

## ORIGINAL ARTICLE

First fungus gnats of genus *Manota* Williston (Diptera: Mycetophilidae) from JapanHeikki HIPPA<sup>1</sup> and Jostein KJÆRANDSEN<sup>2</sup><sup>1</sup>Swedish Museum of Natural History, Stockholm; and <sup>2</sup>Museum of Zoology, Lund University, Lund, Sweden**Abstract**

The genus *Manota* is recorded from Japan for the first time. Three new species, *Manota satoyamanis*, *Manota indahae* and *Manota tunoae* spp. nov., are described, based on specimens collected in an ecological sampling program of arthropods in the “satoyama” landscape of Ishikawa Prefecture. “Satoyama” represents the traditional rural landscape of Japan, which is characterized by a mosaic of secondary forests, plantations, ponds and rice paddy fields. The new species raise the number of Palearctic *Manota* species from five to eight.

**Key words:** first records, Manotinae, new species, satoyama landscape.

**INTRODUCTION**

An ongoing collecting program for arthropods conducted by staff and students at Kanazawa University, Kanazawa, Japan forms a part of an ecological biodiversity survey of the “satoyama” landscape, the traditional rural mosaic landscape of Japan (Nakamura *et al.* 2006). Sampling with window traps at the ground and the canopy levels has resulted in a rich collection of insects from two areas in Ishikawa Prefecture: the Kakuma Campus of Kanazawa University and the Noto Peninsula. Trisnawati and Nakamura (2008) presented an order-level community analysis of materials collected at the Kakuma Campus in which Diptera dominated strongly both in the canopy level (70%) and in the ground level (40%) samples. Fungus gnats (Diptera: Mycetophiliformia) have been sorted out from this material and were offered to the second author (JK) for taxonomic studies. The rich collection includes a number of unnamed fungus gnats and this paper is the first that deals with descriptions of new species.

The genus *Manota* Williston belongs to the small subfamily Manotinae (Hippa *et al.* 2004) of the Mycetophilidae, and has recently attracted considerable attention through the discovery of a large number of

new species, indicating a tremendous diversity in tropical areas around the world (e.g. Jaschhof & Hippa 2005; Hippa 2006, 2007, 2008a,b, 2009). The Holarctic region, however, seems to have a comparatively poor *Manota* fauna. Only four eastern Palearctic species (Ševčík 2002; Papp 2004), one relatively rare and poorly studied European species (Chandler 2005) and one unnamed Nearctic species (Sherman 1920; Vockeroth 1981) are known. Although *Manota* is recorded here from Japan for the first time, rich Oriental elements in the Japanese insect fauna suggest that a number of additional *Manota* species will be found, especially in the southern subtropical parts of the country. This has already been affirmed through contacts with T. Saigusa (Fukuoka) who has initiated collaboration and offered us more material of *Manota* for further studies.

**MATERIALS AND METHODS**

Materials originating from two areas with “satoyama” landscapes are examined. The Kakuma Campus (36°33'N, 136°42'E) of Kanazawa University is situated 5 km south-east of central Kanazawa City. The vegetation of the sampling sites consists mainly of deciduous broad-leaved trees dominated by two oak species *Quercus serrata* and *Q. variabilis*, patches of plantations of Japanese cedar *Cryptomeria japonica* and Moso bamboo *Phyllostachys* sp. The sampling sites and biotopes are described further in detail by Trisnawati and Nakamura (2008). The Noto Peninsula (37°19'N,

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137°0'E) is regarded as a biodiversity hotspot in Japan, traditionally dominated by red pine *Pinus densiflora* forest managed for harvesting matsutake mushroom *Tricholoma matsutake*. The current sampling program covered several forest types: both managed and unmanaged red pine forests, deciduous forest dominated by oaks *Quercus serrata* and *Q. acuta* and evergreen forest with a variety of species (C. Yanto, pers. comm., 2009).

The material was collected from June to November 2005 and 2006 (Kakuma Campus) and from August to October 2008 (Noto Peninsula) using IBOY standard window traps (see Nakashizuka & Stork 2002) filled with 10–50% ethylene glycol. The samples were transferred to and preserved in 80% ethanol. Most type specimens of *Manota* examined in this study were mounted on slides following the procedure described by Kjærandsen (2006). Illustrations were made with the aid of a drawing tube attached to a Leitz Diaplan compound microscope. The type series of the new *Manota* species are deposited in Kyushu University Museum, Japan (KUEC) with some paratypes in alcohol stored at the Museum of Zoology in Lund, Sweden (MZLU).

The morphological terminology follows Hippa and Papp (2007) except for “tegmen” which is here called “aedeagus”. The terminology of the male hypopygium is also explained in Figures 1–3.

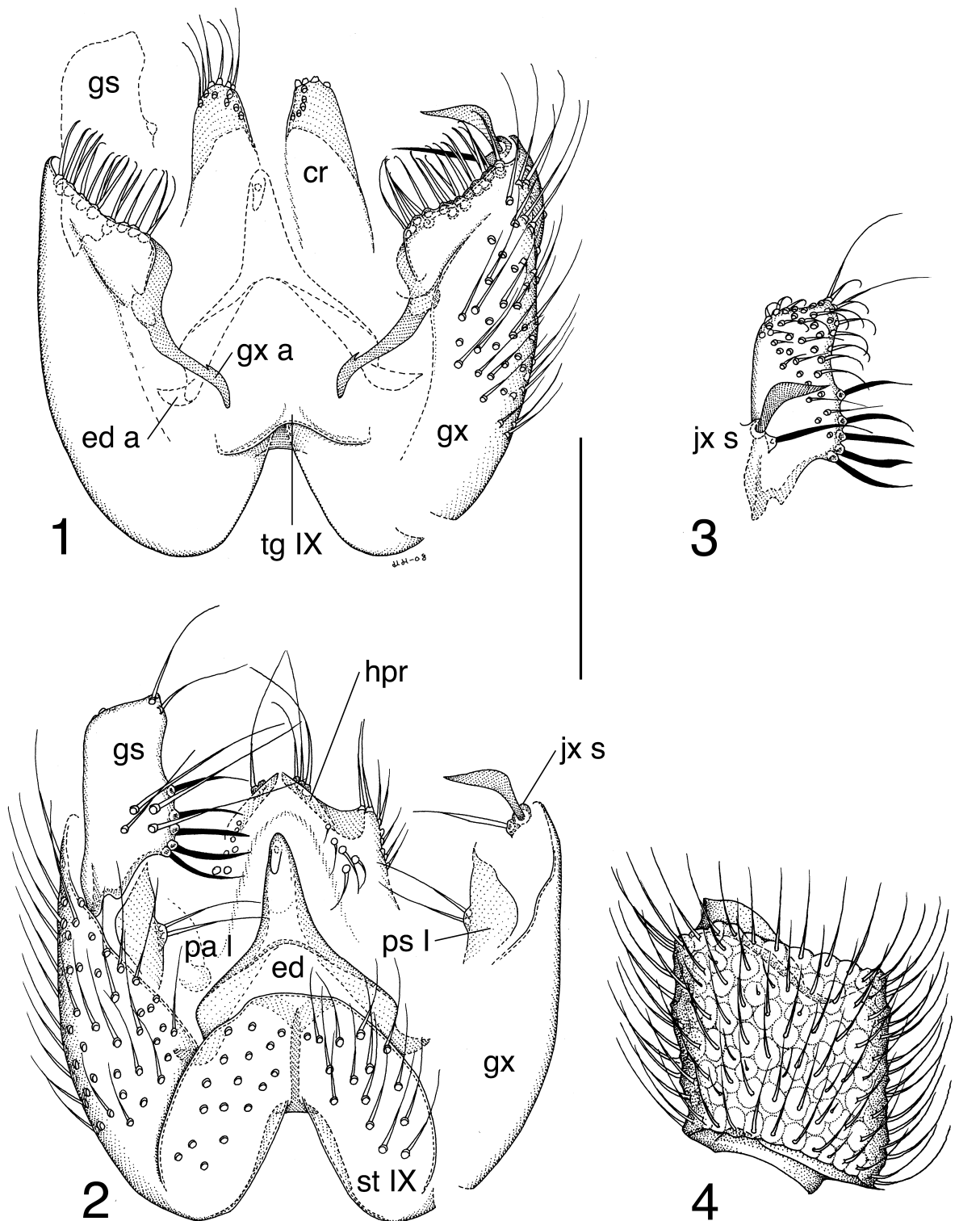
## SYSTEMATICS

### *Manota satoyamanis* sp. nov. (Figs 1–4)

**Male.** Color: The single specimen is apparently strongly faded. Body almost unicolorous, pale brown/yellowish-brown; vertex darker brown; femur 3 infuscated at apex; haltere with darker brown knob. All setosity yellowish or brownish; thicker setae darker than finer setae and trichia. Head: Antennal flagellomere IV as in Figure 4. Palpomere III of maxillary palpus with apicomeresial extension and 3 apically expanded curved sensilla; palpomere IV with parasegment; palpomere V 1.3 times as long as palpomere IV. Number of postocular setae 11. Thorax: Anepisternum with 34–36 setae; anterior basalare with 5–7 setae; pre-episternum II with 14–17 setae; laterotergite bare; episternum III with 4 setae. Wing: similar to *M. yongi* Hippa (Hippa 2006; fig. 2A); length 1.8 mm. Hypopygium (Figs 1–3; mounted with the dorsal side upwards so that the ventral aspect may be somewhat inexact): Sternite IX about one-half of ventral length of gonocoxa, sharply delimited on lateral margin, convex on posterior margin, deeply incised on anterior margin, with setae similar to ventral setae of gonocoxa. Ventral mesial margin of gonocoxa simple, oblique. Parastylar lobe large, flat, medially with 2 medially directed setae

arising from small lobe. Para-apodemal lobe present, exposed in ventral view. Tergite IX sclerotized and distinctly observable on basal margin, but membranous in other parts. Dorsal mesial margin of gonocoxa simple, with lobe on posterior half bearing strong blunt-ended setae at margin on ventral side. Two juxtagonostylar setae present: one longer and rather unmodified; the other shorter and strongly flattened, without distinct common basal body. Gonostylus simple, elongate, subquadrangular, with 5 prominent setae/megasetae at mesial margin on basal half; ventral surface bare except for 4 long setae on basal half and 2 similar ones at apex; dorsal surface with shorter setae on apicomeresial half, bare on basolateral half. Aedeagus subtriangular, with strong lateral shoulders; apex curved ventrad, symmetrical. Hypoproct posteriorly reaching just beyond middle of gonostylus, with prominent posterolateral corners bearing 2 strong setae, ventrally (sternite X) with a group of 5–7 setae on each side. Cerci medially separate. **Female.** Unknown.

**Remarks.** *Manota satoyamanis* is not very similar to any other described species. It shares a rare combination of the following characters with the Oriental *M. cristata* Hippa, 2008, which is also a rather isolated species: (i) bare laterotergite; (ii) laterally sharply delimited sternite IX; (iii) elongate, flat parastylar lobe with 2 setae at middle of mesial margin; (iv) para-apodemal lobe exposed in ventral view; (v) lack of apicolateral apophysis from gonocoxa; (vi) presence of large, plate-like lobe with blunt-ended marginal setae apicomeresially on dorsal side of gonocoxa; (vii) presence of 2 juxtagonostylar setae: one unmodified, but the other flattened megaseta, lacking conspicuous common basal body; (viii) a comb-like row of setae on basomesial part of gonostylus; (ix) symmetrical, ventrad bending apex of aedeagus; and (x) separate, not medially fused, cerci. Otherwise the two species are different in the details of the hypopygium and can be distinguished from each other by: (i) in *M. satoyamanis* the gonostylus is short and broad, a little more than twice as long as broad, and straight, while in *M. cristata* it is long and narrow, about five times as long as broad, and gently bent on its basal half; (ii) in *M. satoyamanis* the setae in the basomesial row on the margin of gonostylus are very strong, strikingly differing from other gonostylar setosity, while in *M. cristata* these setae are similar to the other gonostylar setosity and sub-marginal on the ventral surface; (iii) in *M. satoyamanis* the setae on the dorsal lobe of the gonocoxa are thin, not very different from the other dorsal setosity except for being blunt at extreme apex, while in *M. cristata* most of these setae are broad, flattened megasetae with the rounded apex, strikingly dissimilar to the other dorsal setosity of gonocoxa; and (iv) in



Figures 1–4 *Manota satoyamanis* sp. nov. 1 Hypopygium, dorsal view; 2 hypopygium, ventral view; 3 gonostylus, dorsal view; 4 antennal flagellomere IV, lateral view. Scales, 0.1 mm. cr, cercus; ed, aedeagus; ed a, aedeagal apodeme; gs, gonostylus; gx, gonocoxa; gx a, gonocoxal apodeme; hpr, hypoproct; jx s, juxtagonostylar seta or megaseta; pa l, para-apodemal lobe; ps l, parastylar lobe; st IX, sternite IX; tg IX, tergite IX.

*M. satoyamanis* the ventral setae of hypoproct are normal, short, while in *M. cristata* there are 2 unusually long setae on each side in addition to the usual shorter setosity.

**Holotype.** ♂ (KUEC, JKJ-SPM-016489, on slide), “JAPAN, Ishikawa prefecture, Kanazawa city, Kanazawa University, Kakuma Campus, 36°33′05″N, 136°42′00″E, 109 m a.s.l., ground level of secondary forest dominated by Konara oak (*Quercus serrata*), 23–29 Aug 2005, IBOY window trap (Leg. Indah Trisnawati)”.

**Etymology.** From “*satoyama*” landscape, the Japanese word for the traditional agricultural village that is typified by secondary and coppiced forests, rice paddies and vegetable crop fields.

***Manota indahae* sp. nov.** (Figs 5–7)

**Male.** Color: Both the holotype and the paratypes seem rather faded. Head brown, darker brown at vertex; antennal scapus, pedicellus and 5 basal flagellomeres pale brown; apical flagellomeres slightly darker; mouthparts pale yellowish-brown. Thorax pale brown; scutum posteromedially and scutellum appearing darker brown. Legs pale yellowish-brown; femur III infuscated at apex. Wing unicolorous, pale yellowish-brown; haltere yellowish-brown with darker knob. Abdomen brown; tergites much darker than sternites. All setosity yellowish or brownish; thicker setae seeming darker than finer setae and trichia. Head: Antennal flagellomere IV as in Figure 7. Palpomere III of maxillary palpus with apicomerial extension, with 3 apically expanded, curved sensilla, possibly in addition to 1 or 2, which we can not identify with certainty; palpomere IV with parasegment; palpomere V 1.3–1.4 times longer than palpomere IV. Number of postocular setae 9–12. Thorax: Anepisternum with 22–48 setae; anterior basalare with 0–2 setae; pre-episternum II with 14–21 setae; laterotergite bare; episternum III with 2–8 setae. Wing: Similar to *M. oligochaeta* Hippa (Hippa 2006; fig. 2B) except that A1 is marked only with a row of setae; length 1.6–2.0 mm. Hypopygium (Figs 5,6): Sternite IX about one-half of ventral length of gonocoxa, sharply delimited on lateral margin, transverse on posterior margin, deeply incised on anterior margin, with setae similar to ventral setae of gonocoxa. Ventral mesial margin of gonocoxa roundly angled at parastylar lobe. Parastylar lobe large, flat, with numerous setae on mesial half. Para-apodemal lobe distinct, well exposed in ventral view. Tergite IX membranous. Dorsal mesial margin of gonocoxa simple, with a subapical rather weakly expressed lobe, which is densely setose on its ventral side. Two juxtagonostylar setae present, arising from low inconspicuous common basal body: one

longer and rather unmodified seta; the other shorter and flattened megaseta. Gonostylus simple, elongate-oval, with unmodified setae, but those on apical and mesial part very long. Aedeagus subtriangular; lateral shoulders weak; apex not curved ventrad, symmetrical. Hypoproct posteriorly scarcely reaching middle of gonostylus, with posterolateral angles and approximately 12 scattered ventral setae (sternite X) on each half. Cerci medially separate.

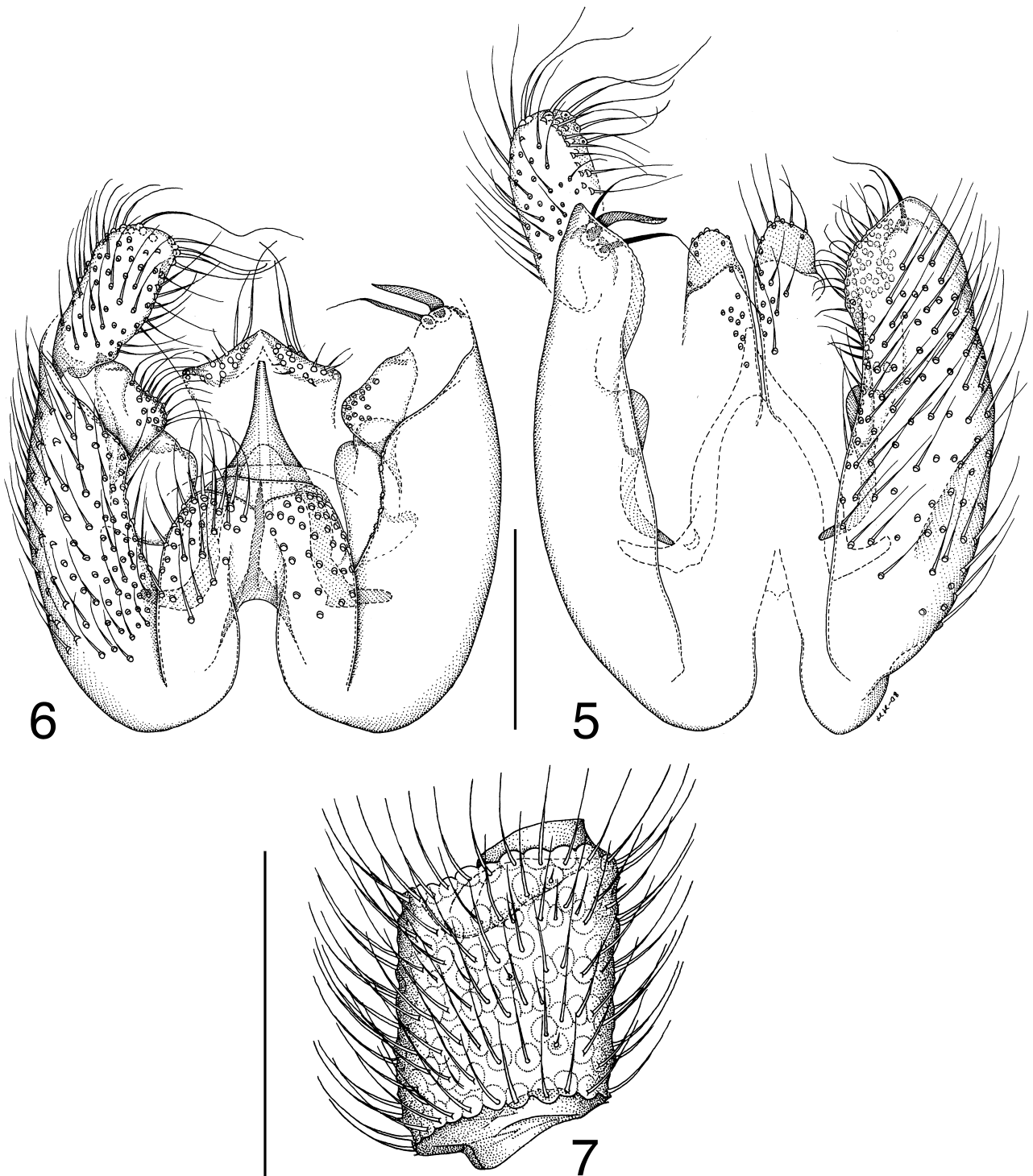
**Female.** Unknown.

**Remarks.** *Manota indahae* is similar in many respects to the Oriental *M. collina* Hippa, 2008: (i) bare laterotergite; (ii) laterally sharply delimited sternite IX; (iii) large plate-like, multisetose parastylar lobe; (iv) presence of 2 juxtagonostylar setae, of which one is thin but the other thick and basally curved; (v) lack of long apicolateral apophysis on gonocoxa; (vi) simple gonostylus with rather unmodified setosity; (vii) angulate lateral margin of hypoproct; and (viii) apically straight, not downwardly bent, symmetrical aedeagus. However, *M. indahae* differs from it because it: (i) has the wing unicolorous, yellowish-brown instead of being apically darker grayish clouded; (ii) lacks a thumb-like lobe subapically at the dorsal mesial margin of gonocoxa; and (iii) has the thicker juxtagonostylar megasetae rather inconspicuously curved on the basal part instead of being strongly geniculate. To a lesser extent, *M. indahae* resembles the Oriental *M. aconcinna* Hippa, 2008, *M. clavulosa* Hippa, 2008 and *M. planilobata* Hippa, 2008. It differs from *M. aconcinna* in its symmetrical apex of the aedeagus and from *M. clavulosa* and *M. planilobata* in the absence of megasetae on the gonostylus.

**Holotype.** ♂ (KUEC, JKJ-SPM-016352, on slide), “JAPAN, Ishikawa prefecture, Kanazawa city, Kanazawa University, Kakuma Campus, 36°33′09″N, 136°41′51″E, 108 m a.s.l., ground level of secondary forest dominated by Konara (*Quercus serrata*) and Abameki (*Q. variabilis*) oaks, 23–29 Aug 2005, IBOY window trap (Leg. Indah Trisnawati)”.

**Paratypes.** Japan: 1 ♂ (KUEC, JKJ-SPM-016098, on slide), same data as holotype except 36°32′6″N, 136°42′03″E, 117 m a.s.l., ground level of Japanese cedar plantation (*Cryptomeria japonica*), 17–23.xi.2005; 1 ♂ (MZLU, type no. 3778-2, JKJ-SPM-016379, in alcohol), same data as holotype; 1 ♂ (MZLU, type no. 3778-3, JKJ-SPM-037027, in alcohol), Yamabushi-yama shrine, Suzu-shi, Noto Peninsula, Ishikawa Prefecture, 37°30′38″N, 137°19′54″E, 200 m a.s.l., canopy of evergreen forest, 11–18.viii.2008 (Leg. Christopher Yanto).

**Etymology.** Named in honor of Dr Indah Triswanati for her sampling, sorting out and offering the majority of the fungus gnats on which this study is based.



Figures 5–7 *Manota indahae* sp. nov. 5 Hypopygium, dorsal view; 6 hypopygium, ventral view; 7 antennal flagellomere IV, lateral view. Scales, 0.1 mm.

*Manota tunoae* sp. nov. (Figs 8–10)

**Male.** Color: Both the holotype and the paratypes seem rather faded, especially the latter. Head pale brown; frons and vertex darker brown; antennal scapus, pedicellus and about 4 basal flagellomeres paler than apical flagellomeres; mouthparts paler than other parts of head. Thorax brown. Legs pale yellowish-brown; femur III infuscated at apex. Wing unicolorous, yellowish-brown; haltere yellowish-brown with knob only slightly darker. Abdomen brown; tergites much darker than sternites. All setosity yellowish or brownish; thicker setae seeming darker than finer setae and trichia. Head: Antennal flagellomere IV similar in relative length (ventral length of the body of flagellomere IV/width of head  $\approx$  0.15) and lateral aspect to *M. indahae* and *M. satoyamanis*. Palpomere III of maxillary palpus with apicomeres extension and 3–4 apically expanded curved sensilla; palpomere IV with parasegment; palpomere V 1.4–1.7 times as long as palpomere IV. Number of postocular setae 9–12. Thorax: Anepisternum with 30–33 setae; anterior basalare with 4–7 setae; pre-episternum II with 10–18 setae; laterotergite bare; episternum III with 5–6 setae. Wing: Similar to *M. oligochaeta* Hippa (Hippa 2006; fig. 2B) except that A1 is marked only with a row of setae; length 1.9–2.0 mm. Hypopygium (Figs 8–10): Sternite IX nearly as long as ventral length of gonocoxa; lateral margin sharply delimited, converging posteriad, posteriorly with narrow medial cleft; anterior margin deeply incised; setae similar to ventral setae of gonocoxa. Ventral mesial structures of gonocoxa unusual, with large, oblique, bare lobe and smaller, more strongly sclerotized, bare lobe between the former and base of gonostylus, both of which probably parts of parastylar lobe. Ventral posterolateral part of gonocoxa produced lobe-like. Parapodomal lobe large but not visible in ventral aspect. Tergite IX membranous, somewhat sclerotized on basal margin. Dorsal mesial margin of gonocoxa simple; gonocoxa subapically with 3 or 4 setae differing from other gonocoxal setosity. One juxtagonostylar seta present, as stout megaseta arising from inconspicuous, low, basal body. Gonostylus elongate, slightly constricted at middle, on apical half with short, blunt-ended megasetae in three, ventral, lateral and dorsal, comb-like rows, otherwise bare except for some rather long setae ventrally on basal half, a couple of similar setae and an isolated, short megaseta at apex. Aedeagus unusual, nearly parallel-sided, with lateral shoulders on apical half, with rounded posterolateral lobe-like corners, and the symmetrical aedeagal orifice lying medially between them and directed posteriad, with

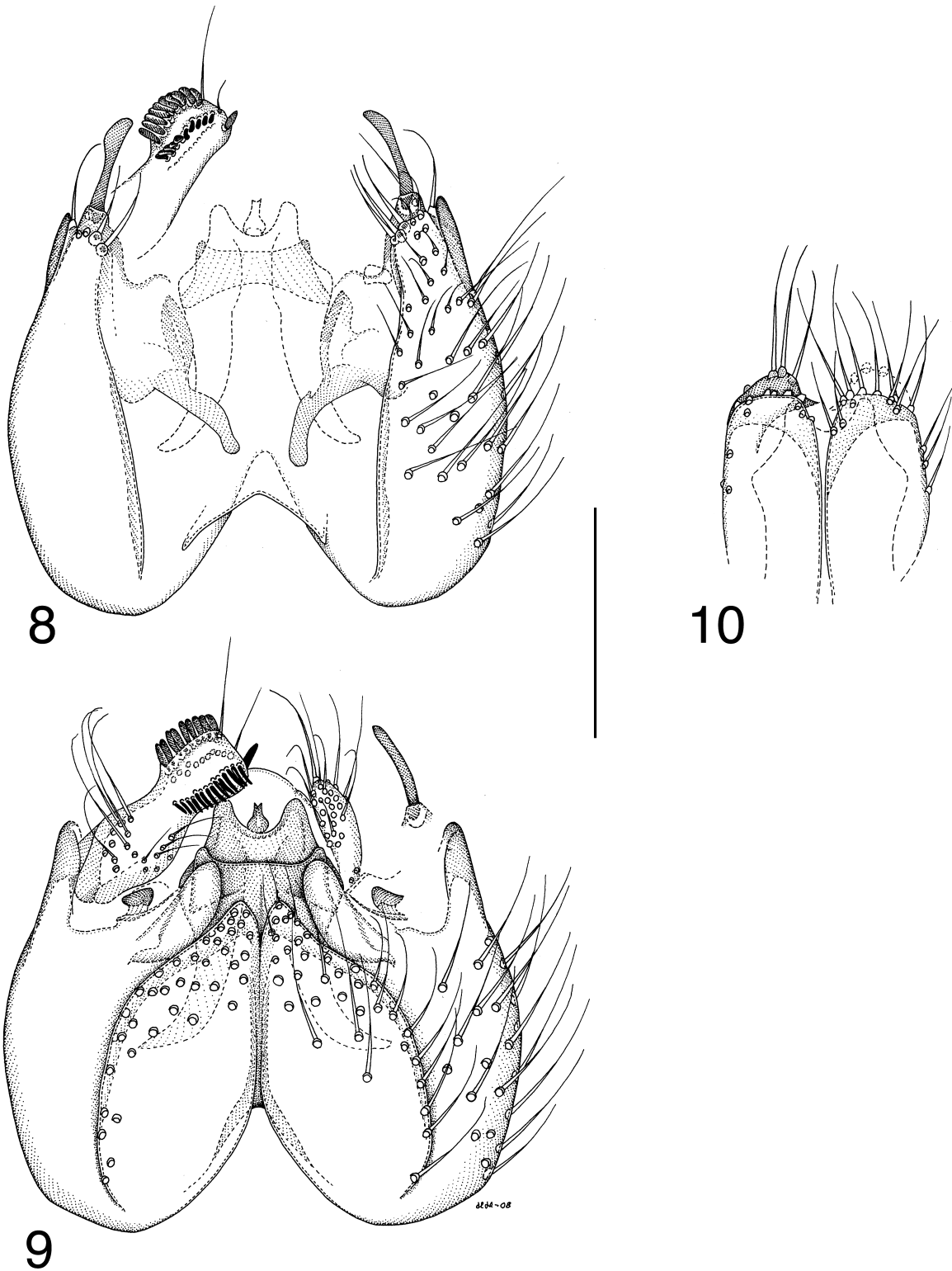
transverse plate-like lobe at level of lateral shoulders on ventral side, unlike any other known *Manota* species. Hypoproct posteriorly reaching just over middle of gonostylus, appearing as 2 elongate, widely separate lobes, with about 30 scattered setae on each. Cerci medially separate.

**Female.** Unknown.

**Remarks.** *Manota tunoae* is immediately distinguished by the three comb-like rows of short, blunt megasetae on the apical half of gonostylus. We know of similar gonostylar megasetae in only the Taiwanese *M. meilingae* Papp, 2004, but in that species they are only 4 in number and form a loose row at the apicomeres margin of gonostylus. Otherwise the two species are very dissimilar. The transverse, sclerotized plate-like lobe ventrally on the aedeagus is also a unique character. It is quite evidently homologous with the basoventral membranous structures of the aedeagus seen in many species, the exact morphology of which has not yet been studied. In one species, the Neotropical *M. bihamata* Jaschhof and Hippa, 2005, there is a transverse lobe that is reminiscent of this, but it is not sclerotized. In other characters, *M. tunoae* and *M. bihamata* are very different. With the broad apical part of the aedeagus bearing lateral lobes, *M. tunoae* is reminiscent of two Oriental species: *M. auriculata* Hippa, 2008 and *M. bifida* Hippa and Papp, 2007, but otherwise these species are largely different. The homology of the two lobes at the ventral mesial margin of the gonocoxa is not quite clear to us. Both could be parts of a bilobed parastylar lobe, or the larger, more anterior one could be a lobe of the ventral mesial margin of the gonocoxa. Neither lobe is setose, as a well-developed parastylar lobe usually seen in *Manota*.

**Holotype.** ♂ (KUEC, JKJ-SPM-016357, on slide), “JAPAN, Ishikawa prefecture, Kanazawa city, Kakuma Campus, 36°33′02″N, 136°41′48″E, 91 m a.s.l., ground level of Maso bamboo plantation (*Phyllostachys* sp.), 23–29 Aug 2005, IBOY window trap (Leg. Indah Trisnawati)”.

**Paratypes.** Japan: 1 ♂ (KUEC, JKJ-SPM-016099, on slide), as holotype except 36°32′37″N, 136°42′07″E, 122 m a.s.l., canopy level of cereal plantation with Japanese millet, 17–23.xi.2005; 1 ♂ (MZLU, type no. 3779-2, JKJ-SPM-016365, in alcohol), as holotype except 36°33′05″N, 136°42′00″E, 109 m a.s.l., canopy level of secondary forest dominated by Konara oak *Quercus serrata*, 23–29.viii.2005; 1 ♂ (MZLU, type no. 3779-3, JKJ-SPM-037026, in alcohol), 3.5 km north-west of Katahime Jinja, Suzu-shi, Noto Peninsula, Ishikawa Prefecture, 37°29′59″N, 137°18′23″E, 129 m a.s.l., canopy of managed forest, 3–11.ix.2008 (Leg. Christopher Yanto).



Figures 8–10 *Manota tunoae* sp. nov. 8 Hypopygium, dorsal view; 9 hypopygium, ventral view; 10 cerci, dorsal view. Scales, 0.1 mm.

*Etymology.* Named in honor of Associate Professor Nobuko Tuno for her efforts to initiate contacts within the project and hosting JK during visits to Kanazawa University.

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## REFERENCES

- Chandler PJ (2005) Fauna Europaea: Mycetophilidae. In: De Jong H (ed.) *Fauna Europaea: Diptera, Nematocera*, version 1.2 ed. [Cited 27 April 2010.] Available from URL: <http://www.faunaeur.org>
- Hippa H (2006) Diversity of *Manota* Williston (Diptera: Mycetophilidae) in a Malaysian rainforest: description of twenty-seven new sympatric species. *Zootaxa* **1161**, 1–49.
- Hippa H (2007) The genus *Manota* Williston (Diptera: Mycetophilidae) in Melanesia and Oceania. *Zootaxa* **1502**, 1–44.
- Hippa H (2008a) New species and new records of *Manota* Williston (Diptera, Mycetophilidae) from the Oriental Region. *Zootaxa* **1723**, 1–41.
- Hippa H (2008b) Notes on Afrotropical *Manota* (Diptera: Mycetophilidae), with the description of seven new species. *Zootaxa* **1741**, 1–23.
- Hippa H (2009) New species and new records of *Manota* Williston (Diptera, Mycetophilidae) from Thailand. *Zootaxa* **2017**, 1–33.
- Hippa H, Jaschhof M, Vilkkamaa P (2004) Phylogeny of the Manotinae, with a review of *Eumanota* Edwards, *Paramanota* Tuomikoski and *Promanota* Tuomikoski (Diptera, Mycetophilidae). *Studia Dipterologica* **11**, 405–428.
- Hippa H, Papp L (2007) The genus *Manota* Williston (Diptera: Mycetophilidae) in Thailand, with the description of seven new species. *Zootaxa* **1528**, 41–60.
- Jaschhof M, Hippa H (2005) The genus *Manota* in Costa Rica (Diptera: Mycetophilidae). *Zootaxa* **1011**, 1–54.
- Kjærandsen J (2006) Review of fungus gnats of the genus *Tarnania* Tuomikoski, with a phylogeny of the *Rymosia* s.l. genus group (Diptera: Mycetophilidae). *Insect Systematics & Evolution* **37**, 121–148.
- Miller G (2005) Linnaeus's legacy carries on. *Science* **307**, 1038–1039.
- Nakamura K, Tanabe SI, Kimura K *et al.* (2006) Satoyama biodiversity and conservation in the Pan-Japan Sea Region. In: Hayakawa K, Tang N. (ed.) *Past, Present and Future Environments of Pan-Japan Sea Region*, pp 510–546. Maruzen Co. Ltd, Tokyo.
- Nakashizuka T, Stork N (2002) *Biodiversity Research Methods: IBOY in Western Pacific and Asia*. Kyoto University Press, Kyoto, Japan and Trans Pacific Press, Melbourne.
- Papp L (2004) Seven new species of Manotinae (Diptera: Mycetophilidae) from Asia and Papua New Guinea. *Acta Zoologica Academiae Scientiarum Hungaricae* **50**, 227–244.
- Ševčík J (2002) *Manota chinensis* sp. n., a second Palearctic species of Manotinae (Diptera: Mycetophilidae). *An International Journal of Dipterological Research* **13**, 23–26.
- Sherman RS (1920) Notes on the Mycetophilidae of British Columbia. *Proceedings of the Entomological Society of British Columbia* **14**, 12–15.
- Trisnawati I, Nakamura K (2008) Abundance, diversity and distribution of above-ground arthropods collected by window traps from satoyama in Kanazawa, Japan: an order level analysis. *Far Eastern Entomologist* **181**, 1–23.
- Vockeroth JR (1981) Mycetophilidae. In: McAlpine JF, Peterson BV, Shewell GE, Teskey HJ, Vockeroth JR, Wood DM. (eds) *Manual of Nearctic Diptera*, pp 223–246. Branch Monograph No. 27. Canada Department of Agriculture Research, Ottawa.