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A TAXONOMIC REVIEW OF THE GENUS METYLOPHORUS PEARMAN (PSOCODEA: PSOCIDAE) IN JAPAN, WITH DESCRIPTION OF THREE NEW SPECIES

By MIWA KIDO AND KAZUNORI YOSHIZAWA

Abstract

KIDO, M. and YOSHIZAWA, K. 2019. A taxonomic review of the genus *Metylophorus* Pearman (Psocodea: Psocidae) in Japan, with description of three new species. *Ins. matsum. n. s.* 75: 19–28, 4 figs.

The Japanese species of the genus *Metylophorus* (Psocodea: Psocidae) were revised. In addition to *M. nebulosus* recorded from Japan in early 1900th, three new species, *M. mutabilis*, *M. rotundispinus* and *M. symmetriformis*, were described and illustrated. A single male specimen having unique hypandrial structures was also treated, and these structures were described and illustrated. However, this specimen was treated as an un-named form. A key to the Japanese species of *Metylophorus* based on male genital structures was provided.

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Introduction

Metylophorus is a genus composed of rather large sized psocid species (forewing length usually over 5 mm) inhabiting living and dead tree branches and trunks. This genus is distributed throughout all the zoogeographical regions except for the Australian Region (Lienhard & Smithers, 2002). Over 50 species of the genus have been described to date, of them, more than half species (26 species) are recorded from China (Li, 2002; Lienhard, 2016). In contrast, only one species, *Metylophorus nebulosus*, which is widely distributed throughout the Palearctic Region, has been known from Japan since its first record in 1906 (Enderlein, 1906; Yoshizawa, 2016). In this study, we revise the Japanese species of *Metylophorus* and describe three new species.

Both dried and alcohol preserved specimens were used. Male genitalia were examined in ethanol after soaking by 10% KOH solution. The forewings and female genitalia were slide-mounted by using euparol. The wing photographs were taken by using the Olympus E-M5 attached to the Olympus SZX16 binocular microscope. The examined specimens are stored in the Hokkaido University Insect Collection (SEHU) unless otherwise specified. Collector's name is not indicated for the specimens collected by Kazunori Yoshizawa. Measurements are given in mm.

Key to Males of Japanese Species of Metylophorus

1. Hypandrium asymmetrical; processes on left side of hypandrial median flap clearly more developed than those on right side (Figs 2AB, 4A–E) 2
-. Hypandrium nearly symmetrical, with similar sized paired processes on each side of hypandrial median flap (Fig. 4F) ..... *M. symmetriformis* Yoshizawa, n. sp.
2. Hypandrial with two well-developed left processes (sometimes with additional tiny processes between them) 3
-. Hypandrial with three well developed left processes (Fig. 4D) ..... *Metylophorus* sp.
3. Hypandrial left processes tightly associated basally, both arising from ventrolateral part of hypandrial median flap (Figs 2AB, 4E) 4
-. Hypandrial left processes distantly located, ventral process arising from ventrolateral corner of hypandrial median flap, and dorsal process arising from middle to more dorsal part of hypandrial median flap (Fig. 4A–C) ..... *M. mutabilis* Kido & Yoshizawa, sp. n.
4. Ventral left hypandrial process directed inwardly (Fig. 2B) ..... *M. nebulosus* (Stephens)
-. Ventral left hypandrial process directed posteriorly (Fig. 4E) .... *M. rotundispinus* Kido & Yoshizawa, n. sp.

Taxonomy

Genus *Metylophorus* Pearman

Meylophorus Pearman, 1932: 202. Type species: *Psocus nebulosus* Stephens, 1836 (by original designation).

Diagnosis. Relatively large sized psocids, forewing length about 5–7mm.

Head blackish-brown in ground color; eyes black; ocelli pale brown, ocellar field black; gena brown, posterior region paler; clypeus brown, ventrally with blackish-brown markings. Antenna black, about 1.5 times longer than forewing length. Mouthparts

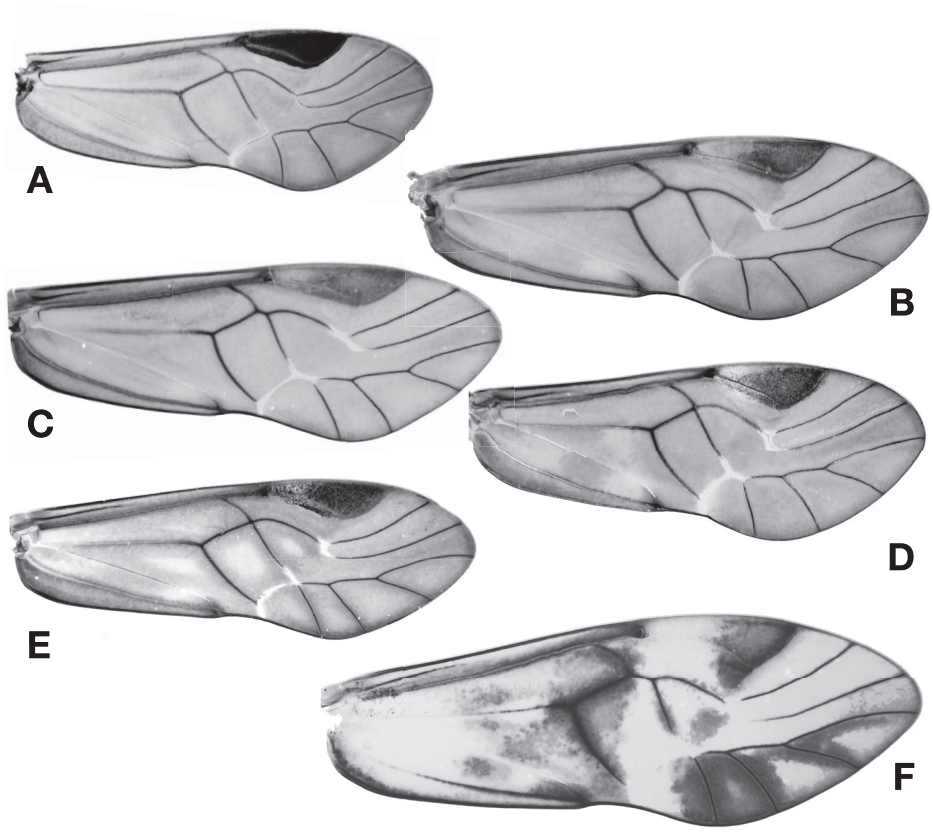

Fig. 1. Forewings of Japanese *Metylophorus* spp. A. *M. nebulosus*, male. B. *M. mutabilis*, male. C. *Metylophorus* sp., male. D. *M. rotundispinus*, male. E. *M. symmetriformis*, male. Note that many differences seen between the photos of different species (e.g., distance of Rs-M fusion or areola postica-M fusion) can also be observed as variations within a species and thus should not be recognized as diagnostic features. F. *M. mutabilis*, pale form female.

brown.

Thorax. Prothorax pale brown. Mesonotum mostly blackish-brown, anterior surface darker, medially with paler field. Metanotum medially with pale field. Meso- and metapleuron brown.

Legs brown; trochanter and femur paler.

Forewing. Brown in ground color (Fig. 1A–E); pterostigma darker; intersection of veins R2+3 and R4+5, first and second sections of areola postica, and CuA2 transparent; color dimorphism presents in female: dark form as described above; pale form with broad transparent regions as shown in Fig. 1F; Rs-M fused for a short distance, roof of areola postica fused to M for short distance.

Abdomen pale brown with blackish-brown irregular markings.

Male terminalia. Clunium with well-developed dorsal flap composed of two lateral large and one small median lobes. Epiproct small. Paraproctal lobe broadend posteriorly, with flattened posterior surface, distal process arising from ventral margin of flat surface. Hypandrium with median flap, lateral margin serrated distally, distal margin with deep notch; with two or three well developed processes on left side, usually with less-developed process, right processes sometimes well-developed processes as on left ones. Phallosome symmetrical, apically with single extension.

Female terminalia. Epiproct and distal lobe of paraproct elongate, protruding posterodorsally. Egg guide of subgenital plate elongate, more than two times longer than basal width. Ventral and dorsal valves of gonapophyses elongate; dorsal valve mostly membranous, without distal process; ventral valve pointed apically. Spermapore plate with long apodeme posterior to spermapore opening.

Remarks. All Japanese species of *Metylophorus* are very similar to each other concerning general characters and most genital structures, which are here described as diagnostic for the genus. Therefore, some of the above features may not be applicable for non-Japanese species of *Metylophorus*.

The males can be identified to species unambiguously by using the hypandrial structures. In contrast, no useful features could be detected for identifying the females. Therefore, females cannot be identified to the species if only females were collected or more than two species were collected at the same time and same locality. In the following species descriptions and the above key, only the male hypandrial structures are used for diagnosing the species. The female specimens are also listed under the "Specimens examined" if the conspecifity with the corresponding male specimens is very likely but, for newly described species, they are excluded from the paratypes for avoiding the possibility to include misidentified specimens into the type series.

Metylophorus nebulosus (Stephens)
(Figs 1A, 2, 3)

Psocus nebulosus Stephens, 1836: 119.
Metylophorus nebulosus: Pearman, 1932: 203; Enderlein, 1906: 246 (first record from Japan).

Specimens examined. [Hokkaido] 1 male, Kafukai, Is. Rebun-to, 31.vii.1994; 1 male 1 female, Himenuma, Is Rishiri-to, 28.vii.1994; many males and femaled, Yamunai-sawa, Is. Rishiri-to, 28.vii.1994; 1 male, Kamuiwakka, Shiretoko, 30.vii.1995; many males and females, Experimental Forest of Hokkaido Univ., Uryu-cho, 2–5.viii.1994; many males and females, Asahidake Spa, Higashikawa-cho, 9–11.viii.1994; 5 males, Chisenupuri, Niseko-cho, 15.viii.1994 (light trap). [Honshu] 6 males 4 females, Forestry Res. Inst., Takizawa City, Iwate Pref., 7.vii.1993; 1 male, Mt. Zao-san, Miyagi Pref., 21.vii.1996; many males and females, Omoriyama Park, Akita City, Akita Pref., 21.vii.1993; 2 males 4 females, same locality, 1.vii.1997; 1 male 1 female, Mt. Asakusa-dake, Tadami-cho, Fukushima Pref., 19.vii.1996; 2 males 2 females, Masutomi Spa, Sutama-cho, Yamanashi Pref., 7.vii.1997; 1 male 2 females, Sengokubara, Hakone, Kanagawa Pref., 17.vii.1994; 7 males, Ashinoko, Hakone, Kanagawa Pref., 24.vi.1997; 1 male, Mt. Horaiji-san, Shinshiro City, Aichi Pref., 21.vi.1997; 1 male 2 females, Mt. Ungetsu-yama, Hamada City, Shimane Pref., 11.vii.1994; 2 males 7 females, Chojabara, Geihoku-cho, Hiroshima Pref., 10.vii.1994; 1 male 1 female, Mt. Kakezu-yama, Geihoku-cho, Hiroshima Pref., 5.ix.1992; 1 male

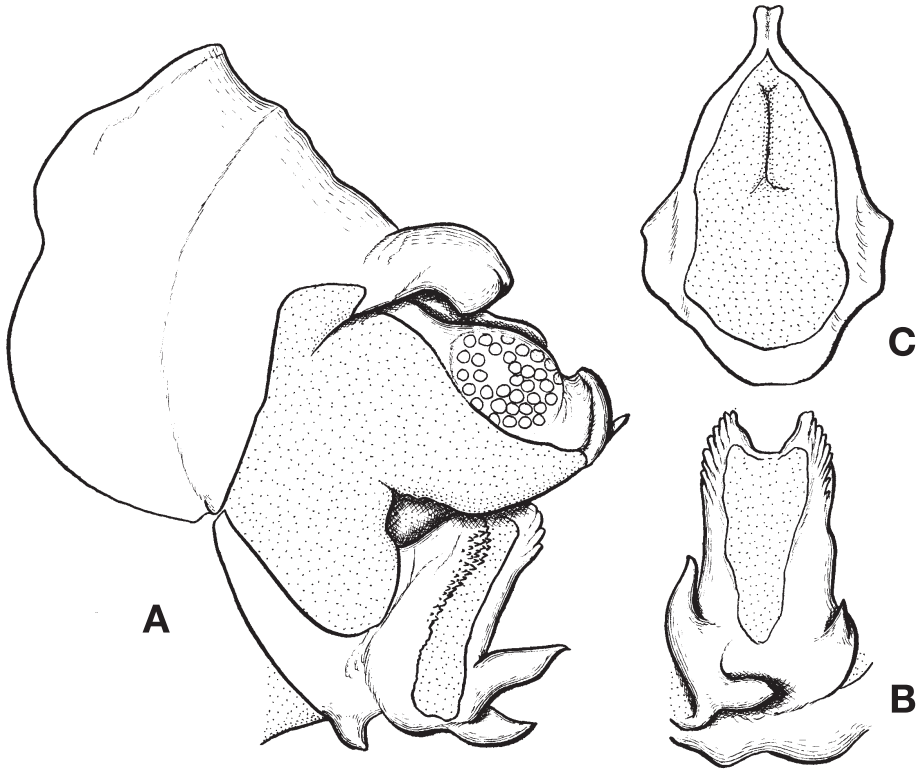

Fig. 2. Male terminalia of *Metylophorus nebulosus*. A. Terminalia, lateral view. B. Hypandrial median flap, posterior view. C. Phallosome, ventral view.

1 female, summit of Mt. Hiei-zan, alt. 850 m, Kyoto Pref., 2.x.1994, leg. C. Lienhard (Natural History Museum, Geneva: NHMG). [Shikoku] 2 males, Mt. Tsurugi-san, Tokushima Pref., 18.vi.1997; 1 male, Tsuchigoya, Ehime Pref., 23.vii.1996; 3 males, Mt. Shiraga-yama, Kochi Pref., 25.vii.1996; 1 male, Sameura Dam, Kochi Pref., 23.vii.1996. [Kyushu] 5 males, Mt. Hikosan, Soeda-cho, Fukuoka Pref., 8.vi.1993; 1 male 4 females, Notoge (bifurcation of roads 496 and 500), nr Mt. Hikosan, alt. 800 m, Oita Pref., 12.x.1994, leg. C. Lienhard (NHMG); 1 male, Befu-kyo, Oita Pref., 22.vii.1996 (light trap); 2 males, Chojabaru, Kokonoe-cho, Oita Pref., 28.vii.1996.

Diagnosis. Hypandrium (Fig. 2AB) asymmetrical; median flap with deep distal notch, with short flat margin medially; two left processes well developed and closely related basally, upper process directed posterodorsally, lower process directed posterointernally; right process small.

Distribution. Palearctic including Japan (Hokkaido, Honshu, Shikoku, Kyushu).

Remarks. *M. nebulosus* has been the only species of this genus previously recorded from Japan, and it cannot be distinguished from the other Japanese species treated below without examining the male hypandrial structures. Therefore, previous records of this species from Japan may also include material of other species of *Metylophorus.*

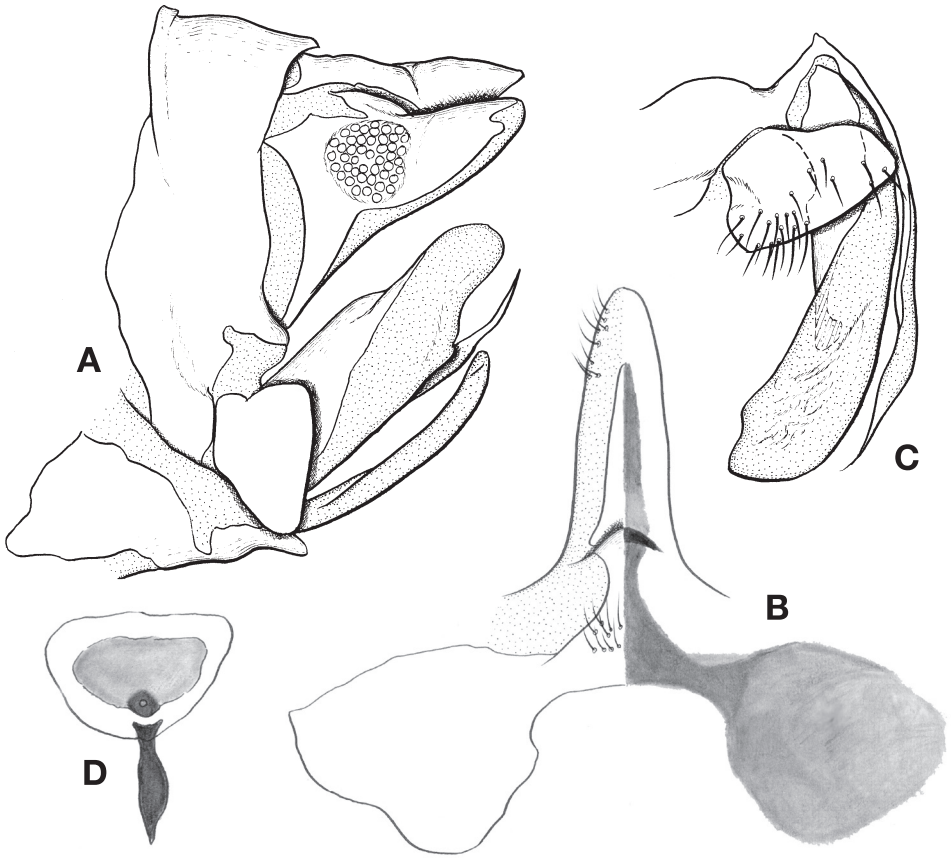

Fig. 3. Female terminalia of *Metylophorus neblosus*. A. Terminalia, lateral view. B. Subgenital plate, ventral view, showing structure (left half, pilosity only partly figured) and pigmentation (right half). C. Gonapophyses, ventral view. D. Spermapore plate, ventral view.

Metylophorus mutabilis Kido & Yoshizawa, n. sp.
(Figs 1BF, 4A–C)

Holotype male. Odai-kyokai, alt. 1560m, Odaigahara, Kamikitayama-mura, Nara Pref., 11.viii.2013, leg. T. Mano.

Paratypes. [Hokkaido] 2 males, Asahidake Spa., Higashikawa-cho, 9.viii.1996, R. Matsumoto; 1 male, Jozankei, Sapporo City, 18.viii.1994; 15 males; Chisenupuri, Niseko-Cho, 14–15.viii.1994, R. Matsumoto & K. Yoshizawa (SEHU and MNHG); 4 males, Miyato, Mukawa-cho, 20.vii.2007, T. Mano. [Honshu] 1 male, Mt. Kudoji-yama, Hirosaki City, Aomori Pref., 27.vii.1996, leg. T. Nakamura; 1 male, Nuruyu, Hanayama Spa., Miyagi Pref., 24.vii.1996; 3 males, Togamura-kamimomose (alt. 664m), Nanto City, Toyama Pref., 21–28.vii.2009, leg. M. Watanabe et al. (Malaise trap); 3 males, same locality and collectors, 15–29.ix.2009; 2 males, Inonedani (alt. 1120m), Arimine, Toyama City, Toyama Pref., 15–28.vii.2009, leg. M. Watanabe et

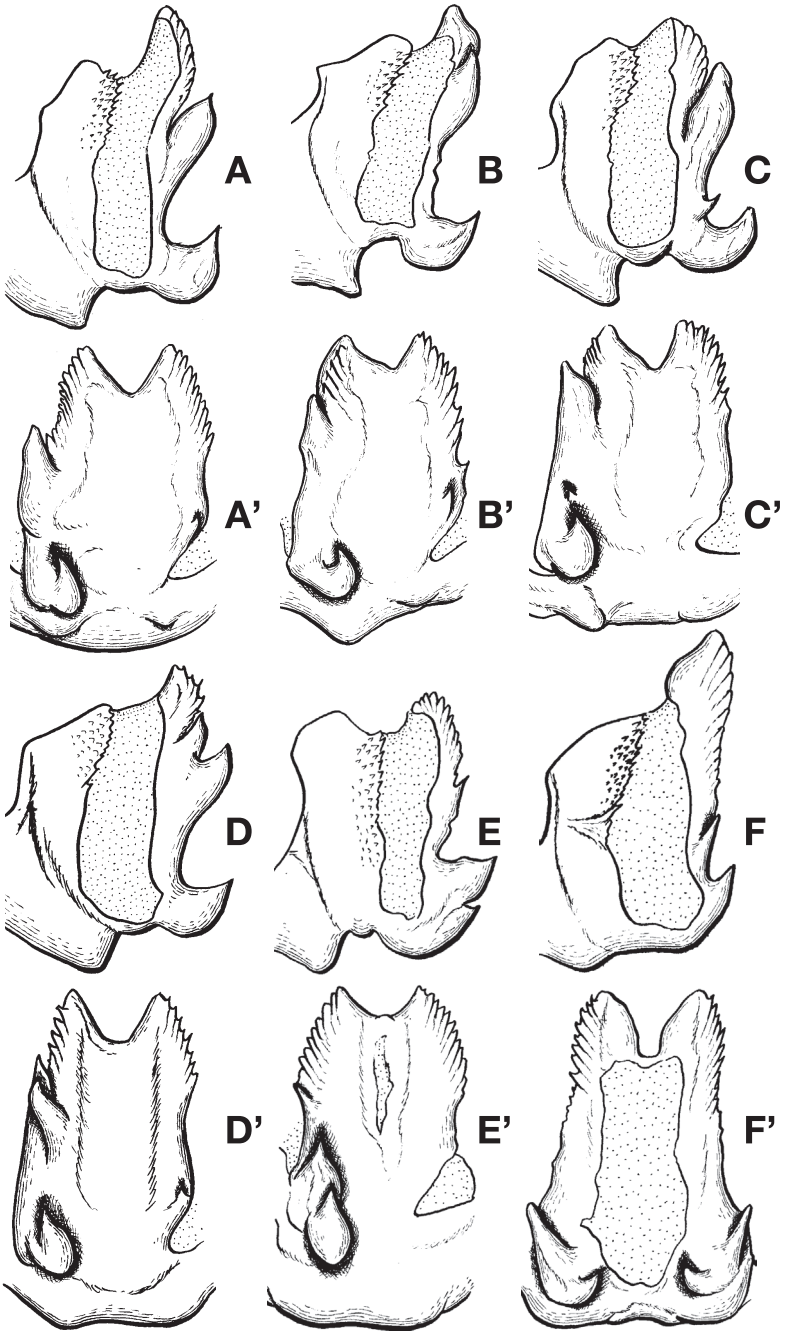

Fig. 4. Hypandrial median flap of Japanese *Metylophorus* spp. in lateral (upper) and ventral views (lower). A–C. *M. mutabilis*, showing intraspecific variation. D. *Metylophorus* sp. E. *M. rotundispinus*. F. *M. symmetriformis*.

al. (Malaise trap); 2 males, Kamegai (alt. 330m), Toyama City, Toyama Pref., 1–8, 15–28.ix.2009, leg. M. Watanabe et al.; 2 males, Jurodani (alt. 1220m), Arimine, Toyama City, Toyama Pref., 14–28.vii.2009, leg. M. Watanabe et al.; 5 males, Masutomi Spa, Sutama-cho, Yamanashi Pref., 19.vii.1996; 1 male, Meihoukuzumi, Gujo City, Gifu Pref., 11.vii.2004, leg. T. Mano; 4 males, Mt. Nonobori-yama (alt. 840m), Kameyama City, Mie Pref., 18.ix.2004, leg. T. Mano; 1 male, Mt. Daisen, Kofu Cho, Tottori Pref., 12.vii.1994; 1 male, Mt. Ungetsu-yama, Geihoku-cho, Hiroshima Pref., 4.ix.1992; 3 males, Mt. Kakezu-yama, Geihoku-cho, Hiroshima Pref., 11.vii.1994.

Non-type specimens examined. [Hokkaido] 9 females, Chisenupuri, Niseko-cho, 14–15. viii.1994; 2 females, Jozankei, Sapporo City, 18.viii.1994; 1 female, Miyato, Mukawa-cho, 20.vii.2007. [Honshu] 2 females, Jurodani (alt. 1220m), Arimine, Toyama City, Toyama Pref., 14–28.vii.2009, leg. M. Watanabe et al.; 1 female, Masutomi Spa., Sutama-cho, Yamanashi Pref., 18.vii.1994.

Description of male genitalia. Hypandrium (Fig. 4A–C) asymmetrical; median flap with deep V-shaped notch distally; two left processes well developed and distantly located, sometimes with tiny process between them (Fig. 4C'), position and shape of upper process variable, arising from middle to dorsal part of median flap and directed posterodorsally to dorsally, lower process directed posteriorly; right process tiny (Fig. 4A', B') or absent (Fig. 4C').

Length. Male: Body (B) 3.8–4.6, forewing (F) 5.8–6.0, hindwing (H) 4.2–4.3; female: B 4.8–6.1, F 5.8–7.2, H 4.2–5.2.

Distribution. Japan (Hokkaido, Honshu)

Etymology. The species epithet refers to the significant morphological variability observed in the hypandrial processes of this species.

Remarks. This species resembles *M. nebulosus* but can be distinguished by the position of the hypandrial left processes and the much smaller right process. This species also resembles *M. plebius* Li, 1989 from China in the condition of the hypandrial processes, but they can be distinguished by the condition of the serration of the median flap (broadly distributed in *M. mutabilis* whereas restricted to distal end in *M. plebius*).

Metylophorus sp.
(Figs 1C, 4D)

Specimen examined. [Shikoku] 1 male, Mt. Kamegamori, Agawa-gun, Kochi Pref., 24.vii.1996.

Remarks. The above-mentioned male specimen collected in Kochi prefecture resembles *M. mutabilis* but apparently differs from it by having an additional well-developed process near the upper left process (Fig. 4D). Although the hypandrial structure of *M. mutabilis* is variable, such variation could not be detected (Fig. 4A–C). Therefore, the specimen with three left processes may represent an independent species. However, because only a single specimen was available from the locality, it cannot be excluded that this form is also continuous to the variation observed in *M. mutabilis*. Therefore, this specimen is here treated as an unidentified sample.

Metylophorus rotundispinus Kido & Yoshizawa, n. sp.
(Figs 1D, 4E)

Holotype male, Hokkaido University campus, Sapporo City, Hokkaido, 2.viii.2018, M. Kido.

Paratypes. [Hokkaido] 4 males, Shirakaba-rindo, Experimental Forest of Hokkaido Univ., Uryu-cho, 7.viii.1994; 1 male, Atsuta, Ishikari City, 12.viii.1994; 1 male, same data as holotype. [Honshu] 1 male, Masutomi Spa, Sutama-cho, Yamanashi Pref., 14.viii.1992; 2 males, Odaigahara, Miyagawa-mura, Mie Pref., 3.viii.2004, leg. T. Mano; 1 male, Soni-kogen, Soni-mura, Nara Pref., 19.vii.2008, leg. T. Mano; 2 males, Odai-kyokai, Odaigahara, Kamikitayama-mura, Nara Pref., 11.viii.2013, leg. T. Mano. [Kyushu] 1 male, Is. Nokono-shima, Fukuoka City, Fukuoka Pref., 21.vi.1993; 28 males, Experimental Forest of Kyushu University (Canopy fogging), Sasaguri-cho, Fukuoka Pref., 21.vi.2003, leg. H. Kojima (SEHU and MNHG); 4 males, same locality, collector, method, 27.vi.2003.

Non-type specimens examined. [Hokkaido] 11 females, Shirakaba-rindo, Experimental Forest of Hokkaido Univ., Uryu-cho, 7.viii.1994. [Kyushu] 6 females, Is. Nokono-shima, Fukuoka City, Fukuoka Pref., 21.vi.1993; 16 females, Experimental Forest of Kyushu University (Canopy fogging), Sasaguri-cho, Fukuoka Pref., 21.vi.2003, leg. H. Kojima; 3 females, same locality, collector, method, 27.vi.2003.

Description of male genitalia. Hypandium (Fig. 4E) asymmetrical, median flap with semicircular notch distally; two left processes well developed, thick, and tightly associated, both directed posterodorsally; right process absent.

Length. Male: B 3.6–4.3, F 4.9–5.3, H 3.7–3.8; female: B 4.3–5.5, F 5.6–6.1, H 4.2–4.5.

Distribution. Japan (Hokkaido, Honshu, Kyushu)

Etymology. The species epithet refers to the thick and basally rounded hypandrial left processes which are characteristic for this species.

Remarks. *M. rotundispinus* resembles *M.nebulosus* in having closely located hypandrial left processes (Figs 2, 4E), but it can be easily distinguished from the latter because the left processes of *M. rotundispinus* are thicker and both directed posterodorsally, and also by lack of the right process.

Metylophorus symmetriformis Yoshizawa, n. sp.
(Figs 1E, 4F)

Holotype male. Togamura-Kamimomose, alt. 664m, Nanto City, Toyama Pref., 28.vii–4.viii.2009, leg. M. Watanabe et al. (Malaise trap).

Paratypes. [Honshu] 4 males, same locality and collectors as for holotype, 21.vii–28.vii.2009 (SEHU and MNHG); 1 male, Ennen-no-mori Park, Shirotori, Gujo City, Gifu Pref., 12.vii.2015, leg. T. Mano.

Description of male genitalia. Hypandrium (Fig. 4F) symmetrical; median flap with deep V-shaped notch distally; right and left processes well-developed, on each side represented by two closely located processes arising from ventrolateral region, upper process directed dorsoexternally, ventral process directed dorsointernally.

Length. Male: B 4.0–4.4, F 5.2–5.7, H 3.9–4.2.

Distribution. Japan (Honshu)

Etymology. The species epithet refers to the symmetrical hypandrial structure characteristic to this species.

Remarks. This species can be distinguished from the other Japanese species by having a symmetrical hypandrium. No species having similar hypandrial structure is known also from other regions.

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References

Enderlein, G. 1906. Die Copeognathen-Fauna Japans. *Zoologische Jahrbücher (Abteilung Systematik)*. 23: 243–256, pls 10, 11.

Li, F. 1989. Eighteen new species of psocids from Shaanxi, China (Psocoptera: Stenopsocidae, Psocidae). *Entomotaxonomia* 11: 31–60.

Li, F. 2002. *Psocoptera of China*. National Natural Science Foundation of China, Science Press, Beijing.

Lienhard, C. 2016. Synthesis of parts 1–10 of the Additions and Corrections to Lienhard & Smithers, 2002: "Psocoptera (Insecta) – World Catalogue and Bibliography". *Psocid News* Special Issue III: 1–221.

Lienhard, C. & Smithers, C. N. 2002. *Psocoptera (Insecta) – World Catalogue & Bibliography*. Instrumenta Biodiversitatis V, Muséum d'histoire naturelle, Geneva.

Pearman, J. V. 1932. Notes on the genus *Psocus*, with special reference to the British species. *Entomologist's Monthly Magazine* 68: 193–204.

Stephens, F. 1836. Illustrations of British entomology, or a synopsis of indigenous insects etc. *London*. 1827–1846.

Yoshizawa, K. 2016. Psocodea. In Hayashi, M., Tomokuni, M., Yoshizawa, K. & Ishikawa, T. (Eds.) *Catalogue of the Insects of Japan. Volume 4 Paraneoptera*, pp. 1–43. The Entomological Society of Japan, Fukuoka.