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Systematic Study of the Genus *Peromitra* Enderlein of Japan (Diptera: Phoridae)

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Abstract. Japanese species of the genus *Peromitra* Enderlein are revised. Five species are recognized and four of them are described as new to science: *P. fimbriata* sp. nov., *P. purpurea* sp. nov., *P. pilosa* sp. nov. and *P. hikosana* sp. nov. A known Japanese species are redescribed and discussed. A key to Japanese species is provided.

Key words: Diptera, Phoridae, *Peromitra*, systematics, new species, Japan.

Introduction

The genus *Peromitra* Enderlein, 1924 comprises 11 species of medium-sized black flies from Europe, Russia and Asia. It is one of the conspicuous genus of European Phoridae fauna and its taxonomy has been made since early 19th in Europe. In Japan, only *Peromitra multisetalis* (Colyer, 1966) has been known from Kunashiri Island.

The genus *Peromitra* is characterized by the following combination of external characters: Ocellar region raised like saddle; anterior ocellus oval; vertex with raised ridge; wing vein Rs with a series of hairs along most of its length on the dorsal face; tip of wing vein Rs only expanding very gradually and not swollen; anepisternum without a single long bristle near posterior margin; hind tibia with a dorsal palisade-like stoutish hairs; male abdominal segment 6 with sternite.

The genus *Peromitra* has been treated as a subgenus of the genus *Borophaga* Enderlein, 1924, since Schmitz (1927). Brown (1992), however, gave *Peromitra* full generic status. According to Brown (1992), the genus *Borophaga* sensu Schmitz (1927, 1951) is polyphyletic, and *Peromitra* is more closely related to *Stichillus* Enderlein, 1924 and *Trineurocephala* Schmitz, 1923 than to *Borophaga* s. str. On the other hand, Disney (1994) suggests that *Peromitra* should be treated as subgenus of *Borophaga*. In this study, we follow Brown (1992) and treat *Peromitra* as a full genus, but systematic rank of *Peromitra* seems to be still problematical.

As a result of recent study, we recognize 4 new species from Japan in addition to the only known species, *P. multisetalis*. Descriptions and diagnoses of these species are given. Male genitalia and female terminalia are illustrated. A key to Japanese species is provided.

Materials and Methods

Most specimens used in this study were naturally dried and glued to micropins. For study of the male genitalia and female terminalia, the terminal abdominal segments were detached from the body and placed in a 10% solution of KOH at 48 degree C for 8 hours, then dropped into an 8% solution of CH_3COOH for 30 minutes, and transferred to distilled water for dissection. Observations were carried out under both binocular stereoscopic and compound light microscopes.

Terminology mostly follows Peterson (1987). Interpretation of female terminalia follows Schmitz (1938). These are not absolute references to terminology and interpretation for Phoridae morphology. Disney (1994, 1998, etc.) suggests different terminology and interpretation from these. Disney (1999) discusses the male genitalia of the Phoridae, and Disney & Michailovskaya (2000) discuss the interpretation on the wing vein. In addition, new interpretation about antenna of Diptera has been recently proposed by Stuckenberg (1999). We would like to wait for a consensus of opinion about terminology and interpretation to be achieved.

Body length was measured from the head (excluding antennae) to the tip of abdominal segment 6. Head width and frons width were measured at the level of maximum head width (Gotô, 1984). Meas-

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urement of wing followed Disney (1994). Wing length was measured from basal bristle of costa to the apex of wing membrane. Costal length was measured from basal bristle to the apex of the costa. First costal sector was measured from the humeral cross vein to vein R_1. Second costal sector was measured from vein R_1 to vein R_{4+5}, if R_{2+3} is absent. Second costal sector was measured from vein R_1 to vein R_{2+3} and 3rd costal sector was measured from R_{2+3} to R_{4+5}, if R_{2+3} is present. The following methods for calculating indices were used, according to Gotô (1984). Frontal index: frons width/head width. Costal index: length of costa/length of wing. Costal sector index: length of 1st costal sector/length of 2nd costal sector. If 3rd costal sector is present, the costal sector ratio was calculated as follows (Disney, 1994). Costal sector ratio: length of 1st costal sector and the 2nd costal sector/the 3rd costal sector. Third costal sector always scores as 1.

Holotype and paratypes of the species described in this paper are preserved in the collection of Biosystematics Laboratory, Graduate School of Social and Cultural Studies, Kyushu University, Fukuoka.

Systematics

Genus *Peromitra* Enderlein

Genus *Peromitra* Enderlein, 1924: 278. Type species: *Phora incrassata* Meigen, 1830 (by original designation).

Peromitra: Schmitz, 1927: 63 (as subgenus of *Borophaga*); 1951: 247 (as subgenus of *Borophaga*).

Peromitra: Brown, 1992: 37.

See Borgmeier (1968) for detailed synonymies before Brown (1992).

Diagnostic Characters of Japanese Species of the Genus *Peromitra*

Medium-sized flies (2–3 mm), with blackish body.

Male. Head: Compound eyes minutely haired. Frons and vertex blackish, somewhat shining, with fine hairs; frons broad, without median furrow but sometimes with short furrow near anterior margin along median line; vertex curved upwardly, forming a ridge along posterior margin; ocellar region raised saddle-like; anterior ocellus oval, facing anteriorly. Frons and vertex with usual conspicuous bristles arranged in 3 transverse rows containing 4 bristles (4–4–4) and outer vertical bristles; supra-antennal bristle absent. Clypeus black to brown, thin. Antenna: First flagellomere enlarged, hairy, generally bean-shaped; arista subapical, with pubescence. Gena without bristles. Palpus with 6–7 unequal robust bristles. Proboscis brown to yellow, short.

Thorax: Scutum finely haired, with a dorsocentral bristle on each side; scutellum flattened, with a pair of long and strong bristles posteriorly and a pair of smaller bristles anteriorly; anepisternum undivided, with fine hairs on upper part, without long and strong bristle on posterior margin.

Wing hyaline, somewhat yellowish or brownish; costa extending nearly half length of wing; vein R_{2+3} generally absent (vein Rs not forked) or obscure if present; tip of vein Rs not swollen or only expanding very gradually; vein Rs with a row of fine hairs along most of its length on the dorsal face; vein M_1 curved at base in various degree, then nearly straight to wing margin or very weakly recurving on distal half; veins M_2 and CuA_1 very weakly sinuate; costal cilia short, 2–2.5 times as long as width of costa on 2nd costal sector.

Legs: Hind femur greatly dilated. Fore tibia generally with a dorsal bristle on proximal half, extra bristle present in *P. multisetalis*, and with a row of short, robust, dorsal spines; 2 weak spurs present at distal end, one nearly dorsal (a little more posterior to the tibial bristle) and the other posteroventral; mid tibia with a dorsal hair palisade, and generally with a pair of bristles on proximal 1/3, one of the pair dorsal and the other anterodorsal, a pair of extra bristles present in *P. multisetalis*, and with an anterior to anteroventral pre-apical bristle, without it in *P. multisetalis*; 2 strong robust spurs ventrally present at distal end; hind tibia with 2 dorsal hair-palisade, and with 1, 2 or 4 bristle(s) containing pre-apical bristle; 3 robust ventral spurs and a series of posterodorsal to posterior weak spurs present at distal end. Fore tarsus dilated, shorter than fore tibia, apical tarsomere often widened; pulvilli widened; claws robust.

Abdomen oval in dorsal view, widest at posterior margin of tergite 2, tergites somewhat shining blackish and ventral part just a little frosted grayish black; tergites with hairs mainly on posterodorsal and lateral portions; hairs more dense and robust on lateral portion than on posterodorsal one; tergite 1 without posterodorsal hairs medially; posterodorsal hairs longer on tergite 6; sternite 6 present and divided into left and right hemisternites.

Male genitalia asymmetric. Epandrium small, arched in horseshoe-shaped, epandrial lobe elongated posteroventrally with hairs, generally without pubescence, pubescent only in *P. fimbriata* sp. nov.; right side often more elongated than left side; anal tube

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composed of a pair of cerci and hypoproct, appearing as small rounded hole and not so protruding; cerci hairy, hypoproct with a pair of hairs. Hypandrium large, produced posteriorly into various shape of lobe, with laterally overhung sack-like area which is membranous and appearing to be minutely punctured as hoof-shape (with compound light microscope). Aedeagus almost tube-like, supported by aedeagal apodeme and club-like arms extending from both sides of hypandrium, two processes often arising from ventral portion.

Female. Very similar to male, but differing as follows: First flagellomere of antenna more globular; clypeus thicker; proboscis larger; abdominal sternite 6 absent.

Female terminalia: Segment 7 membranous, without sclerotized tergite and sternite, hairy; segment 8 membranous generally with sclerotized tergite on dorsal tergal portion; segment 9+10 reduced, membranous with some sclerites; tergite 9 larger than sternite 9, hairy; sternite 9, rounded or nearly tongue-like in shape, hairy; tergite 10 small and short, wider than long, sometimes fused with tergite 9.

***Peromitra multisetalis* (Colyer, 1966)**

(Figs. 1A, 2A, 3A, 4, 9A, E)

Borophaga (*Peromitra*) *multisetalis* Colyer, 1966: 72.

Description and figures of this species are given by Colyer (1966).

This species was originally described from Kunashiri (Kunashir in original description) Island. This species has extra bristles on the tibiae. We have seen several additional specimens of this species in some areas of Japan. Here some additional characters, including male genitalia and female terminalia, are given.

Male. Head (Figs. 1A, 2A): Frons and vertex subshining black; frons without median furrow; frontal index 0.56–0.58; ocellar region raised as in Figs. 1A, 2A, wider than long; frons and vertex with 3 rows of strong bristles, front row and middle row of bristles

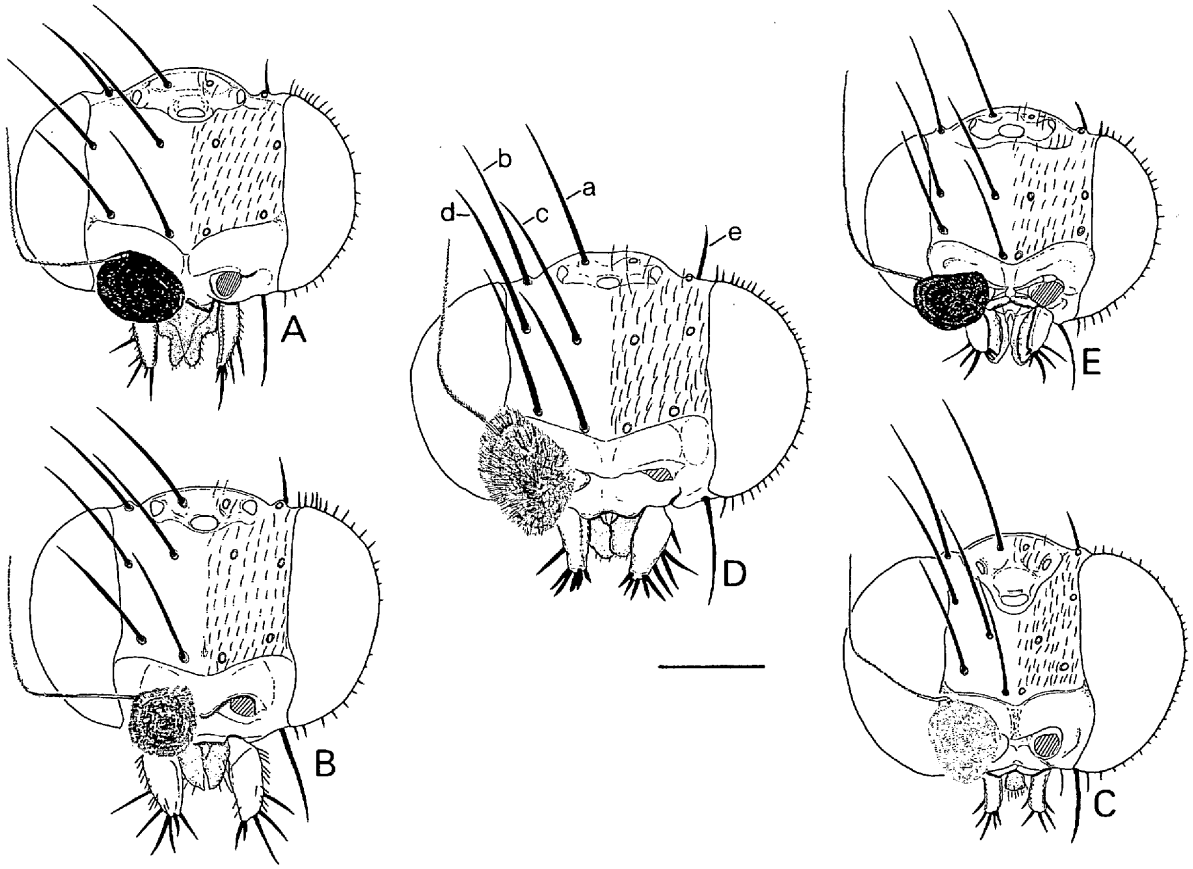

Fig. 1. Male heads in anterodorsal view. —— A, *P. multisetalis*; B, *P. fimbriata* sp. nov.; C, *P. purpurea* sp. nov.; D, *P. pilosa* sp. nov.; E, *P. hikosana* sp. nov. a, postocellar bristle; b, inner vertical bristle; c, upper interfrontal bristle; d, upper fronto-orbital bristle; e, outer vertical bristle. Bristles except outer vertical bristle on frons and vertex, and antenna omitted on left side. Outer vertical bristle and postocular bristles, and hairs of frons and vertex omitted on right side. Scale: 0.25 mm.

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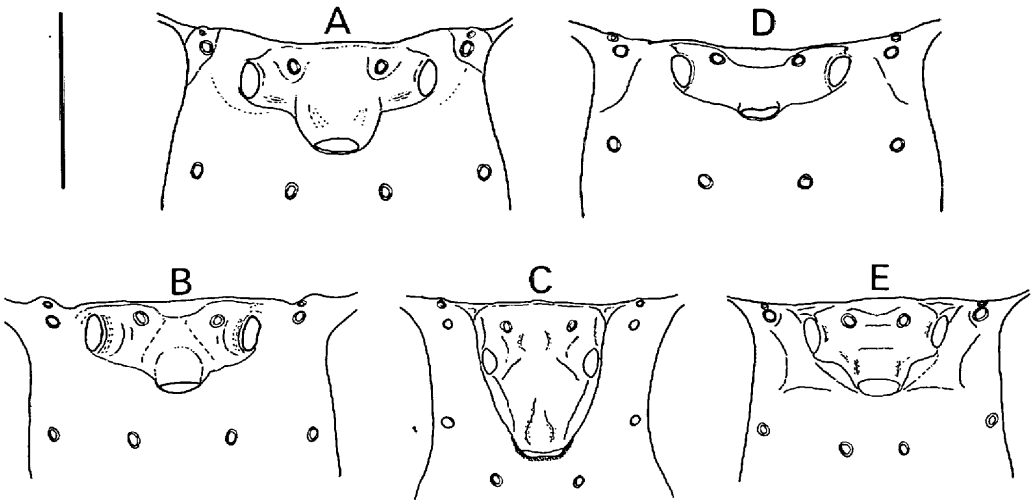

Fig. 2. Male heads (around vertex) in dorsal view. —— A, *P. multisetalis*; B, *P. fimbriata* sp. nov.; C, *P. purpurea* sp. nov.; D, *P. pilosa* sp. nov.; E, *P. hikosana* sp. nov. Bristles represented by their basal sockets. Hairs omitted. Scale: 0.25 mm.

weakly convex anteriorly; upper interfrontal bristle more or less level with upper fronto-orbital bristle; first flagellomere of antenna, orange to brown, bean-shaped, nearly as long as palpus; palpus with about 6 bristles, longest one about 1.5 times as long as palpal width. Thorax: Scutum subshining black with fine decumbent hairs. Wing (Fig. 3A) hyaline, somewhat yellowish, 2.50–3.38 mm long; costal index 0.48–0.52; costal sector index 0.98–1.16; vein Rs not forked (vein R_{2+3} absent); vein M_1 interrupted basally, very weakly curved from there, then nearly straight to wing margin. Legs: Fore tibia with a row of 3 anterodorsal bristles on proximal 1/2; mid tibia with 6 bristles arranged in 3 pairs, one of the pair dorsal, the other anterodorsal; hind tibia with a row of 4 anterodorsal bristles containing pre-apical bristle on its length. Abdomen: Tergites subshining black; sternite 6 present and divided into left and right hemisternites. Male genitalia (Fig. 4): Epandrium small, with many short hairs and some longer hairs posteriorly, posteroventral margin of left side a little more elongated than right side; hypandrium large, produced posteriorly into trapezoidal lobes from both sides and a small tooth above lobe of left side, with laterally overhung sack-like area anteriorly to the lobe; aedeagus almost tube-like in shape, produced into 2 long and bow-like processes, upper process with a rhomboidal plate ventrally, tip of upper process slightly spiral, lower process with hair-like sclerotized minute spines mainly on distal portion. Body length: 2.5–3.0 mm.

Female. Very similar to male, but differing as follows: First flagellomere of antenna more globular, shorter than palpus; abdominal sternite 6 absent. Frontal index 0.60; wing length: 2.95 mm; costal index 0.47; costal sector index 1.23. Female terminalia (Fig. 9A, E): Segment 8 membranous with sclerotized rectangular tergite bearing short hairs; segment 9+10 short; large and oval, well sclerotized tergite 9 present, nearly as long as tergite 8, appearing completely fused with tergite 10, with short hairs, and with a much longer hair near posterolateral corner on each side and with a pair of longer hairs near posterior end; sternite 9 nearly heart-shaped, with a small point anteriorly, hairy; cercus nearly oval, emarginate anteriorly, with 5 hairs, longest one nearly as long as maximum width of tergite 9. Body length: 2.7 mm.

Specimens examined. [HOKKAIDO] 1 female, Kyushu Univ. Exp. Forest, Ashoro-cho, 24–26. vi. 1980, H. Takemoto. [HONSHU] 1 male, Kanayama, Kitakoma-gun, Yamanashi Pref., 1. vii. 1963, T. Saigusa; 3 males, Nobeyama, Nagano Pref., 13. vi. 1986, T. Yasunaga. [KYUSHU] 1 male, Miike, Takaharu, Miyazaki Pref., 28. v. 1977, K. Ohara; 1 male, Mt. Hikosan, Fukuoka Pref., 23. vi. 1969, H. Takeno (Malaise trap).

Distribution. Japan (Kunashiri Is., Hokkaido, Honshu, Kyushu).

Remarks. Colyer (1966) did not mention the inner vertical bristle on the vertex of this species, probably due to damaged type series, but strong inner vertical bristle is observed in front of the outer vertical bristle as in Fig. 1A. It is just a little shorter than postocellar bristle.

The male genitalia of specimens of Miike, Kyushu, are illustrated in Fig. 4. They are basically identical with those of the paratype of this species shown by Colyer (1966). However, Colyer's description is ambiguous about borderline of epandrium and hypandr-

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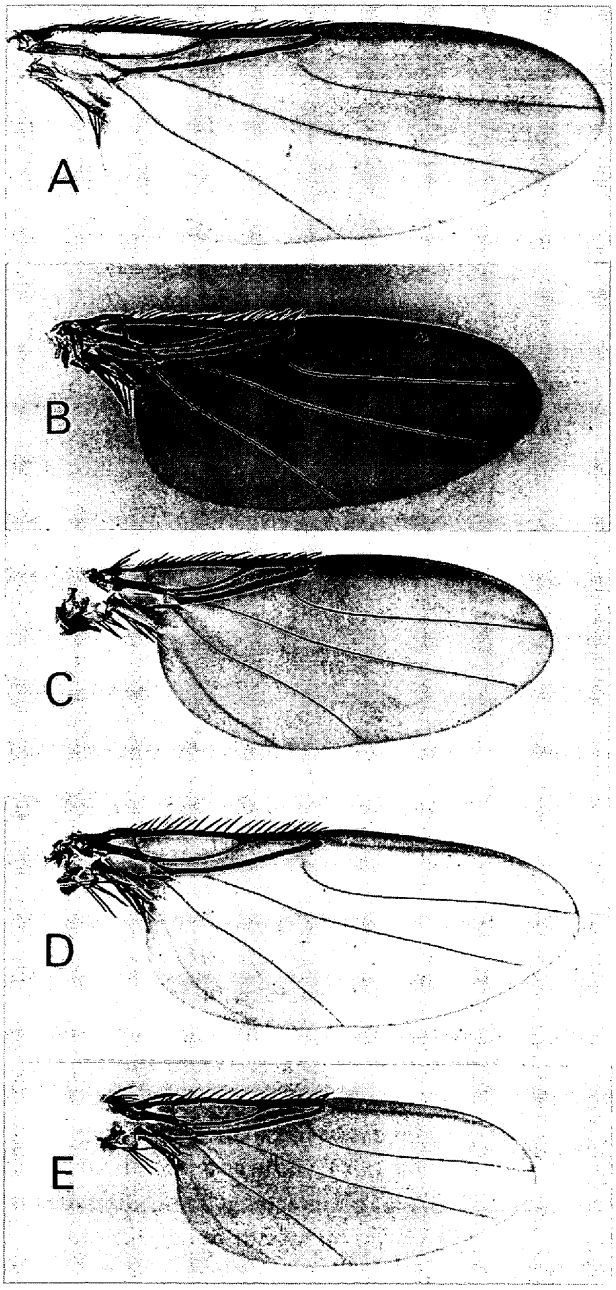

Fig. 3. Male wings. —— A, *P. multisetalis*; B, *P. fimbriata* sp. nov.; C, *P. purpurea* sp. nov.; D, *P. pilosa* sp. nov.; E, *P. hikosana* sp. nov.

ium. The hypandrium of *Peromitra* is not concealed beneath the epandrium as Colyer mentioned in this species. As shown in Fig. 4A, B, the epandrium and hypandrium of this species are typical to *Peromitra*. The Morphology of the aedeagus of Kyushu specimens seems to be identical with the description and figures by Colyer, although he observed aedeagus without anatomizing epandrium and hypandrium. Only slight difference is observed in the degree of spiral convolution of upper process. The spiral of upper process of the aedeagus is less convoluted in a specimen of Kyushu than in that of Kunashiri Island shown by Colyer. Male dried specimens of Mt. Hikosan in Kyushu and Nobeyama in Honshu were investigated, but the degree of the spiral convolution was identical to Fig. 4C, D. This slight difference may be regarded as geographical or individual variation.

***Peromitra fimbriata* sp. nov.**
(Figs. 1B, 2B, 3B, 5)

Diagnosis. Middle row of bristles on frons straight or weakly convex anteriorly; wing vein Rs not forked; hind tibia with an anterodorsal bristle at proximal 1/3 and with a pre-apical bristle; fringe-like strong hairs present on posterior margin of epandrium of male genitalia.

Description. Male. Head (Figs. 1B, 2B): Frons and vertex subshining black; frons with short median furrow near anterior margin; frontal index 0.48–0.52; vertex curved upwardly, forming a ridge along posterior margin; ocellar region raised as in Fig. 1B, 2B, wider than long. Frons and vertex with 3 rows of strong bristles, front row convex anteriorly, middle row in a straight line or weakly convex anteriorly; upper interfrontal bristle higher than upper frontoorbital bristle. Clypeus brownish black, protruding to anterior margin of frons. Antenna: First flagellomere dark orange to brownish, large, bean-shaped, somewhat pointed apically, nearly as long as palpus, pubescent; arista subapically dorsal. Palpus dark orange to brownish, with about 7 bristles, longest one about 1.5 times as long as palpal width. Proboscis dark orange.

Thorax: Scutum blackish brown, shining, with fine decumbent hairs; scutellum blackish brown; pleura brownish.

Wing (Fig. 3B) hyaline, somewhat yellowish, 2.43–2.45 mm long; vein Rs not forked (vein R_{2+3} absent); costal index 0.46–0.47; costal sector index 1.62–1.90; vein M_1 curved at base, then nearly straight to wing margin. Halter: Knob and distal half of stem blackish brown, proximal half of stem brown.

Legs mainly brown, somewhat shining, fore tibia and fore tarsus yellowish. Fore tibia with a dorsal bristle above the middle, a row of spines present below dorsal bristle; mid-tibia with a pair of bristles near proximal 1/3, one of the pair dorsal and the other anterior, and with a pre-apical anterodorsal bristle, 2 unequally long robust spurs present ventrally at distal end, longer one about 1.9 times as long as shorter one; hind tibia with 2 anterior bristles, one at proximal 1/3 and the other pre-apical, 1 dorsal and 3 ventral robust spurs and a series of posterodorsal to posterior weak

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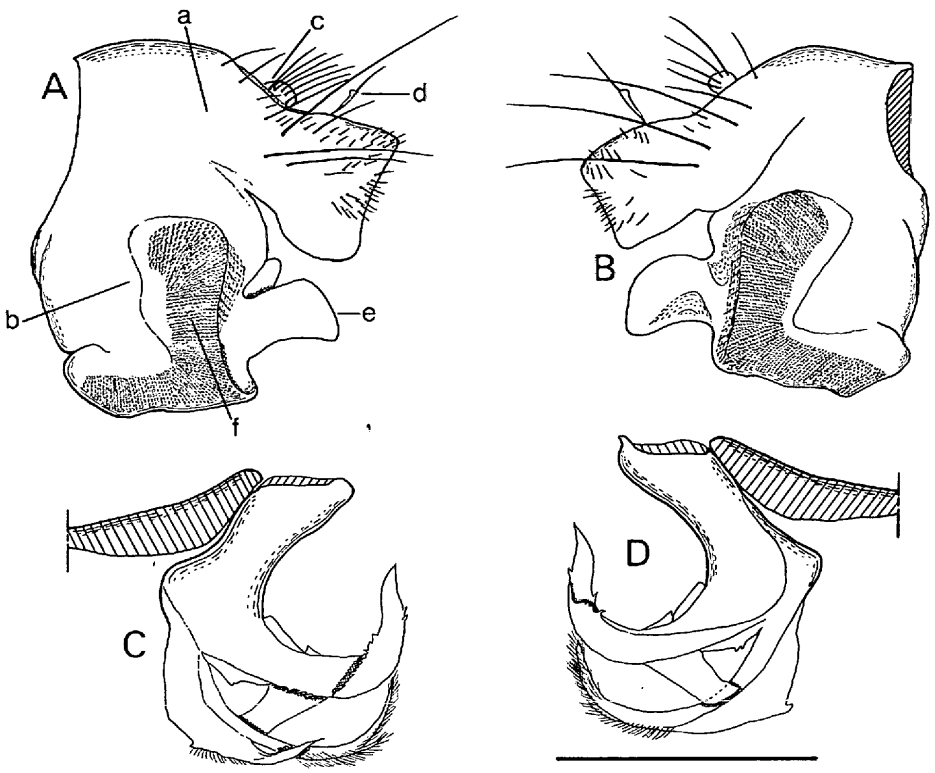

Fig. 4. Male genitalia of *P. multisetalis*. —— A, epandrium and hypandrium in left lateral view; B, ditto in right lateral view; C, aedeagus in left lateral view; D, ditto in right lateral view. a, epandrium; b, hypandrium; c, cercus; d, hypoproct; e, posterior lobe of hypandrium; f, laterally overhung sack-like area of hypandrium. Scale: 0.25 mm.

spurs present at distal end; fore tarsus with apical tarsomere longer than wide; pulvilli about half as long as apical tarsomere.

Abdomen: Tergites subshining black but tergite 1 yellowish; sternite 6 present and divided into left and right hemisternites.

Male genitalia (Fig. 5): Epandrium posteroventrally elongated, with strong fringe-like hairs on posteroventral margin and with fine pubescence posteriorly. Hypandrium large, produced posteriorly into a large rounded lobe and anteroventrally into a small rounded lobe, with distally overhung sack-like area which is situated on anterior portion of hypandrium. Aedeagus asymmetric, not completely tube-like in shape, a little different from in other species of *Peromitra*, tube-like structure divided into left and right plates posteriorly to ventrally, left sclerite developed posteriorly as rounded lobe, and produced posteroventrally into rectangular lobe which is minutely serrated on posteroventral margin; right sclerite developed posteriorly as rounded lobe and anteriorly as a pointed process; left rounded lobe and right rounded lobe put together posteriorly.

Body length: 2.3–2.4 mm.

Female. Unknown.

Holotype: Male, Mt. Hakucho-zan, Izumi-mura, Kumamoto Pref., Kyushu, Japan, 29. vii. 1977, S. Ohara.

Paratypes: [Kyushu] 1 male, same locality as holotype, 30. vii. 1977, T. Gotô; 1 male, same locality as holotype, 7. viii. 1981, K. Ohara; 1 male, Mt. Hikosan, Fukuoka Pref., 27. vii. 1970, K. Takeno (Malaise trap); 1 male, same data except date, 26. vii. 1970.

Distribution. Japan (Kyushu).

Etymology. The name, meaning "fringed", refers to robust fringe-like hairs on epandrium.

Peromitra purpurea sp. nov.

(Figs. 1C, 2C, 3C, 6, 9B, F)

Diagnosis. Ocellar region raised greatly elongated anteriorly; middle row of bristles on frons strongly convex anteriorly; upper fronto-orbital bristle posterior to front ocelli; wing vein Rs forked but vein R_{2+3} obscure; hind tibia without any bristle, except preapical bristle; male abdominal sternites 5 and 6 present; right side of epandrium produced ventrally into long and slender projection from posterior margin.

Description. Deep black species. Male. Head (Figs. 1C, 2C): Frons and vertex subshining deep black; frons without median furrow; frontal index 0.40–0.43; vertex curved upwardly, forming a ridge

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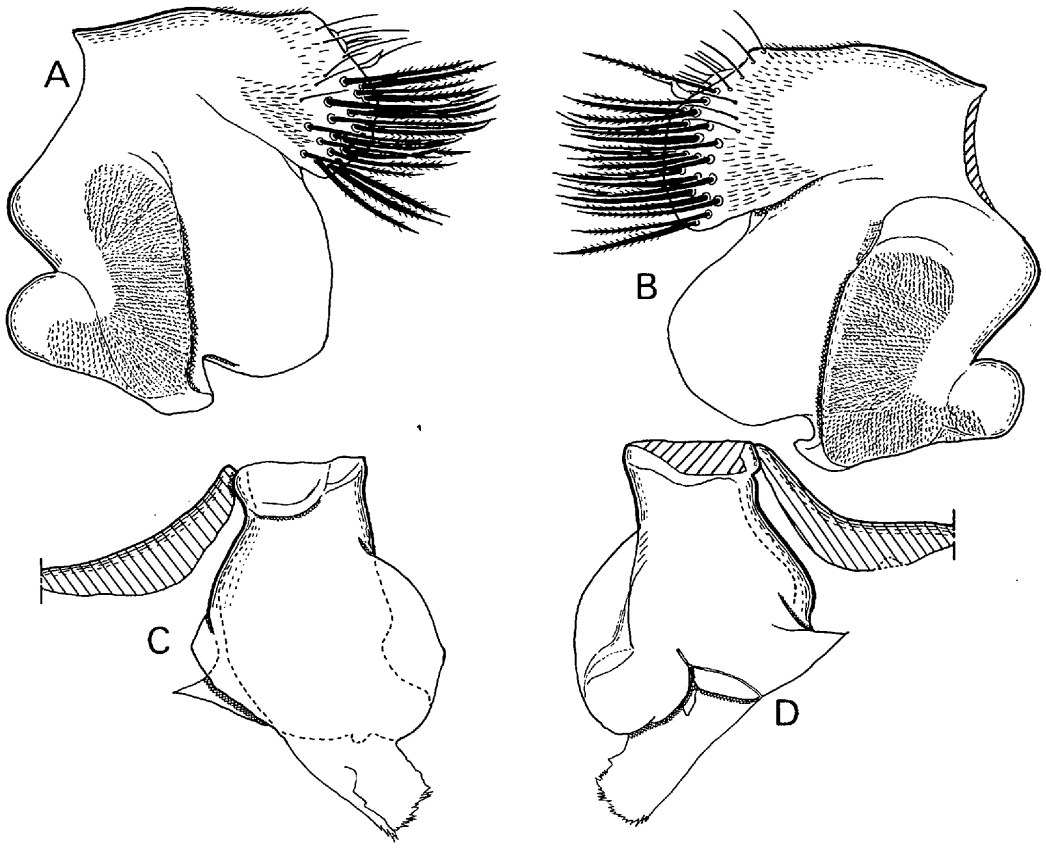

Fig. 5. Male genitalia of *P. fimbriata* sp. nov. —— A, epandrium and hypandrium in left lateral view; B, ditto in right lateral view; C, aedeagus in left lateral view; D, ditto in right lateral view. Scale: 0.25 mm.

along posterior margin; ocellar region raised as in Figs. 1C, 2C, greatly elongated anteriorly, longer than wide. Frons and vertex with 3 rows of strong bristles present, front row convex anteriorly, middle row strongly convex anteriorly; upper fronto-orbital bristle posterior to anterior ocellus; upper interfrontal bristle lower than upper fronto-orbital bristle. Clypeus black, not protruding to anterior margin of frons. Antenna: First flagellomere deep purple to blackish, large, bean-shaped, somewhat pointed apically, nearly as long as palpus, pubescent; arista subapically dorsal. Palpus velvety black, with about 6 bristles; longest one about 1.2 times as long as palpal width. Proboscis brown.

Thorax: Scutum shining black, with fine decumbent hairs; scutellum black; pleura subshining black.

Wing (Fig. 3C) hyaline, smoked with grayish brown, 2.16–2.43 mm long; vein Rs forked but vein R_{2+3} obscure; costal index 0.45–0.48; costal sector ratio 6.2–6.5 : 2.1–2.2 : 1; vein M_1 starting near Rs fork, curved at base, then very weakly recurving on distal half. Halter with brown stem and black knob.

Legs mainly black, somewhat shining, tibiae and tarsi brown to yellowish. Fore tibia with a dorsal bristle above the middle, a row of spines containing about 4 differentiated spines present on distal half; mid tibia with a pair of bristles at proximal 1/3, one of the pair dorsal and the other anterior, and with an anterior pre-apical bristle, 2 unequally long robust spurs present ventrally at distal end, longer one about 1.8 times as long as shorter one; hind tibia without any bristle except a pre-apical anterior bristle, 3 unequally long robust ventral spurs and a series of posterodorsal to posterior weak spurs present at distal end; fore tarsus with apical tarsomere as long as wide; pulvilli about 2/3 as long as apical tarsomere.

Abdomen: Tergites subshining black; sternites 5 and 6 present, both divided into left and right hemisternites.

Male genitalia (Fig. 6): Epandrium with sparse hairs posteriorly, right side more elongated than left side posteroventrally and produced into a long and slender projection. Hypandrium large, with laterally overhung sack-like area situated on anterior portion, and with posterior lobe; posterior margin of the overhung sack-like area developed as a process and a rounded lobe present above the process. Aedeagus truncated cone-like in shape, with some plates ventrally; posteroventral portion of aedeagus with a process

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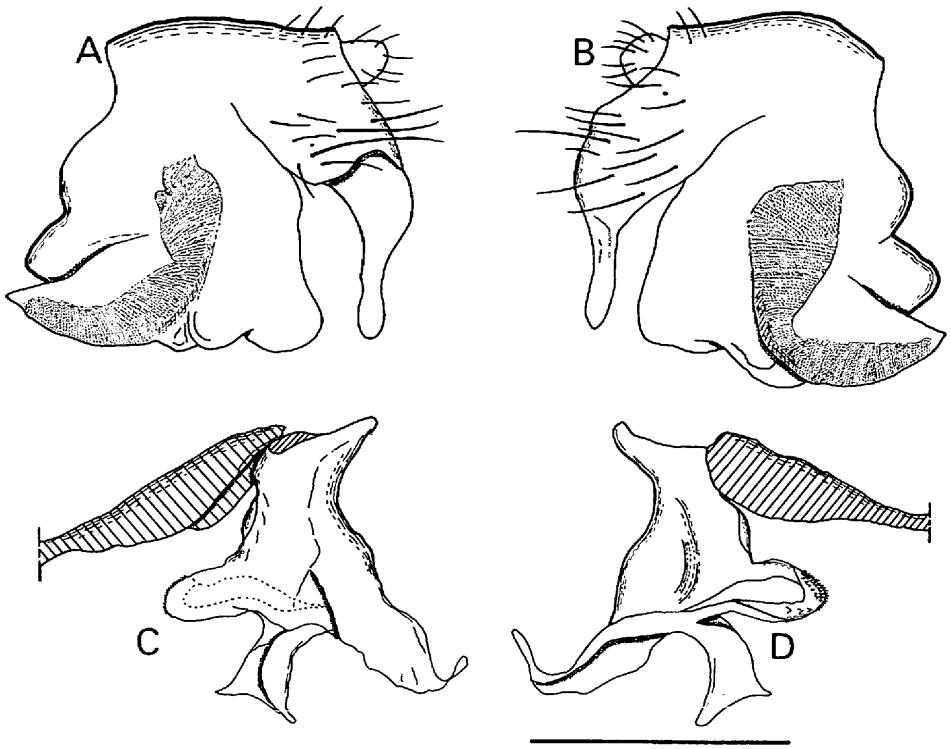

Fig. 6. Male genitalia of *P. purpurea*. sp. nov. —— A, epandrium and hypandrium in left lateral view; B, ditto in right lateral view; C, aedeagus in left lateral view; D, ditto in right lateral view. Scale: 0.25 mm.

with blunt apex, ventral portion with a trapezoidal plate and anteroventral portion with a rounded lobe bearing minute spinulae.

Body length: 1.9–2.4 mm.

Female. Very similar to male, but differing as follows: Antenna more blackish; palpus with much longer bristles, longest one about 1.9 times as long as palpal width; wing vein R_{2+3} more obscure, although appearing near distal 1/3–1/4 of 2nd costal sector as in male specimens; apical tarsomere of fore tarsus longer than wide; pulvilli of fore tarsus smaller, about half as long as apical tarsomere; abdominal sternites 5 and 6 absent. Frontal index 0.51–0.52; wing length: 2.69–2.90 mm; costal index 0.44–0.46; costal sector index 1.21–1.37 (as 1st costal sector/2nd+3rd costal sector, due to obscureness of vein R_{2+3}).

Female terminalia (Fig. 9B, F): Segment 8 membranous with a weakly sclerotized rectangular tergite bearing short hairs; segment 9+10 small and short; well sclerotized tergite 9 present, appearing completely fused with tergite 10, anteriorly arch-shaped, hairy; sternite 9 rounded, hairy; cercus nearly oval, with about 8 hairs, the longest one nearly 3 times as long as cercus.

Body length: 2.4–2.7 mm.

Holotype: Male, Lake Shikaribetsu-ko, Shikaoi-cho, Hokkaido, Japan, 7–11. vii. 2000, H. Nakayama.

Paratypes: 12 males, 4 females, same data as holotype; 1 male, Nakayama-toge, Kimobetsu-machi, Hokkaido, 15. vii. 1980, K. Maeto.

Distribution. Japan (Hokkaido).

Etymology. The name, meaning "purple", refers to the purplish first flagellomere of male specimens.

Remarks. This species was caught in a secondary forest of coniferous trees at Lake Shikaribetsu-ko.

***Peromitra pilosa* sp. nov.**
(Figs. 1D, 2D, 3D, 7, 9C, G)

Diagnosis. Ocellar region raised twice as wide as long or more; ocelli arranged in about 120 degrees at anterior angle; middle row of bristle on frons convex anteriorly; first flagellomere of antenna large with long pubescence; scutum with fine hairs longer especially on posterior margin; wing vein Rs unforked (vein R_{2+3} absent); hind tibia without any bristle except a pre-apical bristle; a robust dorsal spur present on distal end of hind tibia.

Description. Male. Head (Figs. 1D, 2D): Frons and vertex subshining black; frons without median furrow; frontal index 0.51–0.55; ocellar region raised as in Figs. 1D, 2D, twice or more than twice as wide as long; ocelli arranged in about 120 degrees at anterior angle. Frons and vertex with 3 rows of strong

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bristles, front row and middle row convex anteriorly; upper interfrontal bristle more or less level with upper fronto-orbital bristle. Clypeus shining black, not protruding to anterior margin of frons. Antenna: First flagellomere brown to dark yellow, bean-shaped, somewhat pointed apically, nearly as long as palpus, with long pubescence; arista subapically dorsal. Palpus brown, with about 7 bristles, longest one about 1.5 times as long as palpal width. Proboscis brownish.

Thorax: Scutum, brownish black, subshining with fine decumbent hairs, longer especially on posterior margin; scutellum brownish black; pleura brownish.

Wing (Fig. 3D) hyaline, somewhat brownish, 2.41–2.75 mm long; vein Rs not forked (vein R_{2+3} absent); costal index 0.45–0.47; costal sector index 1.39–1.57; vein M_1 curved at base, then very weakly recurving near on distal half. Halter black.

Legs mostly brownish, fore tibia and fore tarsus somewhat yellowish. Fore tibia with a dorsal bristle at proximal 1/3, a row of spines present below the dorsal bristle; mid tibia with a pair of bristles at proximal 1/3, one of the pair dorsal and the other anterior, and with a pre-apical anterodorsal bristle, 2 unequally long robust ventral spurs present at distal end, longer one about 1.6 times as long as shorter one; hind tibia without any bristle except a pre-apical anterior bristle, 1 dorsal and 3 ventral robust spurs, and a series of posterodorsal to posterior relatively strong spurs present at distal end; fore tarsus with apical tarsomere nearly as long as wide; pulvilli about 2/3 as long as apical tarsomere.

Abdomen: Tergites subshining brownish black but tergite 1 more brownish; sternite 6 present and divided into left and right hemisternites.

Male genitalia (Fig. 7): Epandrium small, with sparse hairs posteriorly, right side more elongated than left side posteroventrally, and produced into a process. Hypandrium large, with laterally overhung sack-like area situated on anteroventral portion; anterior portion of overhung sack-like area anteriorly developed as rounded lobe on each side, right side lobe a little more elongated anteriorly than the left side; posterior lobe of hypandrium divided into upper and lower lobes, left side with a square lobe above and a large tooth below it, right side with 2 rounded lobes; upper lobe more protruding posteriorly and lower lobe much smaller, roundish deltoid in shape. Aedeagus almost tube-like, simple at base but greatly modified distally; distal portion widely unfolding, with a ventral plate on left side, the ventral plate posteriorly bearing

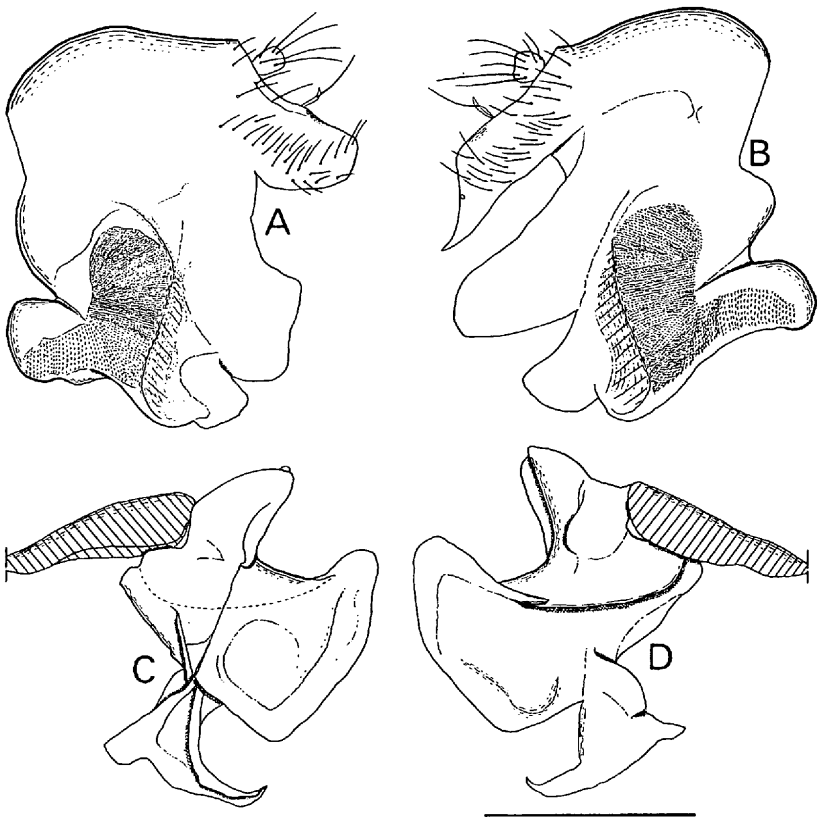

Fig. 7. Male genitalia of *P. pilosa*. sp. nov. —— A, epandrium and hypandrium in left lateral view; B, ditto in right lateral view; C, aedeagus in left lateral view; D, ditto in right lateral view. Scale: 0.25 mm.

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a process.

Body length: 2.2–2.8 mm.

Female. Very similar to male, but differing as follows: Antenna smaller, shorter than palpus, more roundish, with shorter pubescence; clypeus more thick; proboscis larger; palpus brownish with much longer bristles, the longest one about 1.7 times as long as palpal width; abdominal sternite 6 absent. Frontal index 0.55–0.57; wing length 2.83–3.25 mm; costal index 0.45–0.49; costal sector index 1.38–1.46.

Female terminalia (Fig. 9C, G): Segment 8 membranous with well sclerotized large and nearly trapezoidal tergite 8 bearing sparse hairs; segment 9+10 short and small, tergite 9 anteriorly arch-shaped, posteriorly rounded, with short hairs, and with a much longer hair near posterior corner on each side; sternite 9 circular with a small blunt point anteriorly, hairy; tergite 10 small, wider than long in dorsal view, surrounding base of cerci posteriorly to ventrally, with a pair of long hairs; cercus nearly oval, with about 8 hairs, longest one about 3 times as long as cercus.

Body length: 2.8–3.3 mm.

Holotype: Male, Mt. Mukabaki-yama, Nobeoka-shi, Miyazaki Pref., Kyushu, Japan, 3. vi. 1979, T. Gotô.

Paratypes: [Kyushu] 11 males, 3 females, same data as holotype; 7 males, 9 females, same locality and collector as holotype, 9. vi. 1978; 1 male, 2 females, same locality and collector as holotype, 14. vi. 1978; 5 males, 3 females, Miike, Takaharu-cho, Miyazaki Pref., 28. v. 1977, S. Ohara; 3 males, same locality and date, K. Ohara; 1 female, Mt. Takachihonomine, Miyazaki Pref., 9. vi. 1978, T. Gotô; 1 male, Chojabaru, Oita Pref., 17. vi. 1976, S. Hashimoto; 2 males, 1 female, Mt. Hakucho-zan, Izumi-mura, Kumamoto Pref., 9. vii. 1978, T. Gotô; 2 males, 1 female, Mt. Hikosan, Fukuoka Pref., 19. vi. 1978, K. Takeno (Malaise trap); 1 male, same data except date, 22. vi. 1978; 1 male, 1 female, same data except date, 25. vi. 1978; 1 male, same locality, 12. vi. 1973, K. Takeno; 1 male, Mt. Aiko-dake, Yakushima Is., Kagoshima Pref., 11. v. 1983, T. Gotô.

Distribution. Japan (Kyushu, Yakushima Is.).

Etymology. The name, meaning "hairy", refers to long pubescence of the 1st flagellomere of the male antenna.

***Peromitra hikosana* sp. nov.**
(Figs. 1E, 2E, 3E, 8, 9D, H)

Diagnosis. Ocellar region raised about 1.5 times as wide as long; ocelli arranged in about 90 degrees at anterior angle. Distance between upper interfrontal bristles and anterior ocellus nearly equal to that be-

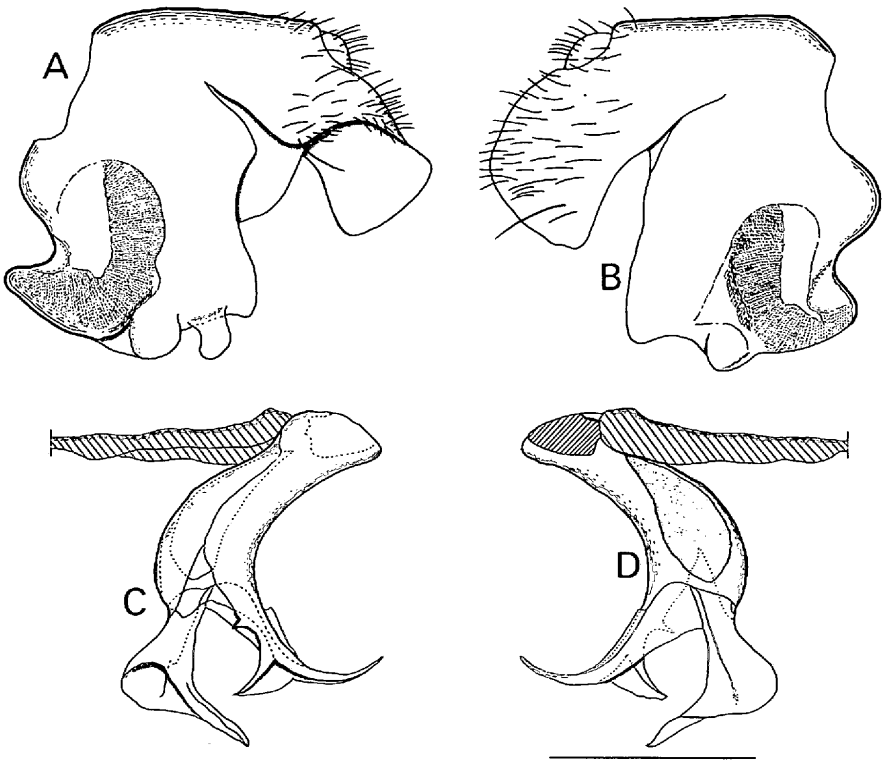

Fig. 8. Male genitalia of *P. hikosana* sp. nov. —— A, epandrium and hypandrium in left lateral view; B, ditto in right lateral view; C, aedeagus in left lateral view; D, ditto in right lateral view. Scale: 0.25 mm.

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tween postocellar bristle and anterior ocellus; middle row of bristles on frons convex anteriorly; wing vein Rs forked but R_{2+3} often obscure; hind tibia without any bristle except a pre-apical bristle; robust dorsal spur absent at distal end of hind tibia; aedeagus with transparent bean-shaped membranous area on right side.

Description. Male. Head (Figs. 1E, 2E): Frons and vertex subshining black; frons without median furrow; frontal index 0.53–0.55; ocellar region raised as in Figs. 1E, 2E, about 1.5 times as wide as long; ocelli arranged in about 90 degrees at anterior angle. Frons and vertex with 3 rows of strong bristles, front row and middle row anteriorly convex; upper interfrontal bristle more or less level with upper frontoorbital bristle. Clypeus brown, not extending to anterior margin of frons. Antenna: First flagellomere brown to dark orange, bean-shaped, somewhat pointed apically, nearly as long as palpus, with short and thick pubescence; arista subapically dorsal. Palpus brown, with about 7 bristles; the longest one about 1.5 times as long as palpal width. Proboscis dark orange.

Thorax: Scutum subshining brownish black, with fine decumbent hairs; scutellum brownish black, somewhat dull; pleura brownish.

Wing hyaline, somewhat brownish, 1.65–2.33 mm long; vein Rs forked but vein R_{2+3} obscure; costal index 0.45–0.50; costal sector ratio 3.5–4.3 : 1.5–1.9 : 1; vein M_1 originated near Rs fork, curved at base, very weakly recurving on distal half. Halter yellow on stem and blackish brown on knob.

Legs brownish, but for fore leg yellowish. Fore tibia with a dorsal bristle above the middle, a row of spines present below dorsal bristle; mid tibia with a pair of bristle at proximal 1/4, one of the pair dorsal and the other anterior, and with a pre-apical anterior bristle, 2 unequally long robust spurs present ventrally at distal end, longer one about 1.7 times as long as shorter one; hind tibia without any bristle except a pre-apical anterodorsal bristle, 3 unequally long robust ventral spurs and a series of posterodorsal to posterior spurs present at distal end; fore tarsus with apical tarsomere as long as wide; pulvilli about half as long as the length of apical tarsomere.

Abdomen: Tergites subshining brownish black but tergite 1 posteromedially yellowish; sternite 6 present and divided into left and right hemisternites.

Male genitalia (Fig. 8): Epandrium small, with hairs posteriorly, right side more elongated posteroventrally than left side. Hypandrium large, with laterally overhung sack-like area situated on anterior portion, and with posterior lobe weakly developing posteroventrally; posterior margin of the overhung sack-like area developed as a rounded lobe, left side more elongated anteriorly than right side; left posterior lobe of hypandrium with a much smaller projection ventrally. Aedeagus tube-like in shape with transparent, bean-shaped membranous area on right side, and with two processes ventrally; posterior process bifurcate.

Body length: 1.6–2.3 mm.

Female. Very similar to male, but differing as follows: First flagellomere of antenna more roundish and shorter than palpus; clypeus thick; proboscis larger; abdominal sternite 6 absent. Frontal index 0.55–0.58; wing length: 2.10–2.88 mm; costal index 0.42–0.47; costal sector ratio 3.1–3.8 : 1.7–1.9 : 1.

Female terminalia (Fig. 9D, H): Segment 8 membranous without tergite, translucent rectangular membrane on dorsal tergal portion; segment 9+10 small and short, posterior margin weakly bilobed; tergite 9 anteriorly arc-shaped and posteriorly rounded, hairy, with a much longer hair near posterior corner on each side; anteriorly bilobed ventral sclerite present anterior to sternite 9, fused laterally with tergite 9; sternite 9 circled, hairy; tergite 10 small, wider than long in dorsal view, surrounding base of cerci posteriorly to ventrally; cercus large, nearly oval, with about 8 hairs, longest one about twice as long as cercus.

Body length: 2.0–3.0 mm.

Holotype: Male, Mt. Hikosan, Fukuoka Pref., Kyushu, Japan, 23. vii. 1970, K. Takeno (Malaise trap).

Paratypes: [Kyushu] Same data except date as holotype, 1 male, 18. vii. 1969; 1 male, 21. vii. 1969; 2 males, 23. vii. 1969; 5 males, 2 females, 25. vii. 1969; 4 males, 1 female, 23. vii. 1970; 3 males, 24. vii. 1970; 4 males, 27. vii. 1970; 3 males, 1 female, 28. vii. 1970; 1 male, 1 female, 29. vii. 1970; 3 males, 1 female, 4. viii. 1970; 4 males, 5. viii. 1970; 5 males, 8. viii. 1970; 5 males, 10. viii. 1970; 1 male 11. viii. 1970; 1 male, 22. vi. 1971; 1 male, 28. vii. 1971; 2 males, 1 female, 29. vii. 1971; 2 males, 2 females, 31. vii. 1971; 2 males, 1 female, 3. vii. 1972; 2 males, 27. vii. 1972; 3 males, 31. vii. 1972; 2 males, 1 female, 1. viii. 1972; 1 male, 2. viii. 1972; 2 males, 4. viii. 1972; 1 male, 26. vii. 1973; 1 male, 1 female, Mitsuse pass, Fukuoka Pref., 21. vii. 1976, S. Hashimoto; 1 male, Gokase-machi, Miyazaki Pref., 9. vii. 1977, T. Gotô.

Distribution. Japan (Kyushu).

Etymology. The name is adjective form of "Mt. Hikosan" where is the type locality.

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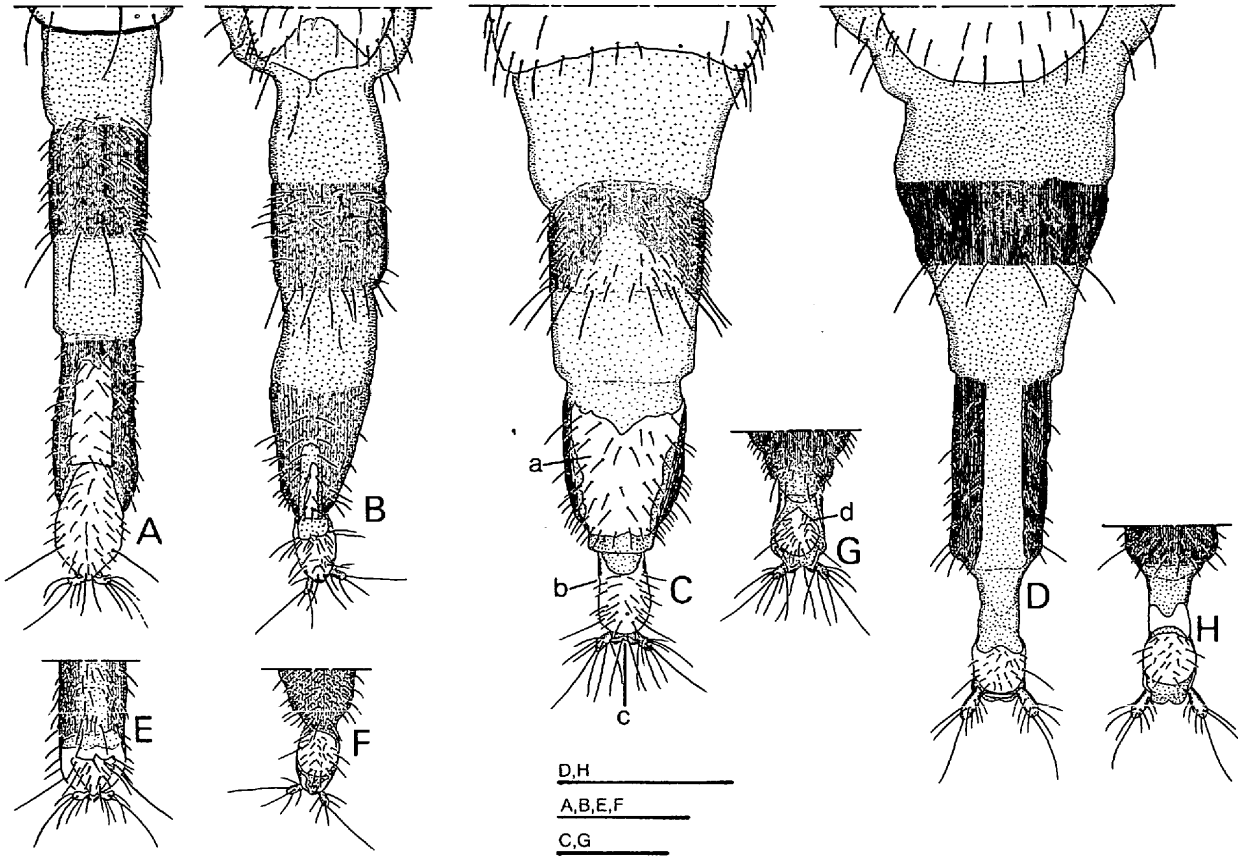

Fig. 9. Female terminalia. —— A–D, in dorsal view; E–H, segment 9+10 in ventral view. A, E, *P. multisetalis*; B, F, *P. purpurea* sp. nov.; C, G, *P. pilosa* sp. nov.; D, H, *P. hikosana* sp. nov. a, tergite 8; b, tergite 9; c, tergite 10; d, sternite 9. Scale: 0.25 mm.

Key to Japanese Species of *Peromitra*

1. Mid tibia with 6 bristles arranged in 3 pairs.... ..... *P. multisetalis*
– Mid tibia with a pair of bristles on proximal 1/3 and with a pre-apical bristle 2
2. Hind tibia with an anterior bristle at proximal 1/3 ..... *P. fimbriata* sp. nov.
– Hind tibia without proximal bristle (only pre-apical bristle present).....3
3. Upper fronto-orbital bristle situated posterior to anterior ocellus (Fig. 2C) ..*P. purpurea* sp. nov.
– Upper fronto-orbital bristle situated anterior to anterior ocellus 4
4. Ocellar region raised up twice as wide as long or more (Fig. 2D); ocelli arranged in about 120 degrees at anterior angle (Fig. 2D); distance between upper interfrontal bristle and anterior ocellus farther than that between postocellar bristle and anterior ocellus (Fig. 2D); a robust dorsal spur present at distal end of hind tibia .... *P. pilosa* sp. nov.
– Ocellar region raised up about 1.5 times as wide as long (Fig. 2E); ocelli arranged in about 90 degrees at anterior angle (Fig. 2E); distance between upper interfrontal bristle and anterior ocellus nearly equivalent to that between postocellar bristle and anterior ocellus (Fig. 2E); a robust dorsal spur absent at distal end of hind tibia .. .. *P. hikosana* sp. nov.

Discussion

Affinity

Peromitra multisetalis has distinct multibristles on the tibiae, and *Peromitra subagilis* (Beyer, 1958) and *Peromitra eumimeta* (Beyer, 1958) from Burma also have same character. *Peromitra multisetalis* is distinguished from them by bristle formation on the mid tibia: Six bristles arranged in 3 pairs in *P. multisetalis*, while 5 bristles arranged in 2 pairs and an anteroventral subapical in *P. subagilis* and *P. eumimeta* (after Beyer, 1958).

Peromitra fimbriata is similar to *Peromitra germanica* (Schmitz, 1918) from Europe, but distinguished from it by the elevation of the ocellar region and long

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and strong fringe-like hairs on the epandrium. *Peromitra germanica* lacks elevation of ocellar region, and has short, dense hairs on the epandrium (Schmitz, 1951).

Peromitra agilis (Meigen, 1830) from Europe has been known as the only *Peromitra* species without any bristle except pre-apical bristle on the hind tibia. *Peromitra purpurea, P. pilosa* and *P. hikosana* have the same character. These species are distinguished from *P. agilis* by the chaetotaxy on the frons. Middle row of bristles are convex anteriorly, and the upper interfrontal bristle is lower than the upper fronto-orbital bristle or level with the latter in these three species, while middle row of bristles are straight (Schmitz, 1951) and the upper interfrontal bristle is higher than the upper fronto-orbital bristle (Figure of head by Becker, 1901, or by Schmitz, 1951) in *P. agilis.*

Variety of the male genitalia and female terminalia

Male genitalia, especially aedeagus, of the species studied in this paper are various in shape. Male aedeagus is considerably modified and distinct in each species, although it is basically tube-like from proximal to distal. The female terminalia are also distinct in each species. Structure of the female terminalia seems to be correlated to male genitalia. The shape of Tergite 8 and 9 of the female are specific in each species. It may also be helpful to identify species, although functional correlation of the female terminalia to the male genitalia is not clear at present.

Laterally overhung sack-like area of Hypandrium

Hypandrium of the male genitalia of this genus has the area which overhangs laterally as a sack. The area is membranous and seems to be minutely punctured as hoof-shape with compound light microscope. This structure is observed not only in *Peromitra* but also in some related genera. It is the "area of thin cuticle that bears a large number of flat, rounded spinuli", according to Browm (1992). Fine SEM photographs of this structure are shown in *Borophaga subsultans* (Linné, 1767) by Brown (1992) at the same time.

Biology

Biology of larval stage of the species of the *Peromitra* in Japan is unknown. Brown (1992) presumed "parasitism of bibionid larvae might be the way of life characteristic of *Peromitra* species", based on the examples that *Bibio marci* (Linnaeus, 1758) larvae are parasitized by *Peromitra incrassata* (Meigen, 1830) (after Morris, 1922), and *Penthetria holosericea* Meigen, 1818 larvae are reported to be parasitized by *Peromitra germanica* (after Gemesi and Disney, 1991).

Separation of Peromitra, Stichillus *and* Borophaga

In Japan, *Stichillus japonicus* (Matsumura, 1916) is common in mountainous region and *Borophaga* species is expected to be found in the future. Separation of *Peromitra, Stichillus* and *Borophaga* seems to be important. When we see the character matrix table of Brown (1992), the polarity of all characters used is identical in *Peromitra* and *Stichillus*. However, *Stichillus* is easily distinguished from *Peromitra* or other genera by distinctly modified vertex which is sharply demarcated from frons forming three loops. *Borophaga* may be distinguished from *Peromitra* and *Stichillus* by the following characters: Ocellar region flat, not modified; tip of wing vein Rs swollen; male abdominal sternite 5 and 6 absent; aedeagus of male genitalia not tube-shaped.

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