



**PACAF
EPIDEMIOLOGICAL LABORATORY**

TECHNICAL REPORT 17-65

**FIFTH EPIDEMIOLOGICAL FLIGHT
CLARK AB, APO SAN FRANCISCO 96274**

ADDITIONAL NOTES ON PHILIPPINE MOSQUITOES

PART I: ARMIGERES ~~BAISI~~

ADDITIONAL NOTES ON PHILIPPINE MOSQUITOES. PART I: *ARMIGERES BAISASI*¹
STONE AND THURMAN, 1958 AND *ARMIGERES JOLOFNSIS* (LUDLOW), 1904.

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¹The opinions expressed herein are those of the author only and do not necessarily reflect those of the United States Air Force. The nomenclature of Stone, Knight and Starcke (1959) has been used throughout. This is Technical Report 17-65 of the 5th Epidemiological Flight.

I. INTRODUCTION

Recent mosquito collections at Clark Air Base, Pampanga, and other places in the Philippines have shown that changes in mosquito fauna have taken place in the last several decades (Baisas, 1935; Dowell & Pippin, 1965). These changes are traceable to the destruction of forests, clearing of bamboo thickets, elimination of wild *Alocasia* sp. (known locally as "biga"), and in some cases, improved sanitary conditions. *Heizmannia scintillans* Ludlow, 1905, for instance seems to have completely disappeared from Clark Air Base. None has been taken there since the holotype was collected when the base was much smaller, surrounded by sylvan areas, and known as Fort Stotsenberg.

More remarkable is the complete or almost complete disappearance from Clark, of *Armigeres baisasi* Stone & Thurman, 1958, and *Armigeres joloensis* (Ludlow), 1904. These mosquitoes were undoubtedly numerous in the early days in Clark, for they are very common during the rainy season in the Philippines, wherever wild bamboo and *Alocasia* sp. abound or where coconut shells and artificial containers are scattered. Yet during the 1957 mosquito collections on and around the base, only a few adults of both species were caught, while the more intensive and extensive 1964-65 collecting got only a single female of *A. baisasi*.

On the other hand, the 1964-65 catches included certain species not previously credited to the Philippines. Among them are:

- (a) A subspecies or variety of *Anopheles ludlowae* which has three dark spots on vein 6
- (b) *Culex (Culex)* sp., the larva of which is similar or identical to the larva of *Culex (Culex) pseudovishnui* Colless, 1957
- (c) *Culex (Culex)* sp., the male of which has a spoon-like proboscis

- (d) *Culex (Lophoceraomyia)* sp., two forms of which do not seem to be among those already described in the literature
- (e) *Uranotaenia* sp., two kinds of which differ from known Philippine uranotaenias.

Over one hundred adults (both sexes) of *A. ludlowae* with three dark spots on vein 3 are now on hand. Primarily for the purpose of inviting it to the attention of other mosquito workers in the Philippines, who may mistake this for *A. parangensis* (Ludlow), 1914, we shall publish its description as soon as possible. Even in Mindanao Island where *A. ludlowae* is much more often encountered than *A. parangensis*, this variety or subspecies may cause confusion. Moreover, the presence of *A. parangensis* in the Philippines north of Mindanao Island has not yet been definitely established by the presence of larvae or by the characteristic of the male terminalia.

Because of these and other changes that have been noticed in recent collections, and in order to assist workers with Philippine mosquitoes, we decided to compare certain recently collected material with existing descriptions and collections and prepare taxonomic notes and keys as necessary. The primary purpose of this paper, the first dealing with these new collections, is to present our findings regarding the characters of the larvae and pupae of *A. joloensis* and *A. baisasi*. However, as new material of five other species was available, we have included it in our studies. In addition, four males and six females with associated pupal skins, six males with associated larval and pupal skins, fifteen other larval and pupal skins, the corresponding adults of which were destroyed in transit, and one whole mounted larva of *A. subalbatus* were obtained from Japan for comparison with the local *A. joloensis*.

Specimens of four other species of Philippine *Armigeres* were also available,

but not included because they were very limited in number, without skin associations and represented by only one of the sexes. They were:

- (a) Two female *Armiaeres (Armigeres) aureolinectus* (Leicester), 1908, collected as larvae in Lilio, Laguna, Luzon Island, in 1932.
- (b) Two male *Armigeres (Armigeres) ejercitoi* Baisas, 1935, taken as pupae and reared to adults in Kolambugan, Lanao, Mindanao Island, on December 10, 1965.
- (c) One male of an undetermined species, taken as a pupa from a bamboo stump in Subic, Zambales, Luzon Island, on November 4, 1965. This has a very clear median pale line running from the midlobe of the scutellum to the anterior border of the mesonotum (Plate 1, c). The markings of the abdominal sternites are quite different from those of the other species treated in this paper.
- (d) Two females of another undetermined species caught in a goat-baited mosquito trap at Gandasuli, Patigol, Jolo Island, on November 29, 1965. The mesonotal scales are badly rubbed.

II. COLLECTIONS

The following specimens were taken as adults:

- (a) One female *A. joloensis* caught while biting at about 10:00 a.m. on August 12, 1965, under the shade of large trees in Mt. Makiling (about 1200 ft. elevation) Laguna Province, Luzon. It was raining intermittently during that day.
- (b) One female and 44 male *A. joloensis*. Caught by net while swarming at about 5:30 p.m. in front of the Forestry School Dormitory in Mt. Makiling at about 1000 feet elevation, on November 4, 1965.
- (c) Four male *A. joloensis* and one female ~~A.~~ *manalangi* caught by net while

flying at about 5:00 p.m. in Mt. Mayon, Albay Province, Luzon Island, at about 2500 feet elevation on November 13, 1965.

- (d) *A. joloensis* - 7 females (3 blooded); *A. malayi* - 33 females (30 blooded). Caught in a carabao-baited mosquito trap in Gandasuli, Paticol, Jolo Island, on November 27, 1965.
- (e) *A. joloensis* - 1 female (blooded); *A. malayi* - 81 females (79 blooded). Caught in the same trap with the same bait at the same place (d above), the next night (November 28, 1965).
- (f) *A. joloensis* - 6 females (2 blooded); *A. malayi* - 14 females (10 blooded) *A. sp.* - two females (1 blooded). Caught in the same trap, at the same place (d above), but with goat as bait, November 29, 1965.
- (g) *A. joloensis* - 13 females (8 blooded); *A. malayi* - 15 females (all blooded). Caught in same trap at the same place (d above) on November 30, 1965, but with a cow as bait.
- (h) *A. joloensis* - 13 females (10 blooded); *A. malayi* - 26 females (24 blooded); *A. sp.* - 2 females (1 blooded). Caught in a light trap at Mampallam, Jolo Island, November 29, 1965.
- (i) *A. joloensis* - 2 females (1 blooded); *A. malayi* - 2 females (1 blooded). Caught in the same trap on November 30, 1965.

The specimens (TABLE I) were taken as larvae and pupae and brought or sent to Pasig, Rizal, where they were reared to adults. Those from Jolo and Mindanao Island were sent by plane. Two series were studied. Members of the IH series were reared to adults and mounted by the author in 1964 for the Institute of Hygiene, University of the Philippines, Manila. Members of the Cl series, were those collected by personnel of the 5th Epidemiological Flight in 1965, and the larvae and pupae were reared to adults, and mounted by the author at Pasig, Rizal. Members of the IH series were all from Laguna Province, Luzon

Island. Members of the C1 series were from the Provinces of Laguna, Quezon, Zambales and Albay on Luzon Island; Jolo Island; and Kolambugan, Lanao, Mindanao Island.

III. METHOD

An excellent time to examine adult *Armigeres*, or other species in which diagnostic markings are located on the abdominal sternites, is when they are freshly killed or immobilized with chloroform fumes. In these states, the abdominal sternites are in the best possible condition for close examination. This method was employed for examining all but a very few laboratory reared *Armigeres*. Even sternite I, which apparently bears no scales naturally, was easily seen.

IV. TAXONOMIC NOTES: ADULTS

1. *Armigeres (Armigeres) joloensis* (Ludlow), 1904.

Ludlow, 1904, describes *A. joloensis* as follows:

"*Desvoidea fusca* Theo. var. *joloensis* n. var.

"The *Desvoidea fusca* sent from Jolo differs from the type in two small points, but as this difference appears in every specimen in a collection of 23 males and females, it seems advisable to note it.

"On the mesothorax is a short median line of white beginning at the scutellum, tapering as it runs cephalad and ending just cephalad of a line drawn perpendicular of the wing joint. The midlobe of the scutellum is also white.

"Taken at Jolo, Jolo, P. I. probably in May, 1903, as it reached San Francisco in August, 1903, but no date nor name of collector accompanied it. By some accident, the collection was not forwarded, so was not included in a list published last year."

Barraud (1934) says: "Specimens in the British Museum received from Miss

Ludlow as *joloensis*, and agreeing with the descriptions, are labelled as from Iloilo, Panay, P. I.; these have the male hypopygium as in *kuchingensis*, and colouring almost as in var. *durhami*, sternites II and VI being almost all white, III-V with broad black apical bands."

Thurman (1959) does not describe *Armigeres joloensis*, but states "females of *A. subalbatus*, *A. joloensis*, *A. durhami*, *A. (?) obturbans*, and *A. (?) ventralis* cannot be distinguished with accuracy on currently employed characters - - - -. The males of the first three species are distinguished on the structure of the male terminalia." Thurman's (1959) description of the abdominal sternites of *A. subalbatus* may, therefore, be taken as an indirect description for the sternites of *A. joloensis*, namely, "Sternite II white scaled; S III apical half dark; S IV apical third dark; S V apical fourth dark; S VI apical fifth dark; S VII dark with subapical white band."

A complete description of *A. joloensis* is for the first time given by Delfinado (1965) in her manuscript on the "Revision of Philippine Mosquitoes." It is an excellent description, but being in manuscript we do not feel free to quote it in full or in part. Suffice it to mention that the description of the mesonotal marking given by Dr. Delfinado is essentially the same as the original description made by Ludlow (1904) quoted above, and her description for the abdominal sternites does not essentially differ from the description given by Thurman (1959) for the abdominal sternites of *A. subalbatus*, also quoted above.

We find a good deal of variation in the markings of the mesonotum among the Philippine *Armigeres* we examined. These markings, being unstable, are of doubtful diagnostic value. Moreover, the mesonotal scales of caught wild adults are largely or completely rubbed and the markings, thereby, obscured or totally lost. Even among those reared in the laboratory, many adults lost their mesonotal

scales in their effort to escape. However, the markings on the abdominal sternites remain fairly intact in all caught wild adults. Those caught in light traps suffered the most "mauling" but when diagnostic characters are located on the sternites, they can be identified without much difficulty.

For these reasons, we describe the markings on the mesonotum and abdominal sternites of *A. joloensis* in detail.

Four males and five females (all except one female, have associated larval and pupal skins) were successfully reared in the laboratory from larvae of *A. joloensis* air shipped alive from Jolo to Pasig. They were taken from a cut bamboo in Mampallam, Barrio Talipao, Jolo Island, on November 27, 1965. It was the height of the dry season on that island then. Very little cut bamboo still contained water and supported mosquito breeding. This was the only site with *Armigeres* larvae. No other *Armigeres* larva beside *joloensis*, was found in cut bamboo or other breeding areas.

Two (or 50%) of the males have a fairly complete pale median mesonotal line,² running from the midlobe of the scutellum to the anterior border of the mesonotum. This line in the third male extends clearly up to only about halfway on the mesonotum. On the fourth, the line is short and terminates only at about the level of the wing roots. In all females the median pale mesonotal line is short.

Viewed under 10x stereoscopic magnification, forty males from Luzon Island, having well preserved mesonotal scales, gave the following impressions: 12 or 30% with the pale median line not extending beyond the level of the wing roots; 21 or 52% with this line reaching about halfway on the mesonotum; and 7 or 18% with this line fairly complete up to the anterior border of the mesonotum. In this respect, therefore, the Luzon Island specimens are closely similar to the

2 One of these is used to illustrate the markings on the mesonotum and abdominal sternites.

specimens from Jolo Island.

The white line itself is composed of broad white scales where it starts on the midlobe of the scutellum. It is also largely composed of the same broad white scales in the prescutellar area. Moderately narrower, but also white, scales are mixed when the line reaches the anterior portion of the pre-scutellar area. Then, narrow, yellowish scales supplant the white ones. This kind of scale, in a single row, then continues in the line to the anterior border of the mesonotum. As the scaling on the anterior of the mesonotum is not thick, the row of golden scales appears broken when viewed under high magnification.

Among the specimens from Jolo, the markings on the abdominal sternites vary very little, although the black bands of the males are frequently broader than the corresponding black bands in the females. As a whole, these markings, despite minor variations, do not differ from the corresponding markings on the specimens from Luzon. The following descriptions of a male and female from Jolo are fair representatives for all *A. joloensis* we examined including those from Luzon. Male: Abdominal sternite I scaleless, the integument pale yellowish; II white scaled; III basal 1/3 white, apical 2/3 dark; IV basal 2/5 white, apical 3/5 dark; V basal 1/2 white, apical 1/2 dark; VI basal 1/6 and apical 1/6 black, area in between, white; VII has a cone-shaped dark area touching the base, its tip reaching about midway to the apex; the subapical white band is crescent-shaped, the tips of the crescent touching the bases of the segment; apical 1/5 of the segment dark. Female: Abdominal sternite I scaleless, integument pale yellowish; II white scaled; III basal 1/2 white, apical 1/2 black; IV basal 3/5 white, apical 2/5 black; V basal 1/5 black, apical 1/4 black, intervening area white scaled; VI basal 1/4 and apical 1/5 black, intervening area, white scaled; VII semi-circular black area at base, horseshoe-shaped subapical white band, apical 1/6 black.

In many male specimens from Luzon, the tips of the crescent-shaped subapical white band do not extend to the base of the segment. In others, the dark bands at the base and at the apex, as well as the subapical white band, are straight. In rare cases among males from Luzon, a few dark scales form an incomplete (white scales alternating) dark ring at the base of IV, and in a few others including one from Jolo, the dark band at the base of V is similarly composed of a row or two of black scales alternating (broken) with a few intermixed white scales. The dark basal bands of V (and that of IV, if present) are easily hidden under the distal margins of the preceding segments in dry, unfed specimens. Often they are at least partly visible in wild-caught blooded adults. There is seldom any difficulty in discerning the dark basal band on VI, except in those few laboratory-reared adults whose abdominal segments are "telescoped" or badly bent double.

Barraud's (1934) statement about the almost all white abdominal sternite VI is found true among many of the males caught while swarming in Mt. Makiling, Luzon Island, but we observed no specimen with the same nearly all-white abdominal sternite II. This was always all white.

2. *Armigeres (Armigeres) subalbatus* (Coquillett), 1898.

Adult *A. subalbatus* cannot be differentiated by external markings from *A. joloensis*, except in the case of some male *A. subalbatus* which have both a median pale line and a pair of submedian pale lines on the mesonotum. LaCasse and Yamaguti (1955) mention these lines. Five out of the ten male *A. subalbatus* available show these three lines distinctly and fairly broadly. These lines in another male are fine and broken. Only the median line, which is narrow, although complete up to the anterior border of the mesonotum, is present in two other males. The median line in the ninth male is short, terminating at about the level of the wing bases. The tenth male has badly rubbed mesonotal scales. Only the median

line, often fairly complete, is present in male *A. joloensis*. No male *A. joloensis* in the materials we examined had the pair of submedian pale lines.

The basal and apical dark bands on abdominal sternites V and VI are visible in nine male *A. subalbatus* (the tenth lost its abdomen). In two of them, a few dark scales arranged in a single row at the base of sternite IV, are present, just as they are also found in some male *A. joloensis*. Among female *A. subalbatus* examined, only the basal and apical dark bands on sternite VI are visible. The apical dark band on V is also visible, but that on its base is presumably hidden under the distal margin of sternite IV.

3. *Armigeres (Armigeres) baisasi* Stone and Thurman, 1958

Adult *A. baisasi* cannot be confused with the adults of other species, except possibly *A. manalangi*. However, a careful examination of the sternites will show the difference as discussed in the paragraph under *A. manalangi*. The description by Stone & Thurman (1958) is satisfactory. We quote it here for purposes of comparison.

"Male. - Medium sized, wing 3.5 to 4 mm.

"Head. - Proboscis and palpus dark; palpus longer than proboscis by 1/2 the length of the last segment. Torus white scaled. Clypeus bare. Vertex covered with white flat scales, few light bronzy scales scattered laterally and medially, few dark upright forked scales at nape.

"Thorax. - Mesonotum with dark coppery, narrow scales; mesonotal border wide, white; prescutellum with medial white spot extending onto the midlobe of the scutellum, the posterior scales broad. Scutellar setae coppery. Halteres with coppery capitulum and light base. Anterior pronotal lobe, posterior pronotal lobe, fore coxa, and propleuron all white scaled. One lower mesepimeral bristle present. Hind femur with dark stripe on dorsum, white scales to apex on anterior

and venter. All tarsi are dark with blue metallic luster. Midclaws equal.

"Abdomen. - Tergites dark with coppery metallic luster. Tergite VIII with basal white spot. Sternites II-VI all white-scaled. Sternite VII dark basally with apical white band. Lateral white markings form a straight line on tergites II-III (II-IV in some paratypes); tergites IV-VI show slight convexity (semi-circles)."

"Female. - Similar in size and coloration to the male. Palpus nearly one-fourth as long as proboscis. White lateral markings on tergites II-VII are small semicircles which may be slightly triangular on IV-V.

"Larva and pupa. - We do not describe these at the present time because the quality of the material does not permit accurate descriptions."

4. *Armigeres (Armigeres) malayi* (Theobald), 1901.³

Like *A. baisasi*, the adults of *A. malayi* are easily recognized by two characters which remain distinct even in those caught in mosquito traps. The principal characters are the white scales (visible under relatively low magnification) on either side of the clypeus, and the entirely white-scaled abdominal sternites II-VII. The white scales on the clypeus may be completely missing in some light trap catches, and the abdominal sternites may be darkened with blood in those caught in animal-baited traps. However, one or the other of the two main diagnostic characters will remain recognizable in even the worst specimens.

5. *Armigeres (Armigeres) manalangi* Baisas, 1935.

The mesonotal scales of one male and two female *A. manalangi* reared from larvae taken from Mt. Mayon are intact. All have three distinct pale golden lines on the mesonotum (Plate 1, d). The median line is complete up to the anterior border of the mesonotum, the posterior portion from the scutellum to the

3 Some male *A. malayi* have three pale golden lines, which at most extend only to about halfway on the mesonotum.

prescutellar area, being distinctly broad. Thence, it narrows rather abruptly and continues to the anterior as a fine line. The pair of submedian lines terminates at about the middle of the mesonotum. These lines are also shown in the specimens among those taken as pupae from Subic, which have the mesonotal scales intact. Abdominal sternites II to VI are white scaled in all those from Mt. Mayon, including one female that was caught while flying. Sternite VII is also white scaled, but with a small (variable in size) dark median, basal patch occurring at about the middle third of the segment. The abdominal sternites of those from Subic are variable in hue: some white scaled, and others rather yellowish with indefinite dark markings on some segments, which become more obscure when the specimens dry up. Sternite VII, however, whether white or yellowish, also has a small dark patch basally at the middle in both sexes. The terminalia of one male from Mt. Mayon, and another male from Subic were mounted and examined. The claspers of the one from Mt. Mayon have 24-26 teeth; those from Subic, 24-25.

The specimens from Mt. Mayon (Albay Province, Luzon Island) were taken as larvae from a tree hole at about 2500 feet elevation on November 13, 1965. A female was caught by net while flying at the same elevation on the same date. The specimens from Subic, Zambales Province, Luzon Island, were taken as pupae from a bamboo stump on September 4, 1965.

6. *Armigeres (Leicesteria) digitatus* (Edwards), 1914.

The abdominal sternites of *A. digitatus* bear the principal differential markings of this species.

The clear and concise description of *digitatus* given by Thurman (1959) is satisfactory for our specimens. It is quoted for purposes of comparison.

"Adult. Medium sized. Wing 4 mm. Vertex and occiput with flat blackish

scales; creamy scales in midspot, lateral patch, and eye margin. Clypeus bare. Proboscis and palpus dark; female palpus $2/3$ length of proboscis. Mesonotum with narrow dark brown scales; narrow border of creamy scales. Scutellum mid-lobe pale scaled. Thoracic lobes and pleura white scaled. Wing dark. Legs mainly dark; femora pale ventrally. Tergites dark brown; T II - T VII each with triangular lateral white marking, the upper margin concave, visible on dorsum of T IV - T VII. Sternites white scaled with narrow apical dark bands."

7. *Armigeres (Leicesteria or Leicesteriomia?) flavus* (Leicester), 1908.

We leave the decision as to what is the correct sub-generic status of *A. flavus*, to those now engaged in a complete revision of all Southeast Asian mosquitoes. Stone, Knight and Starcke (1959) and also Thurman (1959) employ *Leicesteriomia*, but in her manuscript (1965) Delfinado uses *Leicesteria*.

Again, Thurman's (1959) description of *A. flavus* is essentially satisfactory for our specimens and is quoted for comparison. "Salient Characters. Adult. Medium to large sized. Wing three-five mm. Vertex and occiput with creamy yellow scales, few dark scales scattered medially; lateral patch dark; eye margin of drab yellow scales. Female palpus dark; nearly $1/2$ length of proboscis. Male palpus longer than proboscis by length of two apical segments; with narrow medial yellow ring; segments IV and V each with narrow basal yellow ring. Clypeus bare. Torus bright yellowish with few yellow and gray scales. First flagellar unit with gray scales. Thorax not compressed, not extended over head. Mesonotum brown with golden-bronze luster; anterior border wide, of narrow curved yellowish scales. Scutellum drab yellow, few dark scales scattered. Postnotum with four minute, pale setae near apex (easily broken). Anterior pronotal lobe with broad yellow scales, dark scales on dorsal portion; few narrow dark scales mixed. Posterior pronotal lobe with broad shaggy yellowish-white scales. Propleuron with

drab yellow scales. Pleura drab white scaled. Wing dark with few scales at base of costa. Legs predominantly dark with bronzy luster; femora bronzy, venter pale, apex dark; tarsi ringed. Forecoxa with dark midspot. Hind tibia shorter than foretibia or midtibia. All tibiae with ventral pale stripe continuing onto base of tarsus t1. Foretarsus and midtarsus t1-t5 each with small basal white patch or faint pale ring. Hind tarsus t1 and t2 with narrow faint basal and apical pale rings; t3-t5 each with faint basal pale ring. Tergites II-VI dark brown scaled with blue luster each with narrow apical yellow band; band not reaching lateral margin on T IV - T VII all dark; T VIII with basal yellow patch; oblique lateral white marking from base to apex, not extending onto dorsum unless on T VI and T VII. Sternites all yellowish-white scaled." It may be added that in Philippine specimens there are indefinite, variable brownish or dark patches (brownish scales mixed with pale ones) on sternites IV to VI or V and VI. These are variable in position sometimes submedian, sometimes median, sometimes subapical scattered dark scales also variable. In females, scattered dark scales are often found on sternites II-VI. On VII sometimes there are scattered dark or brownish scales submedially and a broken line of similar scales on the distal margin.

8. *Armigeres (Leicesteria) magnus* (Theobald), 1908.

The largest, in average size, of the species discussed here. Another well marked species. The principal characters are quoted from Thurman (1959): "Tergites dark brown with medio-basal yellow marking on T II - T VII; wider on T VI and T VII; lateral white marking on T II- T VII from base nearly to apex, wide, visible from dorsum; secondary yellow patch on T III - T VII basal to white marking, joining dorsal yellow marking on T VI and T VII.

Sternites white scaled; narrow apical dark band on S III to S VI." The sternal markings are variable in the local specimens. A variation is exemplified by a male, as follows: Sternite I scaleless, integument pale yellowish; II white scaled with 5 or 6 dark scales clustered at left apico-lateral corner close to both the distal and lateral borders; III basal 1/2 white, apical 1/2 dark; IV similar to III but with 3 or more white scales at the apical margin; V basal 3/5 white, apical 2/5 dark with one or two dark scales at extreme apex; VI basal 4/5 white with two small dark submedian spots near base (left spot composed of 2 dark scales; right spot, of 5 dark scales); apical 1/5 of segment dark; VII white with subtriangular dark median patch not touching base or apex of the segment, extreme apical rim of the segment dark-scaled."

V. KEY TO ADULTS

1. Abdominal sternites II-VII entirely white scaled; clypeus with a patch of white scales on either side - - - - - *A. malayi*
 Abdominal sternites II-VII not entirely white scaled, clypeus without scales - - - - - 2
2. Abdominal sternites III-VI with dark apical bands, and at least VI has also a basal black band - - - - - *A. joloensis*
A. subalbatus
 Abdominal sternites III-VI with or without apical black bands and VI without dark basal band - - - - - 3
3. Abdominal tergites II-VII with medio-basal yellowish markings - *A. magnus*
 Abdominal tergites II-VII dark or differently marked - - - - - 4
4. Abdominal tergites II-VI with creamy white apical bands; postnotum with weak setae - - - - - *flavus*
 Abdominal tergites II-VI without creamy white apical bands; postnotum

- without setae - - - - - 5
5. Abdominal sternites II-VI white scaled VII dark with an apical white band - - - - - *A. baisasi*
- Abdominal sternites II-VI white or yellowish scaled VII white or yellowish with a small dark basal, median patch - - - - - *A. manalangi*
6. Abdominal sternites II-VII white with narrow apical dark bands - *A. digitatus*
- Abdominal sternites II-VII largely white with indefinite, variable, dark patches on some segments; VII white with a basal semicircular dark patch - - - - - *A. manalangi* (In part)

VI. TAXONOMIC NOTES: PUPAE

1. *Armigeres (Armigeres) joloensis* (Ludlow), 1904 (Plate 2, d).
2. *Armigeres (Armigeres) subalbatus* (Coquillett), 1898 (Plate 3, g).
3. *Armigeres (Armigeres) baisasi* Stone and Thurman, 1958, (Plate 2, c).

The pupa of *A. joloensis* is not differentiable from the pupa of *A. baisasi*. It seems that the pupa of *A. subalbatus* is also not differentiable from the pupae of *A. joloensis* or *A. baisasi* except (if these characters are constant) by the comparatively longer paddle hair (hair 1) and longer hair 9 of abdominal segments VII and VIII. (Plates 2 and 3).

All three species are similar in the arrangement of the principal metanotal and abdominal hairs: metanotal hair 10 weak, with about ten branches; No. 11 twice as long as 10, single, frayed; 11 equal to 10 in length, with three or more weak branches. Segment I: hair 1 the most prominent, divided into some twelve primary branches, each of which is subdivided into several fine branches toward the tip, dark, highly frayed; No. 3 is the next prominent hair, fairly long and thick, single and finely frayed. Segment II: hair No. 1 is a small tuft similar to a main branch of 1 on I, divided into four (more or less) main branches,

each of which is divided into finer branches toward the tip or frayed. No. 3 is similar to but longer than, 3 on I. No. 1 on III is much weaker, branched, placed external to 2 and 3. No. 3 single, somewhat shorter and thinner than 3 on II. Hair 1 on segment IV is weak, branched, postero-internal to 3 in position but external to 2; 3 on this segment (IV) is reduced to a short, branched hair. No. 5, which is very weak and branched on I - III, is very long on IV (somewhat longer than the length of segment V), fairly stout, single and frayed. No. 1 on V is still weak, short and branched. No. 3 is similarly weak and branched. No. 5 (on V) is about equal in length and similar to 5 of IV. On VI and VII, 1, 3 and 5 are all weak and branched. No. 6 (on the latero-posterior corner of the segment) is now the strongest hair of VI, although it is by no means prominent, being single and barely as long as 1/2 the length of segment VII. No. 9 becomes the most prominent hair on VII and VIII. It is quite thick with thick branches, which ordinarily vary in number from two to six on VII, and seven to ten on VIII among specimens from Luzon Island. However, one pupa from Subic, Zambales, Luzon Island, has an unusually, short, slender and less-branched hair 9, similar to some pupae from Jolo Island.

Four out of 10 pupal skin mounts (with correlated adults) of *A. joloensis* from Jolo have a subnormal hair 9: one to three branches on VII, three to six branches on VIII. Such cases lessen the value of hair 9 in practical diagnosis. Fortunately, subnormality seems to be confined only to hair 9, as the fringe and paddle hairs remain normal even in cases where hair 9 is subnormal. Therefore, the paddle and fringe hairs become more important when hair 9 is doubtful in character.

4. *Armigeres (Armigeres) malayi* (Theobald), 1901. (Plate 3, h). Primarily due to the many-branched, but comparatively shorter hair 9 on VII and VIII, the pupae of *A. malayi* can easily be recognized. In addition, its paddle hair is often

branched. Hair three on III is also often divided into three to eight branches.

5. *Armigeres (Armigeres) manalangi* Baisas, 1935 (Plate 3, e). The absence of the paddle hair seems to be a definitive character of this species. Furthermore, many or most of the fringe hairs on the posterior margin of the paddles are branched basally, sub-basally or medially into two to four branches. These are not mere frayings or criss-crossing of the tips of two or more hairs. They should be examined carefully under high magnification for proper detection. These branchings are not shown in the illustration of *A. manalangi*. The branchings are more obvious and occur on more hairs of the specimens from Subic than those from Mt. Mayon. (Only eight pupal skin mounts from Subic and two from Mt. Mayon were available).

The much weaker, more slender and fewer branched hairs 9 of the specimens from Mt. Mayon as opposed to those from Subic, naturally calls to mind the probability of subspecific or varietal differences between the highland (Mt. Mayon) and the lowland (the type locality and Subic) forms of *A. manalangi*. Longer field observations and collections are necessary to resolve this problem. The illustration for the larvae was taken from a Mt. Mayon specimen. No larval material was available from Subic or from ~~that~~ ^{the} type locality. The illustration for the pupae was made from a Mt. Mayon specimen.

Another possibility is that the subnormal hairs resulted merely from insufficient food in unsuitable breeding waters. It is significant to note that the Mt. Mayon specimens of *A. manalangi* larvae were taken from a tree hole with very little water, while the specimens of *A. joloensis* with subnormal hairs from Jolo Island were found in a bamboo stump in which the water was already very low because of drying.

In addition, the pupae of *A. manalangi* and *A. malayi* (especially *A. malayi*

do not share the short extent of the long fringe hair on the external border of the paddle. In other words, the pupae of *A. joloensis*, *A. subalbatus* and *A. baisasi* display some common characters not shared by *A. malayi* and *A. manalangii*, though these latter two species also belong to subgenus *Armigeres*.

6. *Armigeres (Leicesteria) digitatus* (Edwards) 1914 (Plate 3, f).
7. *Armigeres (Leicesteria or Leicestnomyia?) flavus* (Leicester) 1908 (Plate 2, b).
8. *Armigeres (Leicesteria) magnus* (Theobald) 1908 (Plate 2, a).

No pupal characters common to these three species indicate their subgeneric unity except, perhaps, the weak paddle hairs (often absent in *A. magnus*) and the longer extent of the external borders of the paddles covered by the long fringe hairs. The unusual characters found in adult *A. flavus*, viz: the postnotal setae and short hind tibia, are not in the least reflected in the characters of the pupa. On the other hand, the pupa of *A. magnus* displays at least one unique character, the unusually long and developed hair No. 6 on abdominal segment I. Outside of that one character, however, the pupae of *A. flavus* and *A. magnus* are more alike and different from the pupa of *A. digitatus*, although their differences are more in the degree of development of certain hairs than in the kind of hairs. Thus, for instance, the long hairs of the abdominal segments, especially hair 3 of II and III, hair 5 of IV and V, and hair 9 of VII and VIII are comparatively longest in *A. magnus*, longer in *A. flavus* and shortest in *A. digitatus*.

It may furthermore be added that in *A. magnus* hairs 10 and 11 of the metanotum are more developed; hair 6 on I is usually more developed than hair 3 of the same segment. Hair 1 on I is longer and more developed than the equivalent hair in other species. It is reduced on II but still has a very close resemblance to one or two main branches on I on I. Hair 3 on II is longer than 3 on I, whereas 6 of II is shorter than 6 of I, but still prominent. No. 1 is further reduced (weak, branched) on III, while 3 on III is longer than 3 on II, and 6 is much shorter than

6 on I and II No. 5 is the most prominent hair on IV, while 6 on IV is longer than 6 on III. No. 1 and No. 3 on IV are both weak and branched. On V, 5 and 6 are about equal in length, single, and are the most prominent hairs of this segment.

VII. KEY TO PUPAE

1. Paddle hair more developed, fairly stout, single (rarely bifurcate) at least twice as long as the longest fringe hairs. Long fringe hairs extend from the tip of the paddle to only about halfway on the external border - - -

----- *A. joloensis*
A. baisasi
A. subalbatus

Paddle hair absent or very weak. If present, usually shorter or only equal or a little longer than, but less than twice the length of the longest fringe hair. Long fringe hairs occupy more than one half of the external border of the paddle.

2. Hair 6 of abdominal segments I and VI is very prominent, about equal to 3 of I and II and single. Hair 9 of VIII equals or exceeds the length of the paddle - - - - - *A. magnus*

Hair 6 of I and II very weak, branched, less than 1/2 the length of 3 on these segments. Hair 9 of VIII much shorter, usually less than 1/2 the length of the paddle or exceeds 1/2 only slightly - - - - - 3

3. Paddle hair usually branched into two or more branches. It slightly exceeds the length of the longest fringe hairs. Hair 9 of VIII, although many-branched, is distinctly the shortest among the pupae examined. Branching into two or more branches of the long hairs on abdominal segment II or III often occurs - - - - - *A. malayi*

Paddle hair single, weak or absent and seldom branched. Hair 9 of VIII longer.

Branching of the long hair on II or III very rare - - - - - 4

4. Many or most of the fringe hairs along the posterior margin of the paddles branched into two to four branches. Paddle hair absent - - - *A. manalangii*

None or very rarely one or two fringe hairs branched. Paddle hair usually present or absent from one paddle, but present on the other - - - - - 5

5. Hair 3 on II and III, and hair 5 on IV and V equal to or exceeding the length of the respective next succeeding segment. Hair 9 of VII and VIII with six to eight branches each - - - - - *A. flavus*

Hair 3 on II and III, and hair 5 on IV and V equal to exceeding only one half the length of the respective next succeeding segment. Hair 9 on VII and VIII usually with two to four and three to five branches respectively - - - - - *A. digitatus*

VI. TAXONOMIC NOTES: THE LARVAE

1. *Armigeres (Armigeres) joloensis* (Ludlow), 1904 (Plate 4).
2. *Armigeres (Armigeres) subalbatus* (Coquillett), 1898 (Plate 6).
3. *Armigeres (Armigeres) baisasi* Stone and Thurman, 1958 (Plate 5).

It will be impossible to differentiate the larvae of these three species unless the country of origin is known (which is good only for *A. subalbatus* from Japan) or when the number of branches of hair 6 on abdominal segment I exceeds nine (which is good only for a few *A. joloensis*). The lateral hair or hair 6 of abdominal segment I varies in number of branches from five to twelve in *A. joloensis*; five to eight in *A. subalbatus*; and five to nine in *A. baisasi*. On II, the branches of the lateral hair (6) vary from four to eight and four to six respectively.

These three species may be taken as a group having in common certain characters different from other species or group of species among the Philippine *Armigeres* we studied. They are strikingly similar in the many-branched meso-hair 8 and two of the long mesopleurals, meta-7 and two long meta-pleurals, lateral hair 6 of abdominal segments I and II. The similarities are furthermore enhanced by the branchings of these hairs which originate from the base rather than laterally, as frequently seen among anophelines and most other culicines.

Apart, however, from their unique similarities in these hairs, we found other characters which they commonly display, that may be of truly generic and subgeneric importance for *Armigeres*. That is, if these characters are found true in all other *Armigeres* in the Philippines and other countries. We refer first to the confluence of the tubercle bearing meso-8 with the tubercle or plate from which the mesopleurals arise; and the confluence of the plate or tubercle from which meta-8 arises with the plate or tubercle bearing the metapleurals. This is true in all seven species of Philippine genus *Armigeres* we studied. It is true also in *A. subalbatus* from Japan, although LaCasse and Yamaguti (1955) illustrate these hairs as separate from the meso and meta-pleural plates. Second: meso-hairs 5, 6 and 7 arise from a common long plate in all species of subgenus *Armigeres* we examined, including the specimens of *A. subalbatus* from and as shown in the figure of *A. subalbatus* by LaCasse and Yamaguti and also in *A. breinli* as figured by Belkin (1962). However, Belkin's (1962) figure shows meso-hair 8 separate from the mesopleurals. While meta-7 is drawn very close to the metapleurals, it is not clear in Belkin's (1962) reduced illustration whether their tubercles are united or not.

On the other hand, in the species of subgenus *Leicesteria* and subgenus

Leicesteriomyia (?) we examined, mesothoracic hairs 5, 6 and 7 arise from separate small tubercles.

In our studies of the chaetotaxy of the larvae and pupae of *Armigeres*, we used as our guide Belkin's (1962) illustrations and scheme of numerical hair designations.

4. *Armigeres (Armigeres) malayi* (Theobald) 1901 (Plate 7).

Some of the thoracic and abdominal hairs, large and small in *A. malayi* larvae are quite often absent. No trace of their sockets or tubercles could be found. In particular hair 11, an unimportant hair, of the meso and meta-pleurals is frequently absent. Sometimes even the *lh* or 6 of one or two abdominal segments are absent. On the other hand, its long hairs are often longer than the corresponding hairs of other species.

Like meso-5, 6 and 7 of the preceding three species these arise from a common long plate. But they are usually single. Meso-8 and meta-7 are also connected to the meso and meta-pleurals respectively. The long ones are only branched into two or three branches (Plate 7). Hair 6 (the *lh* of abdominal segments I and II) bears two equal branches, seven in less than 1/2 the length of 6. It is usually also 2-branched on I, but may have more branches on II. Hair 3 of VIII has only four or five branches. The comb scales are as shown on Plate 7, g. The other principal hairs of the abdomen beside 6 in *A. malayi* larvae are No. 1 on segments II-VII and No. 13 (ventral) on II-VII. No. 1 is usually branched into two or three branches seldom four. No. 13 is similarly two, three or four branched.

5. *Armigeres (Armigeres) manalangi* Baisas, 1935 (Plate 8).

The same connection of the tubercles of meso-5, 6 and 7, of the tubercle of meso-8 with the plate of the meso-pleurals, and of the plate bearing meta-7 with

the meta-pleural plate occurs in *A. manalangii*. Meso-5, 6 and 7 are usually single, 5 is sometimes branched into two. Meso-8 has three or four branches, and meta-7 has three branches. The *lh* (hair 6) on abdominal segments I and II is relatively short and two or three-branched. Hair 7 is two-branched and is only slightly shorter than 6. Hair three of VIII is comparatively weak and three or four-branched. The comb scales are as illustrated (Plate 8, g).

6. *Armigeres (Leicesteria) digitatus* (Edwards), 1914 (Plate 9).

As shown in Plate 9, meso-hairs 6 and 7 are very close together. Their small tubercles are not confluent and they are far weaker and shorter than meso-5. Meso-8 and meta-7 are only two-branched each. The long meso and meta-pleurals are single. Hair 7 of abdominal I and II is much shorter than hair 6 of these segments and is single. Hair 6 may be branched into two on I, but is single on II. Hair 3 of VIII is rather short with about six branches. The comb scales are highly diagnostic (Plate 9, g).

7. *Armigeres (Leicesteria or Leicesteriomia?) flavus* (Leicester), 1908 (Plate 10).

Plate 10 shows certain hairs. The tubercles of meso-hairs 5, 6 and 7 are not united, but 6 and 7, like those of *digitatus* are very close to each other. Meso-8 and 9, like meta-7 and 9 are each two-branched, but 10 and 12 of both the meso and meta-thoraces are single and nearly equal. The *lh* 6 and 7 of abdominal segments I and II are almost equally long and two or three-branched each. Hair 3 of VIII has more branches than those of the other species. Comb scales are highly diagnostic (Plate 10, g).

8. *Armigeres (Leicesteria) magnus* (Theobald), 1908 (Plate 11).

Meso-5, 6 and 7 are as shown in Plate 11. Their tubercles are not confluent. Meso-8 usually has three branches; 9 has three or four branches; 10

and 12 are quite long, equal and split in
are 3-branched; 10 and 12 are almost equal
branched. The *lh* 6 and 7 of abdominal segments
two or three branches each. No. 3 of VII
(about three). Comb scales are as shown

Note that in *A. flavus* and *A. magnus*
of abdominal segments I and II is equal in
and equality in length of *lh* 7 to *lh* 6 of
of these two species. In the case of *A.*
unusual characters of the adult (setae on
But *A. magnus*, which does not possess such
character in the pupal state--the long hair

IX. KEY TO LARVAE

1. Mesothoracic hair 8, meta-hair 7, and

forming a fairly even line - - - *A. flavus*

nger, but with five branches (three or

ger, with the tips of the serrations

- - - - - *A. magnus*

II about $2/3$ or more the length of hair

ched into two each - - - - - *A. manalangii*

$1/2$ the length of hair 6 of these segments

o six - - - - - 5

ices where they split into several

3 of abdominal segment VIII rather short

hes. Meso-hairs 6 and 7 unusually weak

length of meso-5 - - - - - *A. digitatus*

ly with short lateral serrations.

o-5. Meso-7 exceeds one half the length

- - - - - *A. malayi*

all places, they are, as a whole, the primary contributor to the *Armigeres* (and certain other mosquito) populations. There are no coconut trees in the forests of Mt. Makiling, but picnickers leave many shells of the young coconut in the picnic grounds. These harbor not only *Armigeres*, but the more annoying stegomyias and other mosquitoes. As an example of *Armigeres* breeding, a shell of a young coconut, the only one with water at the edge of the Sierra Madre Mountains, in Puerto Real, Quezon Province, Luzon Island, taken on March 2, 1965, contained many small larvae of *Armigeres*. The contents of this shell was collected and reared. Table II shows the adults that emerged. The remaining 28 larvae were killed, identified and preserved. They were all *A. malayi*.

Next to coconut shells as breeding areas for *Armigeres* are cut bamboo. A limited number of larvae and pupae were found in individual stumps. *A. digitatus*, *A. flavus* and *A. magnus* were taken only from bamboo stumps. *A. digitatus* was not found in 1965. What we examined were adults taken as very young larvae (not mixed with larvae of other species) from a bamboo stump at the foot of Faculty Hill (part of the base of Mt. Makiling), Los Banos Agricultural School, University of the Philippines, Laguna Province. From a single cut bamboo fence post in Subic, Zambales, six pupae and 22 larvae were taken and reared individually. They were all *A. magnus*. There were nine males, thirteen females with associated larval and pupal skins and five males and one female with pupal skin associations only. The specimens of *A. flavus* on hand were all from bamboo stumps (San Pablo City, Laguna), but the collector did not separate the larvae by individual bamboo stumps. *A. joloensis*, *A. baisasi* and *A. malayi* larvae were mixed with *A. flavus* in this collection.

Axils of *Alocasia* sp. and axils of other plants are minor sources of *Armigeres* in Laguna Province.

We recovered no *Armigeres* from tin cans.

XI. SUMMARY

1. Seven species of Philippine *Armigeres* and *Armigeres subalbatus* from Japan are treated in this paper.
2. In the adult stage, it is shown that *Armigeres joloensis* of the Philippines and *Armigeres subalbatus* of Japan have in common certain markings on the mesonotum and abdominal sternites which have not been described before and that the mesonotal markings, including those of other species, are variable or unstable, easily rubbed in caught wild adults and therefore of no great value in routine identification. However, the markings on the abdominal sternites remain fairly intact even in badly damaged specimens, for which reason they are very useful in practical diagnosis.
3. In the pupal stage, it is shown that there is no character of generic or subgeneric value and that the specific differences, except in *Armigeres magnus*, are slight. The pupae of *Armigeres joloensis* and *Armigeres baisasi* cannot be differentiated and the pupa of *Armigeres subalbatus* resembles both very closely.
4. In the larval stage, it is shown that *A. joloensis*, *A. subalbatus* and *A. baisasi* are alike. Further, it is shown that two well marked characters may be of generic and subgeneric importance if these are found to be true for all other *Armigeres* of the Philippines and other countries. First, in all species examined including *A. subalbatus*, the tubercle or plate bearing mesothoracic hair 8 is fused with the plate from which the mesopleurals arise and the tubercle of metathoracic hair 7 is fused with the plate of the metapleurals. Second in those species belonging to the subgenus *Armigeres* (including *A. subalbatus*) mesothoracic hairs 5, 6 and 7 arise from a common elongated plate (true also in *A. breinli* as drawn by

Belkin 1962), but in the species in the subgenus *Leicestertia/Leicestermia*, these mesothoracic hairs arise separately from small plates.

5. The breeding habits from which the collection of 1964-1965 was taken are described.
6. Trapped adults of only two species were attracted to carabaos, cows and goats. Blooded specimens caught in light traps were obviously attracted by the light subsequent to feeding. The lone *A. joloensis* caught biting in the daytime may be an indication of poor human attraction.
7. For the first time, swarming of *A. joloensis* is reported.

ACKNOWLEDGEMENTS

The author is indebted to Colonel Marshall Y. Kremers and Major Frank H. Dowell, 5th Epidemiological Flight, for the chance to work again after retirement from the government service and for the opportunity to visit briefly the United States Museum at Washington, D.C., as well as the laboratories of Professor John N. Belkin in the University of California, Los Angeles. In particular I wish to thank Major Dowell for editing and proof reading the various drafts of this paper and for his many helpful suggestions.

The author also wishes to thank Dr. Benjamin D. Cabrera for permission to use the mosquito materials under his custody at the Institute of Hygiene, University of the Philippines, Manila, and Lt. Col. H. L. Keegan, 406th Medical Laboratory, for supplying *A. subalbatus* specimens.

The author is grateful for the technical assistance of M/Sgt. A. P. Andrews and Mr. J. L. Libay, both of the 5th Epidemiological Flight. Thanks are also due to Mr. ^{Angeles}~~Domingo~~ Matinez who made the illustrations for this paper.

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TABLE I
LARVAL AND PUPAL COLLECTIONS

Species	Without Associated Skins			With Associated Skins		
	Male	Female	Total	Male	Female	Total
<i>A. joloensis:</i>						
IH Series	58	77	135	11	12	23
C1 Series	67	46	113	13	20	33
<i>A. baisasi:</i>						
IH Series	46	119	165	2	19	21
C1 Series	76	57	133	41	23	64
<i>A. malayi:</i>						
C1 Series	21	30	51	1	12	13
<i>A. manalangi:</i>						
C1 Series	5	4	9	1	2	3
<i>A. digitatus:</i>						
IH Series	2	6	8	2	6	8
<i>A. flavus:</i>						
C1 Series	9	20	29	6	17	23
<i>A. magnus:</i>						
C1 Series	14	17	31	9	14	23
Totals	298	376	674	86	125	211

TABLE II
 REARED COLLECTIONS FROM A SINGLE COCONUT SHELL

Species	<u>Without Associated Skins</u>			<u>With Associated Skins</u>			Totals
	Male	Female	Total	Male	Female	Total	
<i>Armigeres baisasi</i>	24	12	36	9	10	19	55
<i>Armigeres joloensis</i>	9	10	19	7	10	17	36
<i>Armigeres malayi</i>	18	12	30	1	4	5	35
Totals	51	34	85	17	24	41	126

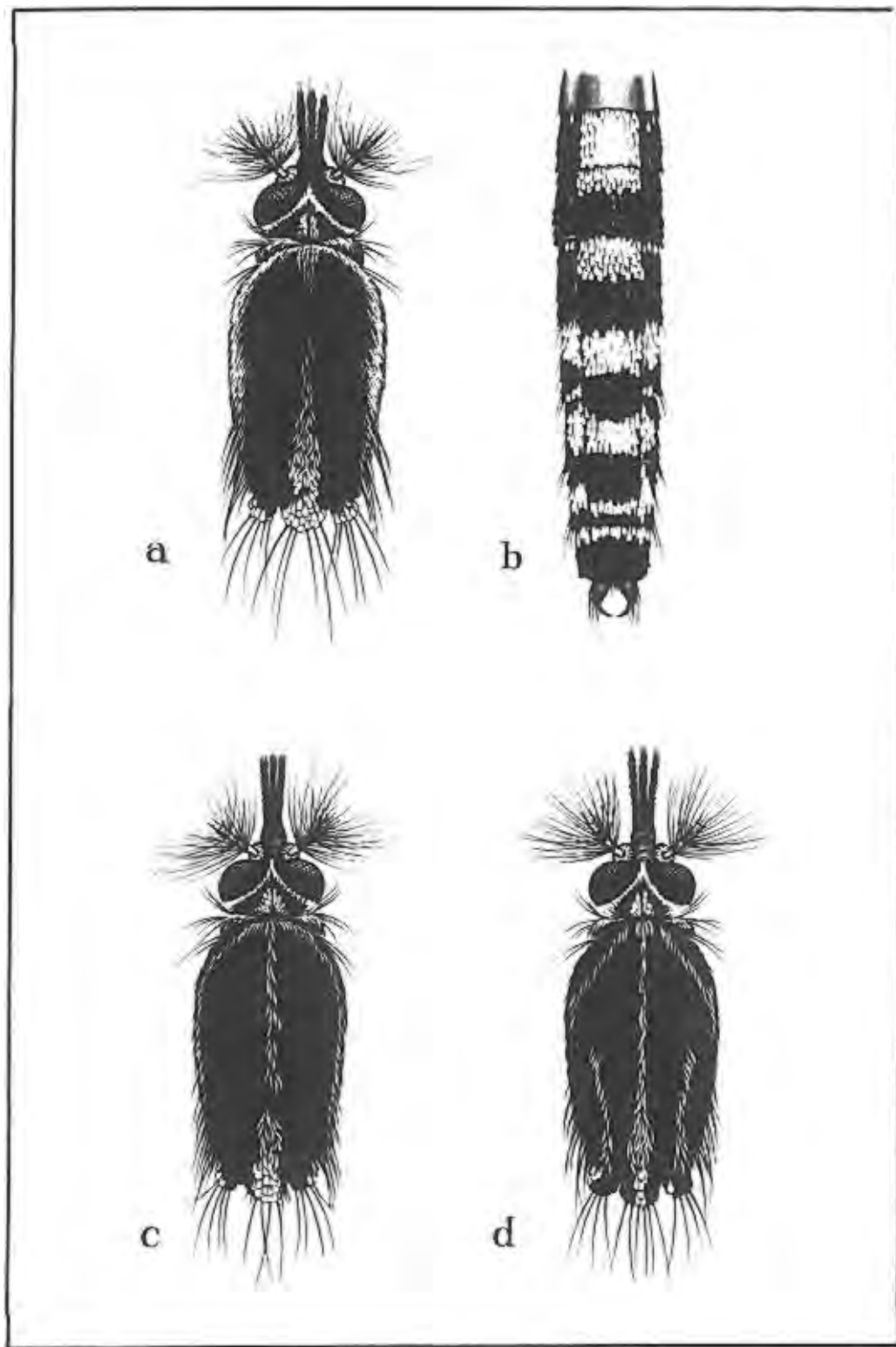


Plate 1. Parts of *Armigeres* adult: (a) Mesonotum and part of the head showing the mesonotal and scutellar markings sometimes found in male *A. joloensis* and male *A. subalbatus*, (b) Ventral aspect of abdomen showing particularly the black basal bands, aside from the apical black bands on sternites V and VI, which are found in all male *A. joloensis* and *A. subalbatus*. Found also in the female, but the basal dark ring on V is often much narrower, (c) Mesonotum and part of the head showing the distinct, though broken median white line of the mesonotum. An undetermined species, (d) Mesonotum and its markings and part of its head of *A. manalangii* from Mt. Mayon.

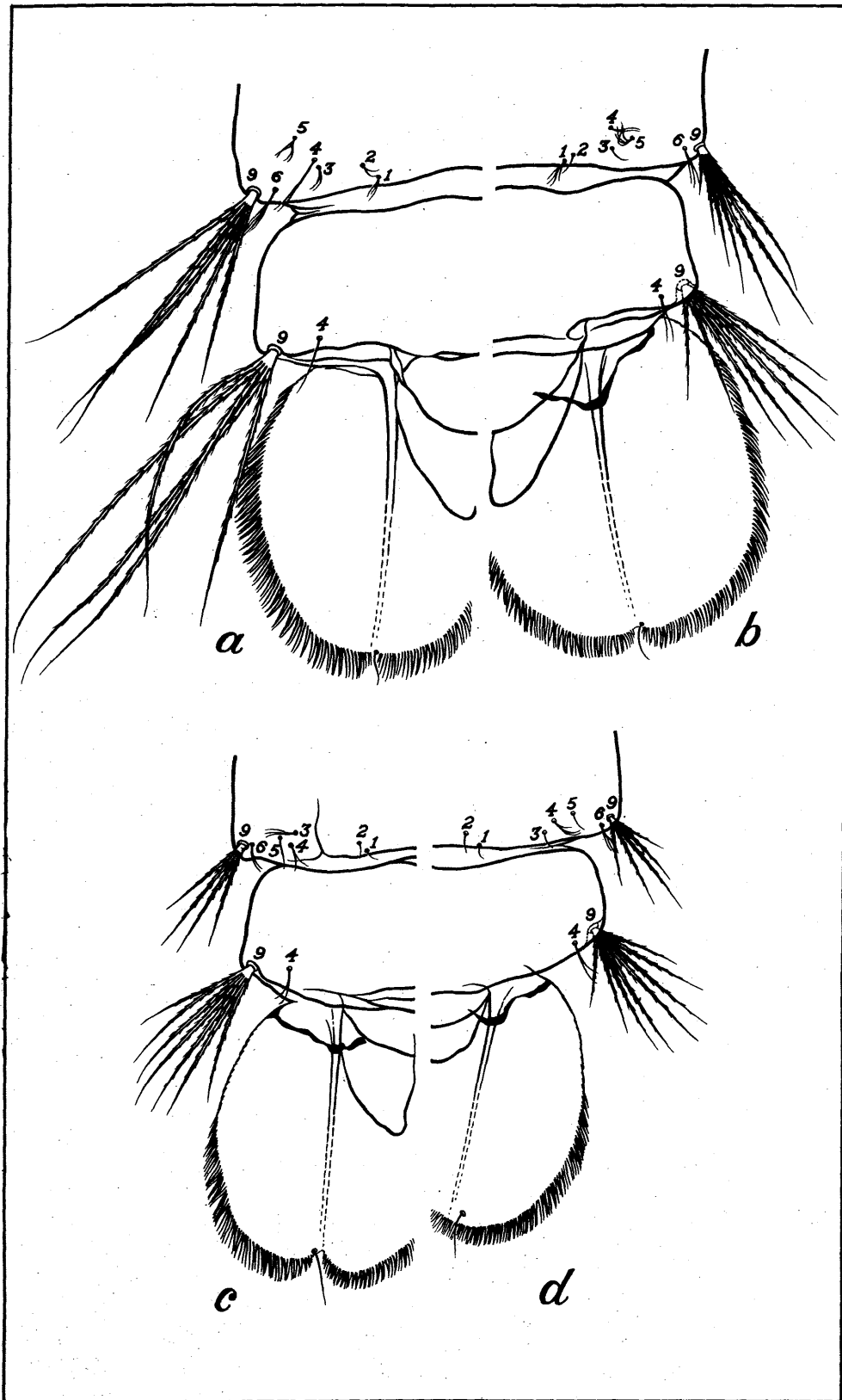


Plate 2. Segments VII and VIII and the paddles of *Armigeres* pupae: (a) *A. magnus*, (b) *A. flavus*, (c) *A. baisasi*, (d) *A. joloensis*.

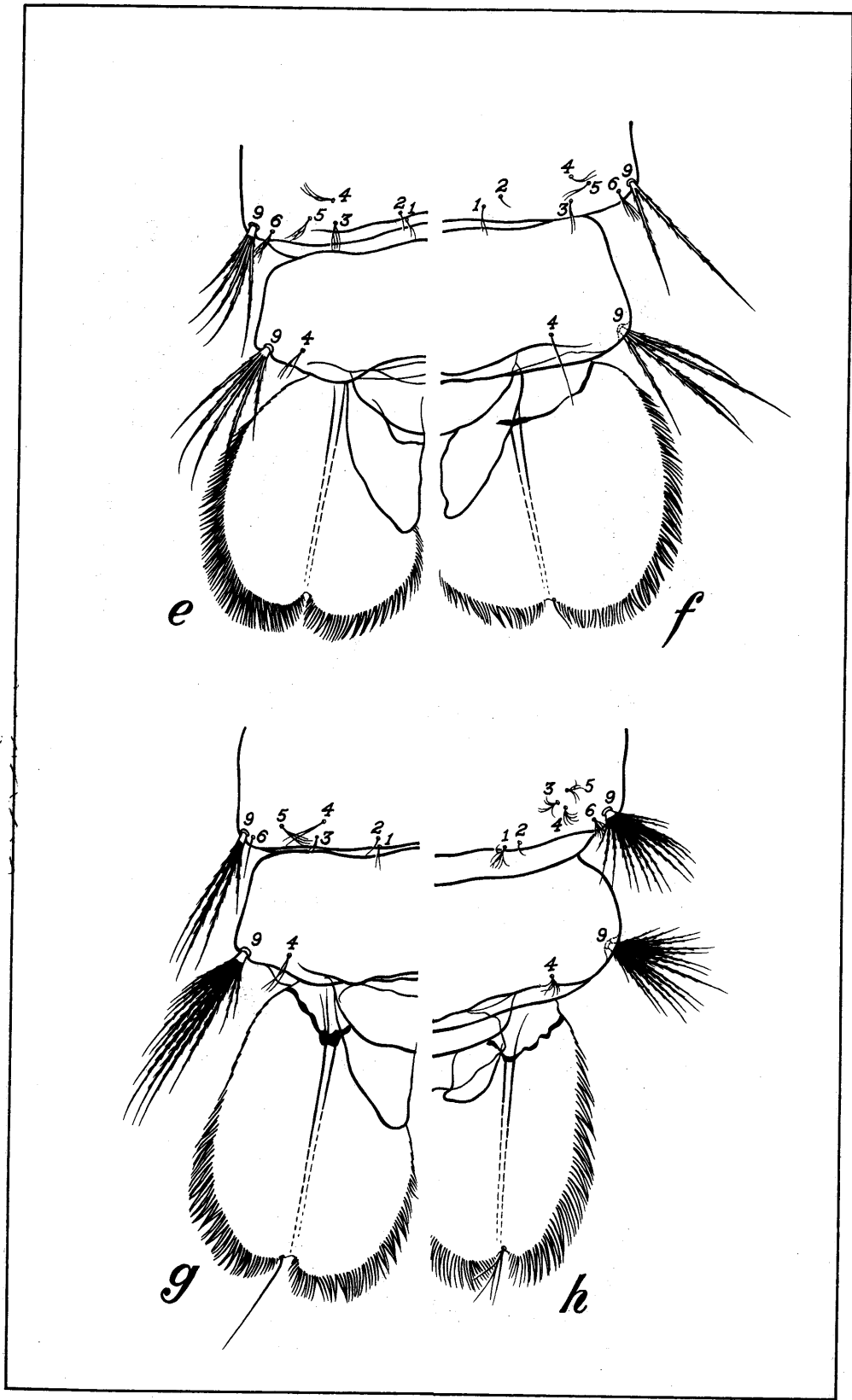


Plate 3^a. Segments VII and VIII and the paddles of *Armigeres* pupae: (e) *A. manalangi*, (f) *A. digitatus*, (g) *A. subalbatus*, (h) *A. malayi*.

^aLetter designations continue from Plate 2.

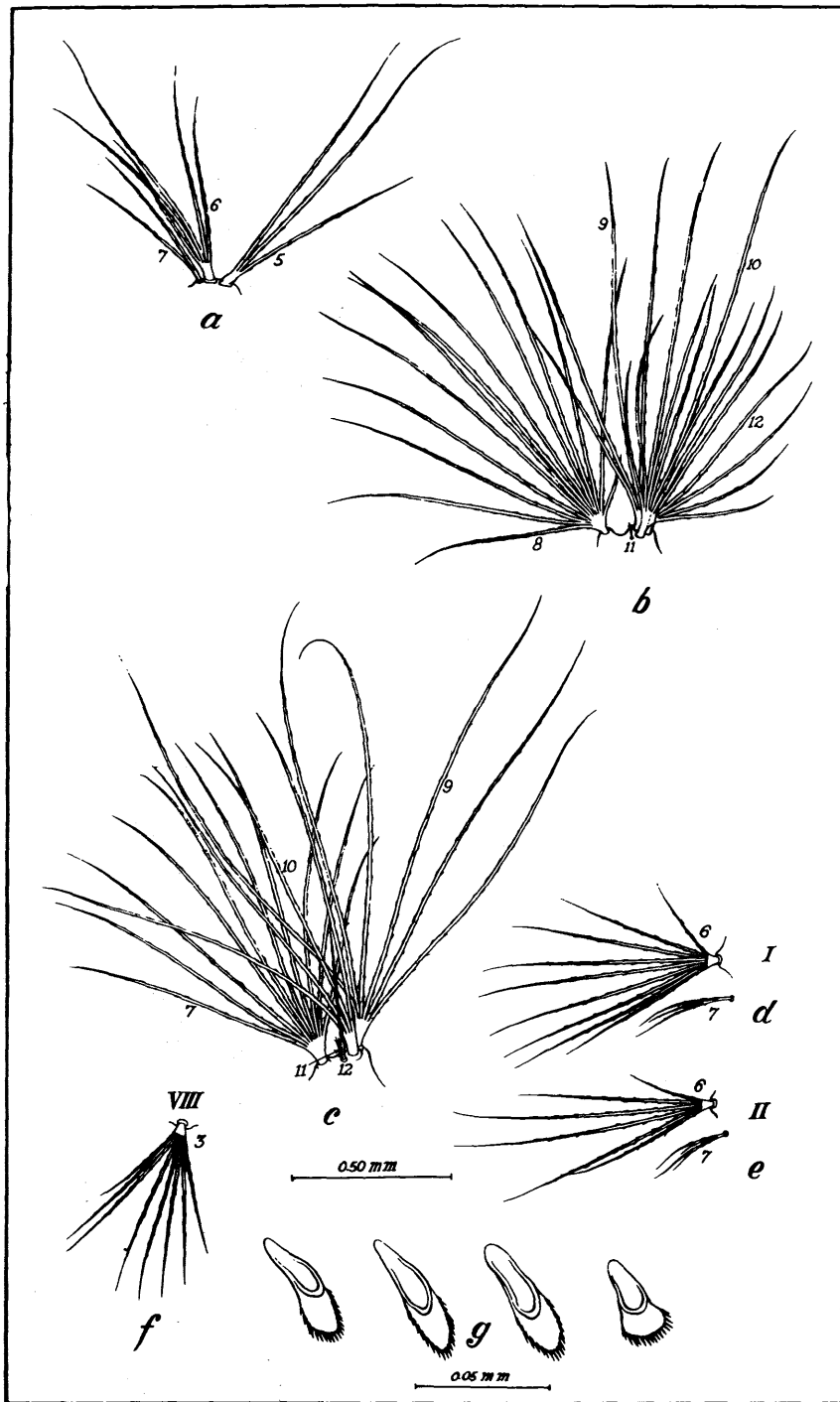


Plate 4. Some hairs and comb scales of *A. joloensis* larva: (a) meso-hairs 5, 6 and 7, (b) meso-hairs 8 to 12, (c) meta-hairs 7, 9 to 12, (d) lateral hairs 6 and 7 of abdominal segment I, (e) lateral hairs 6 and 7 of abdominal segment II, (f) hair 3 on segment VIII, (g) comb scales.

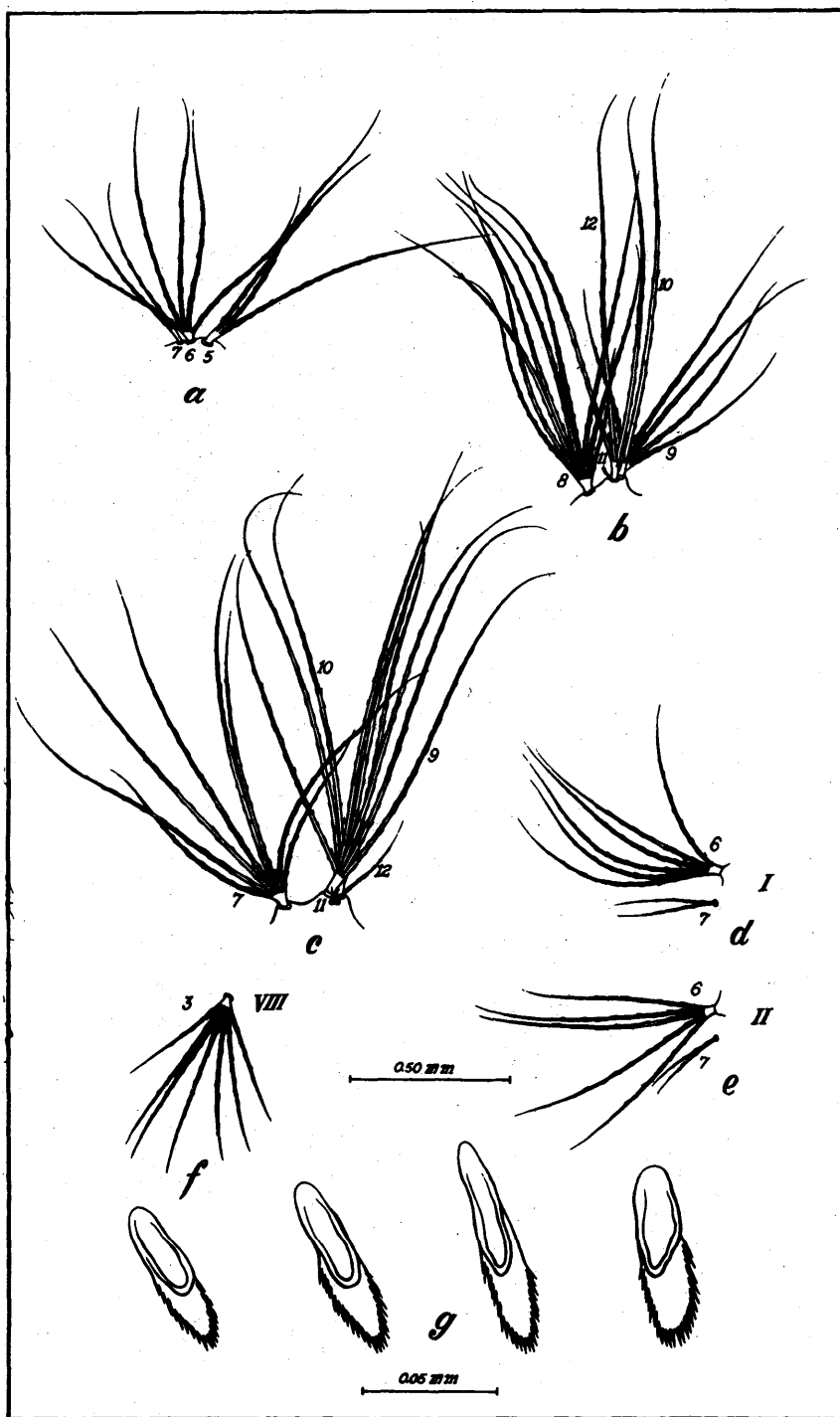


Plate 5. Some hairs and comb scales of *A. baisasi* larva: (a) meso-hairs 5, 6 and 7, (b) meso-hairs 8 to 12, (c) meta-hairs 7, 9 to 12, (d) lateral hairs 6 and 7 of abdominal segment I, (e) lateral hairs 6 and 7 of abdominal segment II, (f) hair 3 on segment VIII, (g) comb scales.

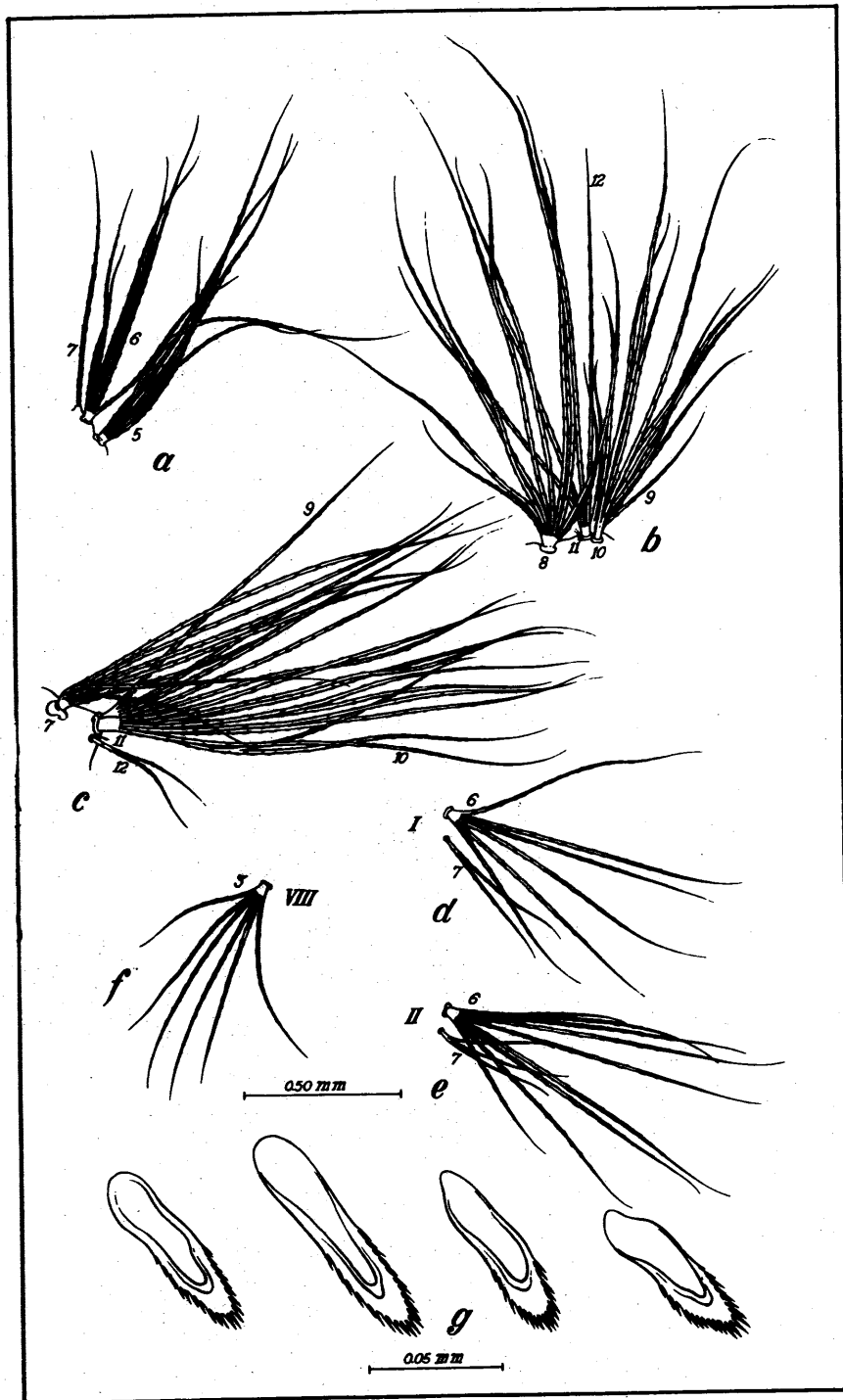


Plate 6. Some hairs and comb scales of *A. subalbatus* larva: (a) meso-hairs 5, 6 and 7, (b) meso-hairs 8 to 12, (c) meta-hairs 7, 9 to 12, (d) the lateral hairs 6 and 7 of abdominal segment I, (e) the lateral hairs 6 and 7 of abdominal segment II, (f) hair 3 on segment VIII, (g) comb scales.

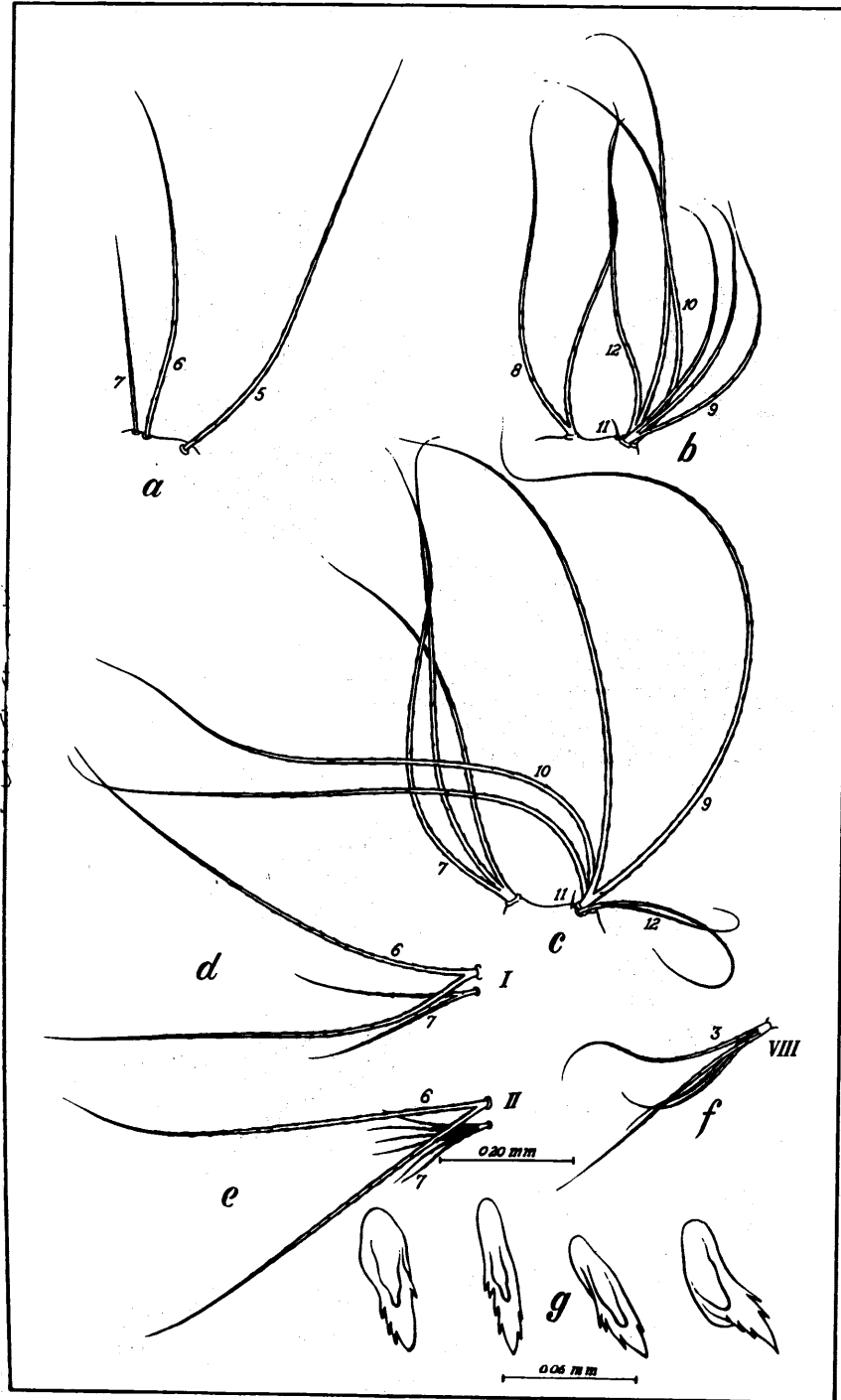


Plate 7. Some hairs and comb scales of *A. malayi* larva: (a) meso-hairs 5, 6 and 7, (b) meso-hairs 8 to 12, (c) meta-hairs 7, 9 to 12, (d) lateral hairs 6 and 7 of abdominal segment I, (e) lateral hairs 6 and 7 of abdominal segment II, (f) hair 3 on segment VIII, (g) comb scales.

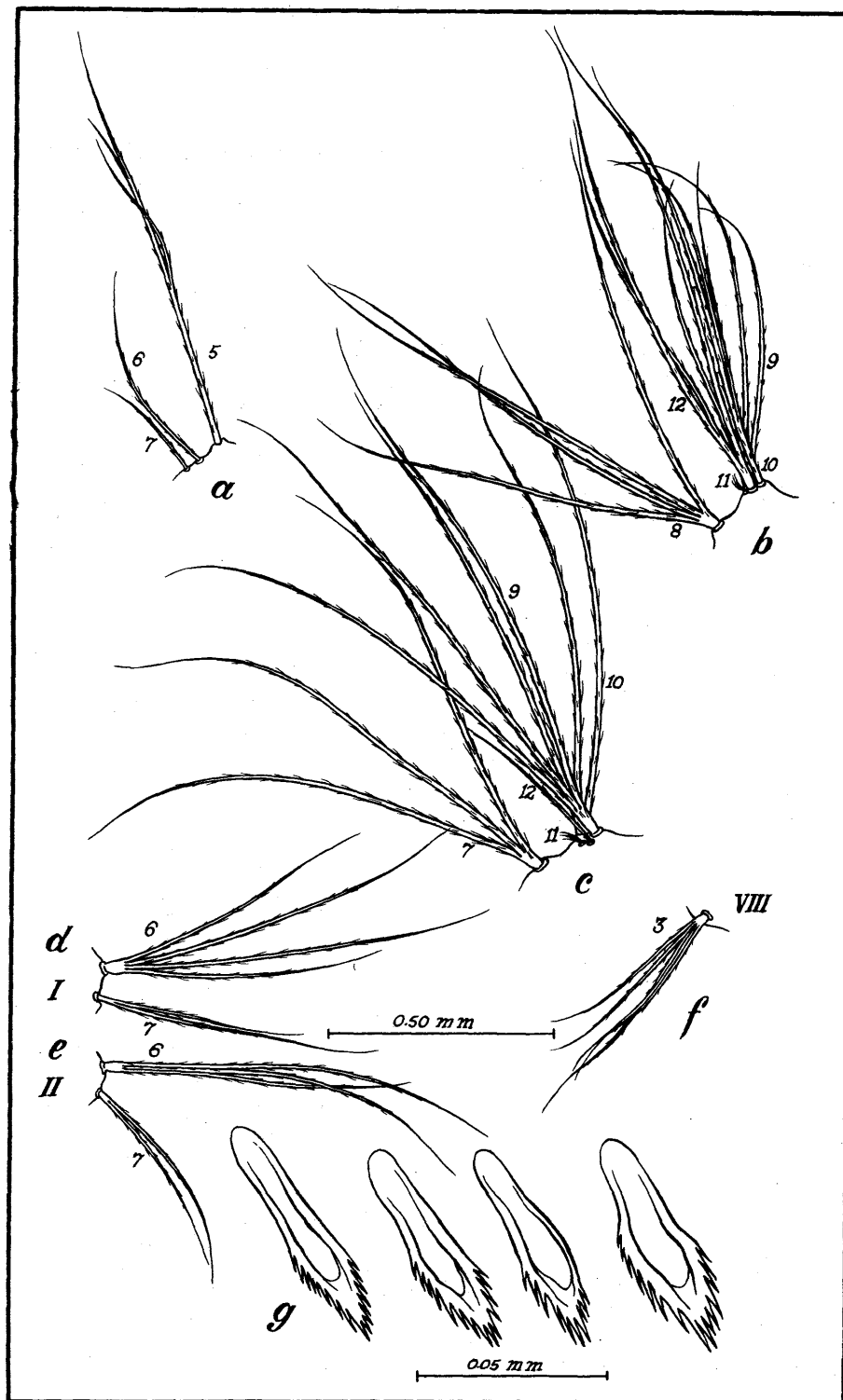


Plate 8. Some hairs and comb scales of *A. manalangi* larva: (a) meso-hairs 5, 6 and 7, (b) meso-hairs 8 to 12, (c) meta-hairs 7, 9 to 12, (d) lateral hairs 6 and 7 of abdominal segment I, (e) lateral hairs 6 and 7 of abdominal segment II, (g) comb scales.

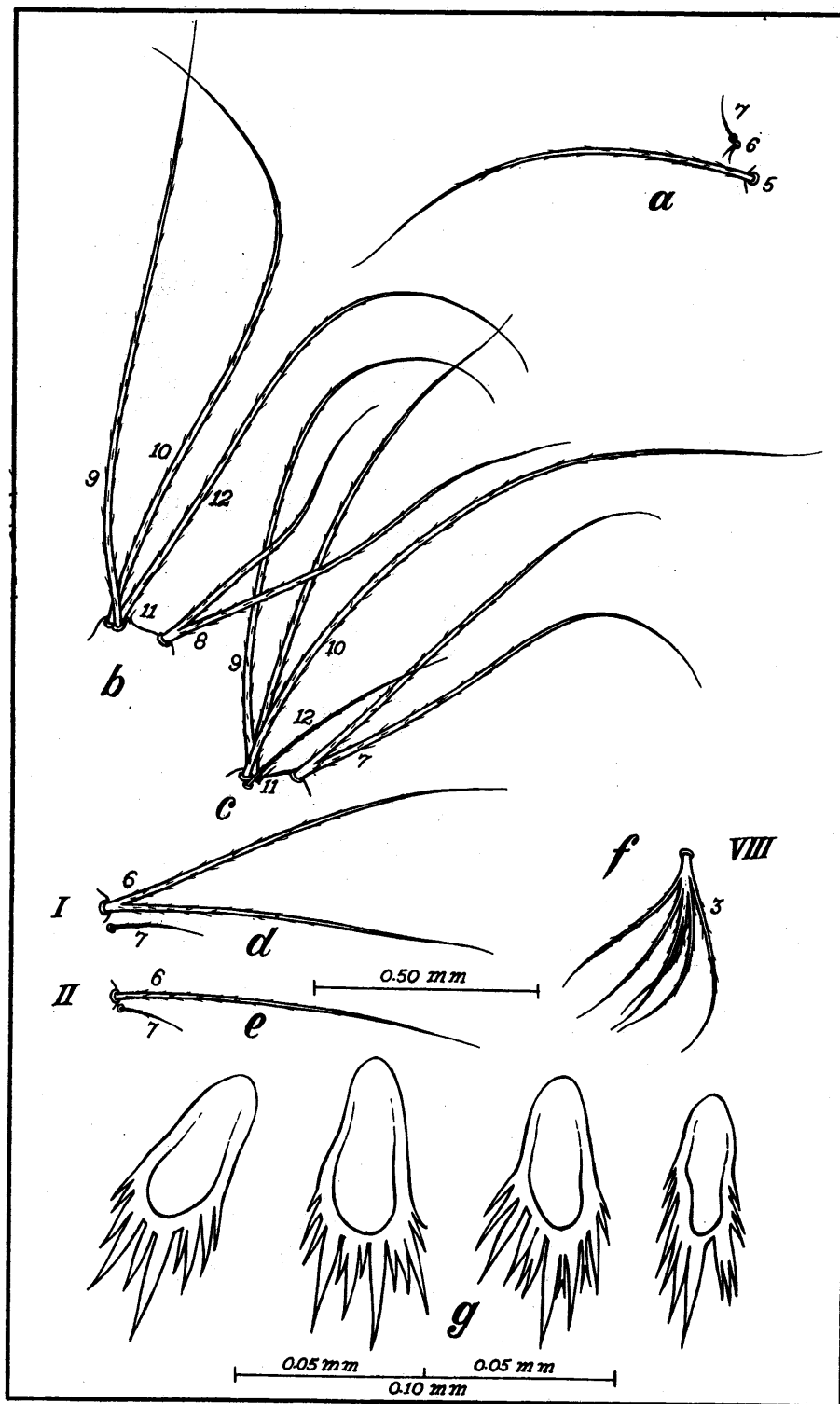


Plate 9. Some hairs and comb scales of *A. digitatus* larva: (a) meso-hairs 5, 6 and 7, (b) meso-hairs 8 to 12, (c) meta-hairs 7, 9 to 12, (d) lateral hairs 6 and 7 of abdominal segment I, (e) lateral hairs 6 and 7 of abdominal segment II, (f) hair 3 on segment VIII! (g) comb scales.

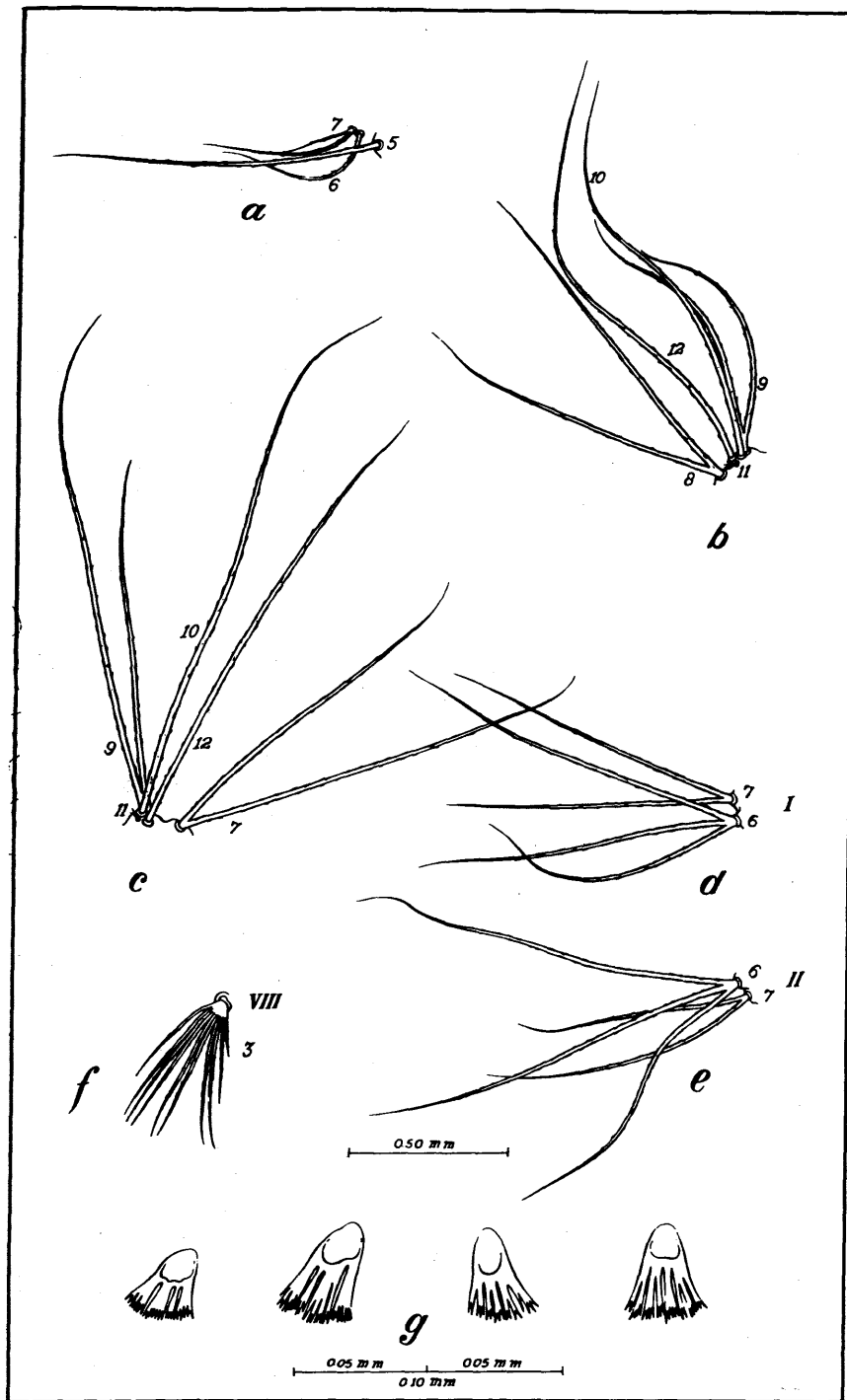


Plate 10. Some hairs and comb scales of *A. flavus* larva: (a) meso-hairs 5, 6 and 7, (b) meso-hairs 8 to 12, (c) meta-hairs 7, 9 to 12, (d) the lateral hairs 6 and 7 of abdominal segment I, (e) the lateral hairs 6 and 7 of abdominal segment II, (f) hair 3 on segment VIII, (g) comb scales.

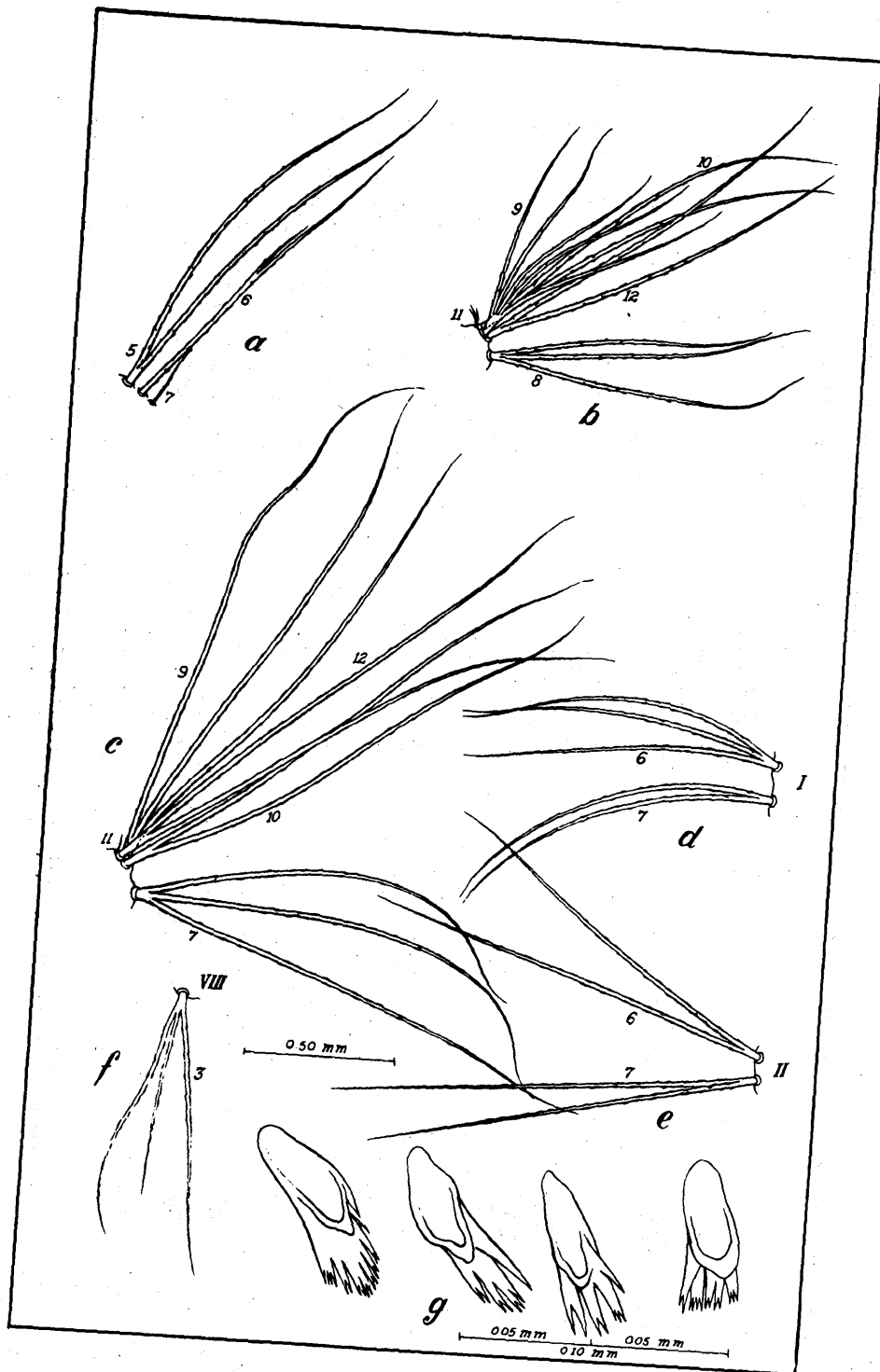


Plate 11. Some hairs and comb scales of *A. magnus* larva: (a) meso-hairs 5, 6 and 7, (b) meso-hairs 8 to 12, (c) meta-hairs 7, 9 to 12, (d) the lateral hairs 6 and 7 of abdominal segment I, (e) the lateral hairs 6 and 7 of abdominal segment II, (f) hair 3 on segment VIII, (g) comb scales.