



The family Hydropsychidae Curtis (Trichoptera) in the Ryukyu Archipelago, southwestern Japan

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Abstract

The caddisfly family Hydropsychidae Curtis is revised for the Ryukyu Archipelago, southwestern Japan. Four new species are described based on adults: *Dipletrona uken* Ito and Nozaki **sp. nov.**, *Homoplectra crassicornes* Nozaki and Ito **sp. nov.**, *Homoplectra trifurcata* Nozaki and Ito **sp. nov.** and *Cheumatopsyche aira* Ito and Nozaki **sp. nov.** Based on examination of type specimens of species described from Taiwan in 1910–1930's: *Cheumatopsyche uchidai* Kobayashi 1987 and *Hydropsyche yaeyamensis* Tanida 1986 are synonymized with *C. clavalis* Martynov 1930 and *H. orbiculata* Ulmer 1911, respectively. Five East Asian species: *Dipletrona burha* Schmid 1961, *Dipletrona albofasciata* (Ulmer 1913), *Cheumatopsyche clavalis* Martynov 1930, *Hydropsyche verrucosa* (Ulmer 1911), and *Macrostemum formosicolum* (Matsumura 1931) are recorded from Japan for the first time and re-described. Adults of two known species, *Cheumatopsyche okinawa* Oláh and Johanson 2008 and *Macrostemum okinawanum* (Matsumura 1931) are re-described. Females of five species, previously known only as males, are described for the first time.

Key words: *Dipletrona*, *Homoplectra*, *Cheumatopsyche*, *Hydropsyche*, *Macrostemum*, adult, new species, new synonym, new record, Taiwan

Introduction

The Ryukyu Archipelago is the chain of more than 200 islands between Kyushu, a main island of Japan, and Taiwan (Fig. 1). The archipelago is topographically divided by the Tokara Channel and Miyako Depression into three parts, northern Ryukyu in the East Palearctic region, and central and southern Ryukyu in the Oriental region (Fig. 1). The faunas of several freshwater animal groups are known to have a high rate of endemic species in the archipelago, especially in central Ryukyu (Nishida *et al.* 2003). For Trichoptera, 104 species, including 40 endemic ones, have been recorded in the archipelago (Ito 2017). In the family Hydropsychidae Curtis, six species including three endemic ones are known (Matsumura 1931; Tanida 1986; Oláh & Johansson 2008; Kuhara & Ito 2017), but several undetermined “species” remain for further study (Tanida 1997; Kuhara & Ito 2017).

We examined extensive material of Hydropsychidae collected from the archipelago, and also investigated the type specimens of several species described from Ryukyu or Taiwan in the 1910–1930's in order to clarify the specific characters and compare with species described later. As a result, we report four new species, two new synonyms, and four newly recorded species from Japan in the present paper. The hydropsychid species previously known in the archipelago are also listed with illustrations for scarcely recorded species. Furthermore, females of five species, known only as males, are described for the first time.

Materials and methods

We examined 1797 adult specimens of Hydropsychidae collected from the archipelago by the first author and Japanese colleagues during 1992–2017. Association of males and females was based on similar general body characters, i.e., color and size, among specimens collected together. Male and female genitalia were figured after

treatment in 10% KOH solution. Morphological terms are indicated in the figure legends, referring to Scheffer and Wiggins (1986), Mey (1998), Oláh and Johansson (2008) and Oláh *et al* (2008). The type specimens of new species are deposited in the collections of the Natural History Museum and Institute, Chiba, Japan (CBM-ZI). Other specimens are deposited in the collections of the authors, unless otherwise indicated in parentheses as follows: HU: Hokkaido University; MT: Masayuki Tanaka, Akita-shi; SCM: Sagami-hara City Museum, Sagami-hara-shi. Specimens are kept in 80% alcohol unless otherwise indicated in parentheses. Collection methods and collectors are abbreviated as follows: L: light trap, M: Malaise trap, P: light pan trap, S: net sweeping, AO: A. Ohkawa, KK: K. Konishi, RS: R. Saito, SI: S. Inaba, TI: T. Ito.

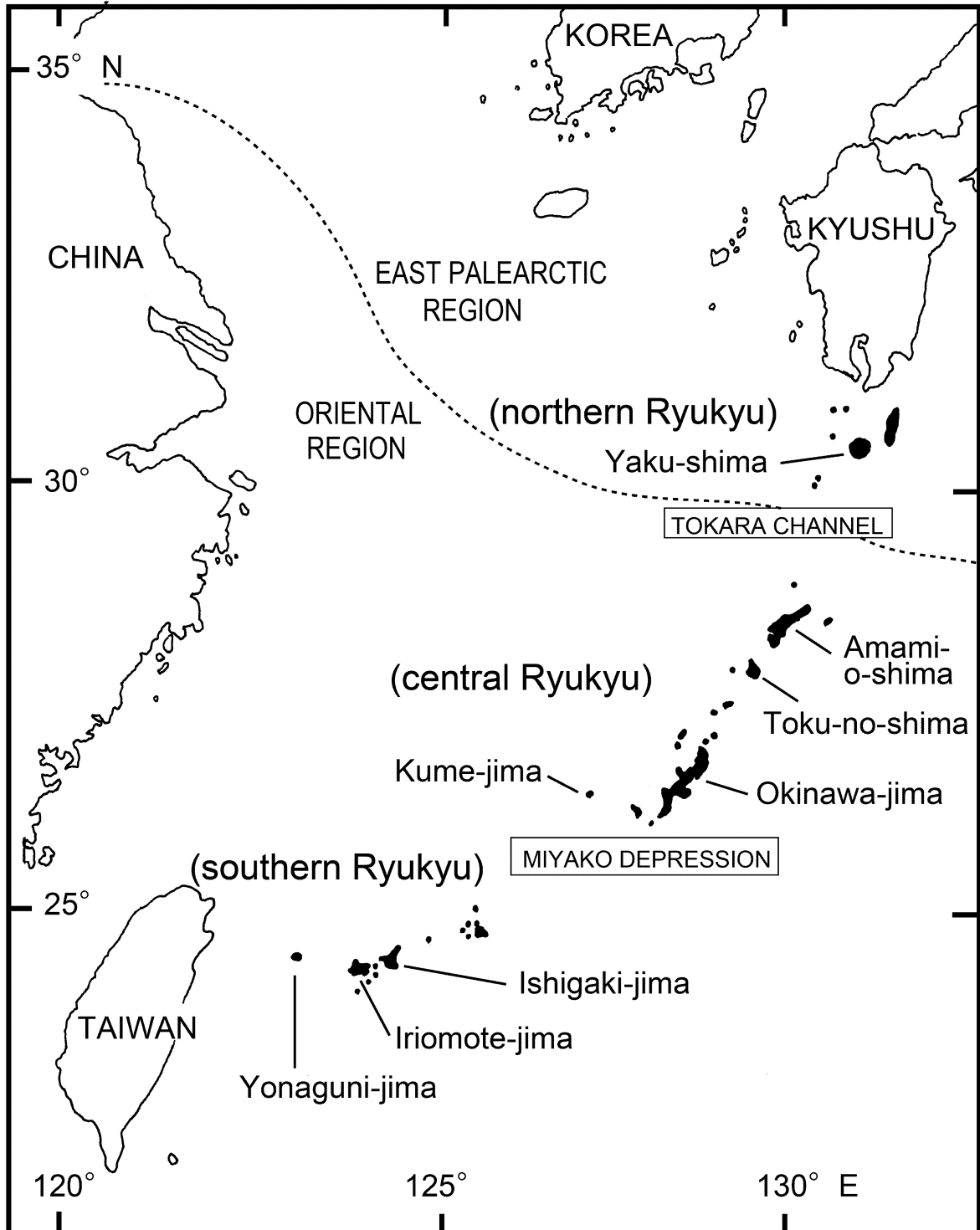


FIGURE 1. Map of the Ryukyu Archipelago. Island names are shown for the islands with hydropsychid caddisfly records.

Species of the family Hydropsychidae found in the Ryukyu Archipelago

Diplectrona kibuneana Tsuda 1940

Diplectrona kibuneana Tsuda 1940, 24–25, 33, figs 1, 2, male, Honshu; Park *et al.* 2017, 5, fig. 4, male, Korea; Kuhara and Ito 2017, 14, 15, Yakushima.

Distribution. Japan: Ryukyu (Yakushima), Hokkaido, Honshu, Shikoku, Kyushu. Korea.

Remarks. This species is widely distributed through the main islands of Japan and Korea, and known from only Yakushima Island in the Ryukyu Archipelago, indicating that this is an East Palearctic species.

Japanese name. Kibune-miyama-shima-tobikera.

Diplectrona burha Schmid 1961

(Figs 2A–2I)

Diplectrona burha Schmid 1961, 200–201, pl. 17, male, Pakistan (Himalaya, Karakoram); Malicky 2002, 1205–1206, 1218, 1233, pl. 14, male, Pakistan, India, Nepal, Thailand, Vietnam, Taiwan.

Adult (Figs 2A–2I). Forewings each 4.9–6.1 mm in male ($n = 8$), 5.6–7.2 mm long in female ($n = 8$). Wing venation typical in the genus. Lateral filaments of segment V longer than the segment in both genders. Internal gland of segment V small, internal gland of segment VIII absent in male.

Female genitalia (Figs 2G–2I). Tergite VIII subquadrate with round postero-lateral corners in lateral aspect. Sternite VIII subquadrate with slightly undulated dorsal margin and nearly rectangular large lateral lobes in lateral aspect. Segment IX obliquely S-shaped in lateral aspects, each antero-ventral corner protruding anteriorly; receptacle of inferior appendage indistinct. Segment X oblique rectangular.

Specimens examined. **Amami-o-shima:** 1 male, Setouchi-cho, Miyama-gawa, small tributary near Daini-miyama-bashi, 26.x.2011, TI, S; 1 female, Uken-son, Kawauchi-gawa, small fall, 25.x.2011, TI, P & S; 3 males, Sumiyo-cho, Kamiya, Kawauchi-gawa, tributary, 20–21.iv.2015, SI, P; 16 males, 9 females, Yamato-son, Yuwan-gawa, headwater, 18–19.iv.2015, SI, P; 3 males, 2 females, Yamato-son, Yuwan-gawa, small stream, 18–19.iv.2015, SI, P; 1 male, Yamato-son, Materia-gawa, 1.v.2017, N. Katsuma. **Okinawa-jima:** 2 females, Nago-shi, Genka-gawa, Hogen-hashii, 22–24.xi.2010, TI, P; 1 male, same locality, 8.iv.2011, TI, P; 1 male, same locality, 17–18.x.2014, TI, L; 1 female, Kunigami-son, Hiji-gawa, 9.iv.2011, TI, L; 1 male, Kunigami-son, Okuma, Okuma-gawa, upper reach, 2.i.2016, M. Enju. **Ishigaki-jima:** 2 males, Omoto-dake, 13–21.x.1999, KK, M; 1 male, same locality, 11.v.2007, KK, L; 1 male, Omoto-dake, small stream near foot path, 13.iv.2011, TI, S; 1 male, same locality, 26.x.2012, TI, S; 3 females, Nagura-gawa, 18 m above sea level (a.s.l.), 25.x.2012, TI, P & S; 1 male, same locality, 27.xi.2013, TI, S; 1 female, Miyara-zawa, 60 m a.s.l., 22.x.2012, TI, S. **Iriomote-jima:** 1 female, Aira-gawa, 25 m a.s.l., 21.iii.2016, TI, L; 1 male, Urauchi-gawa, small stream near Boat Station, 18.x.2015, TI, S.

Distribution. Japan: Ryukyu (Amami-o-shima, Okinawa-jima, Ishigaki-jima, Iriomote-jima). Pakistan, India, Nepal, Thailand, Vietnam, Taiwan. New to Japan.

Remarks. This species is widely distributed in southeastern Asia with some morphological variation in male genitalia (Malicky 2002, Pl. 14). The male of this species is characterized by the long lateral filaments of segment V (1–2 times segment length), small internal glands (“Blasen” of Malicky 2002) of segment V, absence of internal glands of segment VIII, and shape of genitalia (Malicky 2002; Fig. 2A). The male genitalia are distinguished from those of other congeneric species mainly by segment X (Fig. 2C); i.e. each subquadrate lateral lobe (l.l.) often with depression in apical margin in dorsal aspect, the developed mesocaudal lobe (m.c.l.) with middle slit in dorsal aspect, and large preanal appendages (p.a.) (Malicky 2002, pl. 14; Fig. 2C). The female, first described here, is discriminated from those of other congeneric Ryukyu species by the very slightly undulate dorsal margin of sternite VIII (marked with an arrow in Fig. 2G).

Japanese name. Buruha-miyama-shima-tobikera.

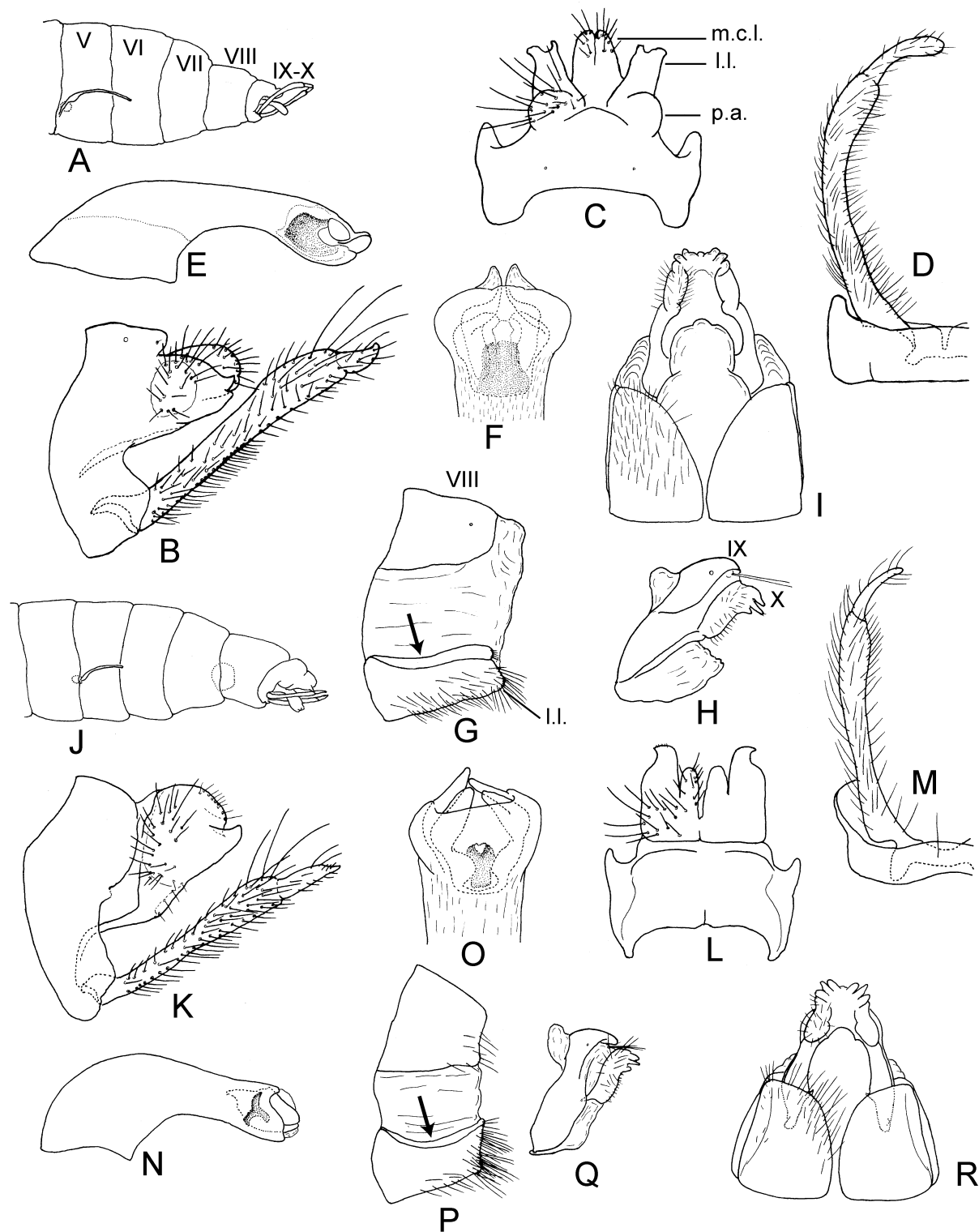


FIGURE 2. *Diplectrona burha* Schmid and *D. albofaciata* Ulmer. *Diplectrona burha* (2A–2I): male (2A–2F): 2A, abdominal segments V–X, left lateral; 2B, genitalia, left lateral; 2C, same, dorsal; 2D, left inferior appendage, ventral; 2E, phallic apparatus, left lateral; 2F, apex of phallic apparatus, ventral; female (2G–2I): 2G, abdominal segment VIII, left lateral; 2H, abdominal segments IX–X, left lateral; 2I, abdominal segments VIII–X, ventral. *Diplectrona albofaciata* (2J–2R): male (2J–2O): 2J, abdominal segments IV–X, left lateral; 2K, genitalia, left lateral; 2L, same, dorsal; 2M, left inferior appendage, ventral; 2N, phallic apparatus, left lateral; 2O, apex of phallic apparatus, ventral; female (2P–2R): 2P, abdominal segment VIII, left lateral; 2Q, abdominal segments IX–X, left lateral; 2R, abdominal segments VIII–X, ventral. Abbreviations: V–X = abdominal segments V–X; l.l. = lateral lobe (paired); m.c.l. = mesocaudal lobe (paired); p.a. = preanal appendage (paired). Arrows, see text.

***Diplectrona albofasciata* (Ulmer 1913)**

(Figs 2J–2R)

Hydromanicus albofasciatus Ulmer 1913, 49–50, male, Taiwan.

Diplectrona albofasciata: Malicky 2002, 1204, 1218, 1228, pl. 9, male, Taiwan.

Specimens examined. **Iriomote-jima:** 1 male, Yuchin-gawa, Yuchin-no-taki, 23.iii.2016, TI, S; 1 male, Urauchi-gawa, Kampire-no-taki, 85 m a.s.l., 25.iii.1999, TI & AO, S. **Yonaguni-jima:** 24 males, 4 females, Higawa-suigen, 31.iii.2010, N. Shimura, M; 3 males, Donan-daki, 13.iv.2011, N. Shimura (pinned).

Adult (Figs 2J–2R). Forewings each 6.2–7.0 mm in male ($n = 3$), 7.1–7.6 mm long in female ($n = 4$). Wing venation typical in the genus. Lateral filaments of segment V as long as segment in both genders. Internal gland of segment V small, internal gland of segment VIII large in male.

Female genitalia (Figs 2P–2R). Tergite VIII subquadrate, anterior margin wider than posterior margin in lateral aspect. Sternite VIII subquadrate with concave dorsal margin and large, nearly rectangular lateral lobes in lateral aspect. Segment IX obliquely S-shaped in lateral aspects, each antero-ventral corner slightly protruding anteriorly; receptacle of inferior appendage indistinct. Segment X oblique rectangular.

Distribution. Japan: Ryukyu (Iriomote-jima, Yonaguni-jima). Taiwan. New to Japan.

Remarks. This species was described based on the males collected from two localities (Ulmer 1913) and recorded from many localities in Taiwan (Hsu 1997; Malicky 2002). The male of this species is characterized by the long lateral filaments of segment V (same length as segment), small internal glands of segment V, large internal glands of segment VIII, and shape of genitalia (Malicky 2002, pl. 9; Fig. 2J). The male genitalia are discriminated from those of other congeneric species mainly by segment X, i.e. each subquadrate lateral lobe with acute lateroposterior corner in dorsal aspect, and the mesocaudal lobes separated by a deep slit and their apices round in dorsal aspect (Malicky 2002; Fig. 2L). Large, pale marks of forewings are present in some Taiwanese males (Ulmer, 1913; Hsu, 1997), but absent in other Taiwanese specimens (Malicky 2002) and all Ryukyu males examined here. Malicky (personal communication 8 July 2017) suggested that they could be the same species, but further study with molecular data may be needed to clarify the taxonomic status. The female, first described here, is discriminated from that of *D. burha* Schmid by the concave dorsal margins of abdominal sternite VIII in lateral aspect (marked with an arrow in Fig. 2P).

Japanese name. Taiwan-miyama-shima-tobikera.

***Diplectrona uken* Ito and Nozaki sp. nov.**

(Fig. 3A–3I)

Diagnosis. The male of this species is similar to that of *Diplectrona erinya* Malicky 2002 from Vietnam in that segment V is longer than its lateral filaments and lacking internal glands, and also in the mid-sized internal glands of segment VIII, and the shape of genitalia (Malicky 2002). However, the male genitalia of *D. uken* are clearly discriminated from those of *D. erinya* as follows: Segment X is divided into one pair of large lobes, each is subtriangular with its inner margin having a stout protuberance subapically in dorsal aspect, and the phallic apparatus with complicated inner sclerites in *D. uken*; but the lobes of segment X are almost rectangular in dorsal aspect and the phallic apparatus is without such sclerites in *D. erinya* (Malicky 2002, Malicky personal communication 22 November 2017).

Adult (Figs 3A–3I). Wings brown, several light brown dots and patterns present in forewings, but often indistinct in alcohol specimens. Forewings 4.3–5.6 mm long ($n = 5$); apical forks I–V present, discoidal cell short, medial cell long in forewings; apical forks I, II, III and V present, discoidal cell long in hind wings. Lateral filaments of segment V slightly shorter than the segment, internal glands of segment V absent, internal glands of segment VIII middle-sized.

Male genitalia (Figs 3C–3I). Segment IX short, anterior margin slightly protruded at ventral 1/4, posterior margin undulating through ventral 2/5 in lateral aspect. Segment X in lateral aspect with upper margin round and dorsal subapex deeply concave, ventrolateral margin sinuous; in dorsal aspect divided into 2 large lobes, each subtriangular with subapical protuberance on mesal edge; shape of protuberances and their apices variable individually, from almost reduced to fairly developed (Figs 3D, 3E, and 3F), even opposite ones of left and right

lobes within single specimen. Inferior appendages with long basal and short distal segments; basal segment nearly straight and gradually thickened from base to apex in lateral aspect, and slightly swollen at apical 1/3 in ventral aspect; distal segment in lateral aspect about 1/6 as long as basal one, with upper and ventral margins almost parallel, and apex round, in ventral aspects width about half width of basal segment, slender and slightly curved mesad. Phallic apparatus evenly thick, with pair of small endothelial processes (e.p.) apicodorsally; internal sclerites large and complicated.

Female. Unknown.

Holotype: Male, **Amami-o-shima**, Uken-son, Yuwan, Kawauchi-gawa, upper reach, 28.2553N, 129.3511E, about 100 m a.s.l., 2.vii.2017, N. Katsuma, L (CBM-ZI 166024).

Paratypes. 2 males, same data as holotype (CBM-ZI 166025–166026).

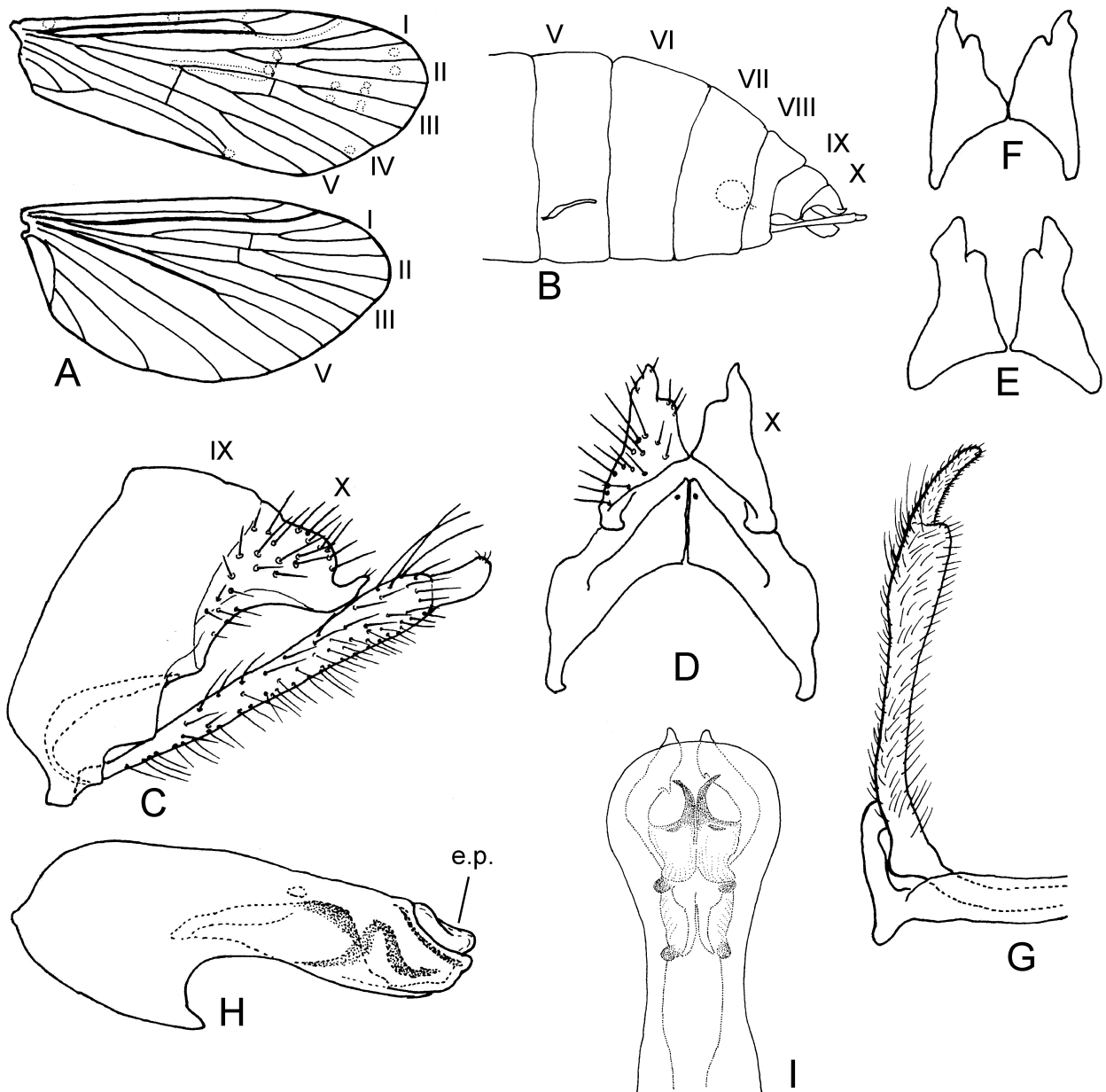


FIGURE 3. *Dipletrona uken* Ito & Nozaki **sp. nov.**, male. 3A, right wings, dorsal, venation and light color marks; 3B, abdominal segments V–X, left lateral; 3C, genitalia, left lateral; 3D, same, dorsal (holotype); 3E, segment X, dorsal, variation (type locality); 3F, same (Iriomote-jima); 3G, left inferior appendage, ventral; 3H, phallic apparatus, left lateral; 3I, apical 2/3 of phallic apparatus, ventral. Abbreviations: I–V = apical forks I–V in 3A; V–X = abdominal segments V–X in 3B–3D; e.p. = endothelial process (paired).

Other specimens examined. **Amami-o-shima:** 2 males, same data as holotype. **Iriomote-jima:** 1 male, Urauchi-gawa, small stream near Boat Station, 18.x.2005, TI, S.

Etymology. The name “*uken*” is a noun in apposition, coined from the type locality.

Distribution. Japan: Ryukyu (Amami-o-shima, Iriomote-jima). Endemic to the central and southern Ryukyu.

Japanese name. Uken-miyama-shima-tobikera.

***Homoplectra crassicornea* Nozaki and Ito sp. nov.**

(Figs 4A–4I)

Homoplectra sp.: Kuhara and Ito 2017, 15, Yaku-shima.

Diagnosis. The male of this species can be recognized readily by its aedeagus having a pair of ventral processes as compared to a single ventral process with a bifid apex in other known males (Weaver 1985, Ruitter 2003, Malicky 2015). The female of this species can be distinguished from that of *H. trifurcata* sp. nov. by the shape of the lateral lobe of the sternite VIII in lateral aspect: The posterodorsal corner of each lobe is round in this species, but acute in *H. trifurcata*.

Adult (Figs 4A–4I). Body and forewings mostly brown in alcohol. Forewings each 8.1–9.0 mm long in male ($n = 5$), 8.5 mm long in female ($n = 1$). Venation typical for the genus. Abdominal sternite V with pair of long finger-like processes near anterolateral margins.

Male genitalia (Figs 4B–4F). Anterior margin of sternite IX smoothly triangular in lateral aspect; tergite IX semi-sclerotized, mostly fused with segment X. Segment X large, semi-sclerotized dorsally, sclerotized laterally, membranous posteroventrally; spine-like process arising from posterolateral margins, directed dorsad. Inferior appendages long, 1-segmented, extending far beyond apex of segment X, apex with short spine-like setae mesally; in lateral aspect club-shaped, with subapex curved slightly upwards; in dorsal and ventral aspects slightly arched with apices pointed to each other. Phallic apparatus large, complex: Phallosome (pha.) somewhat conical with pairs of dorsal processes (d.p.p.) and lateral processes (l.p.p.); dorsal processes about 2/3 length of lateral ones, in lateral aspect arched, each apex with spine surrounded by hair, in dorsal aspect each constricted laterally at midway, forming square shoulder; lateral processes straight, each with subapex slightly bulged and then narrowed into point, with hair apicodorsally. Aedeagus (ae.) and two pairs of processes arising from endotheca (end.); aedeagus long, slightly shorter than lateral processes of phallosome, with subapex narrower; dorsolateral processes of aedeagus (d.p.a.) in lateral aspect each thick and horn-like, with apex directed dorsad, in dorsal aspect each arched, with apices pointed to each other, each apex with single spine surrounded by hair; pair of ventral process of aedeagus (v.p.a.) slender, arising from aedeagus basolaterally, directed posteroventrad, shorter than aedeagus, with single spine surrounded by hair apically.

Female genitalia (Figs 4G–4I). Sternite VIII cleft about half distance from base, forming pair of lateral lobes in ventral aspect, posterodorsal corner of each lobe round in lateral aspect. Segment IX triangular in dorsal aspect, oblique S-shaped in lateral aspect, each ventral margin protruding anteriorly. Segment X narrow rectangular in lateral aspect. Vulvar scale large, with X-shaped marking in ventral aspect.

Holotype. Male, **Yaku-shima:** Shiratani-unsui-kyo, Yaku-cho, (30.3794°N, 130.574°E, 620 m a.s.l.), 12.vii.1992, T. Ogata (CBM-ZI 166070).

Paratype. 3 males, same data as holotype (CBM-ZI 166071–166073).

Other specimens examined. **Yaku-shima:** 1 female, same data as holotype; 1 male, Ara-kawa, Yakusugi-land, 30.304°N, 130.509°E, 12.v.2006, TI, S.

Etymology. The species name (Latin adjective) refers to the thick horn-like processes of the phallic apparatus.

Distribution. Japan: Ryukyu (Yaku-shima). Endemic to northern Ryukyu.

Japanese name. Tsuno-nisemiyama-shima-tobikera.

Remarks. Several additional unnamed *Homoplectra* species have been recorded from Japanese Islands including this species (Nozaki 2018). Homology of the phallic structure in Japanese and North American *Homoplectra* spp. is not yet clear, but processes numbered (1) to (3) and (5) by Ross (1938) probably correspond to the pairs of dorsal processes and lateral processes of the phallosome, and the pairs of dorsolateral processes and ventral processes of the aedeagus as they are named in this study, respectively. Ross (1938) numbered and described the aedeagus as “(4) rod-like apex of the aedeagus proper”.

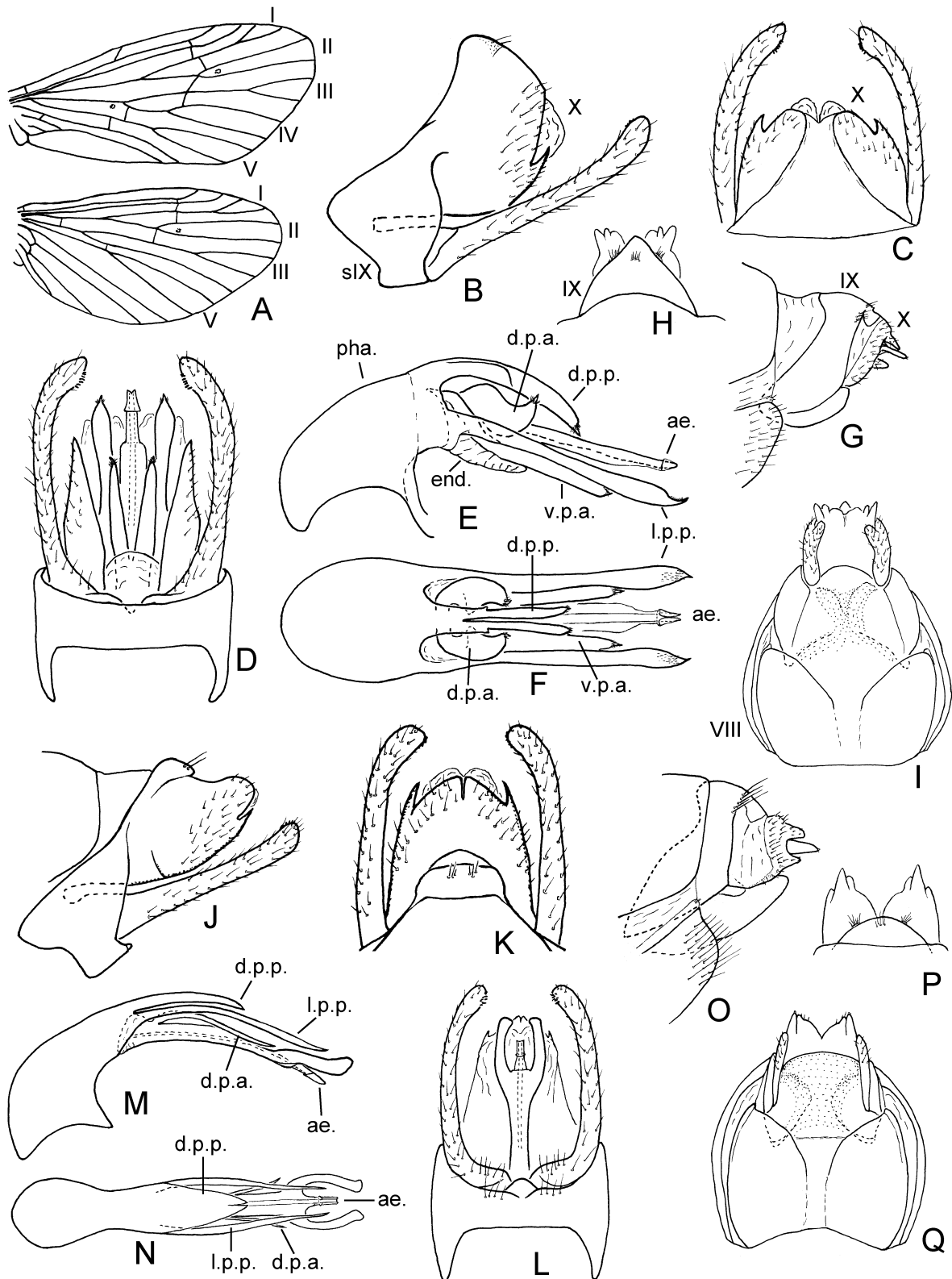


FIGURE 4. *Homoplectra crassicornea* Nozaki & Ito **sp. nov.** and *H. trifurcata* Nozaki & Ito **sp. nov.** *Homoplectra crassicornea* (4A–4I): male (4A–4F): 4A, right wings, dorsal; 4B, genitalia, left lateral; 4C, same, dorsal; 4D, same, ventral; 4E, phallic apparatus, left lateral; 4F, same, dorsal; female (4G–4I): 4G, genitalia, left lateral; 4H, same, dorsal; 4I, same, ventral. *Homoplectra trifurcata* (4J–4Q): male (4J–4N): 4J, genitalia, left lateral; 4K, same, dorsal; 4L, same, ventral; 4M, phallic apparatus, left lateral; 4N, same, dorsal; female (4O–4Q): 4O, genitalia, left lateral; 4P, same, dorsal; 4Q, same, ventral. Abbreviations: I–V = apical forks I–V; VIII–X = abdominal segments VIII–X; sIX = sternite IX; ae. = aedeagus; d.p.a. = dorsolateral process of aedeagus (paired); d.p.p. = dorsal process of phallosome (paired); end. = endotheca; l.p.p. = lateral process of phallosome (paired); pha, phallosome; v.p.a. = ventral process of aedeagus (paired).

***Homoplectra trifurcata* Nozaki and Ito sp. nov.**

(Figs 4J–4Q)

Diagnosis. The male of this species can be readily diagnosed by the unique trifurcated aedeagus from the congeneric members. The female of this species is distinguishable from that of *H. crassicornea* sp. nov. by the difference given in the diagnosis for that species.

Adult (Figs 4J–4Q). Body and forewings mostly brown in alcohol. Forewings each 7.2–8.1 mm long in male (n = 10), 7.3–8.7 mm long in female (n = 10). Venation as in Fig. 4A. Abdominal sternite V with pair of long finger-like processes near anterolateral margins.

Male genitalia (Figs 4J–4N). Sternite IX oblique trapezoid in lateral aspect; posteroventral lobe small, semicircular in ventral aspect. Tergite IX mostly fused with segment X. Segment X large oval in lateral aspect, with short central slit apicodorsally in dorsal aspect; pair of spine-like processes arising posteroventrally, directed dorsad; membranous posteroventrally. Inferior appendages long, 1-segmented, extending slightly beyond apex of segment X, each apex with short spine-like setae mesally. Phallic apparatus large, arcuate in lateral aspect; dorsal process of phallosome (d.p.p) about half length of aedeagus, triangular in dorsal aspect, bilobed apically, each apex acute; pair of lateral processes of phallosome (l.p.p.) long, each apex acute. Aedeagus (ae.) trifurcated apically, pair of lateral lobes (probably fused ventral process of aedeagus) sinuate in lateral aspect, each apex truncate, directed dorsolaterad; dorsolateral processes of aedeagus (d.p.a) paired, long, spine-like.

Female genitalia (Figs 4O–4Q). Sternite VIII cleft about half distance from base, forming pair of lateral lobes, each with posterodorsal corner producing into acute angle in lateral aspect. Segment IX obliquely S-shaped in lateral aspect, round in dorsal aspect. Segment X rectangular in lateral aspect, with dark pigmented ventrolaterally, constriction between segments IX and X wide. Vulvar scale large, with hourglass-shaped marking in ventral aspect.

Holotype. Male, **Amami-o-shima**, Uken-son, Yuwan -gawa, 28.2952N, 129.3170E, 600 m a.s.l., 4.v.2008, TI, S (CBM-ZI 166074).

Paratypes. 14 males, 5 females, same data as holotype (CBM-ZI 166075–166088, 167020–167024).

Other specimens examined. 8 females, same data as holotype; 2 males, 5 females, type locality, 8–9.v.2007, TI, S & L; 4 males, type locality, 20–21.iv.2008, TI, S.

Etymology. Specific name (Latin adjective) refers to the trifurcated processes of the phallic apparatus.

Distribution. Japan: Ryukyu (Amami-o-shima).

Japanese name. Mitsumata-nisemiyama-shima-tobikera.

***Cheumatopsyche infascia* Martynov 1934**

Cheumatopsyche infascia Martynov 1934, 283–285, 341, fig. 205, male, Russia (Far East); Kuhara and Ito 2017, 13–14, Yakushima.

Distribution. Japan: Ryukyu (Yakushima), Hokkaido, Honshu, Shikoku, Kyushu. Korea, Russia (Far East), China (Shaanxi, Szechuan).

Remarks. This is one of the more abundant species of the Hydropsychidae in Far East Asia, including the main islands of Japan and Yakushima Island alone in Ryukyu, indicating that this is an East Palearctic species.

Japanese name. Nami-kogata-shima-tobikera.

***Cheumatopsyche okinawa* Oláh and Johanson 2008**

(Figs 5A–5G)

Cheumatopsyche okinawa Oláh and Johanson 2008, 181–182, figs 295–298, male, Okinawa-jima.

Adult (Figs 5A–5F). Forewings each 6.9–7.0 mm long in male (n = 5), 6.9–7.3 mm long in female (n = 5). Wing venation typical in the genus.

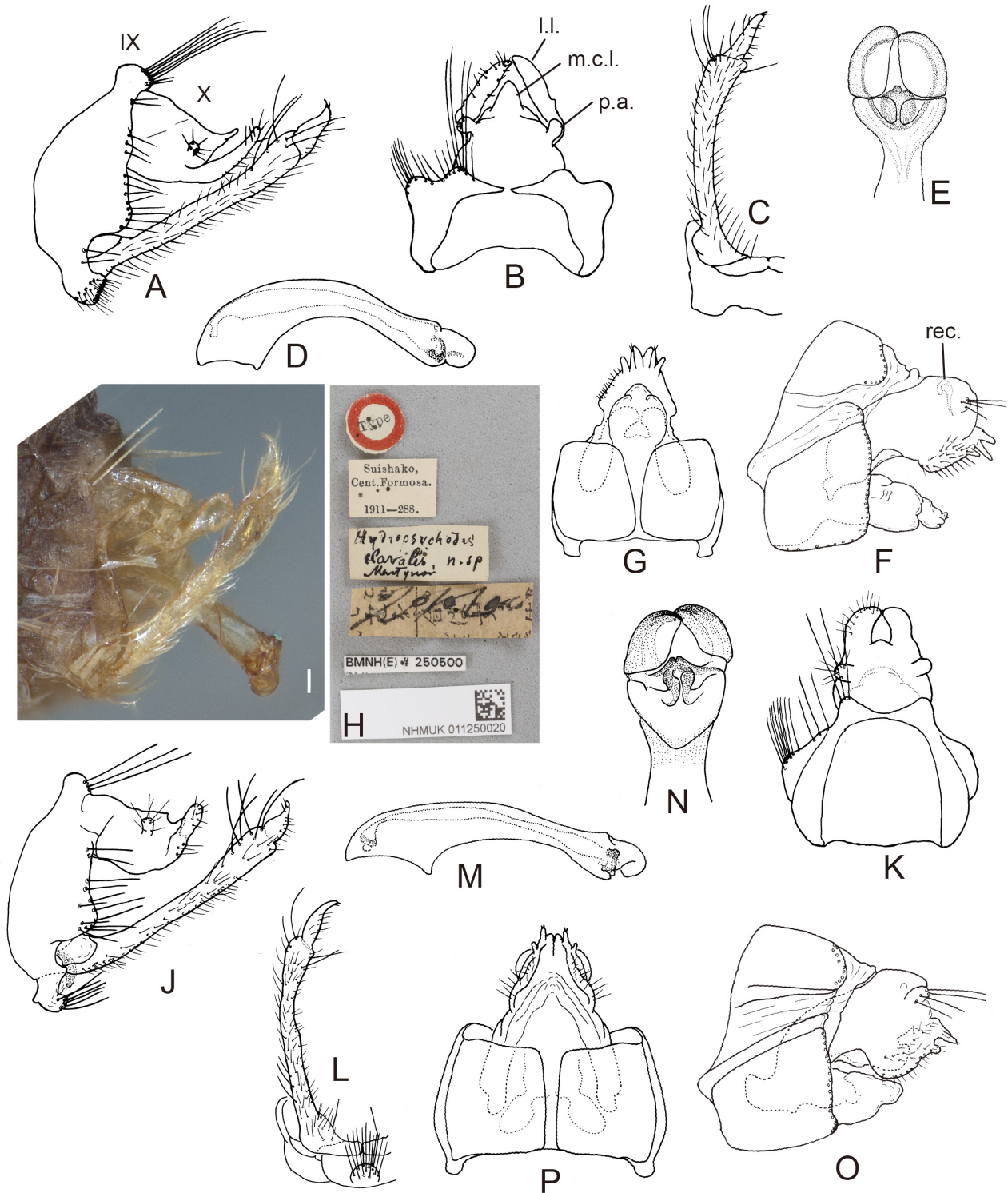


FIGURE 5. *Cheumatopsyche okinawa* Oláh & Johansson and *C. clavalis* Martynov. *Cheumatopsyche okinawa* (5A–5G): male (5A–5E); 5A, genitalia, left lateral; 5B, same, dorsal; 5C, left inferior appendage, ventral; 5D, phallic apparatus, left lateral; 5E, apical part of phallic apparatus, ventral; female (5F, 5G): 5F, genitalia, left lateral; 5G, same, ventral. *Cheumatopsyche clavalis* (5H–5P): Holotype male from Taiwan, photographed by B. Price (5H, 5I): 5H, labels; 5I, genitalia, lateral; male and female from Ishigaki-jima (5J–5P): 5J, male genitalia, left lateral; 5K, same, dorsal; 5L, left inferior appendage, ventral; 5M, phallic apparatus, left lateral; 5N, apical part of phallic apparatus, ventral; 5O, female genitalia, left lateral; 5P, same, ventral. Abbreviations: IX–X = abdominal segments IX–X; l.l. = lateral lobe (paired); m.c.l. = mesocaudal lobe; p.a. = preanal appendage (paired); rec. = receptacle of inferior appendage (paired).

Female genitalia (Figs 5F, 5G). Tergite VIII subquadrate with convex posterior margin in lateral aspect. Sternite VIII subquadrate, larger than tergite VIII, with oblique straight dorsal margin and large subquadrate lateral lobe in lateral aspect, ventral cleft gradually wider from anterior end to posterior one in ventral aspect. Segment IX obliquely S-shaped in lateral aspects; receptacle of inferior appendage (rec.) question-mark shaped. Segment X oblique rectangular.

Specimens examined. Amami-o-shima: 2 females, Uken-son, Kogachi-gawa, tributary, 25.x.2011, TI, S & P. **Okinawa-jima:** 3 males, Nago-shi, Genka-gawa, near Hogen-hashii, 22–24.xi.2010, TI, L & P; 16 females, same locality, 18.iv.2011, TI, P & L; 2 males, Nago-shi, Genka-gawa, 40 m a.s.l., 16.iii.2012, TI, P & L; 3 females, Kunigami-son, Yona-gawa, Nakafukuji-bashi, 18.x.2014, TI, L; 1 female, Kunigami-son, Yona-gawa, Heigi-bashi, 18.iii.2012, TI, S; 1 male, Kunigami-son, Yona-gawa, small tributary, 23–25.xi.2011, TI, S; 1 female, Kunigami-son, Yona, Sukuna-gawa, 21.iii.1999, TI & AO, L; 2 females, Kunigami-son, Shinrin Park, 9–10.iv.2011, TI, L & P. **Kume-jima:** 5 males, 12 females, Shirase Dam, 14.iii.1998, M. Maruyama.

Distribution. Japan: Ryukyu (Amami-o-shima, Okinawa-jima, Kume-jima). Endemic to central Ryukyu.

Remarks. This species was originally described from Okinawa-jima (Oláh & Johanson 2008), and recorded here from Amami-o-shima and Kume-jima. The male of this species is characterized by the large subtriangular mesocaudal lobe of segment X (m.c.l.), each long lateral lobe of segment X (l.l.) with subacute apex and developed, preanal appendage of segment X (p.a.) (Figs 5A–5C). The female, first described here, is separated from other congeneric Ryukyu species by the subquadrate lateral lobe with gently narrowing mesal margins in ventral aspect, and in lateral aspect the question-mark-shaped receptacle (rec.) on each side of segment IX for receiving the inferior appendage (Figs 5F, 5G).

Japanese name. Okinawa-kogata-shima-tobikera.

***Cheumatopsyche clavalis* Martynov 1930**

(Figs 5H–5P)

Cheumatopsyche clavalis Martynov 1930, 82, figs 26–27, male, Taiwan.

Cheumatopsyche uchidai Kobayashi 1987, 40, 46, figs 19–21, male, Taiwan; Oláh *et al.* 2008, 66–67, figs 159–162, holotype male, Taiwan. **New synonym.**

Adult (Figs 5H–5P). Forewings each 5.9–6.2 mm long in male (n = 5), 6.0–6.5 mm long in female (n = 5). Wing venation typical in the genus.

Female genitalia (Figs 5O–5P). Tergite VIII subquadrate with convex posterior margin in lateral aspect. Sternite VIII subquadrate, larger than tergite VIII, with oblique straight dorsal margin and large subquadrate lateral lobes in lateral aspect, ventral cleft almost parallel in ventral aspect. Segment IX obliquely S-shaped in lateral aspects; receptacle of inferior appendage (rec.) dome shaped. Segment X oblique rectangular.

Specimens examined. Ishigaki-jima: 3 males, 1 female, Omoto-dake, 13.x.1999, KK, L; 8 males, 60 females, same locality, 18–19.iii.2002, I. Oshima *et al.*, L; 2 females, Miyara-gawa, 60 m a.s.l., 12.iv.2011, TI, P & S; 11 males, 12 females, same locality, 27.x.2012, TI, P & S; 89 males, 4 females, same locality, 20.x.2015, TI, L; 26 males, 23 females, same locality, 30.iii.2016, TI, L & S; 2 males, 16 females, Miyara-gawa, 45 m a.s.l., 27.x.2012, TI, P; 65 males, 37 females, Nagura-gawa, 8–18 m, 11–12.iii.2009, TI, L, P & S; 11 males, 51 females, same locality, 11–13.iv.2011, TI, L, P & S; 37 males, 34 females, same locality, 25–30.x.2012, TI, L, P & S; 1 male, 3 females, same locality, 26–28.xi.2013, TI & RS, L, P & S; 29 males, 53 females, same locality, 18–20.iii.2016, TI, L, P & S; 28 males, 44 females, Nagura-gawa, Shinsui Park, 11.iv.2011, TI, P; 1 female, same locality, 27.x.2013, TI, L; 5 males, Nagura-gawa, Tore-bashi, 25.x.2012, TI, L; 21 males, 4 females, Nagura-gawa, Takeda, 12.x.1999, KK, L; 5 males, 6 females, Nagura-gawa, Itona, 15.x.1999, KK, L; 1 male, Ara-kawa, 55 m a.s.l., 19.iii.2016, TI, S. **Iriomote-jima:** 1 male, 5 females, Nishi-funatsuki-gawa, Nishi-funatsuki-bashi, 23.iii.1999, TI & AO, L; 1 female, same locality, 12.v.1999, K. Tojo, L; 1 male, same locality, 30.x.2012, TI, P & S; 3 males, 3 females, same locality, 23.iii.2016, TI, L; 1 female, Urauchi-gawa, Kampire-no-taki, 85 m a.s.l., 30.xi.2013, TI, S; 2 males, Yuchin-gawa, 10 m a.s.l., 23.x.2015, TI, L; 1 male, same locality, 22.x.2016, TI, L.

Distribution. Japan: Ryukyu (Ishigaki-jima, Iriomote-jima). Taiwan. New to Japan.

Remarks. *Cheumatopsyche clavalis* was originally described based on a male from Suishako, Taiwan (Martynov 1930). In 2018, we obtained a photograph of the holotype deposited in The Natural History Museum,

London (Figs 5H, 5I; photographed by B. Price). According to the original description and photograph, the male is characterized as follows: Posterior margin of segment IX almost straight with low lobe on ventral half in lateral aspect; each lateral lobe of segment X round apically in lateral aspect; mesocaudal lobe of segment X very low in dorsal aspect; inferior appendages each consisting of almost straight long basal segment and short acute distal segment; and phallic apparatus curved at basal 1/3 and almost straight in apical 3/4. Kobayashi (1987) described a similar species, *C. uchidai*, based on a male from Wulai, Taiwan. Referring to the original description and re-description of the holotype of *C. uchidai* (Oláh *et al.* 2008), we couldn't find any diagnostic characters between *C. clavalis* and *C. uchidai*. Therefore, *C. uchidai* Kobayashi 1987 must be a junior synonym of *C. clavalis* Martynov 1930. Malicky (2014) already noticed the similarity of the two species and emphasized the necessity of examination of the type specimen of *C. clavalis*.

The female, first described here, is separated from other congeneric Ryukyu species by the large subquadrate lateral lobes in ventral aspect (Figs 5O, 5P). This species has been recorded as *C. uchidai* in many localities of Taiwan (Hsu 1997; Malicky 2014), and recorded here with many specimens from Ishigaki-jima and Iriomote-jima.

Japanese name. Konbô-kogata-shima-tobikera (newly given here).

***Cheumatopsyche aira* Ito and Nozaki sp. nov.**

(Figs 6A–6I)

Diagnosis. The male of this species is similar to that of *Cheumatopsyche clavalis* Martynov 1930, originally described from Taiwan, in having an almost straight posterior margin on each side of segment IX and low mesocaudal lobes of segment X (m.c.l.) (Kobayashi 1987; Oláh *et al.* 2008). However, *C. aira* is clearly discriminated from *C. clavalis* as follows: Each lateral lobe of segment X (l.l.) is short, round, widely separated with each other in dorsal aspect in *C. aira*, but moderately long with apicomeral acute corner, closely contacted each other in dorsal aspect in *C. clavalis*; distal segment of each inferior appendage is nearly parallel sided and subquadrate apically in *C. aira*, but tapered and acute apically in *C. clavalis*.

Adult (Figs 6A–6I). Wings brown, many light brown dots and patterns present mainly along margins in forewings, but often indistinct in alcohol specimens; light brown dots absent in hind wings. In males, forewings 5.5–6.3 mm long and hind wings 4.2–4.8 mm long (n = 5); apical forks I–V present, discoidal cell small, medial cell open in forewings; apical forks II, III and V present, discoidal cell short in hind wings. In females, forewings 5.8–6.2 mm long and hind wings 4.3–4.7 mm long (n = 5); apical forks I–V present, discoidal cell small, medial cell longer than discoidal cell in forewing; apical forks II, III and V present, discoidal cell short in hind wing.

Male genitalia (Figs 6B–6F). Segment IX short with gently protruding anterior margins and nearly straight caudal margins in lateral aspect. Segment X with very short mesocaudal lobe (m.c.l.) in lateral and dorsal aspects; lateral lobes (l.l.) short, with length almost as long as width and oval and widely separated each other in dorsal aspect, bar-like in lateral aspect. Inferior appendages slender, directed postero-dorsad in lateral aspect and gently curved posteromesad in ventral aspect; basal segment long, 3.3 times of distal segment; distal segment more slender than basal segment, almost parallel sided in ventral aspect, slightly curved in lateral aspect, each with apex subquadrate. Phallic apparatus with short endothelial process (e.p.), phallosomal sclerite (p.s.) C- and reverse C-shaped in ventral aspect; numerous very small spines on apical part of phallosoma ventrally.

Female genitalia (Figs 6H–6I). Tergite VIII with almost straight anterior margins and convex caudal margins in lateral aspect. Sternite VIII subquadrate, larger than tergite VIII, with oblique straight dorsal margin and large subquadrate lateral lobes in lateral aspect, triangular lateral lobes in ventral aspect, each lobe wide at anterior margin, mesal margin gently curved laterad. Segment IX obliquely S-shaped in lateral aspects. Receptacle of inferior appendage (rec.) distinct, nearly question mark shaped in lateral aspect. Segment X oblique rectangular.

Holotype: Male, **Iriomote-jima**, Taketomi-cho, Aira-gawa (24.3332N, 123.9134E, 5 m a.s.l.), 28–30.x.2012, TI, P (CBM-ZI 166013).

Paratypes. 5 males, 5 females, same data as holotype (CBM-ZI 166014–166023).

Other specimens examined. Iriomote-jima: 17 males, 271 females, same data as holotype; 9 males, 7 females, type locality, 25.iii.1999, TI & AO, L; 2 males, 2 females, type locality, 28.xi–2.xii.2013, TI & RS, M; 3 males, 18 females, type locality, 21–22.iii.2016, TI, P; 12 males, 13 females, type locality, 20–24.x.2016, TI, P; 2 males, 15 females, Aira-gawa, 25–45 m, a.s.l., 1.xii.2013, TI, L, P & S; 11 males, 11 females, same locality,

21.x.2015, TI & RS, L; 12 males, 31 females, same locality, 21.iii.2016, TI, L; 1 male, 16 females, Aira-gawa, 15.iii.2002, I. Oshima *et al.*, L; 10 males, 8 females, same locality, 27.v.2009, K. Tojo, L; 2 males, 3 females, Nishi-funatsuki-gawa, Nishi-funatsuki-bashi, 23.iii.1999, TI & AO, L; 4 females, same locality, 23.iii.2016, TI, L; 1 female, Maera-gawa, 9 m a.s.l., 28.x.2012, TI, L; 4 males, 2 females, Yuchin-gawa, 10 m a.s.l., 23.x.2015, TI, L; 5 males, 4 females, same locality, 22.x.2016, TI, L; 19 males, 25 females, Omijya-gawa, Omijya-bashi, 24.iii.1999, TI & AO, L; 3 females, same locality, 26.v.2009, K. Tojo, L; 8 females, same locality, 29.x.2012, TI, P; 1 female, same locality, 30.xi.2013, TI, P; 2 females, same locality, 21.x.2015, TI; 5 females, same locality, 23.iii.2016, TI, P.

Etymology. The name “*aira*” is a noun in apposition, coined from the type locality.

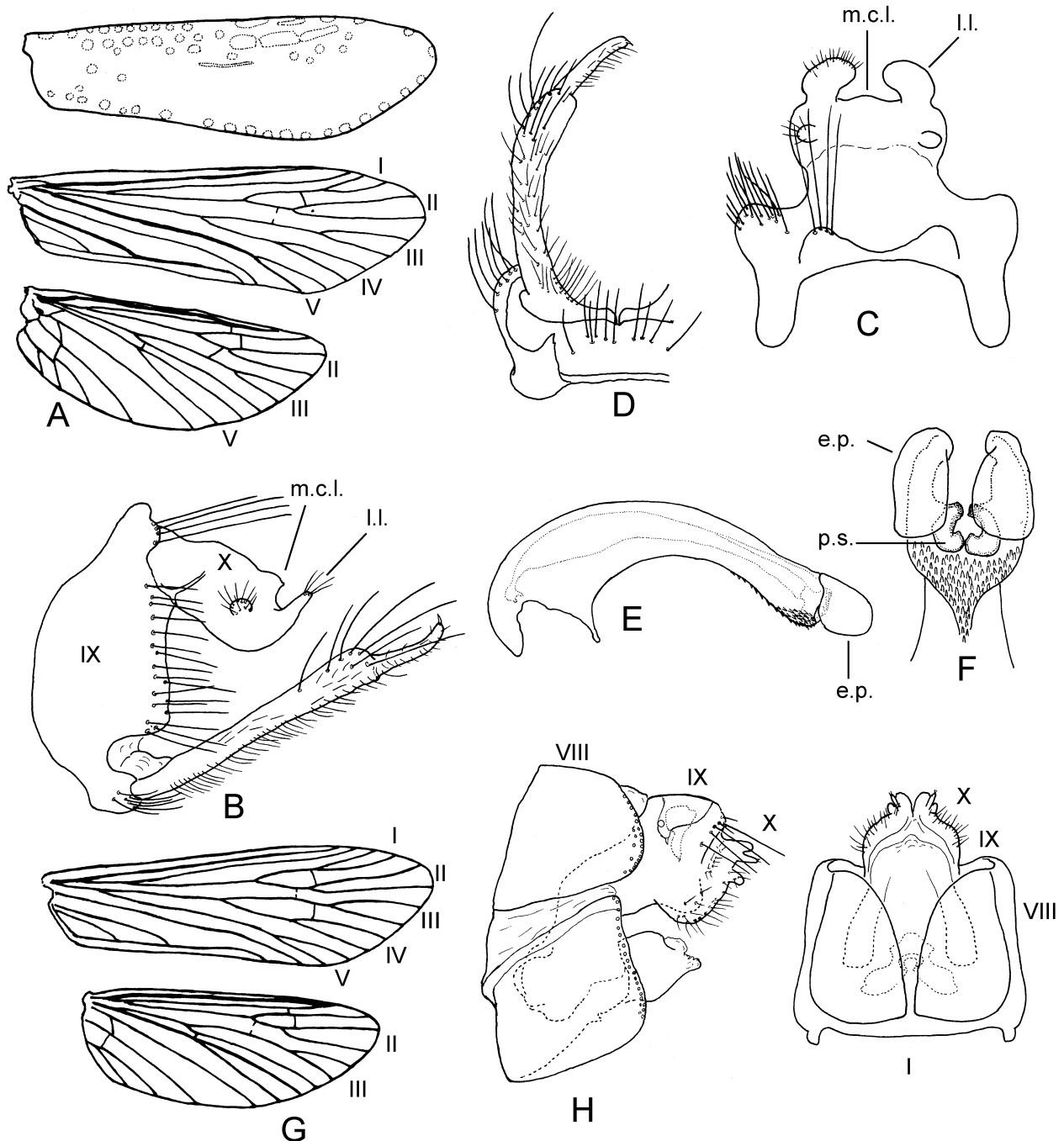


FIGURE 6. *Cheumatopsyche aira* Ito & Nozaki *sp. nov.* Male (6A–6F): 6A, right wings, dorsal, light color marks of forewing, venations of forewing and hind wing; 6B, genitalia, left lateral; 6C, same, dorsal; 6D, left inferior appendage, ventral; 6E, phallic apparatus, left lateral; 6F, apical part of phallus, ventral. Female (6G–6I): 6G, right wings, dorsal; 6H, genitalia, left lateral; 6I, same, ventral. Abbreviations: I–V = apical forks I–V; VIII–X = abdominal segments VIII–X; e.p. = endothecal process (paired); l.l. = lateral lobe (paired); m.c.l. = mesocaudal lobe; p.s. = phallotremal sclerite.

Distribution. Japan: Ryukyu (Iriomote-jima). Endemic to southern Ryukyu.

Remarks. This is the most common hydropsychid caddisflies in Iriomote-jima and sometimes is collected together with *C. clavalis*.

Japanese name. Aira-kogata-shima-tobikera.

***Hydropsyche orientalis* Martynov 1934**

Hydropsyche orientalis Martynov 1934, 276–277, fig. 198, male, Russia (Primorye); Tanida 1986, 468–473, fig. 1, male, female, larva, Hokkaido, Honshu, Shikoku, Kyushu, Amami-o-shima, Okinawa-jima; Tanida 1997, 447; Shimura *et al.* 2014, 43, 55, Amami-o-shima; Kuhara and Ito 2017, 14, 15, Yakushima.

Specimens examined. Amami-o-shima: 14 females, Uken-son, Kogachi-gawa, fall, 19.iii.1999, TI & AO, L; 4 females, Uken-son, Kawaguchi-gawa, 50 m a.s.l., 26.iii.2007, TI, L; 12 females, same locality, 20.x.2014, TI, L; 2 females, Uken-son, 6–8.v.1998, H. Moriya; 1 male, 25 females, Amami-shi, Setouchi, Yakugachi-gawa, middle reach, 5.v.2008, TI, L & S; 14 females, Yamato-son, Materia-gawa, 21.x.2014, TI, L; 1 female, Yamato-son, Yamato-hama, Yamato-gawa, upper reach, 15.v.2014, K. Tojo *et al.*, L; 1 female, Sumiyo-cho, Yakugachi, Yakugachi-gawa, 15.v.2014, K. Tojo *et al.*, L. **Okinawa-jima:** 2 females, Nago-shi, Genka, 9.x.2008, H. Moriya; 2 males, 26 females, Nago-shi, Genka-gawa, near Hogen-hashii, 22–24.xi.2010, TI, L & P; 16 females, same locality, 8.iv.2011, TI, L & P; 1 male, 28 females, same locality, 17–18.x.2014, TI, P & S; 2 females, Nago-shi, Genka-gawa, 40 m a.s.l., 16.iii.2012, TI, L & P; 1 male, 11 females, Kunigami-son, Yona-gawa, Nakafukuji-bashi, 23.xi.2010, TI, P; 2 females, same locality, 18.x.2014, TI, L; 4 females, Kunigami-son, Yona, Sukuna-gawa, 21.iii.1999, TI & AO, L; 2 females, Kunigami-son, Yona, Hiji-gawa, upper reach, 9.iv.2011, TI, L. **Kume-jima:** 5 males, 8 females, Shirase Dam, 14.iii.1998, M. Maruyama.

Distribution. Japan: Ryukyu (Yakushima, Amami-o-shima, Okinawa-jima, Kume-jima), Hokkaido, Honshu, Shikoku, Kyushu. Continental parts of the Far East Asia.

Remarks. This species is one of the most abundant caddisflies in Far East Asia including Japan and also is common in northern and central Ryukyu.

Japanese name. Urumâ-shima-tobikera.

***Hydropsyche orbiculata* Ulmer 1911**

(Fig. 7A–7R)

Hydropsyche orbiculata Ulmer 1911, 397–399, figs 7, 8, male, Taiwan; Malicky and Chantaramongkol 2000, 812, 851, pl. 25, male, Taiwan.

Hydropsyche yaeyamensis Tanida 1986, 479–482, fig. 4, male, female, larva, habitat, Ishigaki-jima; Tanida 1997, 447. **New synonym.**

Specimens examined. Taiwan: 2 males, Nantou, Ren'ai Xiang, Huisun Forest Area, Beigang River, 490 m a.s.l., 3.iii.2015, N. Nishimura, L. **Ishigaki-jima:** 8 males, 60 females, Omoto-dake, 18–19.iii.2002, I. Oshima *et al.*; 2 females, same locality, 26.xi.2003, M. Takai; 1 male, same locality, 20.v.2009, K. Tojo; 1 female, Miyara-gawa, 60 m a.s.l., 12.iv.2011, TI, P; 1 male, 1 female, same locality, 30.x.2015, TI, L; 2 females, Nagura-gawa, 8–18 m a.s.l., 11–13.iv.2011, TI, P & S; 7 females, same locality, 25–31.x.2012, TI, L, P & S; 5 females, same locality, 18–20.iii.2016, TI, L, P & S; 1 male, 5 females, Nagura-gawa, Takeda, 12–19.x.1999, KK, L; 1 female, Nagura-gawa, Itona, 15.x.1999, KK, L; 2 females, Tomino, 5.vi.2003, M. Takai; 1 female, Ara-kawa, 55 m a.s.l., 28.xi.2013, TI & RS, S. **Iriomote-jima:** 2 males, Omija-gawa, Omija-bashi, 24.iii.1999, TI & AO, L; 1 male, same locality, 29.x.2012, TI, P.

Distribution. Japan: Ryukyu (Ishigaki-jima, Iriomote-jima). Taiwan.

Remarks. This species was originally described based on two males from Kanshirei, Taiwan (Ulmer 1911), and recorded in many localities in Taiwan (Hsu 1997; Malicky & Chantaramongkol 2000). However, Tanida found that the specimens from Ishigaki-jima, southern Ryukyu were slightly different from *H. orbiculata* in apical parts of tergite X, and considered them being a new species, i.e., *H. yaeyamensis* Tanida 1986. He showed the diagnosis of *H. yaeyamensis* referring to the Ulmer (1911)'s figures of *H. orbiculata* as follows: Apical parts of tergite X

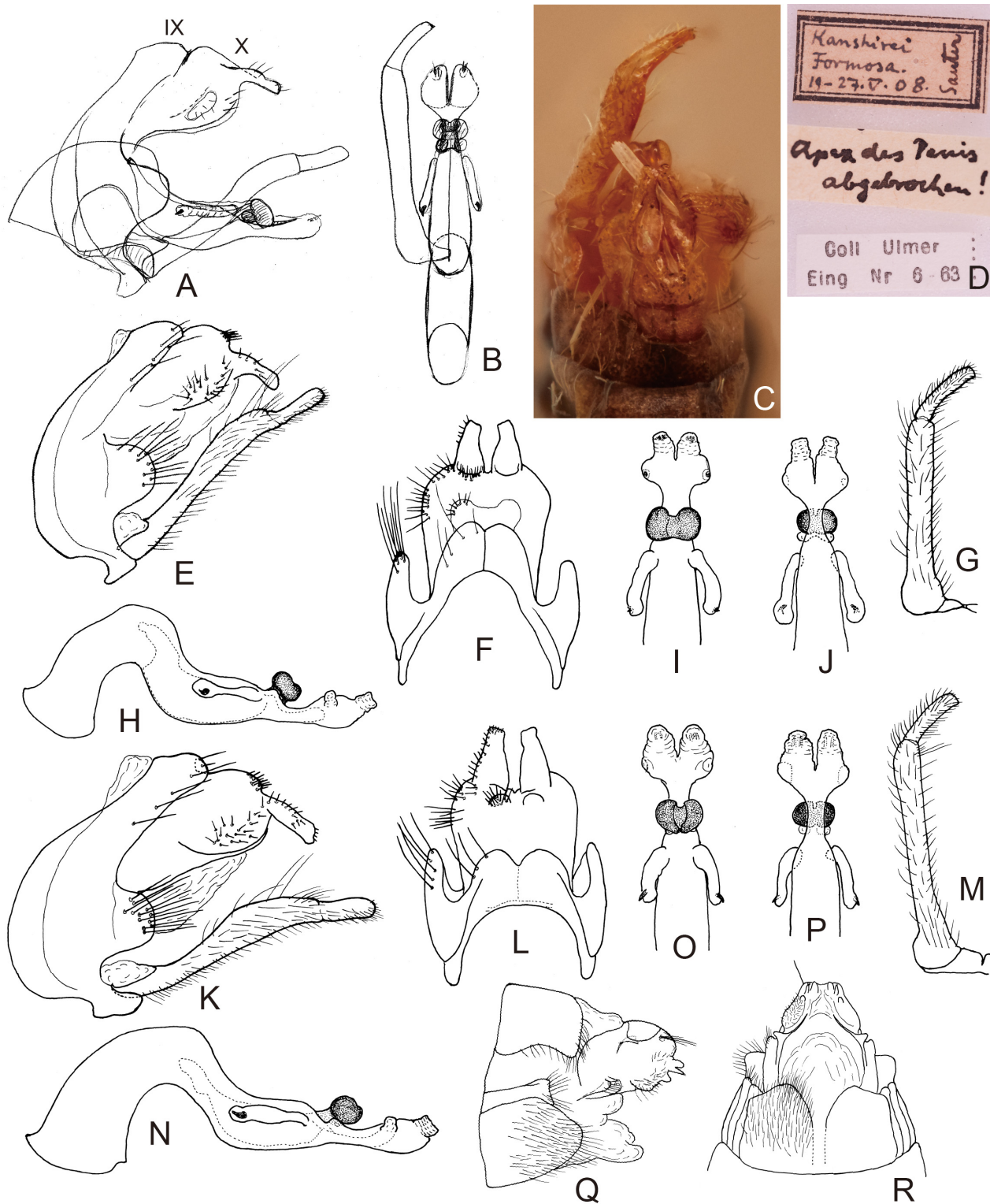


FIGURE 7. *Hydropsyche orbiculata* Ulmer. Holotype male from Taiwan, figured by W. Mey (7A, 7B): 7A, genitalia, left lateral; 7B, left inferior appendage and phallic apparatus, ventral. Paratype male from Taiwan, photographed by T. Dalsgaard (7C, 7D): 7C = genitalia, dorsal; D = labels of paratype. Male from Taiwan, Nantou (7E–7J): 7E, genitalia, left lateral; 7F, same, dorsal; 7G, left inferior appendage, ventral; 7H, phallic apparatus, left lateral; 7I, apical part of phallic apparatus, dorsal; 7J, same, ventral. Male and female from Ishigaki-jima (7K–7R): 7K, male genitalia, left lateral; 7L, same, dorsal; 7M, left inferior appendage, ventral; 7N, phallic apparatus, left lateral; 7O, apical part of phallic apparatus, dorsal; 7P, same, ventral; 7Q, female genitalia, left lateral; 7R, same, ventral. Abbreviations: IX–X = abdominal segments IX–X.

extend in parallel with squarish apices in *H. yaeyamensis*, but curved inwards with acute apices forming an ovoid mesal structure in *H. orbiculata* (Tanida 1986).

In 2017, we obtained figures of the holotype male (label “Formosa, Kanshirei, V.09 Sauter, Coll. Ulmer, 6-63”; figured by W. Mey) and a photograph of a paratype male (label “Kanshirei Formosa, 19–27.v.08, Sauter, Coll Ulmer, Eing Nr 6 63; photographed by T. Dalsgaard) of *H. orbiculata* Ulmer 1911, deposited in the Zoological Museum, Hamburg University (Figs 7A–7D). Although we couldn’t obtain the figure or photograph of the dorsal aspect of the holotype, because it can’t be found at present time (T. Dalsgaard, personal communication, 25 November 2017), segment IX, inferior appendages and phallic apparatus of the holotype (Figs 7A, 7B) and apical parts of tergite X of the paratype (Figs 7C, 7D) are identical to those of Tanida’s male specimens collected from Ishigaki-jima (Tanida 1986, fig. 4; Figs 7K, 7M, 7O, 7P). Therefore, *H. yaeyamensis* Tanida 1986 must be a junior synonym of *H. orbiculata* Ulmer 1911.

The shape of genitalia of the type specimens agrees with that of Taiwanese specimens of *H. orbiculata* (Hsu 1997, fig. 53; Malicky and Chantaramongkol 2000, Tafel 25; Figs 7E–7J).

Japanese name. Yaeyama-shima-tobikera.

***Hydropsyche verrucosa* (Ulmer 1911)**

(Figs 8A–8H)

Hydromanicus verrucosus Ulmer 1911, 397, 399–400, figs 9, 10, male, Taiwan; Malicky & Chantaramongkol 2000, 797, 829, pl. 3, male, Taiwan.

Hydatomanticus verrucosus: Ulmer 1951, 299.

Hydropsyche verrucosa: Geraci *et al.* 2010, 926.

Adult (Figs 8A–8H). Forewings each 8.4–11.2 mm long in male (n = 6), 10.0–11.0 mm long in female (n = 8). Wing venation typical in the genus.

Female genitalia (Figs 8G–8H). Tergite VIII subquadrate with convex dorsal margin in lateral aspect. Sternite VIII cleft about 4/5 from base in ventral aspect, forming pair of lateral lobes, each oval in lateral aspect and subquadrate in ventral aspect. Segment IX nearly rectangular with pair of setal bands caudally in lateral aspect; lateral lobe large; receptacle of inferior appendage (rec.) roundish with two flanges in lateral aspect. Segment X rectangular.

Specimens examined. **Amami-o-shima:** 3 males, 1 female, Yamato-son, Yuwan-gama, 18–19.iv.2015, SI, L. **Ishigaki-jima:** 1 male, 1 female, Ara-kawa, 55 m a.s.l., 19.iii.2016, TI, S. **Iriomote-jima:** 1 male, Urauchi-gawa, Kampire-no-taki, 85 m a.s.l., 29.x.2012, TI, S; 1 male, same locality, 22.x.2016, TI, S.

Distribution. Japan: Ryukyu (Amami-o-shima, Ishigaki-jima, Iriomote-jima). Taiwan. New to Japan.

Remarks. This species was originally described as a species of the genus *Hydromanicus* Brauer based on a male from Kanshirei, Taiwan (Ulmer 1911), and Ulmer (1951) designated this species as the type species of the genus *Hydatomanticus* Ulmer. This species is known in many localities of Taiwan (Hsu 1997; Malicky & Chantaramongkol 2000). The genus *Hydatomanticus* Ulmer was synonymized with the genus *Hydropsyche* Curtis by Geraci *et al.* (2010) with evidence from DNA and male morphology. The male of this species is characterized by the thick apicolateral lobes of segment X with an oblique ridge and round caudal margins; and the long undulated basal segment of the inferior appendage in lateral aspect. The female, first described here, is distinguished from those of other congeneric Ryukyu species by the shape of the large lateral lobes of sternite VIII, i.e. oval in lateral aspect and subquadrate in ventral aspect.

Japanese name. Kobu-shima-tobikera.

***Macrostemum formosicolum* (Matsumura 1931)**

(Figs 9A–9K)

Macronema formosicolum Matsumura 1931, 1132–1133, male, Taiwan.

Macrostemum formosicolum: Malicky 1998, 771, pls. 1, 6, male, Taiwan; Malicky 2014, 1628, Taiwan.

Specimens. Holotype male (pinned, cleared abdomen was dried up in a small vial), labeled “Formosa Matsumura, Type Matsumura, *Macronema formosicot*”, Taiwan (HU). **Ishigaki-jima:** 1 male, Omoto, Nagura-gawa, 21.v.2009, K. Tojo; 1 female, Nagura-gawa, Nagura-dam-ue, 70 m a.s.l., 11.iv.2011, TI, P; 1 male, 3 females, Takeda, 8.v.2010, M. Tanaka (MT).

Distribution. Japan: Ryukyu (Ishigaki-jima). Taiwan. New to Japan.

Remarks. This species was originally described from Taiwan by Matsumura (1931), and previously known only from Taiwan (Malicky 1998, 2014). We examined the holotype male of this species deposited in Hokkaido University (Fig. 9A). The holotype has yellow forewings, and each wing has a large dark marking apically and five dark spots on the central area (Fig. 9B). Specimens examined in this study also have the same coloration although the posterior spot near the anal veins is occasionally indistinct (Fig. 9G2). The genitalic structure of two males collected from Ishigaki-jima agrees well with that of the holotype (Figs 8C–F, H–K) although the phallosclerites of the holotype are protruded from the apex of phallosome, probably because of drying.

In addition, one *Macrostemum* female was collected from Iriomote-jima (Aira-gawa, 5 m a.s.l., 25.iii.1999, by TI & AO). Forewings of this female bear similar markings to those of *M. formosicolum*, but lack a dark spot on the anal area. Although this female probably belongs to this species, we hold the identification until more specimens become available.

Japanese name. Taiwan-shima-tobikera.

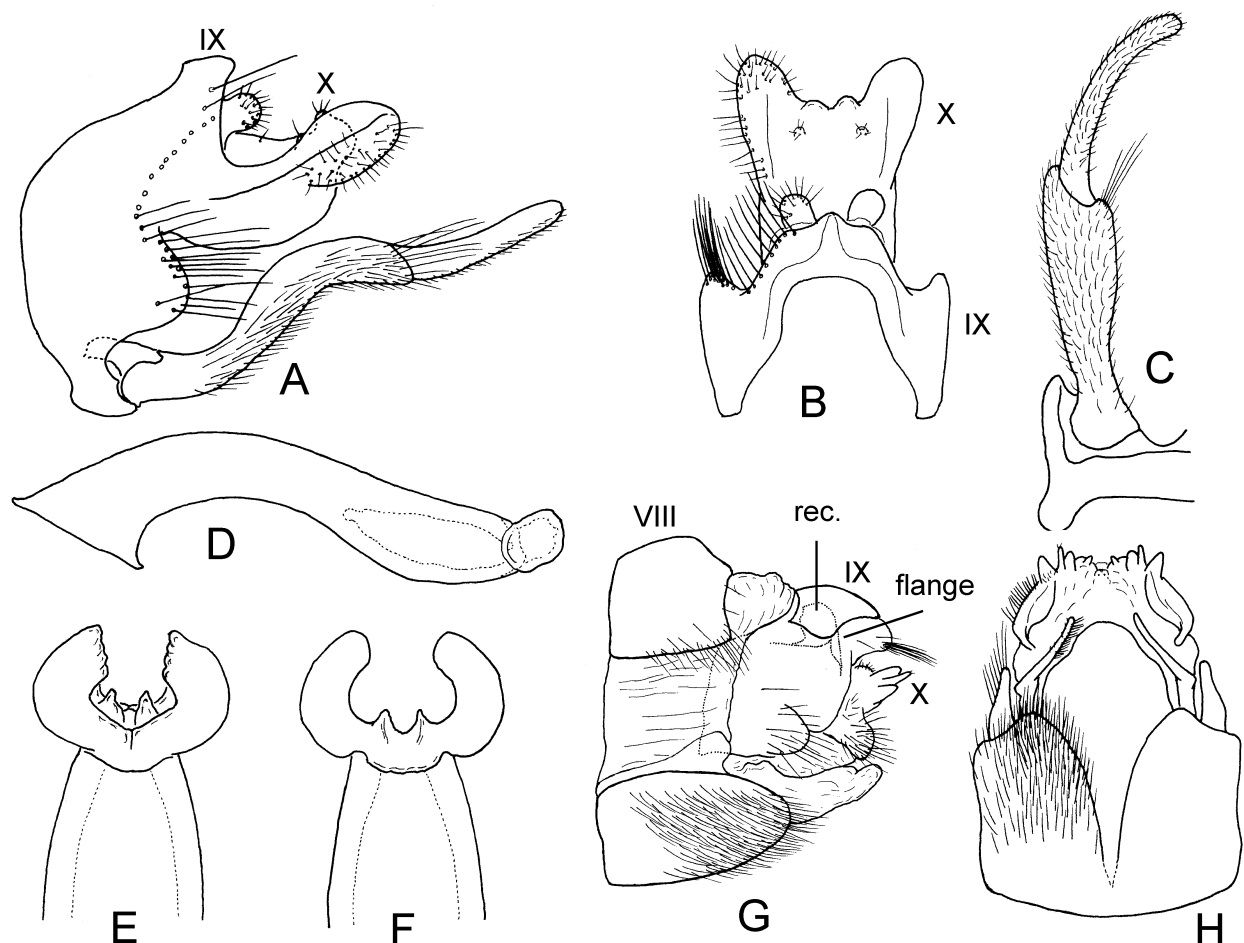


FIGURE 8. *Hydropsyche verrucosa* (Ulmer). Male (8A–8F): 8A, genitalia, left lateral; 8B, same, dorsal; 8C, left inferior appendage, ventral; 8D, phallic apparatus, left lateral; 8E, apical part of phallic apparatus, dorsal; 8F, same, ventral. Female (8G, 8H): 8G, genitalia, left lateral; 8H, same, ventral. Abbreviations: VIII–X = abdominal segments VIII–X; rec. = receptacle of inferior appendage (paired).

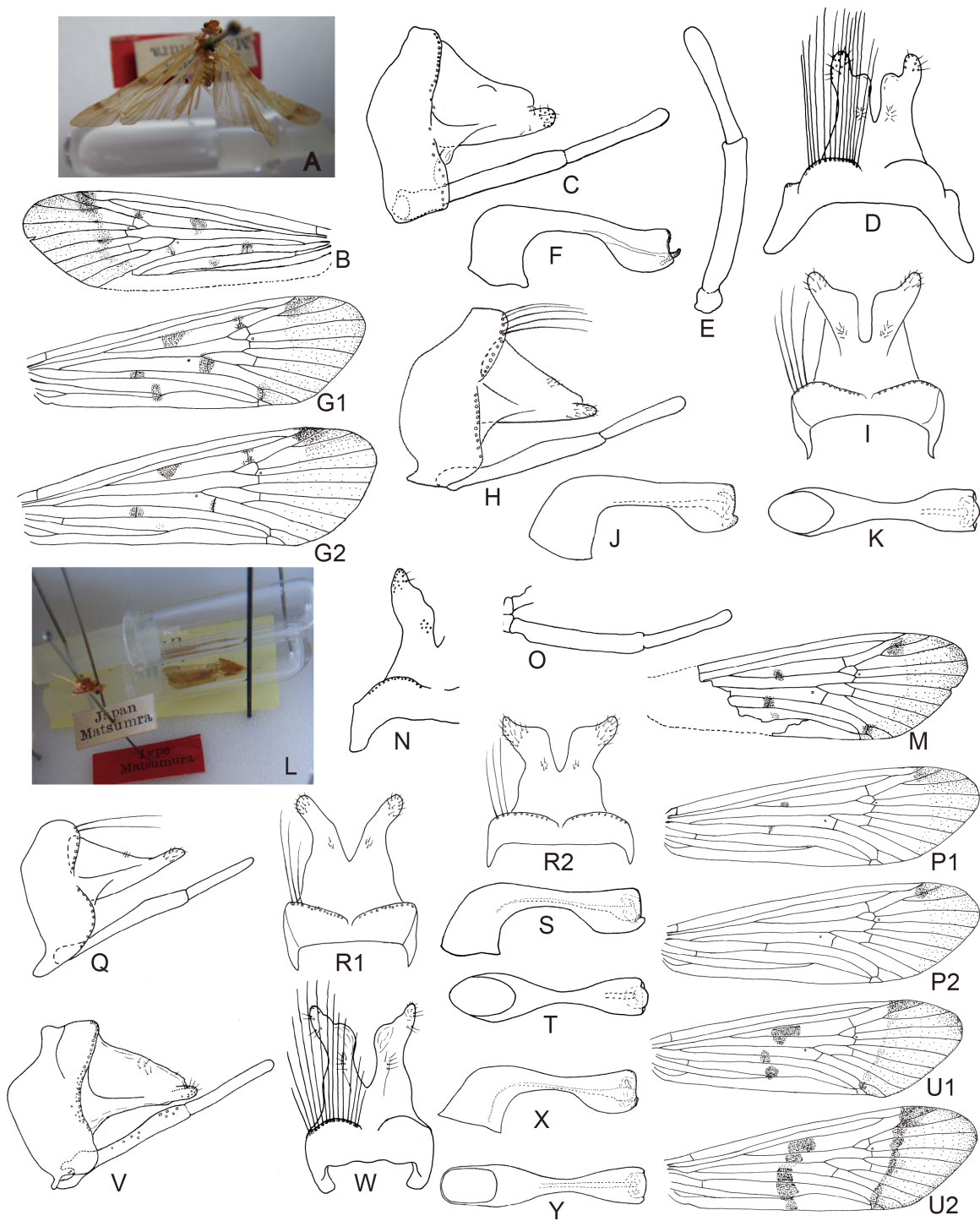


FIGURE 9. *Macrostemum formosicolum* (Matsumura) and *M. okinawanum* (Matsumura). *Macrostemum formosicolum* (9A–9K): Holotype male from Taiwan (9A–9F): 9A, habitus, dorsal; 9B, left forewing, dorsal, venation and dark markings; 9C, genitalia, left lateral; 9D, same, dorsal; 9E, right inferior appendage, ventral; 9F, phallic apparatus, left lateral; specimens from Ishigaki-jima (9G–9K): 9G1, 9G2, right forewings, venation and dark markings (9G1, female; 9G2, male); 9H, male genitalia, left lateral; 9I, same, dorsal; 9J, phallic apparatus, left lateral; 9K, same, ventral. *Macrostemum okinawanum* (9L–9Y): Holotype male from Okinawa-jima (9L–9O): 9L, habitus, dorsal; 9M, right forewing, dorsal; 9N, genitalia, dorsal; 9O, right inferior appendage, ventral; specimens from Okinawa-jima (9P–9T): 9P1, 9P2, male right forewings, venation and dark markings; 9Q, male genitalia, left lateral; 9R1, 9R2, male genitalia, dorsal; 9S, phallic apparatus, left lateral; 9T, same, ventral; specimens from Amami-o-shima (9U–9Y): 9U1, 9U2, male right wings, dorsal; 9V, male genitalia, lateral; 9W, same, dorsal; 9X, phallic apparatus, lateral; 9Y, same, ventral.

***Macrostemum okinawanum* (Matsumura 1931)**

(Figs 9L–9Y)

Macronema okinawanum Matsumura 1931, 1133, male, Okinawa.

Macrostemum okinawanum: Kuranishi and Kimura 2001, 17–18, figs 1, 2, male, Amami-o-shima, Toku-no-shima, Okinawa-jima.

Specimens. Holotype male (pinned, cleared abdomen was dried up in a small vial), labeled “Japan Matsumura, v.1907, Type Matsumura, *Macronema okinawanum*”, Okinawa-jima (HU). **Amami-o-shima:** 10 males, Mt. Yuwan-dake, 300 m a.s.l., 19.vi.1998, K. Mizota, L; 1 male, 1 female, Sumiyo-cho, 24.vi.2007, M. Takai (SCM); 2 females, Uken-son, 8.v.1998, H. Moriya; 1 male, Uken-son, 1.vii.2007, M. Takai (SCM); 6 males, 1 female, Yuwan-gama, 18–19.iv.2015, SI, P; 1 male, Yamato-son, Yuwan-gawa, small stream, 18–19.iv.2015, SI, P; 2 males, Yuwan-gama, headwater, 18–19.iv.2015, SI, P; 2 males, Amami-shi, Naze-Asato, small stream, 20–21.iv.2015, SI, P; 1 female, Amami-shi, Sumiyo-son, Yakugachi-gawa, 29.iv.2017, N. Katsuma. **Okinawa-jima:** 1 male, Kunigami-son, Okuma, 3.vi.2003, M. Tanaka (MT); 1 male, 1 female, same locality, 24.ix, 2005, M. Tanaka (MT).

Distribution. Japan: Ryukyu (Amami-o-shima, Toku-no-shima, Okinawa-jima). Endemic to central Ryukyu.

Remarks. This species was originally described from Okinawa-jima by Matsumura (1931), and Kuranishi and Kimura (2001) recorded from Amami-o-shima and Toku-no-shima for the first time. The holotype male deposited in Hokkaido University is in poor condition (Fig. 9L), but general appearance is similar to that of *M. formosicolum*. The dark markings on the right forewing are similar to that of the latter, but dark spots on cross veins, r and m-cu, are absent in the holotype of *M. okinawanum* (Fig. 9M). One male specimen collected from Okinawa-jima also has similar markings as the holotype (Fig. 9P1), but most dark spots of other specimens (1 male and 1 female) are indistinct or absent (Fig. 9P2). Kuranishi and Kimura (2001) reported that markings of forewings were variable in the Okinawa-jima population. On the other hand, specimens collected from Amami-o-shima have large and distinct markings, and the central three dark spots often fuse into a large arched band (Kuranishi and Kimura 2001, fig. 2; Figs 9U1, 9U2). These Amami-o-shima specimens also lack spots on cross veins r and m-cu.

We could not observe the holotype genitalia in detail because the abdomen in the small vial was dried and shrunk. However, morphology of two males collected from Okinawa-jima is very similar to that of *M. formosicolum*, although dorsal aspects of segment X are variable (Figs 9R1, 9R2). Male genitalia of specimens collected from Amami-o-shima are also similar to those of *M. formosicolum* (Figs 9V–9Y), but the apico-ventral lip of the phallosome is slightly shorter than that of the latter (Figs 9X, 9Y).

Since populations of Okinawa-jima and Amami-o-shima may be a subspecies of *M. formosicolum*, further study with molecular data is needed to clarify the taxonomic status of this species. *Macrostemum okinawanum* has been listed in the Japanese Red List as a near-threatened species (Ministry of the Environment of Japan 2017).

Japanese name. Okinawa-hoshi-shima-tobikera.

Acknowledgements

We are sincerely grateful to David E. Ruitter, Oregon, for his critical reading our manuscript, Drs. Wolfram Mey, Natural History Museum, Berlin, and Thure Dalsgaard, Hamburg University, Hamburg, for offering the drawing and photograph of type specimens of *Hydropsyche orbiculata* Ulmer, and to Dr. Ben Price, the Natural History Museum, London, who kindly offered us the photograph of the type specimen of *Cheumatopsyche clavalis* Martynov under "Copyright Trustees of The Natural History Museum". Our deep thanks are also due to Dr. Kazunori Yoshizawa, Hokkaido University, Sapporo, for the loan of type specimens of *Macrostemum* spp., and Drs. Hans Malicky, Austria, Janós Oláh, Budapest, and Chang-hai Sun, Nanjing Agricultural University, Nanjing, for their advice through our studies. Drs. Noboru Nishimura, Yabu-shi; Shu Inaba, Shimoda-shi; Noriyoshi Shimura, Yokohama-shi; Nobuyuki Katsuma, Ushiku-shi; Hirofumi Moriya, Sagami-hara-shi; Masayuki Tanaka, Akita-shi; Mikio Takai, Kami-shi; Koji Tojo, Shinshu University; Kazuhiko Konishi, Ehime University; and the late Takeshi Ogata, Fukuoka-shi, gave or loaned us many valuable materials. Our field trips and reference work were helped by Drs. Kokichi Hatta, Aisai-shi; Takaaki Kitamura, Okinawa Kitayama High School; Ayuko Ohkawa, Tokyo University; Rie Saito, Fukushima Prefectural Office; and Shizuko Morimoto, Izumi-sano-shi.

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