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Discovery of the genus *Eoneureclipsis* Kimmins (Trichoptera: Psychomyiidae) from Japan

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Abstract

Four new species of *Eoneureclipsis* (Trichoptera: Psychomyiidae) are described from Japan: *E. montanus* n. sp., *E. shikokuensis* n. sp., *E. okinawaensis* n. sp. and *E. yaeyamaensis* n. sp. Illustrations of male wing venation and genitalia of both sexes are provided. A distribution map is also presented for the 4 species.

Key words: Trichoptera, Psychomyiidae, *Eoneureclipsis*, new species, Japan

Introduction

The genus *Eoneureclipsis* was erected by Kimmins (1955) for *Eoneureclipsis limax* Kimmins, 1955, in the Family Polycentropodidae. Later, Schmid (1972) transferred this genus to the Family Psychomyiidae on the basis of characters of the tibial spurs, wing venation, maxillary palpi, and genitalia. Ten species of *Eoneureclipsis* are recognized from India and Southeast Asia; Malaysia, Myanmar, Thailand, Vietnam (Malicky and Chantaramongkol 1989, Malicky 1995, Malicky and Chantaramongkol 1997, Malicky *et al.* 2004, Malicky 2009, Thamsenanupap *et al*. 2005).

In the course of trichopteran surveys in Japanese rivers, males and females belonging to *Eoneureclipsis* were found by the authors and colleagues. Our close examination of the genitalia revealed 4 undescribed species. In this paper we describe and illustrate the males and females of the new species of *Eoneureclipsis* from Japan.

Materials and methods

All specimens were collected from Japan (Ibaraki, Shizuoka, Mie, Aichi, Tokushima, Kochi and Okinawa Prefectures). Specimens were collected by light traps, Malaise traps (1.7 m wide, 1.8 m height, 1 mm mesh) and sweeping. The illustrations of genitalia are made from specimens prepared for examination by clearing their abdomens in a solution of KOH. Terminology mainly follows Kimmins (1955) and Schmid (1972) for adult males, and Schmid (1972) for adult females. The type specimens are deposited in the collections of the Natural History Museum and Institute, Chiba (CBM).

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Taxonomy

Family Psychomyiidae Walker, 1852

Genus *Eoneureclipsis* Kimmins, 1955

Eoneureclipsis montanus Torii and Nishimoto new species

(Figs 1, 2, 6)

Polycentropodidae Gen. sp.: Morita 2001: 220 (list).
Eoneureeclipsis sp.: Morita 2006: 197 (list).
Eoneurecliplsis sp.: Katsuma 2006: 35, 43 (list and figures).
Eoneureclipsis sp.: Torii and Hattori 2006: 35, 36 (list).

Diagnosis. The male is easily recognized by the intermediate appendages with apical branches subequal in length and crossed at about midlength. The phallus is slender and almost straight except downcurved basally. The female is very similar to that of *E. akrichalakchmi* Schmid, a species known only from females, but can be distinguished by the rectangular vaginal apparatus in ventral view with a truncate proximal edge.

Description. Head (Fig. 1 B) without ocelli; anterior and anteromesal setal warts united and trefoil-shaped; posterior setal warts large and oval; posterolateral setal warts large. Antennae (Fig. 1 A) slightly shorter than forewings. Maxillary palpi (Fig. 1 C) each 5-segmented, ca. 2.0 mm long; relative lengths of 5 segments ca. 1.0:1.5:1.7:1.4:3.0. Labial palpi (Fig. 1D) each 3-segmented, ca. 0.9 mm long; relative lengths of 3 segments ca. 1.0:1.3:2.2. Tibial spurs 3-4-4. Body blackish brown; antennae uniformly yellowish brown, palpi pale brown; legs pale brown or yellowish brown, spurs same color; wings blackish gray. Both pairs of wings (Figs 2 A, B) elliptical, each with rounded apex; hind wing costal margin not sinuate and without projection as in other psychomyiid genera. Forewing length: male 6.8-9.1 mm (mean=8.1 mm, n=7); female 7.0−9.6 mm (mean=8.1 mm, n=11). Hind wing length: male 6.1−7.3 mm (mean=6.7mm, n=7); female 5.9−8.3 mm (mean=6.8 mm, n=11). Venation (Figs 2 A, B) typical for genus and similar in 2 sexes; forewings each with forks I, II, III, IV, and V, discoidal cell short, median and thyridial cells relatively elongate and about same length; hind wings each with forks I, II, III, and V, small discoidal cell present.

Male genitalia (Figs 2C−G). Tergum IX produced posteriorly into small triangular plate in dorsal view; membraneous bulge with rounded apex below tergum IX in dorsal view. Inferior appendages each 2-segmented, basal segments of these appendages incompletely but widely fused mesally with each other, each bearing single small black spine on mesodistal corner; terminal segments each gradually tapered and slightly curved mesad in ventral view with stout black teeth on mesal edge. Superior appendages long, slightly concave laterally, relatively narrow, rounded apically in lateral view. Intermediate appendages slender throughout their whole length in lateral view, each bifid apically with 2 branches subequal in length and crossed at about midlength. Phallus slender, almost straight except in basal 3rd, terminating in bifid aedeagus with slender, cylindrical dorsal lobe and expanded ventral lobe.

Female genitalia (Figs 2 H−I). Segment IX absent or completely fused with segment X. Segment X very long, gradually tapered and slightly curved upward. Segment XI with dark brown, short silky hairs along ventral suture; pair of cerci distally. Basal portion of vaginal apparatus narrow, with small proximal extension in lateral view, rectangular and truncate proximally in ventral view.

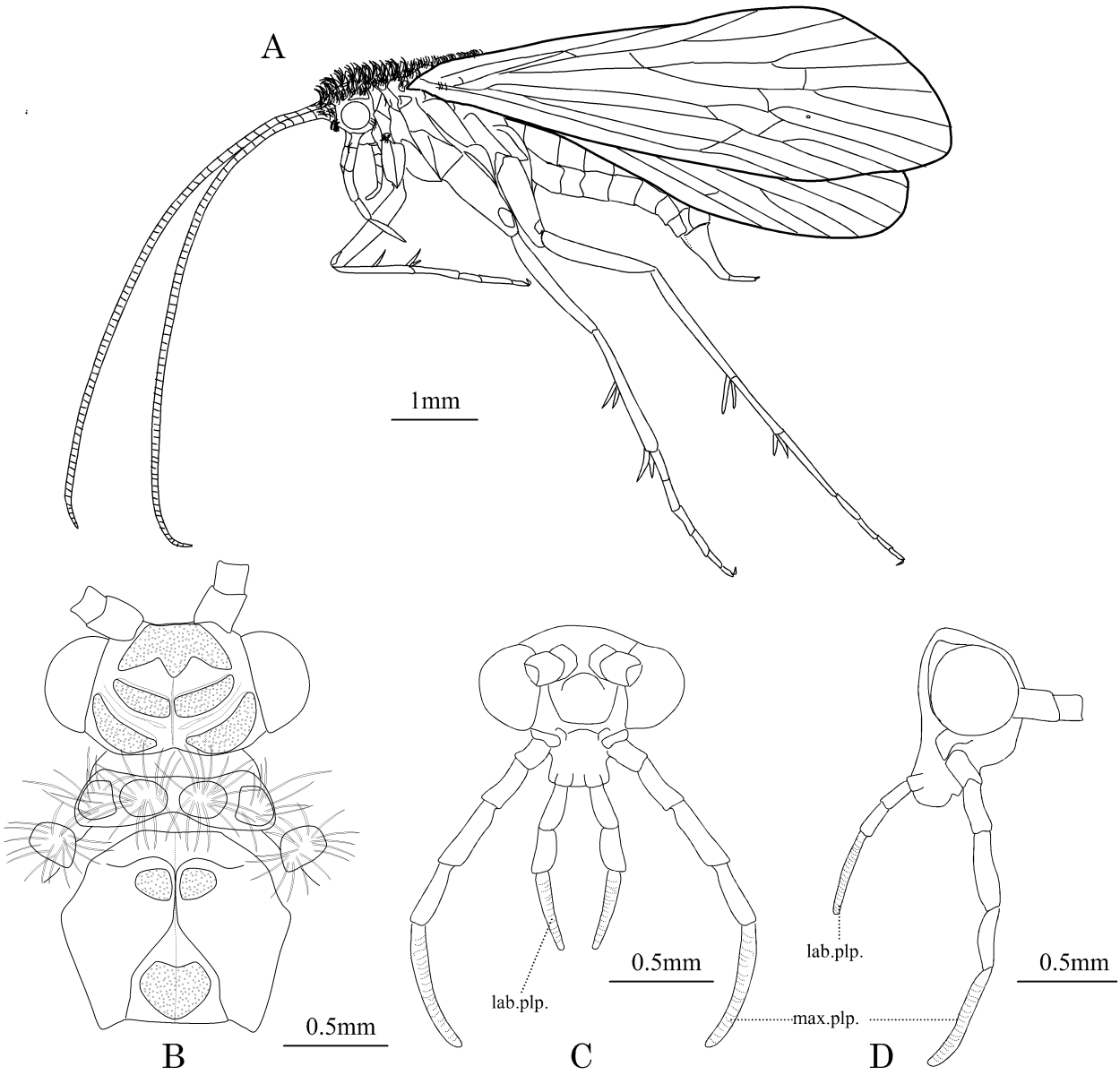

FIGURE 1. *Eoneureclipsis montanus* new species from Seto-gawa. A—Adult female, left lateral; B—Male head and thorax, dorsal; C—Male head, maxillary and labial palpi, frontal; D—Male head, maxillary and labial palpi, right lateral. Abbreviations: lab. plp. = labial palp; max. plp. = maxillary palp.

Distribution (Fig. 6). Japan (Honshu: Ibaraki, Shizuoka, Aichi, Mie).

Type material. Holotype: Male (in alcohol): JAPAN. Mie: Iseji (34°23'03"N, 136°39'52"E), Minami-ise-cho, Watarai-gun, 7.V.2008, H. Morita (CBM-ZI-138358). **Paratypes:** 1 male, 4 females (in alcohol), same data as holotype (CBM-ZI-138359-138363).

Other material examined. Ibaraki: 1 male, 1 female (in alcohol), Ogawa (34°23'03"N, 136°39'52"E), Sekimoto-cho, Kitaibaraki-shi, 20.V.2003- 17.VI.2003, T. Inoue. Shizuoka: 1 male, 1 female (in alcohol), Utouge-no-taki (34°59'05"N, 138°11'33"E, 460 m a.s.l.), Fujieda-shi, Shizuo, 25.V.2008, T. Torii; 1 male (pinned), Mitsumine, Yokosawa (1100 m a.s.l.), Shizuoka-shi, 6.VI.2003, T. Torii; 1 male (pinned), Suishodani, Amagiyugashima-cho (720 m a.s.l.), Izunokuni-shi, 4.VI.1989, T. Hattori, 2 females (in alcohol), Yokosawa (550 m a.s.l.), Shizuoka-shi, 8.VI.2001, T. Hattori; 1 female (in alcohol), Mitsumine Yokosawa (1080 m a.s.l.), Shizuoka-shi, 14-15.VI.2005, T.

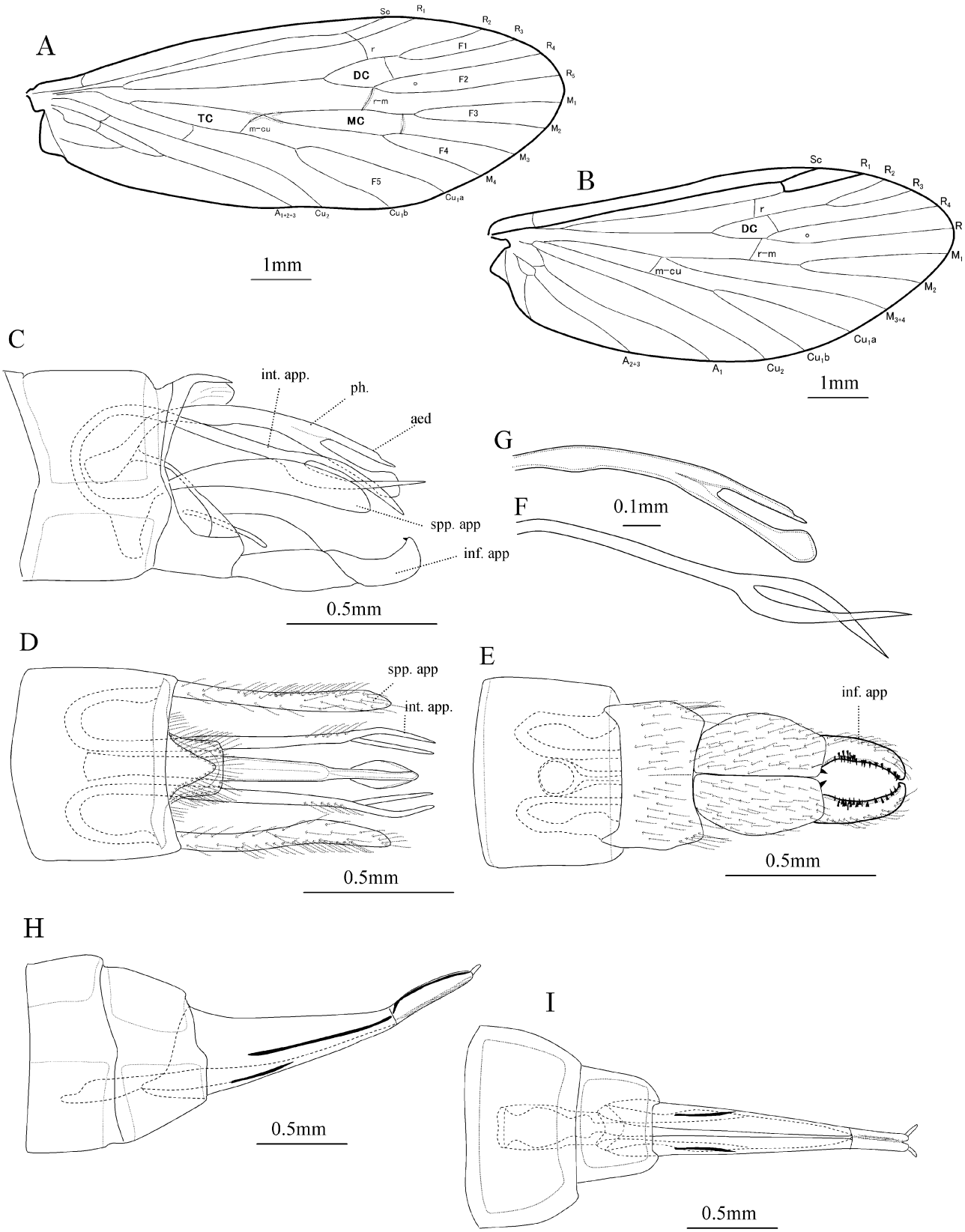

FIGURE 2. *Eoneureclipsis montanus* new species from Seto-gawa. A − male right forewing venation, dorsal; B − male right hind wing venation, dorsal. Male genitalia: C − left lateral; D − dorsal; E − ventral; F − left intermediate appendage, left lateral; G − phallus, left lateral. Female genitalia: H − left lateral; I − ventral. Abbreviations: A = anal veins; aed. = aedeagus; Cu = cubital veins; DC = discoidal cell; inf.app. = inferior appendage; int.app. = intermediate appendage; M = median veins; MC = median cell; pha. = phallus; R = radius; Sc = subcosta; sup.app. = superior appendage; TC = thyridial cell.

Hattori. Aichi: 1 male (in alcohol), Asahi-cho, Aichi Pref., 29.V.1999, T. Tanaka. Mie: 4 males, 1 female (in alcohol), same data as holotype.

Etymology. The name is derived from the primary habitat, mountain streams.

Japanese name. Ô-kuda-tobikera.

Eoneureclipsis shikokuensis Torii and Nishimoto new species

(Figs 3, 6)

Diagnosis. The male of this species is generally similar to the preceding *E. montanus*. It is distinguished from the latter by the following features: terminal segments of inferior appendages are moderately curved mesad, each with a concave inner margin in ventral view; superior appendages are truncate apically; the lower branch of each intermediate appendage is strongly curved upward and about twice as long as the upper branch; the phallus is abruptly bent caudoventrad near midlength. The female is very similar to other Japanese congeners, but can be distinguished by the basal portion of the vaginal apparatus being thick and hemispherical proximally in lateral view and elongate-oval in ventral view.

Description. General morphology and coloration similar to those of *E. montanus*. Maxillary palpi each 5-segmented, ca. 2.5 mm long; relative lengths of 5 segments ca. 1.0:1.5:2.0:1.5:3.0. Labial palpi each 3-segmented, ca. 1.3 mm long; relative lengths of 3 segments ca. 1.0:1.1:2.6. Forewing length: male 8.1-9.7 mm (mean=8.7 mm, n=4); female 7.9–8.9 mm (mean=8.6 mm, n=3). Hind wing length: male 6.4-8.0 mm (mean=7.0 mm, n=4); female 6.7−7.4 mm (mean=7.1 mm, n=3). Venation (Figs 3A, B) typical for genus and similar in 2 sexes.

Male genitalia (Figs 3C−G). Tergum IX produced posteriorly into broad triangular plate in dorsal view; membranous bulge with rounded apex below tergum IX in dorsal view. Inferior appendages each 2-segmented, basal segments incompletely but widely fused mesally with each other, each bearing single small black spine on mesodistal corner; terminal segments each moderately curved mesad with concave inner margin bearing stout black teeth. Superior appendages long, slightly sinuate in dorsal view, each gradually widening distally to truncate apex in lateral view. Intermediate appendages each slender but slightly broadened before apical bifurcation in lateral view, with upper branch strongly curved upward and about twice as long as downcurved lower branch. Phallus relatively broad in lateral view, abruptly bent caudoventrad near midlength, terminating in bifid aedeagus with slender, cylindrical dorsal lobe and expanded ventral lobe.

Female genitalia (Figs 3H−I). Segment IX absent or completely united with segment X. Segment X very long, gradually tapered and slightly curved upward. Segment XI with dark brown, short silky hairs along ventral suture; pair of cerci distally. Basal portion of vaginal apparatus thick and hemispherical proximally in lateral view and elongate-oval in ventral view.

Distribution (Fig. 6). Japan (Shikoku: Tokushima, Kochi).

Type material. Holotype: Male (in alcohol): JAPAN. Tokushima: Semidani (33°47'45"N, 134°12'26"E, 350 m a.s.l.), kitô-mura, Naka-gun, 5.V.2009, T. Torii (CBM-ZI-138364). **Paratypes**: 1 female, (in alcohol), same data as holotype (CBM-ZI-138366); 1 male (in alcohol), Kounose-kyo (33°46'46"N, 134°05'05"E, 700 m a.s.l.), Naka-cho, Naka-gun, 6.v.2009, T. Torii (CBM-ZI-138365). Kochi: 1 male (in alcohol), Araki-toge (33°40'05''N, 133°31'33''E, 700 m a.s.l.), Kochi-shi, 21.v.2008, T. Takai & T. Ito (CBM-ZI-138367).

Other material examined. 1 male (pinned), same locality as holotype, 25. IV. 2004, T. Hattori. Kochi: 1 female (in alcohol), Tsuro (32°45'45"N, 133°00'35"E, 50 m a.s.l.), Tosashimizu-shi, 2. iv. 2005, T. Takai.

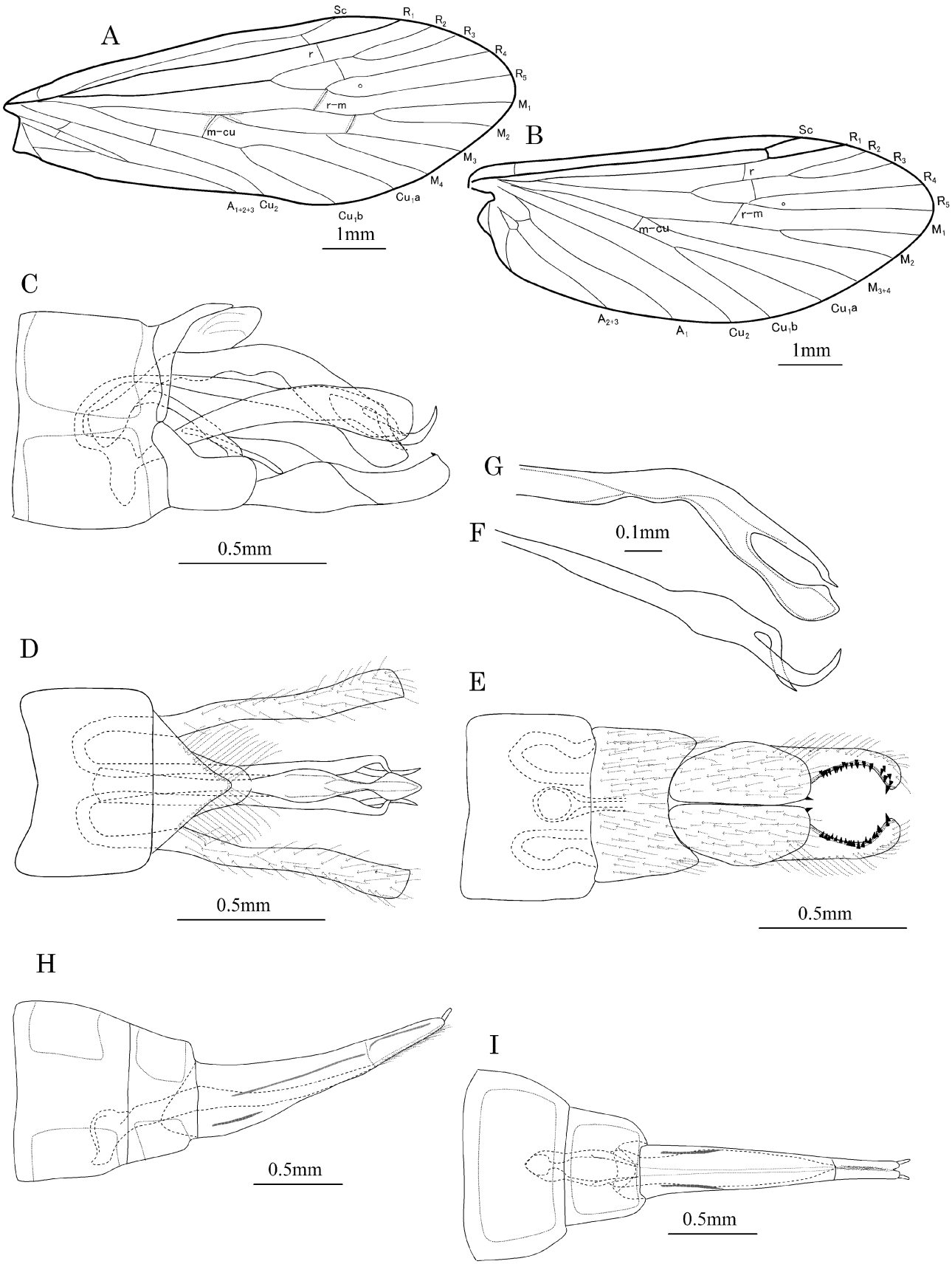

FIGURE 3. *Eoneureclipsis shikokuensis* new species from Tosayama. A—Male right forewing venation, dorsal; B—Male right hind wing venation, dorsal. Male genitalia: C—left lateral; D—dorsal; E—ventral; F—intermediate appendage, left lateral; G—phallus, left lateral. Female genitalia: H—left lateral; I—ventral.

Etymology. Named after Shikoku, the distributional province of the species.

Japanese name. Shikoku-ô-kuda-tobikera.

Eoneureclipsis okinawaensis Torii and Nishimoto new species

(Figs 4, 6)

Diagnosis. The male differs from other Japanese species by the following characters: The superior appendages are broad throughout their length; the intermediate appendages are spiniform, each with a twisted outer branch; the terminal segment of each inferior appendage is stout; the phallus has a short, angulate dorsal projection before the aedeagus. The female can be separated by the basal portion of the vaginal apparatus being rectangular in ventral view, with an anterior margin shallowly bilobed in lateral view.

Description. General morphology and coloration similar to those of *E. montanus*. Maxillary palpi each 5-segmented, ca. 1.7 mm long; relative lengths of 5 segments ca. 1.0:1.0:1.6:1.0:2.5. Labial palpi each 3-segmented, ca. 0.9 mm long; relative lengths of 3 segments ca. 1.0:0.9:2.0. Forewing length: male 5.8–7.8 mm (mean=6.8 mm, n=2); female 7.8 mm (n=1). Hind wing length: male 4.9–6.5 mm (mean=5.7 mm, n=2); female 6.5 mm (n=1). Venation (Figs 4A−B) typical for genus and similar in 2 sexes.

Male genitalia (Figs 4C−G). Tergum IX produced posteriorly into broad trapezoidal plate in dorsal view; membranous bulge with rounded apex below tergum IX in dorsal view. Inferior appendages each 2-segmented, basal segments incompletely but widely fused mesally with each other, each bearing single black spine on mesodistal corner; terminal segment stout, expanded apically and terminating in triangular apex directed mesad in ventral view, with strong black teeth on mesal edge. Superior appendages long, broad throughout length, each with truncate apex in lateral view. Intermediate appendages spiniform, each bifid apically with outer branch twisted and extended outward, inner branch somewhat sinuate and slightly longer than one-half length of outer branch. Phallus in dorsal view conspicuously thick, abruptly bent downward before aedeagus with short, angulate dorsal projection; posterior margin of aedeagus with V-shaped notch in lateral view.

Female genitalia (Figs 4H−I). Segment IX absent or completely united with segment X. Segment X very long, gradually tapered and slightly curved upward. Segment XI with dark brown, short silky hairs along ventral suture; pair of cerci distally. Basal portion of vaginal apparatus rectangular in ventral view with anterior margin shallowly bilobed in lateral view.

Distribution (Fig. 6). Japan (Ryukyu Islands: Okinawa-jima).

Type material. Holotype: Male (in alcohol): JAPAN. Okinawa: Ginama, Kunigami-son, Okinawa-jima, 7.XII.2007, M. Kimura (CBM-ZI-138368). **Paratypes**: Okinawa: 1 male, 2 females (in alcohol), Oh-kawa, Matsuda, Ginoza-son, Okinawa-jima, 11. I. 2008, M. Kimura (CBM-ZI-138369-138371).

Other material examined. 1 male (in alcohol), same date as holotype; 1 male (in alcohol), Iehara forest road, Kunigami-son, Okinawa-jima, 5.XII.2007, M. Kimura.

Etymology. Named after Okinawa-jima, the type locality of the species.

Japanese name. Okinawa-ô-kuda-tobikera.

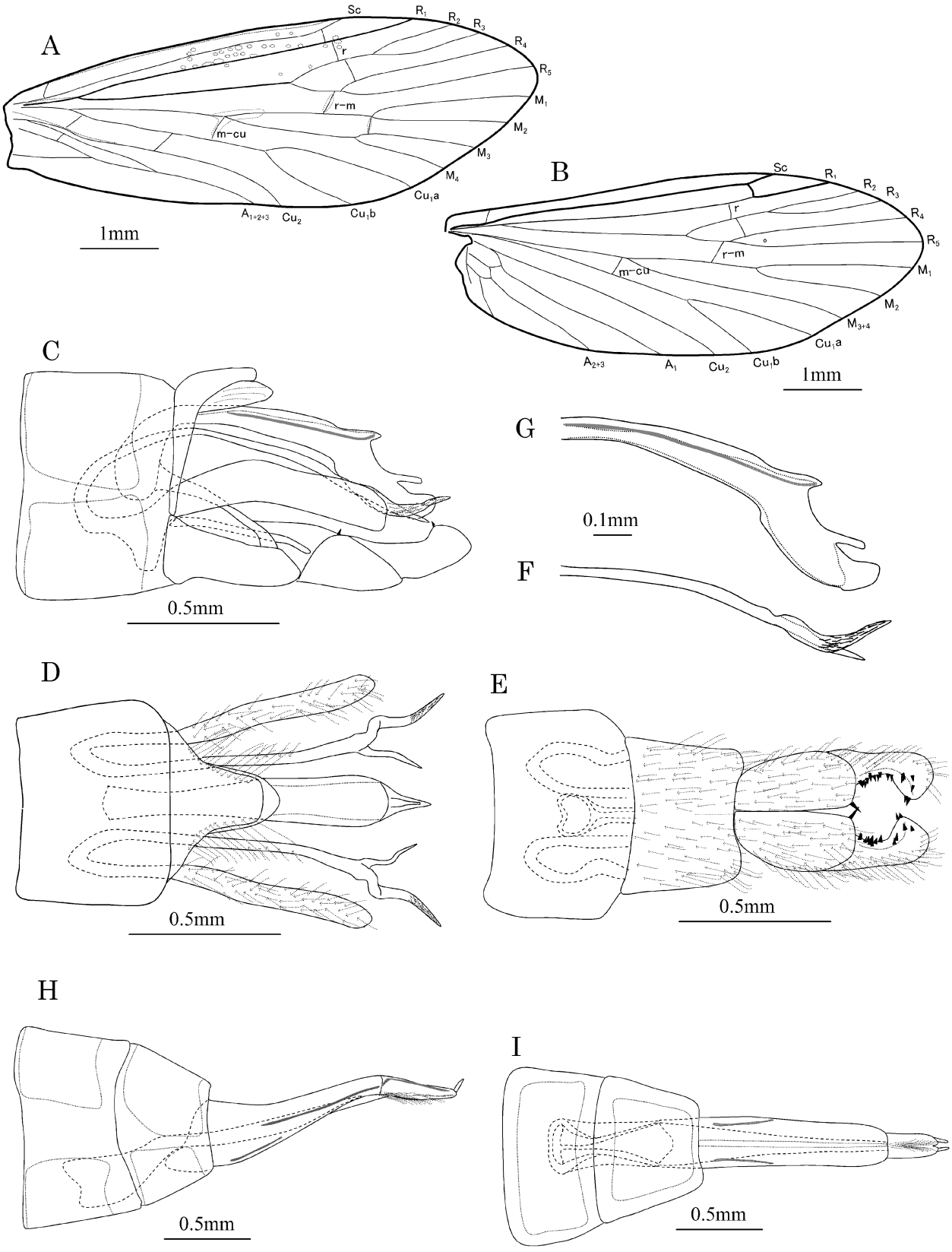

FIGURE 4. *Eoneureclipsis okinawaensis* new species from Ginama. A—male right forewing venation, dorsal; B—male right hind wing venation, dorsal. Male genitalia: C—left lateral; D—dorsal; E—ventral; F—intermediate appendage, left lateral; G—phallus, left lateral. Female genitalia: H—left lateral; I—ventral.

***Eoneureclipsis yaeyamaensis* Torii and Nishimoto new species**
(Figs 5−6)

Diagnosis. The male of this species is generally similar and closely related to *E. okinawaensis*, but is distinguished from the latter by the following features: The outer branches of the intermediate appendages are not twisted; the terminal segment of each inferior appendage has a less-expanded apex; the phallus bears a small dorsal hump before the aedeagus instead of an angulate projection as in *E. okinawaensis*. The female can be distinguished by the basal portion of the vaginal apparatus being narrowly rectangular and slightly concave anteriorly in ventral view.

Description. Though slightly smaller in size, general morphology and coloration, this species otherwise similar to *E. okinawaensis*. Maxillary palpi each 5-segmented, ca. 1.6 mm long; relative lengths of 5 segments ca. 1.0:1.4:2.2:1.5:3.4. Labial palpi each 3-segmented, ca. 0.7 mm long; relative lengths of 3 segments ca. 1.0:0.9:1.5. Forewing length: male 4.9-5.6 mm (mean=5.2 mm, n=5); female 4.6–6.1 mm (mean=5.4 mm, n=5). Hind wing length: male 4.1-4.8 mm (mean=4.4 mm, n=5); female 4.2−5.2 mm (mean=4.9 mm, n=5). Venation (Figs 5A-B) typical for genus and similar in 2 sexes.

Male genitalia (Figs 5C−G). Tergum IX produced posteriorly into trapezoidal plate in dorsal view; membranous bulge with rounded apex below tergum IX in dorsal view. Inferior appendages each 2-segmented, basal segments incompletely fused mesally with each other, each bearing single black spine on mesodistal corner; terminal segments each strongly curved mesad with less expanded apex, bearing stout black teeth on mesal edge. Superior appendages each long, broad throughout length except basal constriction, with truncate apex in lateral view. Intermediate appendages spiniform, each bifid apically with outer branch recurved throughout its length and not twisted, inner branch about one-half length of outer branch. Phallus in dorsal view relatively thick, with small dorsal hump before aedeagus; posterior margin of aedeagus with narrow incision in lateral view.

Female genitalia (Figs 5H-I). Segment IX absent or completely united with segment X. Segment X very long, gradually tapered and slightly curved upward. Segment XI with dark brown, short silky hairs along ventral suture; with pair of distal cerci. Basal portion of vaginal apparatus narrowly rectangular and slightly concave anteriorly in ventral view.

Distribution (Fig. 6). Japan (Yaeyama Islands: Ishigaki-jima, Iriomote-jima).

Type material. Holotype: Male (in alcohol): JAPAN. Okinawa: Nagura-gawa, Shiramizu, Ishigaki-shi (24°24'33"N, 124°11'18"E) Ishigaki-jima, 13-21.X.1999, K. Konishi and S. Belokobyski (CBM-ZI-138372). **Paratypes:** Okinawa: 5 males, 5 females (in alcohol), Omoto-dake, Ishigaki-shi, Ishigaki-jima, 13-21.X.1999, K. Konishi (CBM-ZI-138373-138382).

Other material examined. 9 males, 4 females (in alcohol), same data as paratypes; 1 male (in alcohol), Nishifunatsuki-gawa, Otomi, Taketomi-cho, Iriomote-jima, 23.III.1999, T. Ito and A. Ohkawa.

Etymology. Named after the Yaeyama Islands, the distribution area of the species, including Ishigaki-jima and Iriomote-jima.

Japanese name. Yaeyama-ô-kuda-tobikera.

Discussion

The 14 species of genus *Eoneureclipsis* are distributed in the subtropical and temperate zones of the Oriental and Palearctic Regions. The Japanese species are distributed in the northeasternmost area of the genus including the temperate zone of the Palearctic Region, being reported here from the East

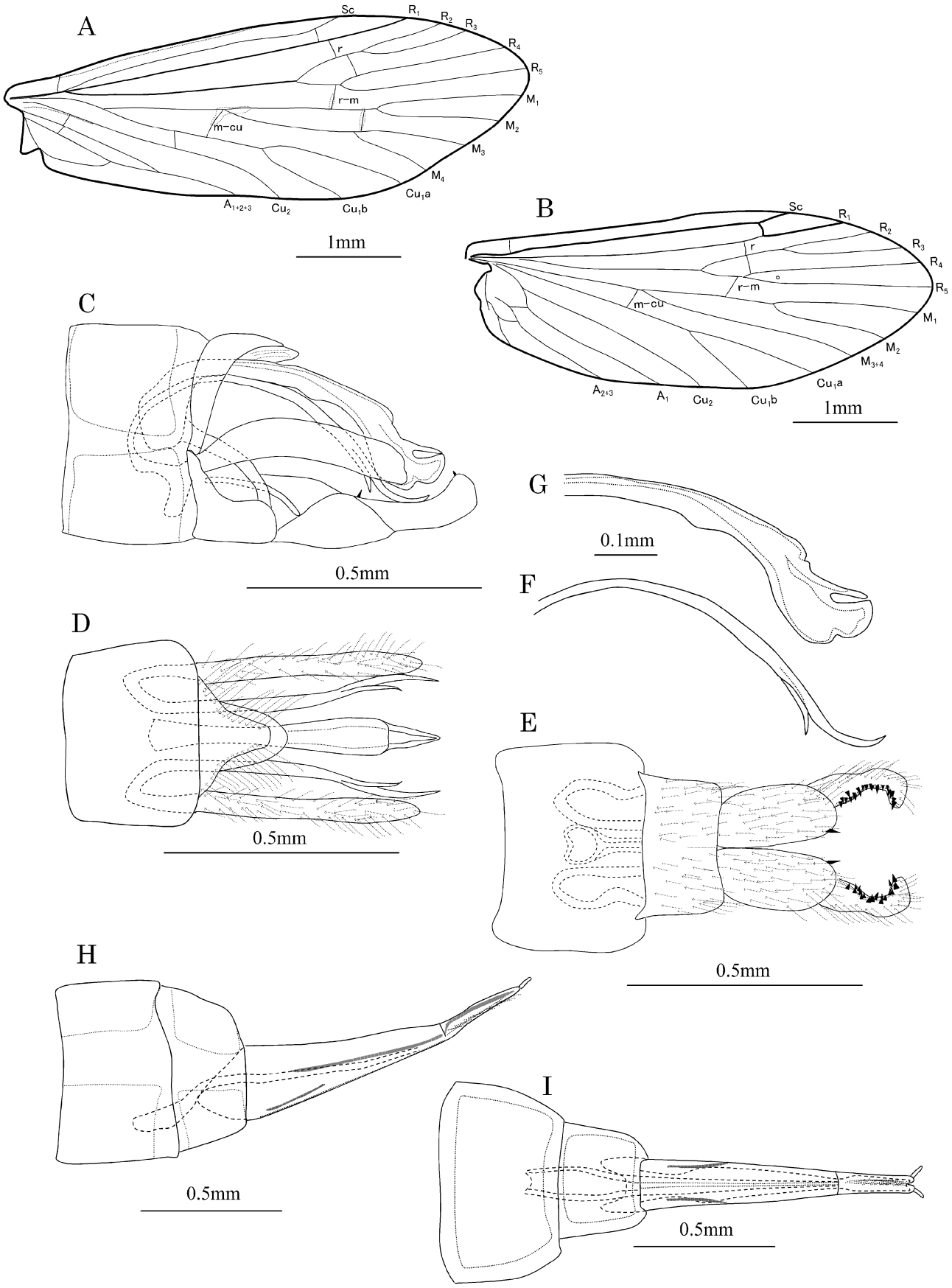

FIGURE 5. *Eoneureclipsis yaeyamaensis* new species from Nagura-gawa. A—male right forewing venation, dorsal; B—male right hind wing venation, dorsal. Male genitalia: C − left lateral; D—dorsal; E—ventral; F—intermediate appendage, left lateral; G—phallus, left lateral. Female genitalia: H—left lateral; I—ventral.

Palearctic Region for the first time. The male genitalia of the 4 species of *Eoneureclipsis* from Japan are apparently closely related and very similar. However, their distribution is restricted to separate islands (Honshu, Shikoku, Okinawa, and Yaeyama). These facts indicate that a common ancestor of the Japanese *Eoneureclipsis* species extended its range northeastward and allopatric speciation has occurred relatively recently, due to the geographical isolation of the Japanese islands.

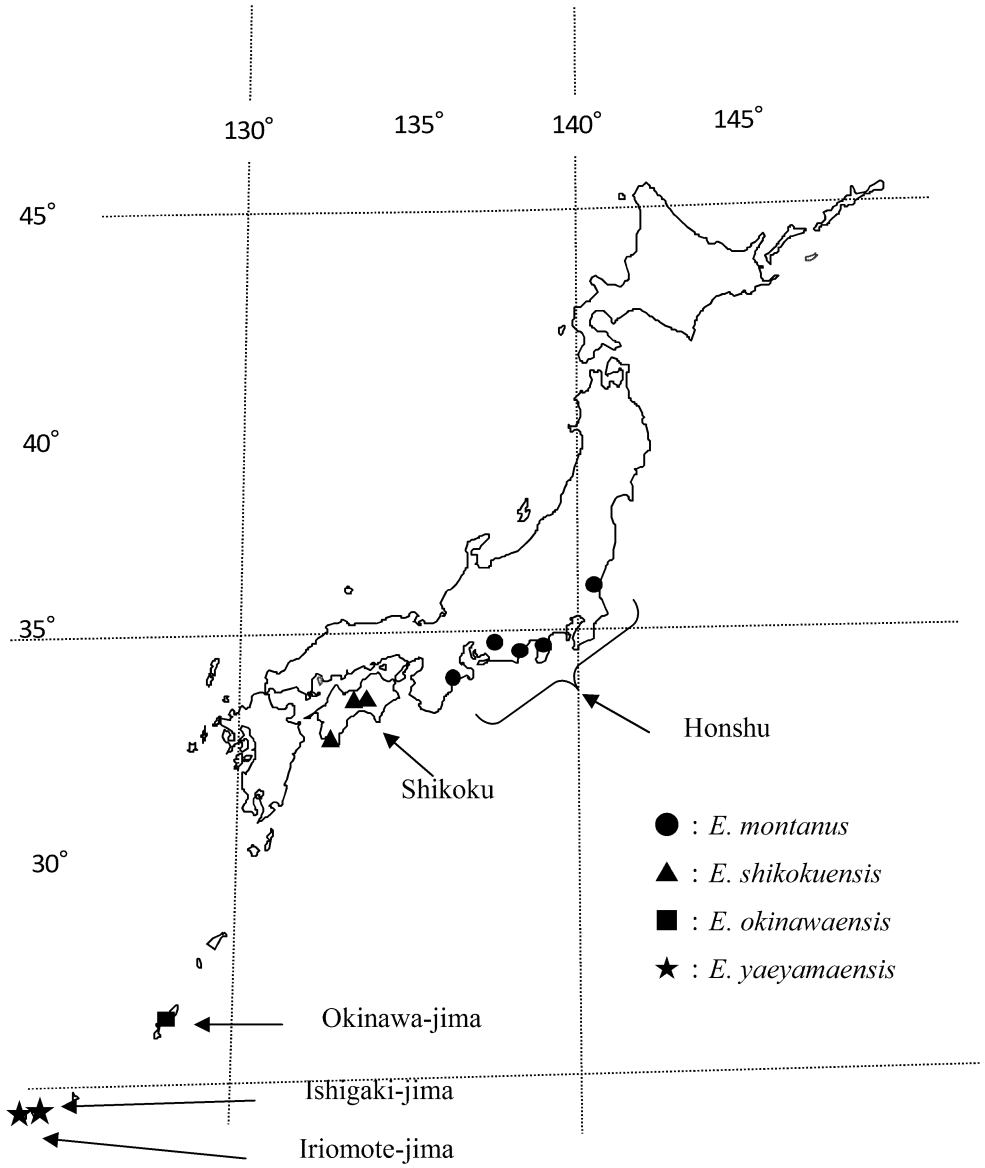

FIGURE 6. Collection sites of *Eoneureclipsis* species in Japan. Symbols: circle = *E. montanus*; triangle = *E. shikokuensis*; square = *E. okinawaensis*; star = *E. yaeyamaensis*.

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