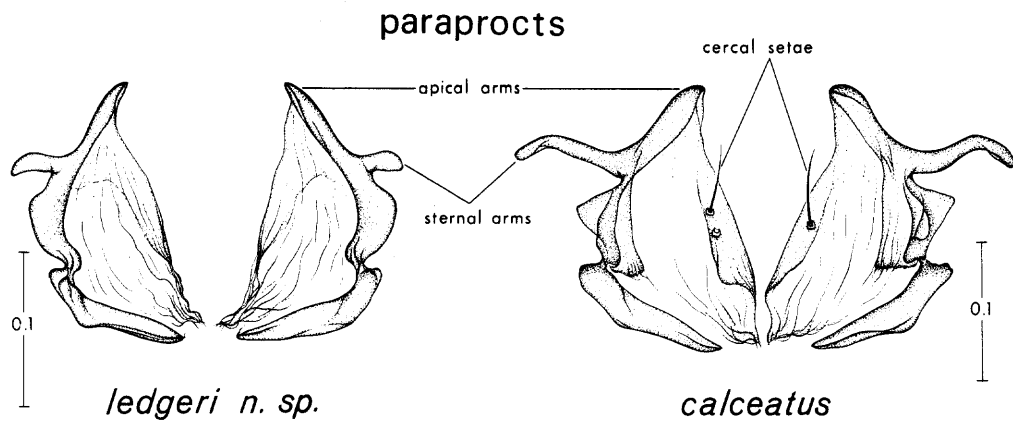
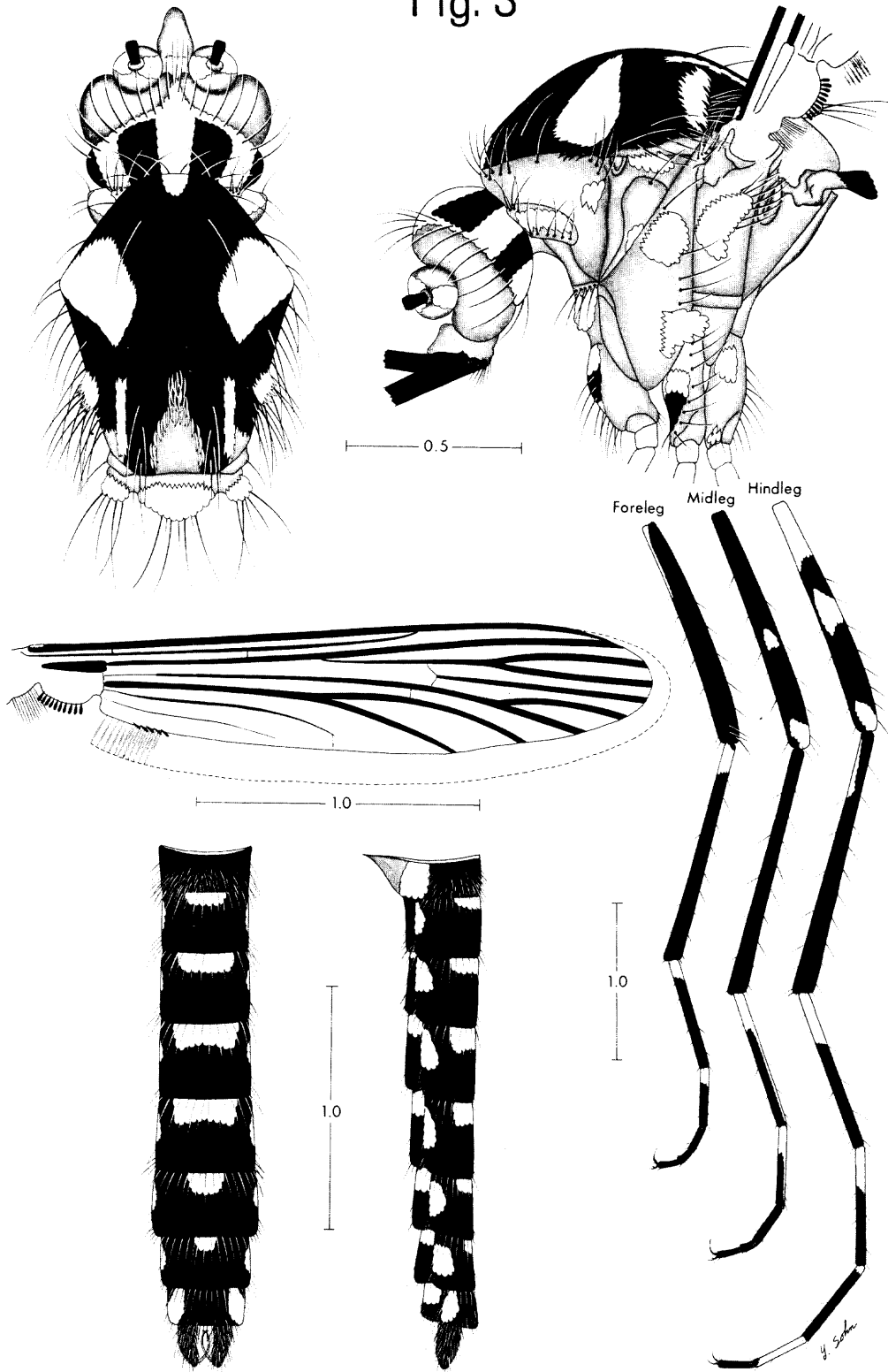


Fig. 2



Aedes (Stegomyia) calceatus Edwards

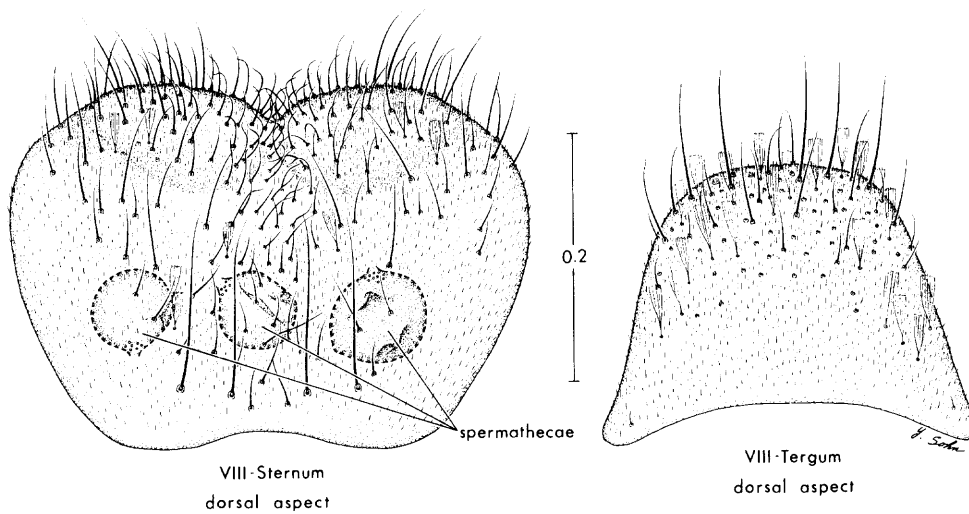
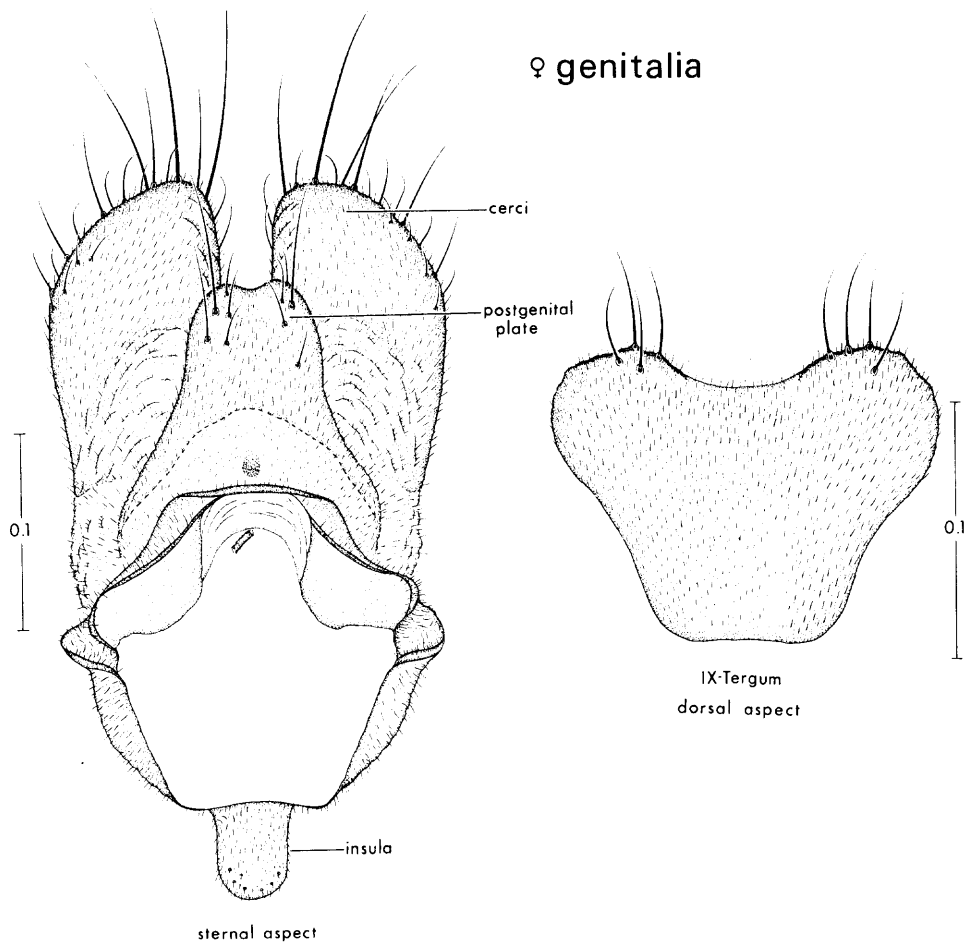
Fig. 3



Aedes (Stegomyia) ledgeri n. sp. ♂

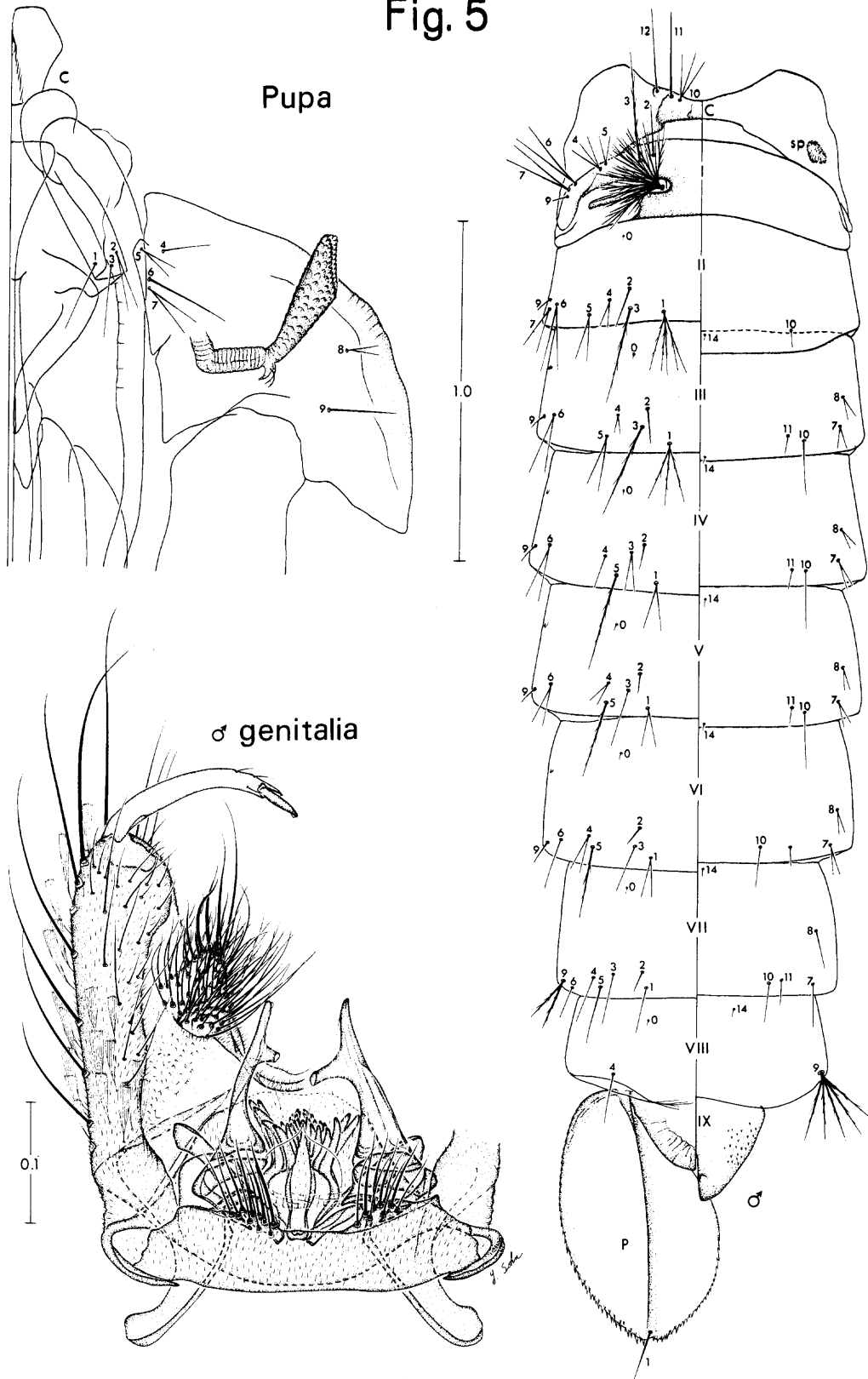
Fig. 4

♀ genitalia



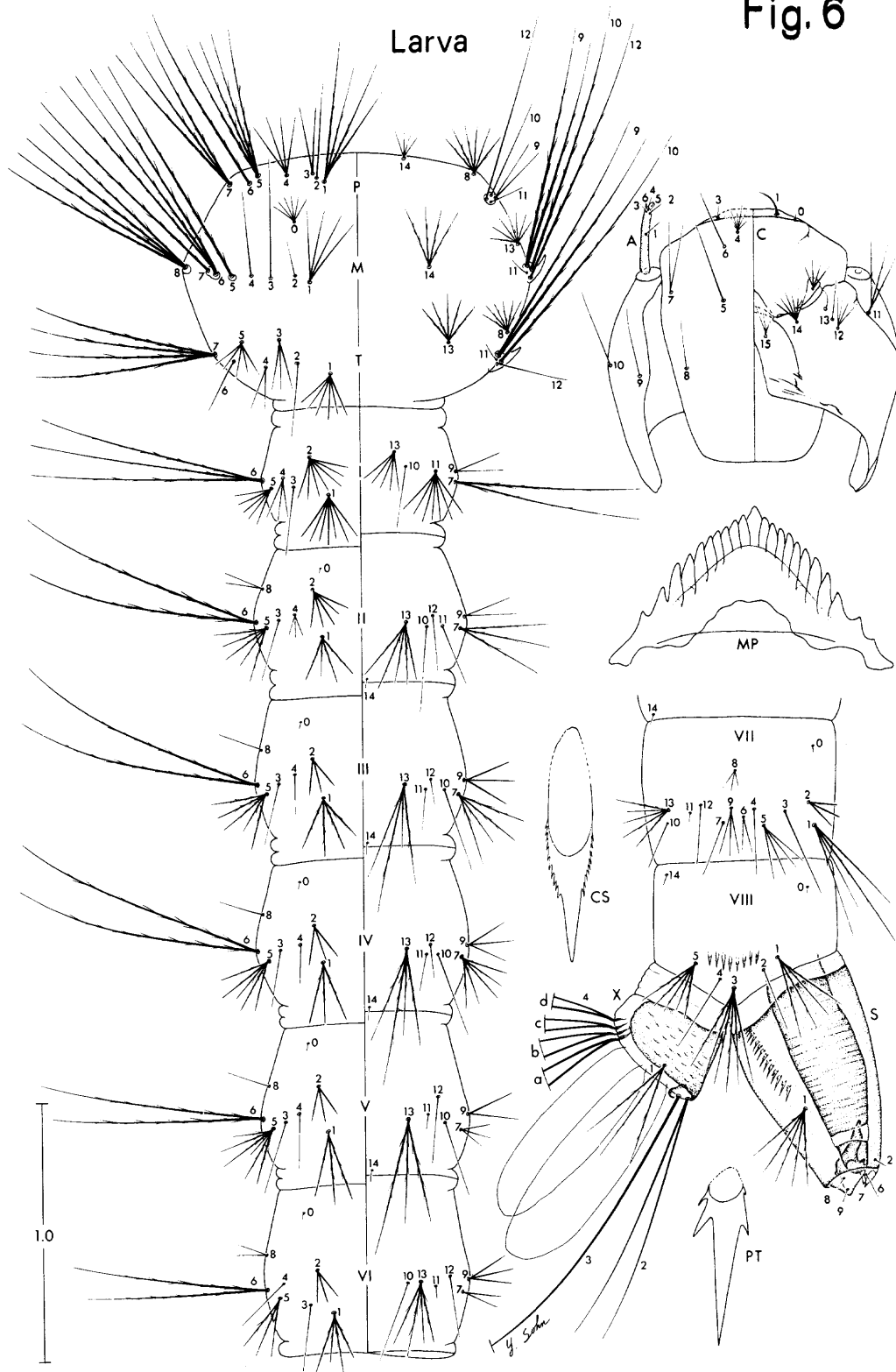
Aedes (Stegomyia) ledgeri n. sp.

Fig. 5



Aedes (Stegomyia) ledgeri n. sp.

Fig. 6



Aedes (Stegomyia) ledgeri n. sp.

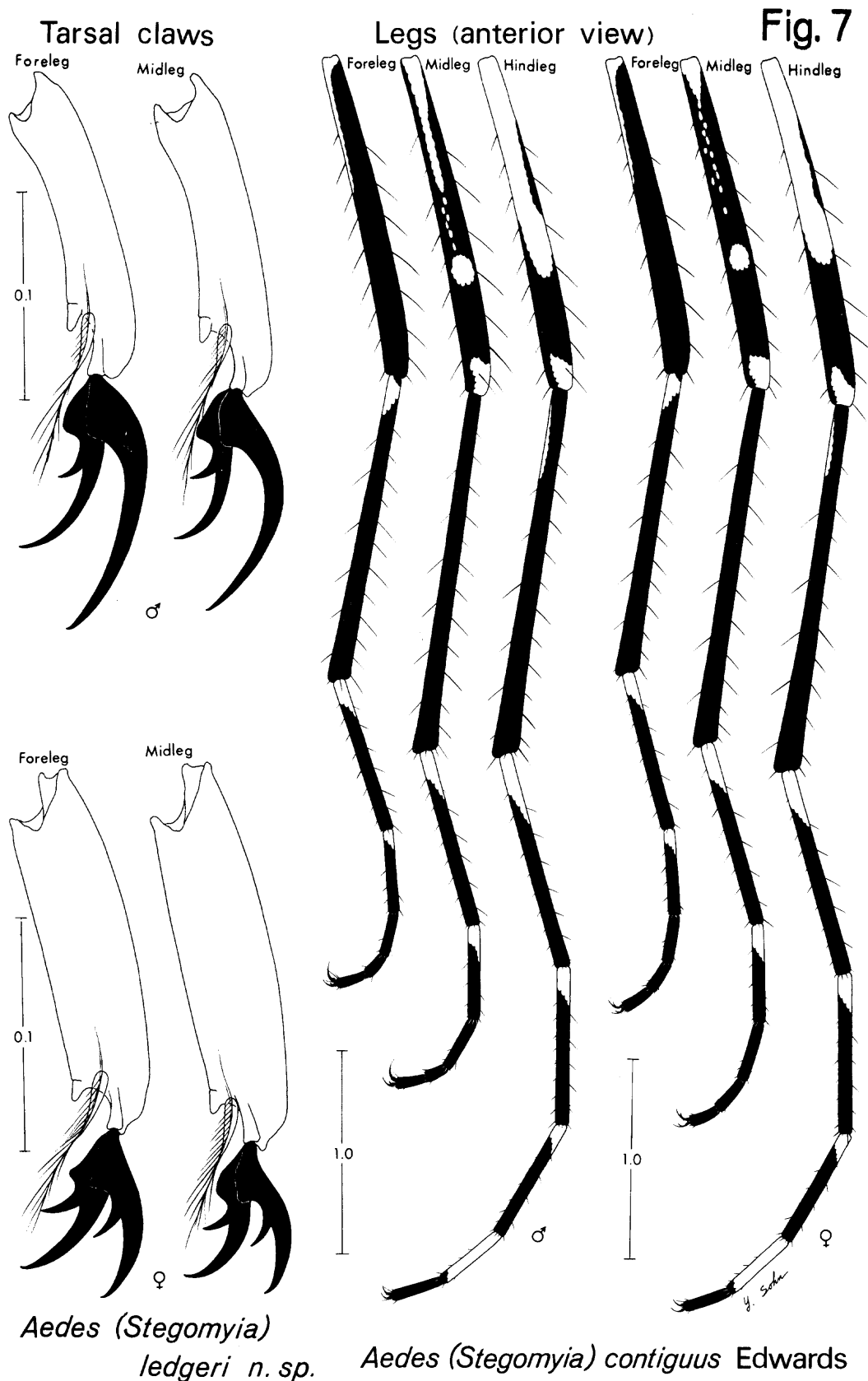
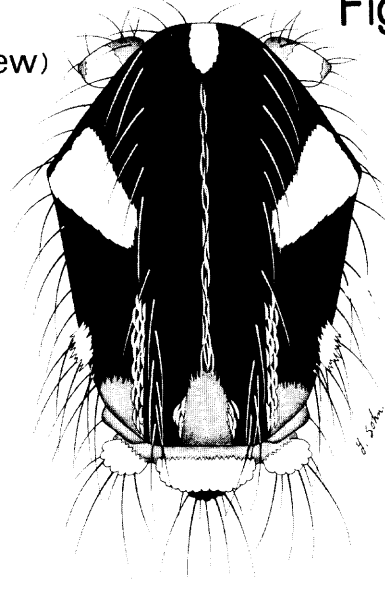
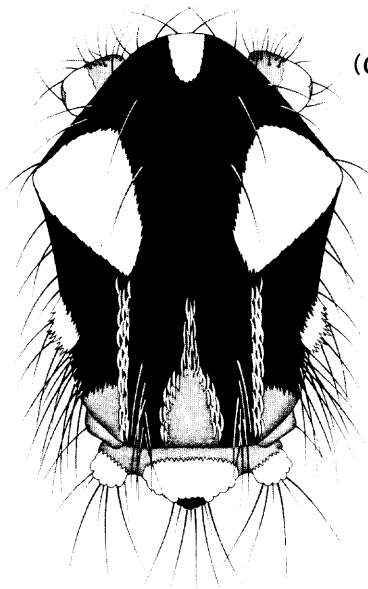


Fig. 8

Thorax
(dorsal view)



calceatus ♂

contiguus ♂

♀ Foretarsomeres 1, 2 (posterior view)



calceatus

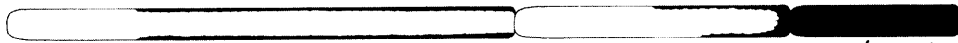


ledgeri n. sp.



contiguus

♀ Midtarsomeres 1, 2 (posterior view)



calceatus



ledgeri n. sp.

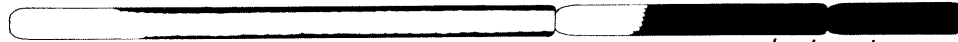


contiguus

♂ Foretarsomeres 1, 2 (posterior view)



calceatus

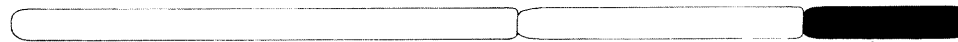


ledgeri n. sp.



contiguus

♂ Midtarsomeres 1, 2 (posterior view)



calceatus



ledgeri n. sp.



contiguus

