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Two New Species of *Aedes* (Culicidae, Diptera) from Japan

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Satyu Yamaguti and Ryozo Tamaboko

Abstract

In 1951 the junior author reported two unnamed species of the genus *Aedes* from Mt. Haku-san, Ishikawa Prefecture, suggesting the first species to be related to *Aedes* (*Ochlerotatus*) *punctor*. An examination made by the senior author on large numbers of additional specimens collected at the same locality in 1952 and 1953 has revealed that each of the two represents a new species, so that *Aedes* (*Ochlerotatus*) *hakusanensis* is proposed for the first species, and *Aedes* (*Aedes*) *pseudoesoensis* for the second species.

**Two New Species of *Aedes* (Culicidae, Diptera)
from Japan
(with 4 Plates)**

By

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In 1951 the junior author reported two unnamed species of the genus *Aedes* from Mt. Hakusan, Ishikawa Prefecture, suggesting the first species to be related to *Aedes* (*Ochlerotatus*) *punctor*. An examination made by the senior author on large numbers of additional specimens collected at the same locality in 1952 and 1953 has revealed that each of the two represents a new species, so that *Aedes* (*Ochlerotatus*) *hakusanensis* is proposed for the first species, and *Aedes* (*Aedes*) *pseudoesoensis* for the second species.

The larvae of the these two species were found associated in two round, moderately sunlit, ground pools 1750 and 1900 m a. s. l. respectively. The adults were taken at different levels between 1000 m and 2500 m. They were seen sucking human blood in the daytime. The hibernating ova appear to hatch in early July, and the adults emerge all of a sudden in late July through early August, probably once a year.

1. *Aedes* (*Ochlerotatus*) *hakusanensis* n. sp. (Pl. I & II)

ADULT FEMALE. — *Head*: Vertex with golden narrow curved scales and dark and golden upright forked scales on broad median area; of the latter scales the golden ones are especially numerous posteromedianly and the dark ones posterosubmedianly. Lateral region with yellowish pale broad appressed scales. Torus dark brown, pale scaled and dark haired medially. Palpus and proboscis dark, former one-seventh to one-eighth as long as latter. *Thorax*: Scutal integument black, clothed with bronzy to golden narrow curved scales which are somewhat paler and broader on

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the prescutellar area, along the lateral margins as well as on the scutellar lobes. Anterior pronotal lobe with few golden narrow curved scales and more numerous paler spatulate scales, posterior lobe with golden narrow curved scales for most part and few pale broader scales at posterior end. Pleuron black, with patches of yellowish pale broad appressed scales on propleuron, sub- and postspiracular areas, paratergite, sternopleuron and mesepimeron; the scales on the sternopleuron and mesepimeron are paler than those of the other patches. Wing 3.8-4.8 mm long; vein scales narrow, entirely dark both dorsally and ventrally. Halter knob pale scaled. *Legs*: Femora pale ventrally, dark dorsally; patellar spots narrow. Tibia and tarsi dark throughout. *Abdomen*: First tergite with median patch of dingy pale scales. Second to seventh tergites with yellowish pale basal bands which are continuous laterally with the ventrobasal tergal patches. Eighth segment not retractile, with pale scales scattered. Sternites broadly pale banded basally, with apical margin dark scaled.

Female terminalia: Eighth sternite and tergite truncate. Ninth tergite with a pair of half-sclerotized semicircular lobes each bearing three or four minute setae. Insula with two pairs of setae. Sigma and cowl flattened apically. Postgenital lobe with distinct median notch. Cerci blunt-pointed, reaching about 0.15 mm beyond postgenital lobe. Spermatothecae 3, subglobular.

ADULT MALE.—Palpus dark, a little longer than proboscis. Distal portion of long segment and penultimate segment densely bristled ventrally; two terminal segments distinctly flattened. Wing about 4-5 mm long. Fore and mid tarsal claws unequal, dissimilar, one-toothed; hind claws equal, similar, one-toothed.

Male terminalia: Basistyle cylindrical, about four times as long as wide at middle, scaled on lateral and dorsal surfaces, with four or five, long, terminally curved setae dorsally opposite apical lobe; apical lobe broadly rounded, covered with short recumbent setae and some longitudinally striated ones; basal lobe prominent, with densely setose apical margin elongated dorsoventrally. The most ventral seta on the basal lobe is much stronger than the other marginal setae and hook-shaped terminally like some of its neighbors. Dististyle slender, shorter than basistyle, slightly expanded before middle, pilose and longitudinally striated, with a row of three or four spicular hairs along convex margin of distal portion;

terminal claw bilobed at tip, about one-seventh as long as dististyle. Claspette stem slightly outcurved, pilose for greater proximal part, with two papillated hairs medially at base; filament a little shorter than stem, curved, swollen near base, tapering to a rather blunt recurved tip. Mesosome subcylindrical, somewhat constricted toward middle, nearly twice as long as wide, open apically and dorsally; apicoventral margin with rounded notch, apical dorsal margin very finely denticulated; ventrobasal opening longer than wide. Paramere articulated with basal plate beyond middle; apical portion heavily sclerotized, with rough surface; basal portion expanded dorsoventrally to support mesosome. Apical claw of paraproct reduced, without accessory tooth on concave side. Anal membrane with seven papillated hairs apically and a deep median cleft, on each side of which is a chitinous shield of irregular outline. Ninth sternite lobes small, longer than broad, each bearing three to five short stout spines.

PUPA.—Trumpet elongate funnel-shaped, 0.5–0.52 mm long; paddle ovate, 0.9–0.95×0.63–0.65 mm, slightly projecting at origin of apical seta.

LARVA.—*Head*: Broader than long. Preclypeal spiniform, incurved, with fine accessory hair dorsolaterally. Clypeals lacking. Postclypeal fine, 3 to 5 forked, just anteromedial to middle frontals. Inner frontal 2 to 5 forked, middle 2 or 3 forked, both unbarbed; outer slightly barbed, 5 to 11 forked. Inner sutural single or double, outer 2 to 4 forked. Orbital single or double. Ventrolateral stellate, 5 to 11 forked. Ventrally medial to the eye are two hairs, the anterior being single and the posterior 4 to 7 forked. Postmental 3 to 6 forked. Inner and outer postmaxillaries single. *Antenna*: Shorter than head, spined all over, with proximal ventral spines definitely smaller than others, tipped with a fine seta, a basally jointed spine and a proximally chitinized hyaline process bearing a spinelet sideways on the chitinous portion; subterminal setae unequal, longer one spiniform, reaching beyond terminal seta, with false joint near tip; antennal 5 to 9 forked, not reaching tip of antenna, inserted before middle of shaft. *Mouth parts*: Palatals barbed. Maxilla with a densely bristled pad medially, two very stout spines close together dorsally between two densely haired areas; maxillary palp plump, somewhat constricted, with four rodlets and a conical sensory papilla at tip. Mandible spined pos-

terolaterally, with a finely pectinate blade and two stout spines at anterolateral corner; cutting organ consisting of a pectinate ventral blade, a four-toothed main saw with one blunt anterodorsal spine, and two dorsal teeth, of which the anterior is double or complex, and the posterior is single or double and continued onto the denticulous transverse ridge lying immediately posterodorsal to the main saw. Lateral blades of labrum very finely pectinate. Stylets exactly tandem, with a blunt denticle between two pairs. Ventral labial plate triangular, with 26 or 27 denticles; apron hairs plumose. *Prothorax*: Dorsal principal tufty. Shoulder hairs well developed, 2-4, 1 and 2-3 forked respectively. Inner dorsolateral fine, single, seldom double; middle double or triple, outer single. Lateral 3 to 5 forked, sublateral 2 or 3 forked. Ventrolateral consisting of a long single bristle, two smaller single hairs and a minute tuft. Ventral single or double. *Mesothorax*: Dorsal principal single or double, comparatively long; accessories small, 2-5, 1-2 and 2-3 forked respectively. Inner dorsolateral single, middle 4 to 7 forked, outer single, latter two close together. Lateral 6 to 11 forked, with accessory tuft ventrally. Sublateral consisting of two long single bristles, a 5 to 10 forked tuft, two bifid basal teeth and minor comb teeth. Ventral tufty. *Metathorax*: Of the six dorsals the outer two are single, others 1-4, 1-2, 4-8, and 2-4 forked respectively. Lateral 7 to 12 forked, with accessory tuft ventrally. Sublateral consisting of a single bristle, a 5 to 8 forked tuft, two finer simple hairs and basal comb teeth. Ventral tufty. *Abdomen*: Lateral principals are as follows: Segment I, 2 bristled, dorsal double, rarely triple, ventral single; segment II to VI, 1 bristled, double. *Eighth segment*: Comb scales 10 to 30 in number, spiniform, fringed on each side at base, arranged in 2 or 3 transverse rows; Pentad hairs 3-5, 1, 5-8, 1 and 3-5 forked respectively. Siphon subcylindrical, with prominent acus, $0.86-1.1 \times 0.27-0.42$ mm; siphonal index 2.4-3.1:1. Pecten confined to basal half of siphon, made up of 14-26 evenly spaced teeth, apical tooth may be more or less widely spaced. Individual tooth with 2 to 6 basal denticles on one side. Siphonal hair 4 to 8 forked, longer than basal diameter of siphon, inserted at or before middle of siphon. Apicodorsal hair fine, nearly as long as apical pecten tooth. *Anal segment*: Longer than wide. Saddle 0.3-0.38 mm long, incompletely ringed, with acus at each anterior basal corner; saddle hair

single, long. Dorsal tuft consisting of an upper pair of long single bristles and a lower pair of 5 to 8 forked bristles. Ventral brush consisting of 19 to 22 bristles, of which the 2 to 5 anterior are shorter and lie outside the grid; individual bristle 2 to 7 forked. Gills long, tapered distally, $1.5 - 1.8 \times 0.1 - 0.2$ mm.

DISCUSSION: This species differs from the most closely related *Aedes* (*Ochlerotatus*) *punctor* Kirby, 1837, in the wing scales being entirely dark, in the tibiae and first tarsal segments being dark throughout, in the ventral setae on the basal lobe of the basistyle being recurved like the most ventral one, and in the ventrobasal opening of the mesosome being longer than wide instead of wider than long. The differences in the larval characters between the present species and the related species are shown in the following table.

	<i>A. punctor</i>	<i>A. communis</i>	<i>A. hakusanensis</i>
Inner frontal	single or double	single	2 - 5 forked
Middle frontal.	single or double	single	2 or 3 forked
Anterior shoulder hair . .	single	single or double	2 to 4 forked
Posterior shoulder hair . .	single or double	2 or 3 forked	2 or 3 forked
Mesothoracic dorsal principal	small, tufty	single or double, short	single or double, long
Saddle	completely ringed	half-ringed	not completely ringed
Saddle hair	tufty	single	single

2. *Aedes* (*Aedes*) *pseudoesoensis* n. sp. (Pl. III & IV)

ADULT FEMALE.—*Head:* Vertex with pale golden slender scales in median field, on either of which is a large dark patch of broad appressed scales. Numerous dark upright forked scales in posterior submedian area, pale golden narrow scales along eye margin, and greyish white broad appressed scales in lateral region. Torus brown, with minute pale or dark scales medially. Proboscis and palpus dark throughout, former about six times as long as latter. First flagellar segment of antenna pale scaled medially. *Thorax:* Scutal integument dark, clothed with golden or pale bronzy slender scales which are less numerous on the fossal area and entirely lacking at the center of the prescutellar area. Similar

scales on each lobe of scutellum as well as on anterior and posterior pronotal lobes, though the scales forming a patch near the posterior margin of the posterior pronotal lobe may be somewhat broader and paler. Pleuron brownish dark, with patches of pale spatulate scales, one each on propleuron and mesepimeron, two on sternopleuron. Postspiracular area with bristles and narrow curved scales anteriorly and somewhat broader scales posteriorly. Paratergite with golden narrow curved scales. No lower mesepimeral bristle. Wing 3.5-4.2 mm long, vein scales dark, mostly narrow, without spots. Halter knob pale scaled. *Legs*: Femora pale ventrally and dark dorsally, with narrow patellar spots; tibiae indistinctly pale striped ventrally, dark elsewhere, tarsi dark throughout. *Abdomen*: First tergite with a median patch of dark broad scales. Second to seventh tergites with pale, very narrow, basal bands. Except for the third and fourth these bands are not continuous laterally with the ventrobasal patches, which tend to extend over the dorsal side as they proceed backward. The second band forms a distinct median patch. Sternites pale and dark scaled, dark scales predominating apically. Eighth segment largely retracted within seventh segment.

Female terminalia: Eighth tergite truncate, eighth sternite triangularly notched at median posterior margin. Ninth tergite saddle-shaped, produced backwards into paired nodular lobes, each of which bears 11 or 12 setae. Insula not differentiated. Sigma flattened apically, cowl very wide, with flattened chitinous margin apically. Postgenital lobe approximately quadrate, convex laterally and distinctly incised apically, with two dorsal and eight or nine ventral setae on each side. Cerci tapered toward apex, reaching about 0.13 mm beyond postgenital lobe. Spermatothecae 3, subglobular (one larger than other two), measuring about 90 μ , 75 μ and 75 μ in length respectively.

ADULT MALE.—Proboscis attenuated at middle third, about seven times as long as palpus. Wing 2.7-3.6 mm long. Fifth to seventh basal tergal bands continuous with lateral patches extending from ventral side, or inconspicuously interrupted laterally. Eighth tergite may be pale scaled all over. Fore and mid tarsal claws unequal, dissimilar; larger claw with a branch near base, smaller claw untoothed. Hind tarsal claws equal, similar, untoothed.

Male terminalia: Basistyle tapered to blunt-pointed cone, at

the base of which is attached the dististyle, and which bears long setae apically and dorsally; proximal portion of basistyle scaled and bristled laterally and dorsally, with a dense group of long and short setae dorsomedially just distal to base of claspette, its inner basal margin densely bristled, forming a small setose conical projection just ventral to base of claspette. Dististyle consisting of a conical basal projection bearing several small setae, and a long arcuate process, whose convex apical margin is fringed with a single, partly double, row of denticles, of which a few proximal ones may be much smaller, sharp-pointed and somewhat widely spaced, while the other ones are blunt-pointed. In addition to these denticles there is a zigzag row of extremely fine pointed denticles dorsal to the above mentioned fringe. Claspette reduced to a small pointed pilose process bearing one or two setae at apex and two or three setae subapically. In this respect it differs from that of *Aedes esoensis* Yamada, in which the claspette has only one seta or two in addition to the apical. Mesosome consisting of a cylindrical basal portion and a bulbous apical portion bearing two pairs of heavily sclerotized dorsal spines just as in *A. esoensis*. Paramere enlarged at middle, where it is articulated with the basal plate. Paraproct terminating in a simple apical claw; its ventral arm running transversely dorsal to base of ninth sternite lobe and joining its fellow of the other side in median line. Ninth sternite lobes short cylindrical or rather nodular, with numerous fine setae.

PUPA.—Trumpet and paddle similar to those of *Aedes esoensis* Yamada, measuring 0.5–0.55 mm long and 0.75–0.9×0.5–0.6 mm respectively.

LARVA.—*Head*: Broader than long. Preclypeal slender, indistinctly barbed or not, with accessory hair posterolaterally. Postclypeal 6 to 8 forked, level with inner frontals or just in front of them. Frontals well developed, in same line; inner 5 to 8 forked, middle 3 to 7 forked, outer 9 to 13 forked. Inner sutural 2 to 4 forked, outer 2 to 5 forked. Orbital 3 to 5 forked. Ventrolateral stellate, 5 to 8 forked. Anterior ventral hair medial to eye 2 to 4 forked, posterior tufty, 5 to 10 forked. Postmental 2 to 6 forked. Inner and outer postmaxillaries single. *Antenna*: Shorter than head, rather sparsely spined, somewhat dark at extreme base as well as distally, tipped with one spine, one seta and proximally chitinized hyaline process; subterminal setae unequal; longer one rather spiniform,

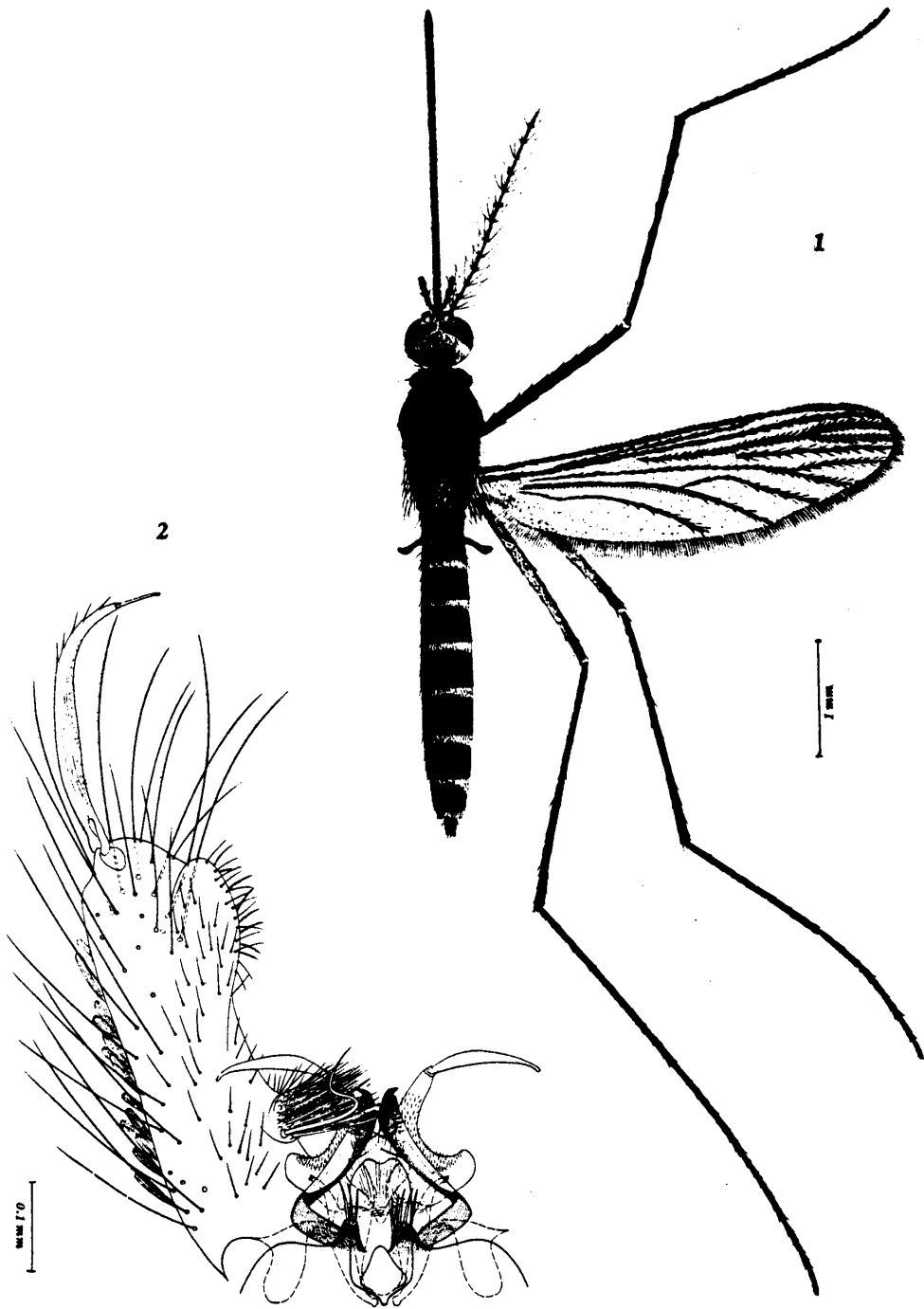
reaching beyond terminal seta. Antennal 6 to 11 forked, inserted before middle of shaft, reaching to tip of antenna. *Mouth parts*: Suprapalatals branched distally, palatals barbed. Maxilla distinctly denticled on posterolateral surface, fringed with short barbed setae along posterior medial margin; maxillary palp small, subcylindrical except for base, with four rodlets and a sensory papilla whose tip is produced into a hyaline process. Mandible sparsely spined on dorsolateral aspect, with a finely pectinate blade and two arcuate spines at anterolateral corner. Cutting organ consisting of a pectinate ventral blade, a four-toothed main saw with an anterodorsal spine, and two dorsal teeth, of which the smaller anterior has an accessory denticle and the posterior is simple or has an accessory denticle near base, with its base continued onto a denticulous ridge. Labral blades finely pectinated along apical margin. Stylets without chitinous denticulations between two pairs. Dorsal labial plate with a four-toothed transverse ridge at apex; ventral labial plate triangular, with 24 to 27 marginal denticles; apron hairs mostly unilaterally plumose. *Prothorax*: Dorsal principal tufty. Shoulder hairs small, especially the anterior and middle, which are 2 to 4 and 1 or 2 forked respectively, posterior definitely longer than other two, always single. Inner dorsolateral small, 2 to 4 forked, middle and outer long, single. Lateral 2 to 4 forked, sublateral a little smaller, single or double. Ventrolateral consisting of a minute tuft and three small hairs, one of which may be single or double. Ventral double. *Mesothorax*: Dorsal principal and first accessory small, 3 to 6 and 1 to 3 forked respectively, longest second accessory single, third 2 to 4 forked. Inner dorsolateral single, middle 4 to 6 forked, outer single, latter two close together. Lateral 5 to 7 forked, with accessory tuft ventrally. Sublateral consisting of two single bristles, a 6 or 7 forked bristle and forked or comblike basal spines. Ventral tufty. *Metathorax*: Outer two dorsals single, first to fourth 2-4, 3-6, 7-13 and 2-4 forked respectively. Lateral 5 to 8 forked, with accessory tuft ventrally. Sublateral consisting of a single and a 3 or 4 forked bristle, a fine simple hair, an extremely fine tuft, and comblike basal spines. Ventral tufty. *Abdomen*: Lateral principal hairs are as follows: Segment I, 2 bristled; dorsal 2 to 4 forked, ventral single or double; segment II, 1 bristled, double or triple; segment III to VI, 1 bristled, single. *Eighth segment*: Comb scales 9 to 16

in number, arranged in a zigzag row; individual scale fringed laterally except for its strong spiniform point. Pentad hairs 3-5, 1-2, 4-9, 1 and 6-10 forked respectively. Siphon slightly tapered toward apex, with prominent acus, $1.0-1.3 \times 0.25-0.38$ mm; siphonal index 3-4:1. Pecten extending beyond middle of siphon, made up of 11 to 19 spiniform teeth, of which the apical two are widely spaced; individual tooth 1 to 5 denticled on one side near base, 1 to 3 denticled on opposite side. Siphonal hair small, 2 to 5 forked, nearly as long as apical diameter of siphon, inserted about twice as far from base as from apex. Apicodorsal hair very fine, much shorter than apical pecten tooth. Near the apex of the siphon there are two pairs (one subdorsal and one subventral) of minute 1 to 4 forked hairs. *Anal segment*: Longer than broad. Saddle 0.3-0.35 mm long, reaching halfway down the sides of the segment, without acus at basal corner; saddle hair single, occasionally 2 or 3 forked, comparatively long. Dorsal tuft consisting of an upper pair of 6 to 10 forked bristles and a lower pair of long single bristles. Ventral brush of ten or twelve, 3 to 8 forked tufts, of which the short anterior three or four are outside the grid. Gills slender, $1.2-1.75 \times 0.15-0.2$ mm, ventral pair only slightly shorter.

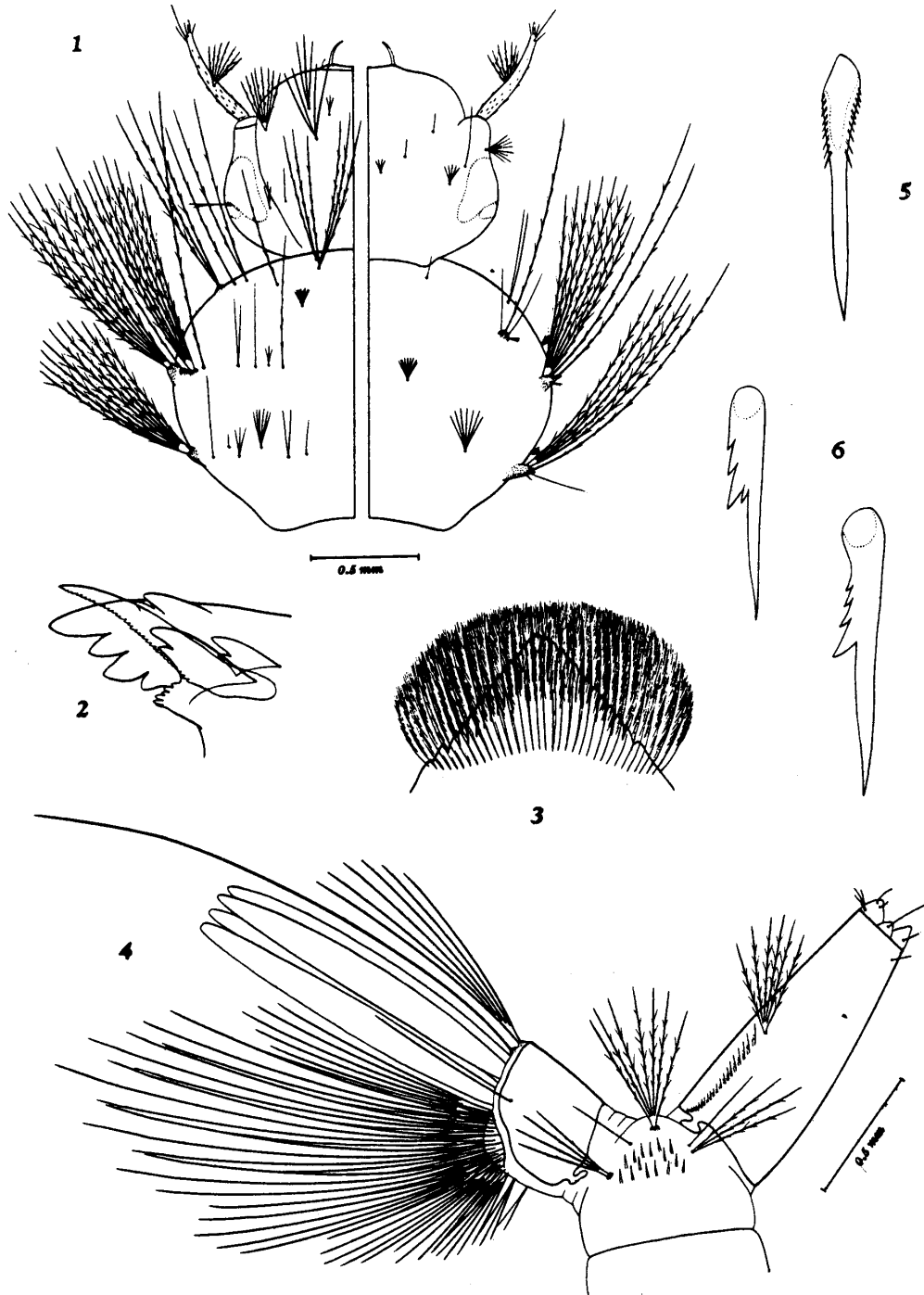
DISCUSSION: This species resembles *Aedes* (*Aedes*) *esoensis* Yamada, 1921, so closely that on cursory examination it may be easily confused with the latter, but differs in the adult chiefly in the body size, in the basal tergal bands being much smaller and not continuous laterally with the ventrobasal patches except for the third and fourth, etc. In the larvae there are more definite differences in the dorsal cutting teeth, in the apical denticulation of the dorsal labial plate, in the extent of the pecten, in the position of the siphonal hair, and in the number of the additional siphonal hairs, etc.

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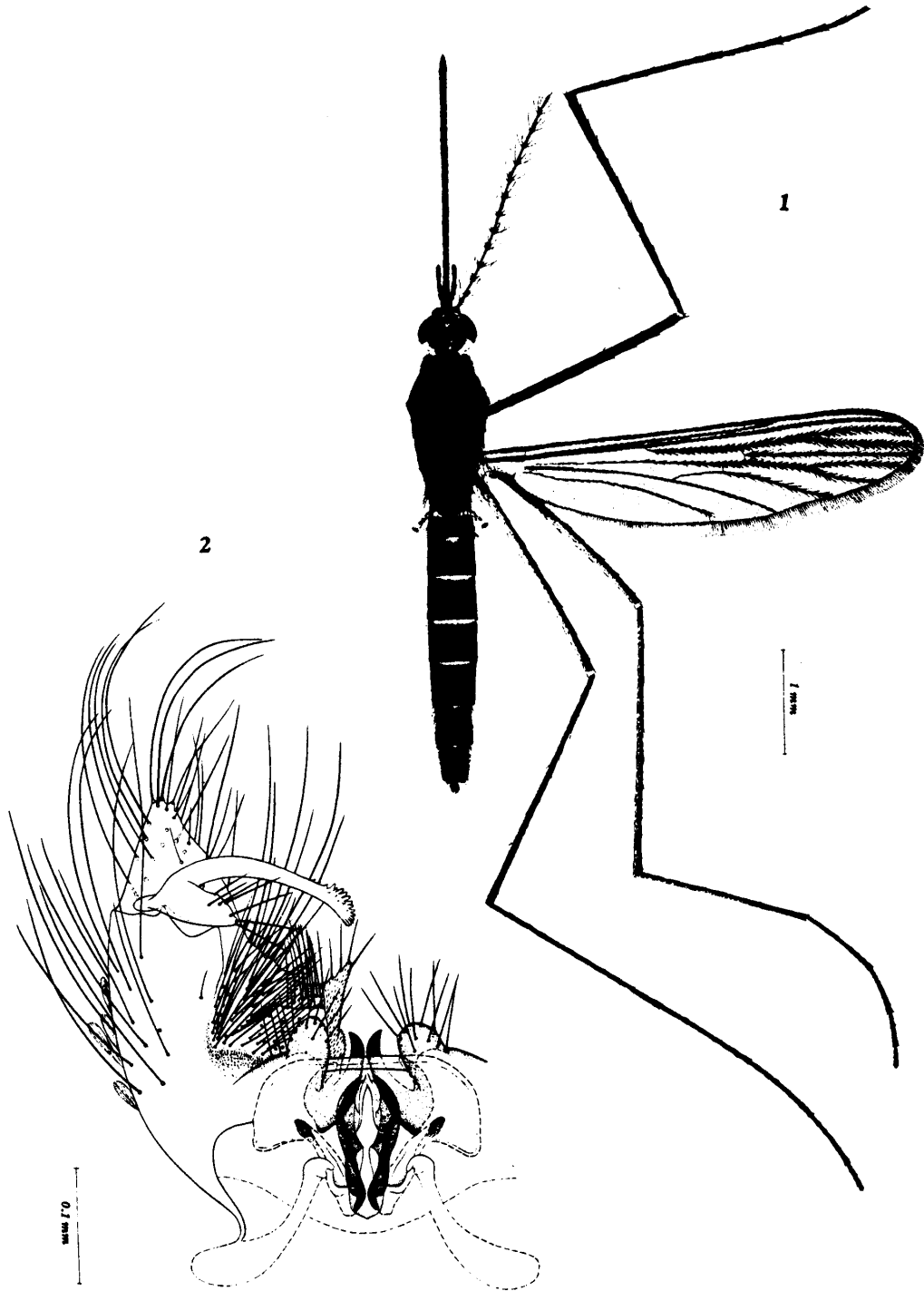


Aedes (Ochlerotatus) hakusanensis n. sp. :
1. adult female, 2. male terminalia, ventral view.

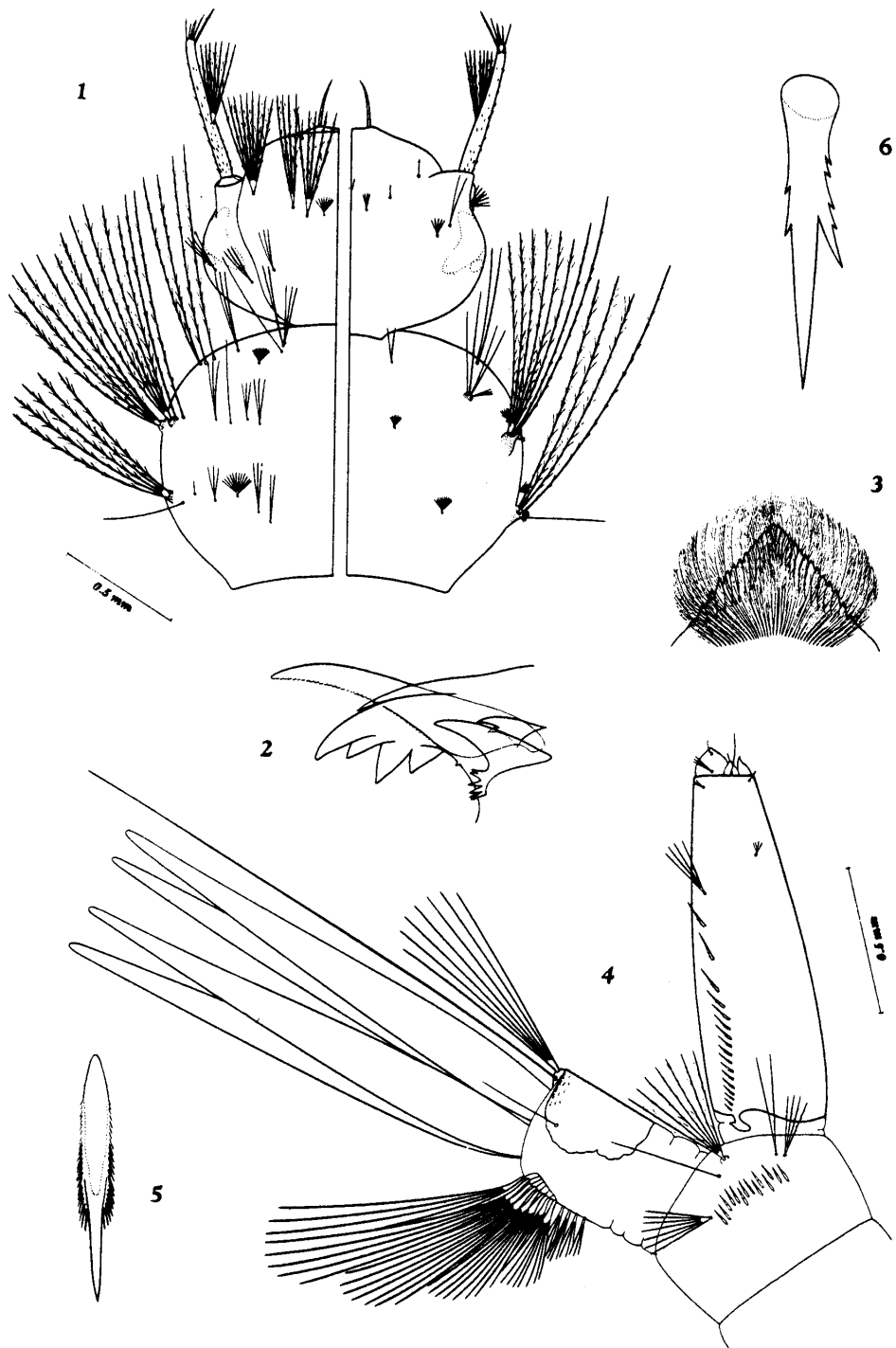


Aedes (Ochlerotatus) hakusanensis n. sp. (larva):

1. head and thorax, 2. cutting organ of mandible, 3. labium,
4. posterior extremity, 5. comb scale, 6. pecten teeth.



Aedes (Aedes) pseudoesoensis n. sp. :
1. adult female, 2. male terminalia, ventral view.



Aedes (Aedes) pseudoesoensis n. sp. (larva):

1. head and thorax, 2. cutting organ of mandible, 3. labium,
4. posterior extremity, 5. comb scale, 6. pecten tooth.