



RESEARCH PAPER

Taxonomic revision of the tribe Zoraidini (Hemiptera: Fulgoromorpha: Derbidae) from Korea

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Received 29 January 2012;
accepted 19 July 2012.

doi: 10.1111/j.1748-5967.2012.00463.x

Abstract

The Korean planthopper tribe Zoraidini is revised taxonomically. Five genera are recognized in the Korean fauna: *Diostrombus* Uhler, 1896, *Losbanosia* Muir, 1917, *Pamendanga* Distant, 1906, *Shirakiana* Metcalf, 1945, *Zoraida* Kirkaldy, 1900. Among them, the genus *Shirakiana* is recorded for the first time in Korea. Nine species, four of which are recognized new to Korea: *S. infumata* (Matsumura), *Z. koanmania* Matsumura, *Z. hubeiensis* Chou et Huang, and *Z. kuwayamae* (Matsumura). Previous record of one species, *Z. pterophoroides* (Westwood, 1851), is removed from the list of Korean fauna because it was erroneously reported, based on a misidentification. All species are described and illustrated, and identification keys to genera and species are provided.

Key words: Auchenorrhyncha, Derbid planthopper, Fulgoroidea, taxonomy.

Introduction

Derbidae Spinola, 1839 is one of the largest and most morphologically differentiated families in Fulgoromorpha and comprises the subfamilies Cedusinae Emeljanov, 1992, Derbinae Spinola, 1839 and Otiocerinae Muir, 1917. The tribe Zoraidini Muir, 1918 is one of the nine tribes in the subfamily Otiocerinae with several hundred species worldwide (Emeljanov 1995; Szwedo 2006). This group of insect fauna is poorly known in Korea. Previously, only the following five species belonging to this tribe were described primarily based on external morphology by Lee (1979): *Diostrombus politus* Uhler, *Nomuraida hibarensis* Matsumura, *Pamendanga matsumurae* (Muir), *Zoraida horishana* Matsumura and *Zoraida pterophoroides* (Westwood). Later, Kwon and Huh (2001) provided a revised checklist including one more species, *Zoraida albicans* Anufriev, 1968, that belongs to this tribe from Korea and then no further work was done. The aim of this study, therefore, is to provide a taxonomic revision of Korean Zoraidini with the description of male genital structures because these provide a better means to differentiate taxa at the species level.

Recent investigation of specimens of this tribe revealed the presence of following other four species which are new

to Korea: *Shirakiana infumata* (Matsumura), *Zoraida koanmania* Matsumura, *Zoraida hubeiensis* Chou et Huang and *Zoraida kuwayamae* (Matsumura). The voucher specimens of *Zoraida pterophoroides* (Westwood 1851), previously examined by Lee and Kwon (1979) and Kwon and Huh (2001), have been rechecked recently, and found that *Zoraida hubeiensis* Chou et Huang, 1985 was erroneously treated as *Zoraida pterophoroides* (Westwood 1851). Depending on the above findings and the unavailability of the species in the present investigation, the previous record of *Zoraida pterophoroides* (Westwood 1851) is removed from the list of Korean fauna. All recorded and unrecorded species are redescribed in this paper with illustrations and key to the genera and species are provided.

Materials and methods

The terminology used in this study follows Yang and Wu (1993) and Zelazny and Webb (2011). The genital segments of examined specimens were observed in glycerin jelly using a stereoscopic microscope (Olympus SZX 12, Olympus, San Diego, CA, USA). Photographs of the specimen were made using JUJAK 5.5 (DIXI 3000, DIXI Optics, Daejeon, Korea) digital camera. Illustrations were scanned

with HP Scanjet 4850 (Hewlett-Packard Company, Houston, TX, USA). Image and plate compositions are produced using the software Helicon Focus 5.1 (Helicon Soft Ltd., Kharkov, Ukraine) and Adobe Photoshop CS3 (Adobe, San Jose, CA, USA), respectively. Spinal formula means the numbers of apical spines of the hind tibiae and 1st and 2nd hind tarsomeres.

Specimens examined in the present study are deposited in the collection of the School of Applied Bio-sciences, Kyungpook National University (KNU), Daegu, Republic of Korea.

Taxonomy

Family Derbidae Spinola, 1839
 Subfamily Otiocerinae Muir, 1917
 Tribe Zoraidini Muir, 1918

Key to genera of the tribe Zoraidini from Korea

1. Antennae very short and conical shape. Mesonotum with indistinct carinae *Diostrombus* Uhler
 – Antennae long and elongate. Mesonotum with distinct carinae 2
2. Third median sector of forewing furcate *Pamendanga* Distant
 – Third median sector of forewing not furcate 3
3. Second and third sectors of forewing without cross veins and posterior margin at near middles with three cross veins in an oblique line *Shirakiana* Metcalf
 – Second or third sector of forewing with cross veins and posterior margin at near middles without such an oblique line of cross veins 4
4. Ventral margin of forewing evenly curved before apex of claval and cubital veins, and margin not undulate *Zoraida* Kirkaldy
 – Ventral margin of forewing angulately produced but apex of claval and cubital veins, and margin undulate *Losbanosia* Muir

Genus *Diostrombus* Uhler, 1896

Diostrombus Uhler, 1896: p. 283. Type species: *Diostrombus politus* Uhler, 1896.

Diagnosis. Head roundish above, including the large eyes, prominent in front, where it is grooved on the middle line, a little wider above, and carinate on each lateral margin. Rostrum extended to the posterior coxae. Antennae short, second antennomere claviform, completed by a very slender bristle. Eyes broadly circular. Mesonotum large, tumidly convex, scutellar portion very broadly curved, carinae very feeble or absent. Costal area of forewing cover contracted for a long space beyond the middle followed near the tip by

two diagonal veins, ScRA and RP form an areol cell, Ms1 and Cu1 connected by a small cross vein, all median sector single, usually 6. Hind wings much less than half as long as forewings, acute at apex. Abdomen contracted near the base, last ventral segment armed each side with a long, curved appendage.

Diostrombus politus Uhler, 1896 (Fig. 1)

Diostrombus politus Uhler, 1896: p. 284; Matsumura 1900: p. 210; Muir 1914: p. 49; Metcalf 1945: pp. 29–30; Nast 1972: p. 77; Lee and Kwon 1977: p. 94; Morimoto 1989: p. 87; Kwon and Huh 1995: p. 41, Kwon and Huh 2001: pp. 312–313.

Description. Body length (including forewing): male 9.0–10.0 mm (N = 28), female 10.0–10.5 mm (N = 33); forewing length: male 8.0–8.5 mm (N = 28), female 8.5–9.0 mm (N = 33).

Coloration. General body color bright orange-red and highly polished. Head and thorax (Fig. 1b) shiny orange-red. Antennae and clypeus (Fig. 1c) yellowish red. Rostrum yellowish brown except apex, fuscous. Eyes black. Forewing (Fig. 1d) covers tinged with pale brown, the veins dark brown, the costal area yellowish. Hind wing yellowish brown, bordered posteriorly with dark brown, veins also yellowish brown.

Head and thorax. Head rounded. Head with eyes narrower than pronotum (1:1.57). Vertex wider at base than long in middle line (1.6:1), at apex narrower than at base (1:1.8), lateral margin ridged, depressed medially. Frons (Fig. 1c) narrow between eyes, lateral carinae elevated forming a furrow medially. Clypeus tricarinate, median portion convex with distinct median carina. Apical segment of rostrum almost as long as wide, reaching to posterior coxae. Antennae short, second antennomere claviform, and completed by a very slender bristle. Eyes semicircular or inverse conical. The median length of pronotum less than the length behind eyes, posterior margin concave medially, carinae absent. Mesonotum large, dorsally convex, in lateral view raised above the vertex, median and lateral carinae indistinct or absent, posterior end depressed, scutellar portion very broadly curved. Forewings narrow, 4.2 times as long as widest part. Hindwing 3.6 times shorter than forewing, narrow, acute at apex. Spinal formula of hind leg 4–7(8)(9)–8(9).

Male genitalia. Anal segment (Fig. 1h,i) long and straight, wider at base, narrow and sharply pointed at apex, anal style sets about middle. Aedeagus (Fig. 1e–g) shaft wide apically with three processes, another bifurcate process sets at middle. Genital styles (Fig. 1j) symmetrical, elongated, narrow, slightly curved apically, subapical short teeth present, inner margin with a process at base, narrow and sharply pointed apically. Pygofer very short, nearly hidden by preceding segment.

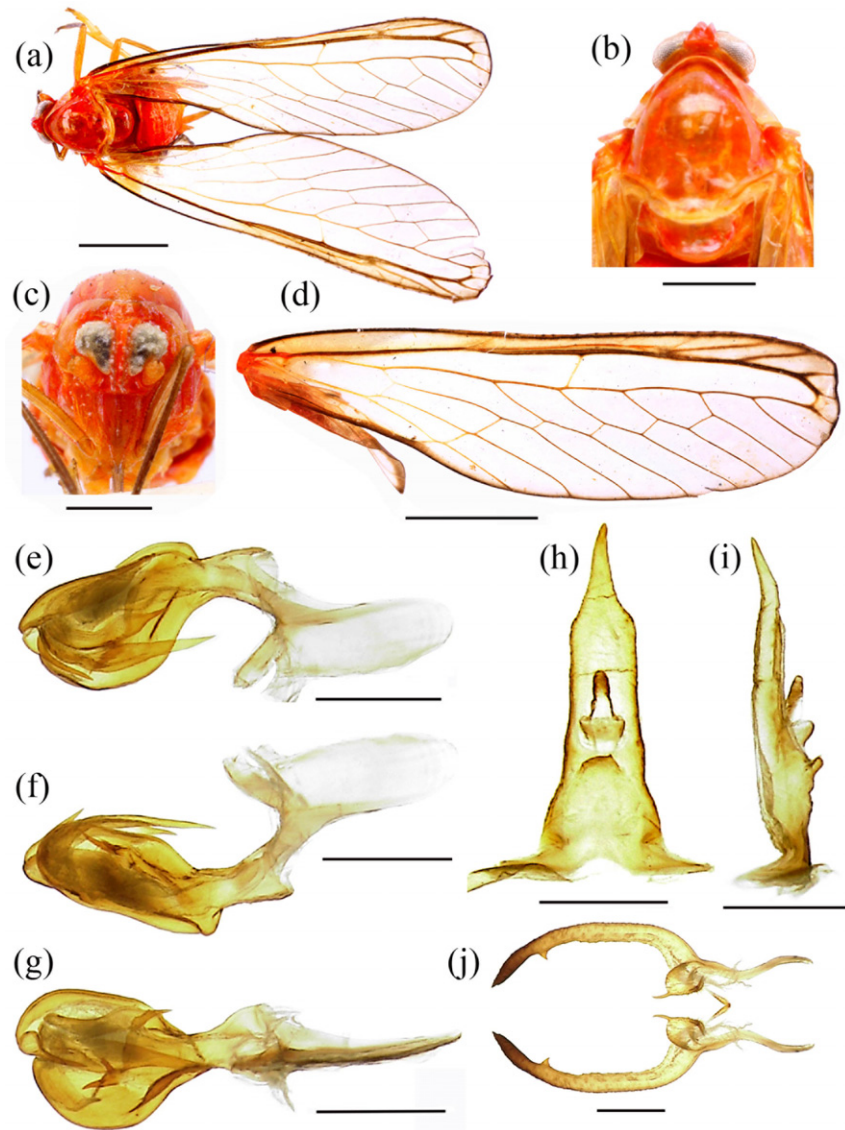


Figure 1 *Diostrombus politus* Uhler. (a) Dorsal habitus; (b) vertex, pronotum and mesonotum; (c) frons and clypeus; (d) forewing and hind wing; (e) aedeagus (left lateral view); (f) ditto (right lateral view); (g) ditto (ventral view); (h) anal segment (dorsal view); (i) ditto (lateral view); (j) genital styles (latero-ventral view). Scale bars (a, d) 2.0 mm; (b, c) 1.0 mm; (e–j) 0.5 mm.

Material examined: 1 male, Songnisan, Chungcheongbuk-do, Korea, 9.ix.2001, Y. J. Kwon; 1 male, 1 female, Daejeon city, Chungcheongnam-do, Korea, 29.vii.1993, S. L. An; 1 male, Chunghwa-myeon, Chungcheongnam-do, Korea, 19.viii.1993, S. L. An; 1 male, Dansan Myeon, Gyeongsangbuk-do, Korea, 17.viii.1982, Y. J. Kwon; 1 female, same locality, 13.viii.1983, Y. J. Kwon; 1 male, 1 female, Mt. Hwanghaksan, Gyeongsangbuk-do, Korea, 27.viii.1985, Y. J. Kwon; 2 males, 3 females, Yecheon, Gyeongsangbuk-do, Korea, 3.ix.2008, Y. J. Kwon; 15 males, Gunwi, Gyeongsangbuk-do, Korea, 17.vii.2011, Y. J. Kwon; 17 females, Gunwi, Gyeongsangbuk-do, Korea, 17.vii.2011, Y. J. Kwon; 1 male, 3 females, Surisan, Gyeonggi-do, Korea, 21.viii.1996, Y. J. Kwon; 1 male, Mt. Naejangsan, Jeollabuk-do, Korea, 14.viii.1981, Y. J. Kwon; 2 males, 1

female, Cheonhwangsan, Jeollabuk-do, Korea, 12.ix.1999, Y. J. Kwon; 1 male, 2 females, Gwancheon, Jeollabuk-do, Korea, 29.vii.2006, E. Y. Huh; 1 male, Pyeonjang, Jeollabuk-do, Korea, 29.vii.2006, E. Y. Huh; 1 male, 2 females, Taein, Jeollabuk-do, Korea, 30.vii.2006, E. Y. Huh; 1 female, Chilbo, Jeollabuk-do, Korea, 30.vii.2006, E. Y. Huh.

Distribution. Korea, Japan, China, Taiwan.

Host plant: *Avena sativa* (cf. Kor. Soc. Plant Prot. 1986), Graminae spp. (cf. Lee & Kwon 1977, 1979), *Hordeum* spp. (cf. Kor. Soc. Plant Prot. 1986), *Hordeum vulgare* var. *hexastichon* (cf. Kor. Soc. Plant Prot. 1986), *H. vulgare* var. *nudum* (cf. Kor. Soc. Plant Prot. 1986), *Oryza sativa* (cf. Lee & Kwon 1977, 1979; Kor. Soc. Plant Prot. 1986), *Oryza sativa* var. *terrestris* (cf. Kor. Soc. Plant Prot. 1986), *Secale*

cereale (cf. Kor. Soc. Plant Prot. 1986), *Solanum tuberosum* (cf. Lee & Kwon 1977, 1979), *Triticum aestivum* (cf. Kor. Soc. Plant Prot. 1986).

Genus *Losbanosia* Muir, 1917

Losbanosia Muir, 1917: p. 85. Type species: *Losbanosia bakeri* Muir, 1917.

Nomuraida Matsumura, 1935: p. 79. Type species: *Nomuraida hibarensis* Matsumura, 1935, by monotypy, synonymised by Chou *et al.* 1985: p. 50; Szwedo and Adamczewska 2004: pp. 1–11.

Diagnosis. Vertex small, flat, trapeziform, strongly narrowing forward. Frons linear. Antennae long, cylindrical second antennomere. Postclypeus with sharp median carina and weak lateral carinae. Mesonotum swollen, with 3 carinae. Ventral margin of forewing angularly produced between apex of claval and cubital veins, thus forming dorsal margin nearly parallel with ventral margin, ventral margin undulate.

Losbanosia hibarensis (Matsumura, 1935) (Fig. 2)

Nomuraida hibarensis Matsumura, 1935: pp. 79–80; Doi 1936: p. 102; Nast 1972: p. 78; Lee and Kwon 1979: p. 961; Anufriev & Emeljanov 1988: p. 475; Kwon and Huh 1995: p. 41, Kwon and Huh 2001: pp. 312–313.

Losbanosia hibarensis: Chou *et al.* 1985: p. 50; Yang and Wu 1993: pp. 37–38; Liang and Suwa 1998: p. 149.

Description. Body length (including forewing): male 12.6–13.0 mm (N = 05), forewing length: male 11.5–11.8 mm (N = 05).

Coloration. General color reddish brownish (Fig. 2a). Vertex reddish brown with yellow brown lateral margin. Frons, clypeus, antennae and eyes reddish brown (Fig. 2b). Rostrum yellow except apex, fuscous. Pronotum reddish brown with yellow margin and granules. Mesonotum usually yellowish brown. Forewings (Fig. 2c) hyaline, with castaneous stripe along anterior margin, posterior margin of the stripe projecting backwards in the shape of 3 teeth, veins partly red, partly brown. Hind wings with castaneous apically, veins reddish brown. Thorax brown to yellowish brown. Legs yellow to yellowish brown. Margins of abdominal segments carmine-red, dorsally brown with granules. Genital segment carmine-red.

Head and thorax. Head with eyes narrower than pronotum (1:1.57). Vertex wider at base than long in middle line (2.5:1), at apex narrower than at base (1:2.5), flat, trapeziform, excavated medially, not surpassing before eyes. Frons linear between eyes, longer in middle line than wide at widest part (4.2:1), disc depressed in entire length, wide at apex. Clypeus tricarinate, median carina sharp and prominent. Antennae long, second antennomere cylindrical, flag-

ellum originated from subapical point. The median length of pronotum as long as the median length of vertex (1:1), length behind eyes greater than median length (1.9:1), pronotum with several pits. Mesonotum tricarinate, scutellar portion broadly developed. Forewings (Fig. 2c) narrow, 3.4 times as long as widest part, median cells short, their length and width about equal Hindwing 3.1 times shorter than forewing. Spinal formula of hind leg 5–5–5(4).

Male genitalia. Anal segment in lateral profile (Fig. 2j) long, wider at basal half, slender apical half, in dorsal view (Fig. 2i) concave both lateral margin medially, longer in middle line than wide at base (2.75:1), bluntly pointed at apex, anal style sets near middle. Aedeagus (Fig. 2d,e) shaft longer and curved apically, flagellum terminating with a long process, directed cephalad. Genital styles (Fig. 2g,h) large, elongated, apical half wider than basal half in dorso-lateral view (Fig. 2h), inner margin with a small process at middle, subapically and apically lobed, inner ventral margin incised at middle. Medioventral process of pygofer (Fig. 2f) narrow at apical half, hairy, apex acute, wide at base.

Materials examined. 1 male, Cheamsan, Jeollanam-do, Korea, 28.vii.1999, Y. J. Kwon; 1 male, Chogyesan, Jeollanam-do, Korea, 10.ix.1998; 1 male, Gayasan, Gyeongsangnam-do, Korea, 12.viii.1996; 1 male, Yecheon, Gyeongsangbuk-do, Korea, 2.viii.2008, same collector.

Distribution. Korea, Japan, Taiwan, China, Russia.

Remarks. This species was reported as *Nomuraida hibarensis* Matsumura from Korea previously but it has already been synonymized to genus *Losbanosia* by Chou *et al.* 1985.

Genus *Pamendanga* Distant, 1906

Pamendanga Distant, 1906: p. 298. Type species: *Pamendanga rubilinea* Distant, 1906 (India).

Paraproutista Muir, 1913: p. 77. Type species: *Paraproutista ceramensis* Muir, 1913

Diagnosis. Vertex obtuse-angulate, strongly depressed. Face narrow, laminate, convex and centrally carinate. Clypeus shorter than face and tricarinate. Antennae long, second segment cylindrical, flagellum arising apically. Third median sector of forewing furcate.

Pamendanga matsumurae (Muir, 1918) (Fig. 3)

Pamendanga rubilinea (nec Distant): Matsumura, 1914: p. 297.

Paraproutista matsumurae Muir, 1918: p. 422.

Paraproutista variegata Muir, 1914: p. 51, synonymized with *Paraproutista matsumurae* Muir, 1918 by Yang and Wu 1993.

Pamendanga matsumurai: Ishihara 1965: p. 130; Anufriev and Emeljanov 1988: p. 476.

Pamendanga rubilinea (nec Distant): Lee and Kwon 1977: p. 94.

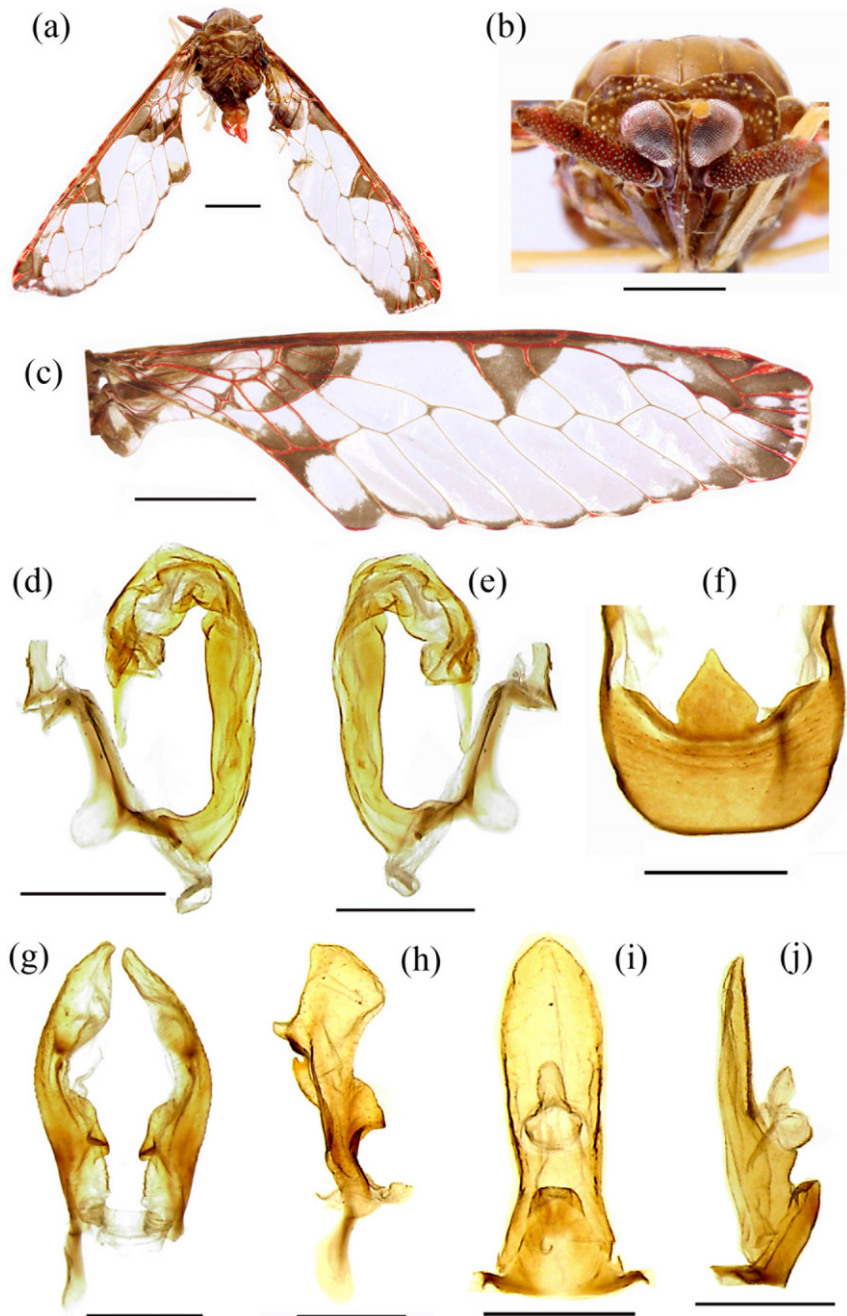


Figure 2 *Losbanosia hibarensis* (Matsumura). (a) Dorsal habitus; (b) frons and clypeus; (c) forewing wing; (d) aedeagus (left lateral view); (e) ditto (right lateral view); (f) pygofer (ventral view); (g) genital styles (latero-ventral view); (h) ditto (dorsal view); (i) anal segment (dorsal view); (j) anal segment (lateral view). Scale bars (a, c) 2.0 mm; (b) 1.0 mm; (d–j) 0.5 mm.

Pamendanga matsumurae: Nast 1972: p. 77; Kwon and Lee 1979: p. 66; Morimoto 1989: p. 87; Kwon and Huh 2001: p. 314.

Description. Body length (including forewing): male 8.0–8.2 mm (N = 02), female 8.9–9.2 mm (N = 04); forewing length: male 7.0–7.2 mm (N = 02), female 8.0–8.2 mm (N = 04).

Coloration. General color pale yellow to yellow brown (Fig. 3a). Vertex and frons yellowish brown. Clypeus yellow.

Rostrum yellow except apex, fuscous. Eyes brown to dark brown. Antennae yellowish brown. Pronotum and mesonotum pale yellow. Forewings (Fig. 3a) semihyaline, with numerous, small, scattered brown spots forming bands transversely, apical portion of sub-costal and radial veins reddish, other veins pale yellow, transverse veins surrounded with brown color. Hind wing hyaline, with scattered brown spots, veins fuscous spreading out into the membrane. Thorax with ventral area yellowish brown. Legs pale yellow. Abdomen

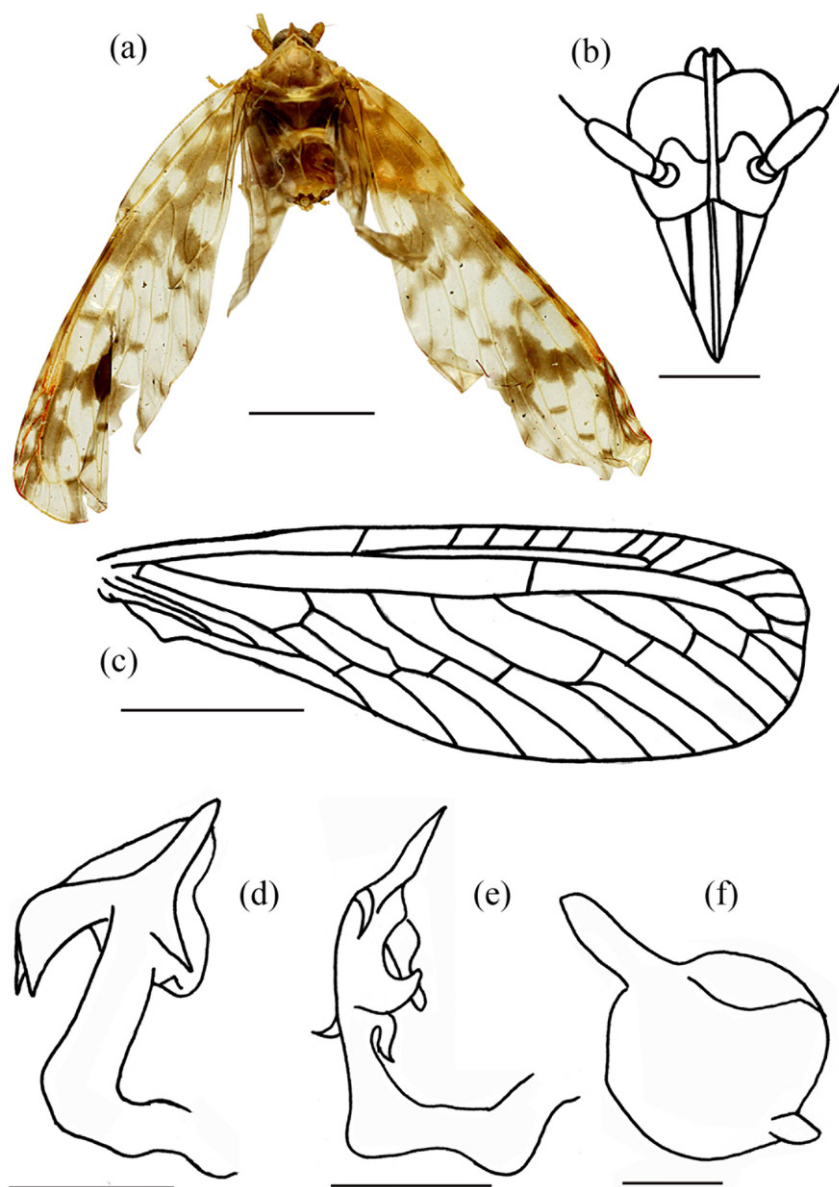


Figure 3 *Pamendanga matsumurae* (Muir). (a) Dorsal habitus; (b) frons and clypeus; (c) forewing; (d) aedeagus (dorsal view); (e) ditto (right lateral view); (f) genital stylus. Scale bars (a, c) 2.0 mm; (b) 0.5 mm; (d–f) 0.25 mm.

dorsally yellow with several dark brown spots, ventrally yellow. Genitalia yellow brown.

Head and thorax. Head with eyes narrower than pronotum (1:1.86). Vertex narrow, triangular, grooved, widened posteriorly. Frons (Fig. 3b) narrow, laminate and convex. Clypeus shorter than face, tricarinate, median carina sharp and prominent. Antennae long, second antennomere cylindrical with numerous sensory pits, flagellum originated from apical point. The median length of pronotum less than that of vertex (1:1.33), anterior margin between eyes angular, length behind eyes greater than median length (3.3:1),

median carinae distinct. Mesonotum tricarinate, scutellar portion broadly developed. Forewings (Fig. 3c) narrow, 3.1 times as long as widest part, third median sector furcate. Hindwing moderately long and narrow. Spinal formula of hind leg 5–4–3.

Male genitalia. Aedeagus (Fig. 3d,e) shaft curved apically and broad, in right lateral view, one short curved process originated from middle of flagellum, and terminating with a long process; in left lateral view, flagellum with one short process and another bifurcate process near the base. Genital styles (Fig. 3f) rounded with a narrow process.

Material examined. 1 male, Gyeryongsan, Chungcheongnam-do, Korea, 20.viii.1978, Y. J. Kwon; 1 female, Hakgasan, Gyeongsanbuk-do, Korea, 21.viii.1998; 2 females, Seoraksan, Gangwon-do, Korea, 15.ix.1984; 1 male, Deogyusan, Jeollabuk-do, Korea, 14.viii.1991; 1 female, Naejangsan, Jeollabuk-do, Korea, 14.viii.1981, all same collector.

Distribution. Korea, Japan, Taiwan, Russia.

Host plants. *Acer* spp. (cf. Lee & Kwon 1979; For. Res. Ins. 1995; Lee & Chung 1997), *A. buergerianum* (cf. For. Res. Ins. 1995), *A. cissifalium* (cf. For. Res. Ins. 1995), *A. ginnala* (cf. For. Res. Ins. 1995), *A. japonicum* (cf. For. Res. Ins. 1995), *A. mono* (cf. For. Res. Ins. 1995), *A. ne-gundo* (cf. For. Res. Ins. 1995), *A. okamotoanum* (cf. For. Res. Ins. 1995), *A. palmatum* (cf. For. Res. Ins. 1995), *A. pseudo-sieboldianum* (cf. For. Res. Ins. 1995), *A. pseudo-sieboldianum koreanum* (cf. For. Res. Ins. 1995), *A. saccharinum* (cf. For. Res. Ins. 1995), *A. tegmentosum* (cf. For. Res. Ins. 1995), *A. triflorum* (cf. For. Res. Ins. 1995), *A. tschonoskii rubripes* (cf. For. Res. Ins. 1995), *A. ukurunduense* (cf. For. Res. Ins. 1995), *Carpinus cordate* (cf. Lee & Kwon 1979), *Tilia* spp. (cf. Kor. Soc. Plant Prot. 1986), *T. amurensis* (cf. Kor. Soc. Plant Prot. 1986), *T. mandshurica* (cf. Kor. Soc. Plant Prot. 1986), *T. miqueliensis* (cf. Kor. Soc. Plant Prot. 1986), *T. semicostata* (cf. Kor. Soc. Plant Prot. 1986), *Ulmus* spp. (cf. For. Res. Ins. 1995; Lee & Chung 1997), *U. davidiana* (cf. For. Res. Ins. 1995), *U. davidiana japonica* (cf. For. Res. Ins. 1995), *U. laciniata* (cf. For. Res. Ins. 1995), *U. parvifolia* (cf. For. Res. Ins. 1995), *U. pumila* (cf. For. Res. Ins. 1995).

Genus *Shirakiana* Metcalf, 1945

Shirakiana Metcalf, 1945: 57. Type species: *Shirakiana infumata* (Matsumura 1914).

Shirakia Matsumura, 1914: 303. Type species: *Shirakia infumata* Matsumura, 1914, by monotypy.

Diagnosis. Vertex at middle near hind margin with more or less rectangular broken transverse carina. Antennae longer than face. Clypeus with three distinct carinae. Mesonotum tricarinate, median carina with three terminals where lateral two granulated. Forewing near middle with 3 cross veins in an oblique line, between second and third sectors without cross veins, claval vein ending hind margin.

Shirakiana infumata (Matsumura, 1914) (Fig. 4)

Shirakia infumata Matsumura, 1914: pp. 303–304; Schumacher, 1915: p. 123.

Shirakiana infumata: Metcalf, 1945: p. 57; Liang and Suwa 1998: p. 150.

Description. Body length (including forewing): male 12.0–12.4 mm (N = 04), female 12.5–13.0 mm (N = 05); forewing length: male 10.5–11.0 mm (N = 04), female 11.5–12.0 (N = 05).

Coloration. General color yellowish brown to brown (Fig. 4a). Vertex, frons and clypeus brown with yellowish carinae. Eyes dark brown. Antennae brown, slightly reddish brown near the base of flagellum. Pronotum and mesonotum brown, carinae of mesonotum yellow. Forewings (Fig. 4b) semihyaline, with numerous scattered brown spots, ventral half brown, sub-costal, radial and median longitudinal veins orange-red, other veins reddish brown, transverse veins surrounded with brown color. Hind wing brown. Thorax with ventral area yellowish brown, dorsally brown. Legs yellow brown. Abdomen dorsally brown, ventrally yellow brown. Genitalia also yellow brown.

Head and thorax. Head with eyes narrower than pronotum (1:1.4). Vertex narrow, apical margin V-shaped, connected to posterior margin by a median carina. Frons narrowly wide with a distinct long sulcus at middle. Clypeus tricarinate, distinct. Antennae long, second antennomere cylindrical with numerous sensory pits, about 5 times longer than wide at widest part, flagellum originated from subapical point. Pronotum with pits, median length of pronotum more than that of vertex medially (2:1), anterior margin between eyes convex, length behind eyes greater than median length (4.7:1). Mesonotum tricarinate, median carina with 3 terminals posteriorly where lateral terminals granulated, lateral carinae distinct and continuous up to half of the mesonotum, rest part granulated. Forewings narrow, 4.1 times as long as widest part, between second and third sectors without cross veins, near middle with 3 cross veins in an oblique line, claval vein ending hind margin. Hind wing moderately long and narrow, about 2 times shorter than forewing. Spinal formula of hind leg 5–5(6)–4(5–7).

Male genitalia. Anal segment in lateral profile (Fig. 4i) long, wider at basal half, slender and curved apical half, anal style sets about middle; in dorsal view (Fig. 4h), about twice as long as widest part, acute and angulate at apex. Aedeagus (Fig. 4c,d) shaft somewhat curved, one short sclerotized process at apex that observed from both sides. Flagellum curved with two sclerotized processes, moderately short one at base and longer one originated near base and separated from the main body, apically curved and hook-like, two lobes of flagellum terminated with short processes. Genital styles (Fig. 4f,g) symmetrical, in profile long, apical half more wide than basal half, lateral margin at middle notched, forming small processes, with numerous hairs dorsally and laterally. Medioventral process of pygofer (Fig. 4j) broadly developed, apical margin slightly concave at middle, process with numerous hairs.

Material examined. 4 males, 5 females, Kwangnung, Gyeonggi-do, Korea, 13.viii.1994, Y. J. Kwon.

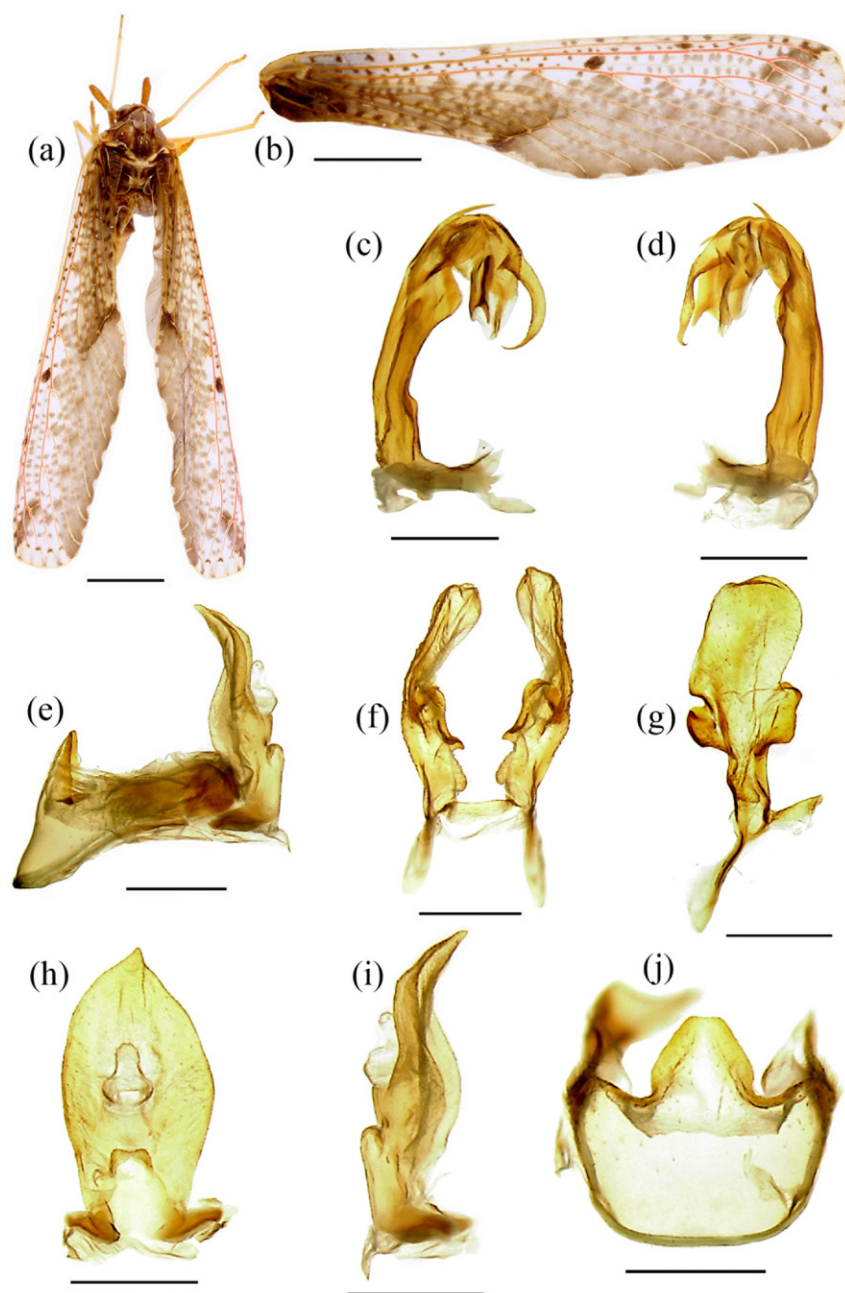


Figure 4 *Shirakiana infumata* (Matsumura). (a) Dorsal habitus; (b) forewing; (c) aedeagus (right lateral view); (d) ditto (left lateral view); (e) male genital block with pygofer and anal segment (lateral view); (f) genital styles (latero-ventral view); (g) ditto (dorsal view); (h) anal segment (dorsal view); (i) ditto (lateral view); (j) pygofer (ventral view). Scale bars (a, b) 2.0 mm; (c–j) 0.5 mm.

Distribution. Korea (new record), Taiwan.

Remarks. This species can be distinguished easily from any other species of Zoraidini by the morphological features of forewings (Second and third sectors of forewing without cross veins and posterior margin at near middles with three cross veins in an oblique line, with numerous scattered brown spots) and the shape of male genitalia. It is reported here for the first time in Korea.

Genus *Zoraida* Kirkaldy, 1900

Zoraida Kirkaldy, 1900: p. 242. Type species: *Thracia sinuosa* Kirkaldy, 1900.

Diagnosis. Head including eyes narrower than pronotum. Vertex small, narrowing forward, with angulate anterior margin. Frons not projecting forward before eyes, lateral carinae linear, a sulcus medially, widening to apex. Antennae

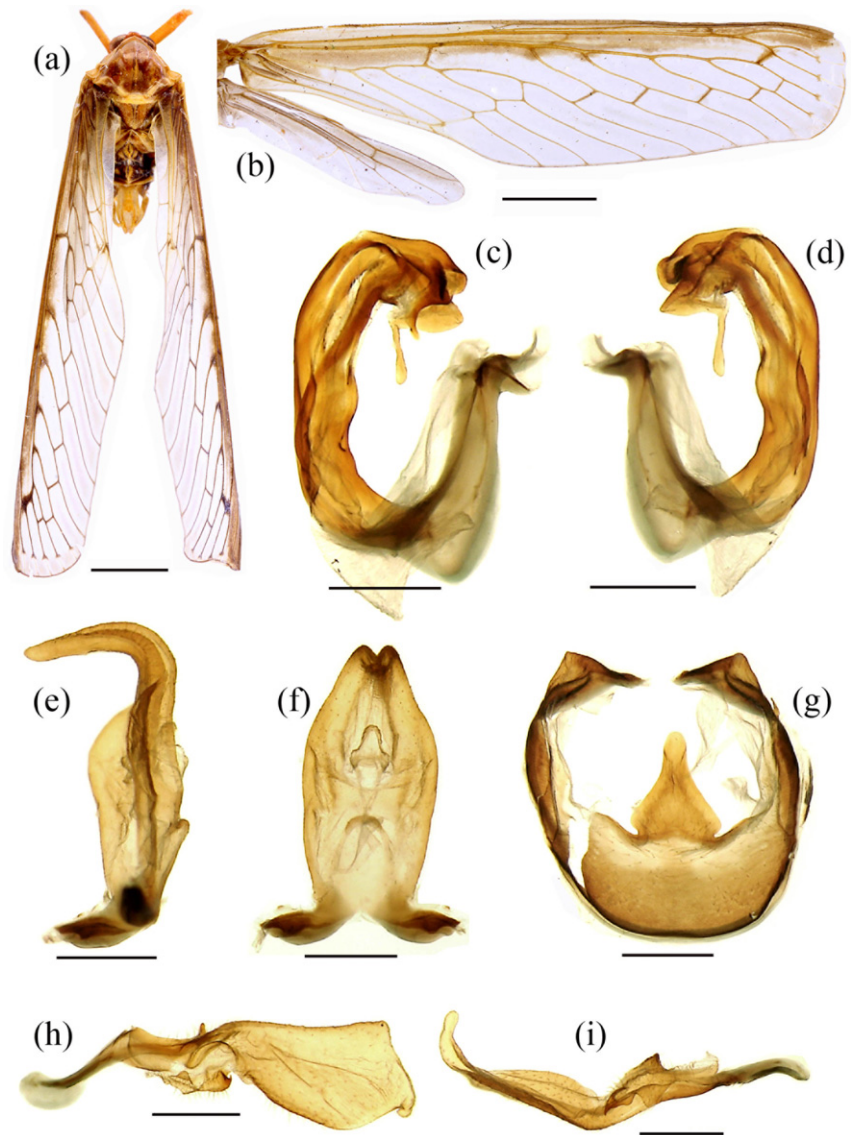


Figure 5 *Zoraida albicans* Anufriev. (a) Dorsal habitus; (b) forewing and hind wing; (c) aedeagus (right lateral view); (d) ditto (left lateral view); (e) anal segment (lateral view); (f) ditto (dorsal view); (g) pygofer (ventral view); (h) genital stylus (dorso-lateral view); (i) ditto (ventro-lateral view). Scale bars (a, b) 2.0 mm; (c–i) 0.5 mm.

long, cylindrical or flattened, flagellum attached subapically. Postclypeus with 3 sharp carinae. Eyes shallowly incised ventrally. Ocelli absent. Pronotum with hind margin deeply angulated medially, median carina distinct. Mesonotum swollen, with 3 carinae. First median sector of forewing branched, with 3–6 veins reaching to hind margin. Male genitalia with medioventral process.

Key to species of the genus *Zoraida* from Korea

1. Second antennal segment flat. Apex of forewings with row of V-shaped dark small spots on veins distant from terminal margin (Fig. 5b) *Z. albicans* Anufriev
 - Second antennal segment cylindrical. Apex of forewings without row of V-shaped dark spots on veins distant from terminal margin 2
2. Forewings with dark brown transverse fasciae originated from basal cell to posterior margin of claval end and then medially forwarded to apex like wave (Fig. 9c) *Z. kuwayamae* (Matsumura)
 - Forewings without dark brown transverse fasciae originated from basal cell to posterior margin of claval end and medially forwarded to apex like wave 3
3. Body length (including forewings) small (11–12 mm); forewing 4.7 times longer than widest part; aedeagus with a longer process of flagellum that curve at middle and apex *Z. koannania* Matsumura
 - Body length (including forewings) comparatively large (15–18 mm); forewing 4.5–4.6 times longer than widest part; aedeagus with a longer process of flagellum that almost straight, not curved 4

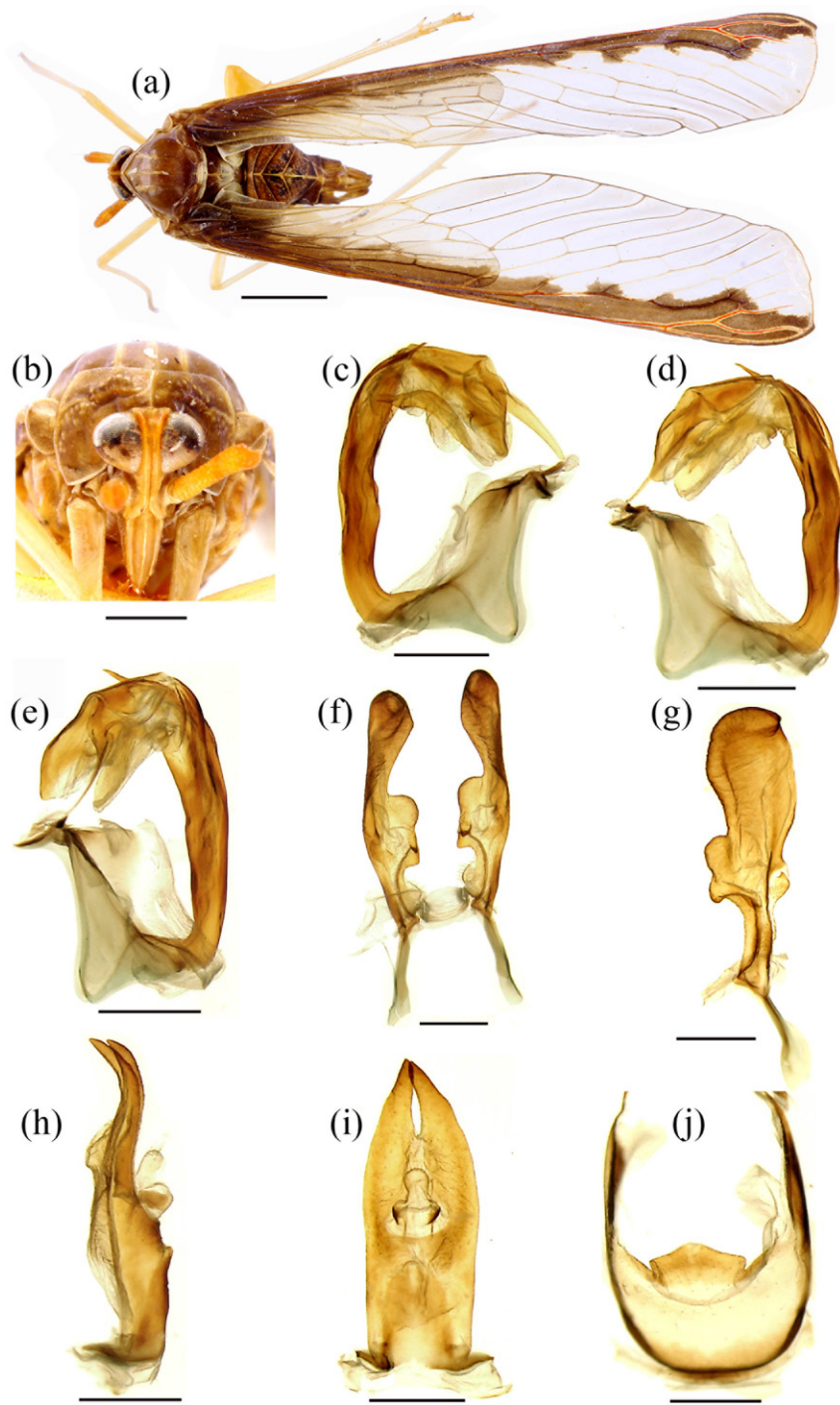


Figure 6 *Zoraida horishana* Matsumura. (a) Dorsal habitus; (b) frons and clypeus; (c) aedeagus (right lateral view); (d) ditto (left lateral view); (e) ditto (left latero-ventral view); (f) genital styles (latero-ventral view); (g) ditto (dorsal view); (h) anal segment (lateral view); (i) ditto (dorsal view); (j) pygofer (ventral view). Scale bars (a) 2.0 mm; (b) 1.0 mm; (c–j) 0.5 mm.

4. Forewings with slightly undulated posterior margin of dark brown stripe (Fig. 6a); dorsolateral margin of genital styles (Fig. 6g) with lobe like process at middle; aedeagus (Fig. 6c–e) with three spinose processes, one at apex of aedeagus shaft, another two from flagellum
*Z. horishana* Matsumura

– Forewings with brown stripe, posterior margin not undulated (Fig. 7c); dorsolateral margin of genital styles (Fig. 7g) incised as V-shaped at middle; aedeagus (Fig. 7d,e) with one long spinose process at flagellum
*Z. hubeiensis* Chou *et* Huang

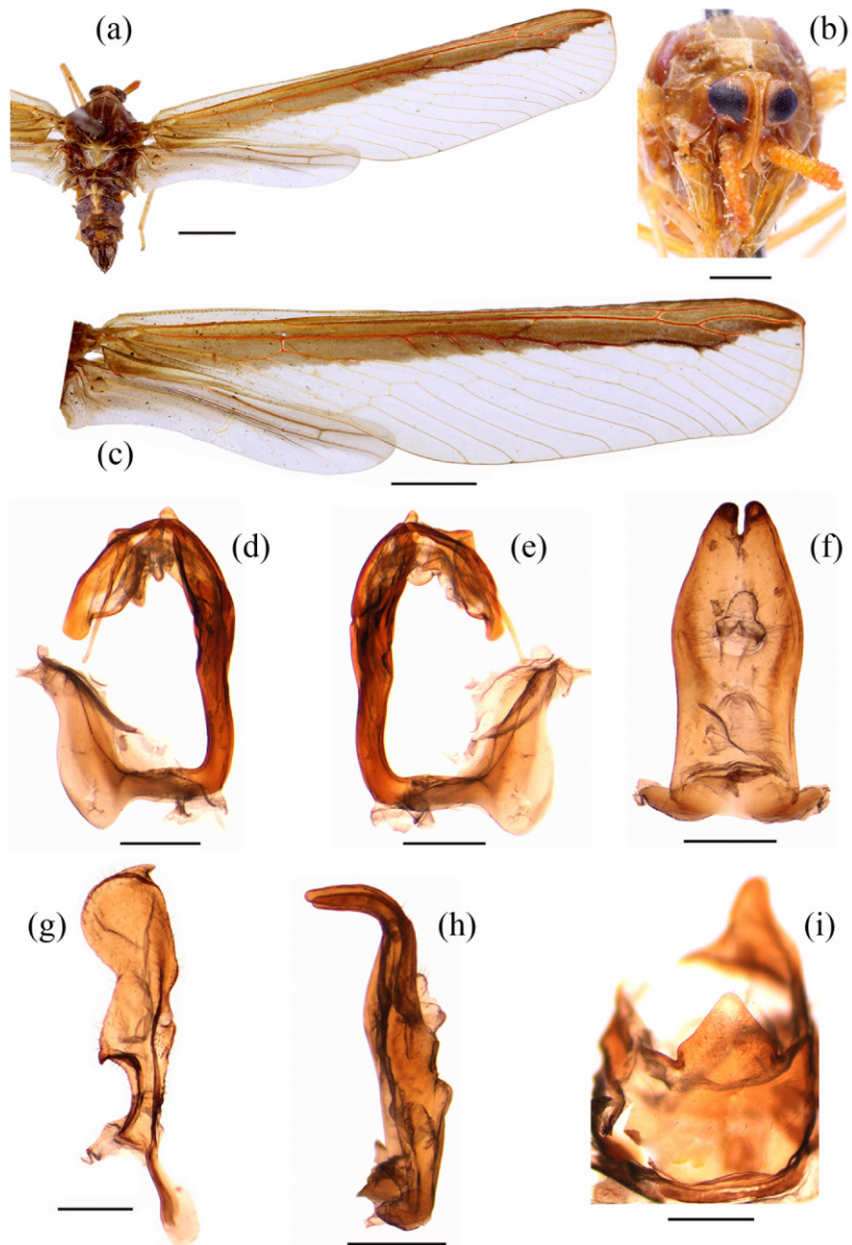


Figure 7 *Zoraida hubeiensis* Chou et Huang. (a) Dorsal habitus; (b) frons and clypeus; (c) forewing and hind wing; (d) aedeagus (left lateral view); (e) ditto (right lateral view); (f) anal segment (dorsal view); (g) genital stylus (dorso-lateral view); (h) anal segment (lateral view); (i) pygofer (ventral view). Scale bars (a, c) 2.0 mm; (b) 1.0 mm; (d–i) 0.5 mm.

***Zoraida albicans* Anufriev, 1968 (Fig. 5)**

Zoraida albicans Anufriev, 1968: pp. 135–137; Nast 1972: p. 78; Anufriev and Emeljanov 1988: p. 475; Kwon *et al.* 1994: p. 93; Kwon and Huh 2001: p. 315; Anufriev 2009: p. 68.

Description. Body length (including forewing): male 13.5–15.0 mm (N = 03), female 16.0–17.0 mm (N = 05); forewing length: male 12.0–13.0 mm (N = 03), female 14.0–15.5 (N = 05).

Coloration. General color pale brown (Fig. 5a). Vertex, frons and clypeus slightly reddish brown to brown. Eyes

dark brown. Antennae yellowish brown with slightly reddish shade. Pronotum pale yellow. Mesonotum brown with yellowish carinae, scutellum pale yellow. Forewings (Fig. 5b) hyaline to semihyaline, brown, with row of V-shaped dark small spots on veins near apex. Hind wings light brown with whitish powdering. Thorax with ventral area yellowish brown, dorsally brown. Legs yellow brown. Abdomen brown to dark brown.

Head and thorax. Head with eyes narrower than pronotum (1:1.48). Vertex small, narrowing forward, with angulate anterior margin. Frons not projecting forward before eyes, lateral carinae linear, a sulcus medially, widening to apex.

Clypeus tricarinate, median carina ridged and distinct. Frons slightly shorter than clypeus (1:1.2). Antennae long, second antennomere flat with numerous sensory pits, about 7 times longer than wide at widest part, flagellum originated from subapical point. Pronotum length behind eyes greater than median length (2:1). Mesonotum tricarinate, median carina distinctly terminated to posterior end, lateral carinae half of length distinctly terminated at the end. Forewings narrow, 4.1 times as long as widest part, apex of forewings with row of V-shaped small spots on veins distant from terminal margin. Hind wing moderately long and narrow, about 2.2 times shorter than forewing. Spinal formula of hind leg 5–5–5.

Male genitalia. Anal segment in lateral profile (Fig. 5e) long, wider at basal half, apical half slender and horizontally curved; in dorsal view (Fig. 5f), longer in middle line than widest part (2:1), anal style sets at middle. Aedeagus shaft curved; flagellum, right lateral view (Fig. 5c), with one short sclerotized process at apex, and left lateral view (Fig. 5d), with comparatively long sclerotized process at apex. Genital styles (Fig. 5h,i) angulate and acute at apex, hook-shaped wide lobe at near base. Medioventral process of pygofer (Fig. 5g) broadly developed, apical half narrow, concave, blunt at apex, dorsocaudal process asymmetrical.

Material examined. 2 females, Juwangsang, Gyeongsanbuk-do, Korea, 28. vii. 1984, Y. J. Kwon; 1 female, Yecheon, Gyeongsanbuk-do, Korea, 2.viii.2008; 1 female, same locality, 7.viii.2008; 1 male, Dongducheon, Gyeonggi-do, Korea, 22.viii.2006; 1 female, Seolaksan, Gangwon-do, 9.viii.1976; 2 males, Paegunsan, Jeollanam-do, 13.viii.1999, all same collector.

Distribution. Korea, Russia.

Host plant. Unknown.

***Zoraida horishana* Matsumura, 1914 (Fig. 6)**

Zoraida horishana Matsumura, 1914: p. 302; Doi 1933: p. 89; Nast 1972: p. 78; Lee and Kwon 1979: p. 960; Anufriev and Emeljanov 1988: p. 475; Morimoto 1989: p. 87; Yang and Wu 1993: pp. 49–51; Liang and Suwa 1998: p. 149; Kwon and Huh 1995: p. 41, Kwon and Huh 2001: pp. 315–316.

Description. Body length (including forewing): male 15.0–17.0 mm (N = 06), female 16.5–17.5 mm (N = 03); forewing length: male 14.0–15.5 mm (N = 06), female 15.0–16.0 (N = 03).

Coloration. General color brown to dark brown (Fig. 6a). Vertex and frons slightly reddish brown to brown, clypeus yellowish brown. Eyes dark brown to black. Antennae slightly reddish yellow. Pronotum, mesonotum brown with yellowish carinae, metanotum dark brown base with whitish end. Forewings (Fig. 6a) hyaline, with dark veins and castaneous longitudinal stripe along anterior margin occupying

whole subcostal cell. Hind wings also hyaline. Thorax yellowish brown to brown. Legs yellow brown. Abdomen brown to dark brown.

Head and thorax. Head with eyes narrower than pronotum (1:1.6). Vertex small, narrowing forward, with angulate anterior margin, vertex medially shorter than pronotum (1:3). Frons not projecting forward before eyes, lateral carinae linear, a sulcus medially, widening to apex. Clypeus tricarinate, distinct and equally elevated. Frons slightly shorter than clypeus (1:1.2). Antennae long, second antennomere cylindrical with numerous sensory pits, about 5 times longer than wide at widest part, flagellum originated from subapical point. Pronotum granulated medially, length behind eyes greater than median length (1.66:1). Mesonotum tricarinated. Forewings narrow, 4.48 times as long as widest part, with castaneous longitudinal stripe along anterior margin occupying whole subcostal cell, posterior margin of the stripe undulated, running behind anterior medial vein. Hind wing moderately long and narrow, about 2.14 times shorter than forewing. Spinal formula of hind leg 5–5–5.

Male genitalia. Anal segment in lateral profile (Fig. 6h) long, wider at more than half of length, near apical part slender and slightly curved; in dorsal view (Fig. 6i), longer in middle line than widest part (2:42), medially furcate at apex, anal style sets at middle. Aedeagus (Fig. 6c–e) shaft slightly curved with one sclerotized spinose process at apex; flagellum membranous with two blade-like long processes, one originated from base and another from near apex. Genital styles (Fig. 6f,g) with apical portion rounded, small finger shaped process at apex, ventrally incised at middle, dorsolateral margin with basal part somewhat membranous with small lobe-like process at its surface. Medioventral process of pygofer (Fig. 6j) broadly developed at base, apical half narrow, convex, blunt at apex.

Material examined. 1 male, Hwanghaksan, Gyeongsanbuk-do, Korea, 28. ix. 1991, Y. J. Kwon; 1 male, Hakkasan, Gyeongsanbuk-do, Korea, 21.viii.1998; 1 male, 2 females, Yecheon, Gyeongsanbuk-do, Korea, 7.viii.2008; 1 male, Gwangneung, Gyeonggi-do, Korea, 14.viii.1994; 1 female, Bukhansan B, Gyeonggi-do, Korea, 21.viii.2001; 1 male, Sinbulsan B, Gyeongsangnam-do, Korea, 30.vii.2003; 1 male, Cheamsan, Jeollanam-do, Korea, 28.vii.1999, all same collector.

Distribution. Korea, Japan, Taiwan, Russia.

Host plant. Unknown.

***Zoraida hubeiensis* Chou et Huang, 1985 (Fig. 7)**

Zoraida hubeiensis: Chou *et al.* 1985: p. 57.

Description. Body length (including forewing): male 16.5 mm (N = 01), female 18.0 mm (N = 01); forewing length: male 15.0 mm (N = 01), female 16.5 (N = 01).

Coloration. General color brown to dark brown (Fig. 7a). Vertex, frons and clypeus yellowish brown (Fig. 7b). Eyes dark brown to black. Antennae brownish yellow. Pronotum, mesonotum brown with yellowish carinae, metanotum yellowish white. Apex of rostrum black. Forewings (Fig. 7c) hyaline, with castaneous longitudinal stripe along anterior margin occupying subcostal cell to median longitudinal vein, subcostal area near base hyaline, longitudinal veins on stripe reddish. Hind wings also hyaline with light brownish shade along subcostal area. Thorax and abdomen brown to dark brown, dorsally yellowish lining on middle segments. Legs yellow brown. Genital segment brown to dark brown. Head and thorax. Head with eyes narrower than pronotum (1:1.7). Vertex small, narrowing forward, with angulate anterior margin, vertex medially shorter than pronotum (1:2.5). Frons not projecting forward before eyes, lateral carinae linear, a sulcus medially, widening to apex. Clypeus tricarinate, distinct and equally elevated. Frons slightly shorter than clypeus (1:1.27). Antennae long, second antennomere cylindrical with numerous sensory pits, about 6.3 times longer than wide at widest part, flagellum originated from subapical point. Pronotum granulated medially, length behind eyes greater than median length (1.6:1). Mesonotum tricarinate, lateral carinae half of length distinctly terminated at the end. Forewings narrow, 4.6 times as long as widest part, with castaneous longitudinal stripe along anterior margin occupying whole subcostal cell except basal part, posterior margin of the stripe almost straight, running behind anterior medial vein. Hind wing moderately long and narrow, about 2.2 times shorter than forewing. Spinal formula of hind leg 5–6(7)–5.

Male genitalia. Anal segment in lateral profile (Fig. 7h) long, wider at basal half, apical half slender and horizontally curved; in dorsal view (Fig. 7f), longer in middle line than widest part (1:2.36), anal style sets at near middle. Aedeagus (Fig. 7d,e) shaft slightly curved; flagellum, right lateral view, with one short finger-shaped lobe at base and another folded lobe overlapped, and in left lateral view, with a long, slender, sclerotized process extended to apex. Genital styles (Fig. 7g) angulate and beak-shaped at apex, dorsolateral margin of genital styles incised deeply at middle and base, ventral margin with a hook-like small process basally. Medioventral process of pygofer (Fig. 7i) broadly developed at base, apical half narrow, and blunt at apex, dorsocaudal process asymmetrical.

Material examined. 1 male, Dongducheon, Gyeonggi-do, Korea, 22.vii.2006, Y. J. Kwon; 1 female, Seolaksan, Gangwon-do, Korea, 21.viii.1974, all same collector.

Distribution. Korea (new record), China.

Host plant. Unknown.

Remarks. While studying the derbid specimens in the Insect Collection of the Kyungpook National University, Korea, we found that this species was erroneously treated as

Zoraida pterophoroides (Westwood, 1851) based on a misidentification. Therefore, previous record of *Zoraida pterophoroides* is removed from the list of Korean fauna, and the opportunity of reporting a new record, *Zoraida hubeiensis* Chou *et* Huang, 1985, has been taken in this paper.

***Zoraida koannania* Matsumura, 1914 (Fig. 8)**

Zoraida koannania Matsumura, 1914: p. 302; Schumacher 1915: p. 123; Yang and Wu 1993: p. 67; Liang and Suwa 1998: p. 150.

Description. Body length (including forewing): male 11.0 mm (N = 02), female 12.3 mm (N = 01); forewing length: male 10.0 mm (N = 02), female 11.0 (N = 01).

Coloration. General color brown to dark brown (Fig. 8a). Vertex, frons and clypeus yellowish brown (Fig. 8b). Eyes dark brown. Antennae brownish yellow with shade of red. Pronotum, mesonotum dark brown with yellow brown carinae, metanotum yellow. Rostrum golden yellow except apex, fuscous. Forewings hyaline, with dark brown costal stripe, longitudinal veins brown, apical four veins near apex with dark spots, cross vein dark brown. Hind wings also hyaline with brownish veins. Ventral aspect of thorax and abdomen yellow, dorsal aspect dark brown. Legs yellow brown. Genital segment yellowish brown.

Head and thorax. Head with eyes narrower than pronotum (1:1.63). Vertex small, narrowing forward, with angulate anterior margin, vertex medially shorter than pronotum (1:1.33). Frons not projecting forward before eyes, lateral carinae linear, a sulcus medially, widening to apex. Clypeus tricarinate, distinct and equally elevated. Frons slightly shorter than clypeus (1:1.3). Antennae long, second antennomere cylindrical with numerous sensory pits, about 4 times longer than wide at widest part, flagellum originated from subapical point. Pronotum granulated medially, length behind eyes greater than median length (2.5:1). Mesonotum tricarinate. Forewings narrow, 4.7 times as long as widest part, costal stripe with lower margin very slightly undulated. Hind wing moderately long and narrow, about 2.21 times shorter than forewing. Spinal formula of hind leg 5–5–5(6).

Male genitalia. Anal segment in lateral profile (Fig. 8e) long, wider at basal half, apical half slender and horizontally curved; in dorsal view (Fig. 8f), longer in middle line than widest part at base (1:1.73), anal style sets at near middle. Aedeagus (Fig. 8c,d) shaft gently curved; flagellum bilobed, right lateral view, with a short process at base, and in left lateral view, with a long, sclerotized process curved at middle and apex. Genital styles (Fig. 8i,j) pentagonal-shaped, wide at apical half, a hook-like process laterally near at base. Medioventral process of pygofer (Fig. 8g) broadly developed at middle, pentagonal-shaped and bluntly developed at apex.

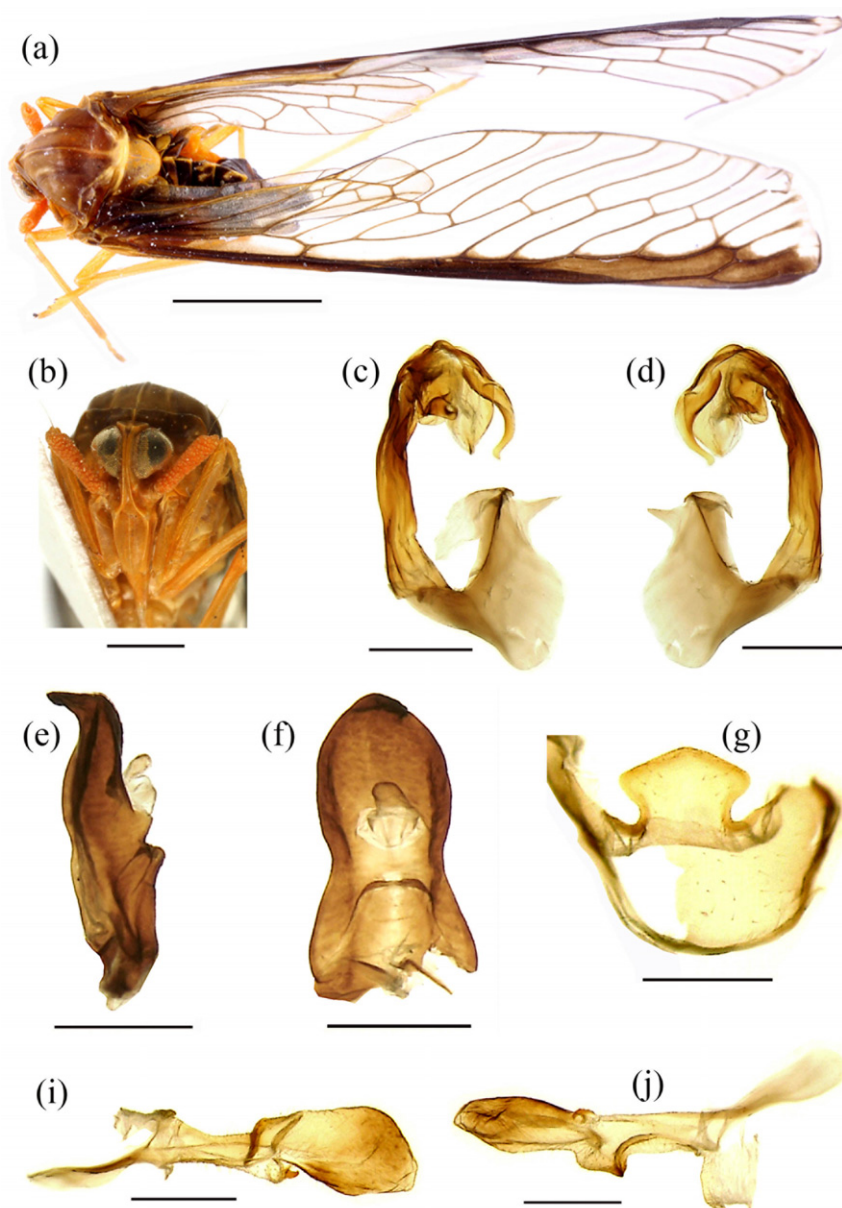


Figure 8 *Zoraida koannania* Matsumura. (a) Dorsal habitus; (b) frons and clypeus; (c) aedeagus (right lateral view); (d) ditto (left lateral view); (e) anal segment (lateral view); (f) ditto (dorsal view); (g) pygofer (ventral view); (i) genital stylus (dorso-lateral view); (j) ditto (ventro-lateral view). Scale bars (a) 2.0 mm; (b) 1.0 mm; (c–j) 0.5 mm.

Material examined. 2 males, Chilbo, Jeollabuk-do, Korea, 30.vii.2006, Y. J. Kwon; 1 female, Chongwansan, Jeollanam-do, Korea, 10.viii.1999, all same collector.

Distribution. Korea (new record), Taiwan.

Host plant. Unknown.

Remarks. This species is closely related to *Z. horishana*, but can be distinguished from the latter in: body somewhat smaller, metanotum not whitish, costal stripe with lower margin comparatively less undulated, genital styles and aedeagus shape different.

***Zoraida kuwayamae* (Matsumura, 1913) (Fig. 9)**

Thracia kuwayamae Matsumura, 1913: p. 63.

Zoraida kuwayamae Matsumura, 1914: p. 303; Nast 1972: p. 78; Liang and Suwa 1998: p. 150.

Description. Body length (including forewing): female 18.0 mm (N = 02); forewing length: female 16.5 (N = 02). Coloration. General color dark brown (Fig. 9a). Vertex, frons and clypeus brown. Eyes dark brown to black. Antennae dark brown with shade of red. Pronotum, mesonotum

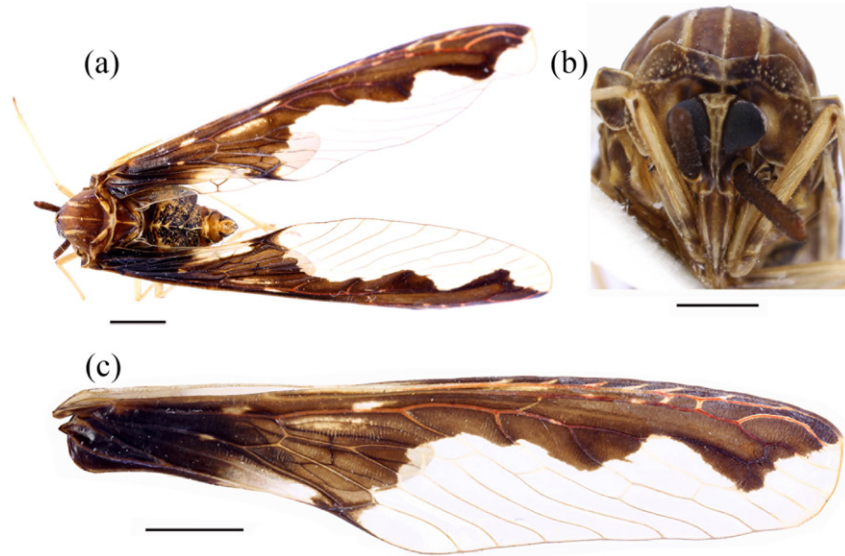


Figure 9 *Zoraida kuwayamae* (Matsumura). (a) Dorsal habitus; (b) frons and clypeus; (c) forewing. Scale bar (a, c) 2.0 mm; (b) 1.0 mm.

dark brown with yellow brown carinae, metanotum also dark brown with yellow midline. Forewings with dark brown costal stripe, longitudinal veins brown and tinge with red. Hind wings hyaline with brownish veins. Legs yellow brown. Ventral and dorsal aspect of thorax and abdomen dark brown. Genital segment yellowish brown.

Head and thorax. Head with eyes narrower than pronotum (1:1.8). Vertex small, narrowing forward, with angulate anterior margin, vertex medially shorter than pronotum (1:2.5). Frons not projecting forward before eyes, lateral carinae linear, a sulcus medially, widening to apex. Clypeus tricarinate, distinct and equally elevated. Frons (Fig. 9b) slightly shorter than clypeus (1:1.1). Antennae long, second antennomere cylindrical with numerous sensory pits, about 5.7 times longer than wide at widest part, flagellum originated from subapical point. Pronotum granulated medially, length behind eyes greater than median length (2.3:1). Mesonotum tricarinate. Forewings (Fig. 9c) narrow, 4.4 times as long as widest part, costal stripe originated from basal cell to posterior margin of claval end and then medially forwarded to apex, strongly undulated. Hind wing moderately long and narrow, about 2.2 times shorter than forewing. Spinal formula of hind leg 5–6–5(6).

Material examined. 1 female, Tonggosan, Gyeongsanbuk-do, Korea, 13.viii.1992, Y. J. Kwon; 1 female, Yecheon, Gyeongsanbuk-do, Korea, 2.viii.2008, all same collector.

Distribution. Korea (new record), Japan.

Host plant. Unknown.

Remarks. Although the male of this species was unavailable in our investigation, it can be easily distinguished from other species of this genus by the forewing pattern (Forewings with dark brown transverse fasciae originated from

basal cell to posterior margin of claval end and then medially forwarded to apex like wave). It is also recorded for the first time in Korea.

Acknowledgments

We are grateful to the reviewers for their valuable comments and helpful suggestions to improve the manuscript. This research was supported by Kyungpook National University Research Fund, 2012.

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