

New Records of Five Ennomine Moths (Lepidoptera: Geometridae; Ennominae) from Korea

Sei-Woong Choi^{1,*}, Sung-Soo Kim²

¹Department of Environmental Education, Mokpo National University, Muan 534-729, Korea

²Research Institute for East Asian Environment and Biology, Seoul 134-852, Korea

ABSTRACT

The subfamily Ennominae is one of the most species-rich taxa of Geometridae that include more than 9,700 species worldwide and over 280 species in South Korea. Herein, we present the first report of five species of Ennominae. *Abraxas flavisinuata* can be characterized by the white wings, a thick black postmedial line that is medially and dorsally broken with an orange band, large rounded black discal dots on the forewing, and a black dotted postmedial line on the hindwing. *Lomographa claripennis* can be characterized by the whitish wings, the black undulating postmedial line as well as the minute blackish discal dot on the forewing, and the black undulating postmedial line with a minute black discal dot on the hindwing. *Arichanna tetrica* can be characterized by the grayish forewings, thick black transverse ante- and postmedial lines, a large blackish discal dot, whitish apical streak on the forewing, and scattered black dots on the whitish hindwing. *Apocleora rimosa* can be characterized by the brown ground color of the fore- and hindwings, the black slanted ante- and postmedial lines of the forewing, and two black medial lines on the hindwing. *Ouraapteryx japonica* can be characterized by the white wings, the dark brown transverse ante- and postmedial lines with a long discal dot on the forewing, and the dark brownish transverse antemedial line as well as a termen that has a sharp white tail with one large dark reddish dot and one small black dot on the hindwing.

Keywords: taxonomy, Geometridae, Lepidoptera, Ennominae, Korea

INTRODUCTION

Ennominae, slender-bodied moths with a medium to large wingspan, is the largest subfamily of the Geometridae and contains over 9,700 species worldwide. The monophyly of the group is well defined (Sihvonen et al., 2011) and can be identified by the absence of an M_2 vein as a tubular vein in the hindwing (Minet and Scoble, 1999). In South Korea, the subfamily includes about 280 species (Kim et al., 2001; Choi, 2006). Herein we describe five species of Ennominae for the first time: *Abraxas flavisinuata* Warren, *Lomographa claripennis* Inoue, *Apocleora rimosa* (Butler), *Arichanna tetrica* (Butler), and *Ouraapteryx japonica* Inoue.

Examination of adults, including the male and female genitalia, is in reference to Scoble (1992). Abbreviations are as follows: TL, type locality; GW, Gangwon-do; GG, Gyunggi-do; GN, Gyungsangnam-do; JB, Jeollabuk-do; and JN, Jeollanam-do.

SYSTEMATIC ACCOUNTS

Order Lepidoptera Linnaeus, 1758
Family Geometridae Stephens, 1829
Subfamily Ennominae Duponchel, 1845
Genus *Abraxas* Leach, [1815] 1830

¹**Abraxas flavisinuata* Warren (Figs. 1A, 3A)

Abraxas flavisinuata Warren, 1894: 420. TL: Japan.

Abraxas sugitanii Inoue, 1942: 14, Pl. 4, figs. 11, 12; Pl. 6, fig. 1. TL: Japan, Kyoto Prefecture, Mt Kurama; Osaka Prefecture, Mino.

Material examined. 1 ♀, Korea, JB, Namwon-gun, Sanae-myon, Mt. Jirisan, 35°22'33"N, 127°34'57"E, 518 m, 4 Sep 2010, Choi SW.

Diagnosis. This species can be characterized by the white ground color of the fore- and hindwings, a thick black post-

Korean name: ¹*짧은띠얼룩가지나방 (신칭)

© This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/3.0/>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

***To whom correspondence should be addressed**

Tel: 82-61-450-2783, Fax: 82-61-450-2789
E-mail: choisw@mokpo.ac.kr

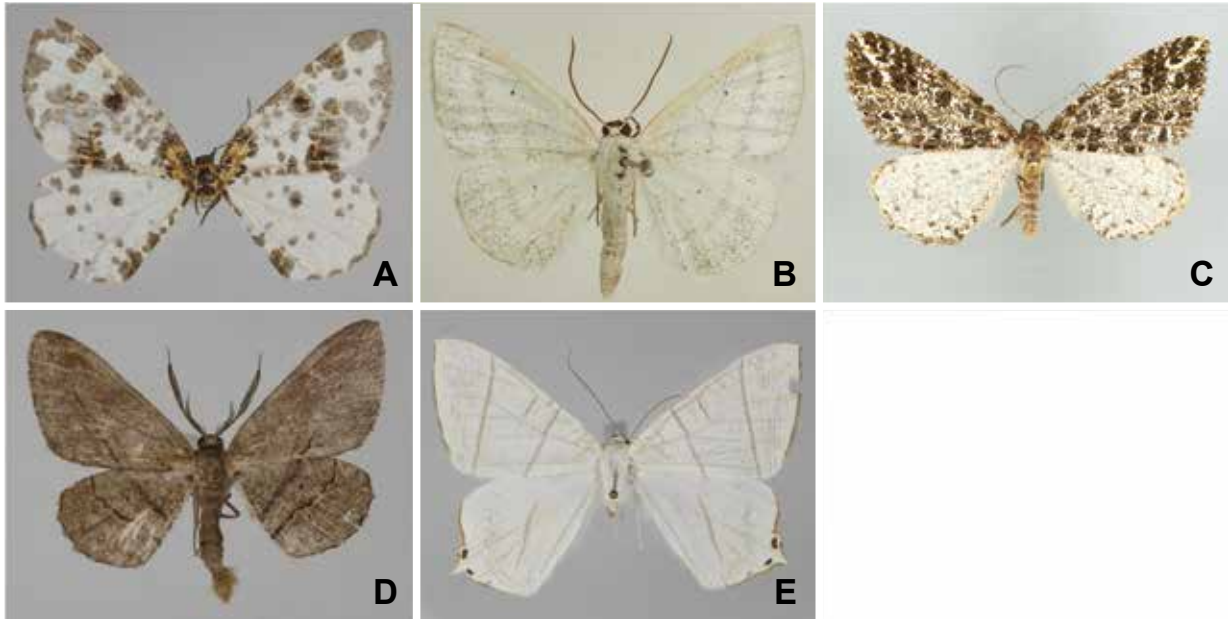


Fig. 1. Adults. A, *Abraxas flavisinuata* Warren; B, *Lomographa claripennis* Inoue; C, *Arichanna tetrica* (Butler); D, *Apocleora rimosa* (Butler); E, *Ourapteryx japonica* Inoue.

medial line that is medially and dorsally broken with an orange band, a large rounded black discal dots on the forewing, and a black dotted postmedial line on the hindwing. This species is similar to *Abraxas grossulariata*, but can be distinguished by the medially broken postmedial line, medially triangular-shaped marking on the termen of the forewing, and largely whitish postmedial line on the hindwing. The female genitalia can be identified by the large, semi-circular lamella postvaginalis; a strongly sclerotized ductus bursae, and ovate corpus bursae bearing a large stellate signum.

Description. Wingspan 38 mm. Antennae filiform; frons slender and black; labial palpi short, less than the eye diameter, do not project beyond frons. Body covered with yellowish scales. Forewing: white, basal part yellowish with black dentate basal line; brown antemedial line, costally and medially scattered dots; postmedial line thick, dark brown, dotted, medially absent, dorsally with yellow band; discal dot large, rounded, black inside and orange outside; termen white with black triangular marking medially. Hindwing: whitish, antemedian and postmedian with a few dark brown dots, postmedian dorsally with yellow marking. **Male genitalia:** Unavailable. **Female genitalia:** Papillae anales simple, not projected; apophyses posteriores almost twice the length of apophyses anteriores; lamella postvaginalis large, semi-circular; antrum broad; ductus bursae short, strongly

sclerotized; corpus bursae ovate with large stellate signum.

Distribution. Korea, Japan.

Remarks. Nine species of *Abraxas* are distributed throughout South Korea, including the newly recorded *Abraxas flavisinuata* (Kim et al., 2001).

Genus *Lomographa* Hübner, [1825] 1816

¹Lomographa claripennis* Inoue (Figs. 1B, 2A–C, 3B)**
Lomographa claripennis Inoue, 1977: 322, fig. 54. TL: Japan, Shizuoka Prefecture, Odaru Spa, Nashimoto.

Material examined. Korea: 3♂ 1♀, GG, Gwangju, Mt. Taewhasan, 37°18'N, 127°18'E, 150 m, 24 Jun 2006, Choi SW; 2♀, GN, Hadong-gun, Hwagae-myon, Uisin, Mt. Jirisan, 35°18'21"N, 127°38'11"E, 702 m, 21 Jun 2009, 13 Jun 2013, Choi SW.

Diagnosis. This species can be characterized by the whitish ground color of the fore- and hindwings, the black undulating postmedial line as well as the minute blackish discal dot on the forewing, and the black undulating postmedial line with a minute black discal dot on the hindwing. This species is similar to *Lomographa lungtanensis*, but can be distinguished by the broad, undulating postmedial line of the fore- and hindwings. The male genitalia can be identified by a long, bent uncus; the digitate socii; the long, slender

Korean name: ¹*붉은줄흰가지나방 (신칭)

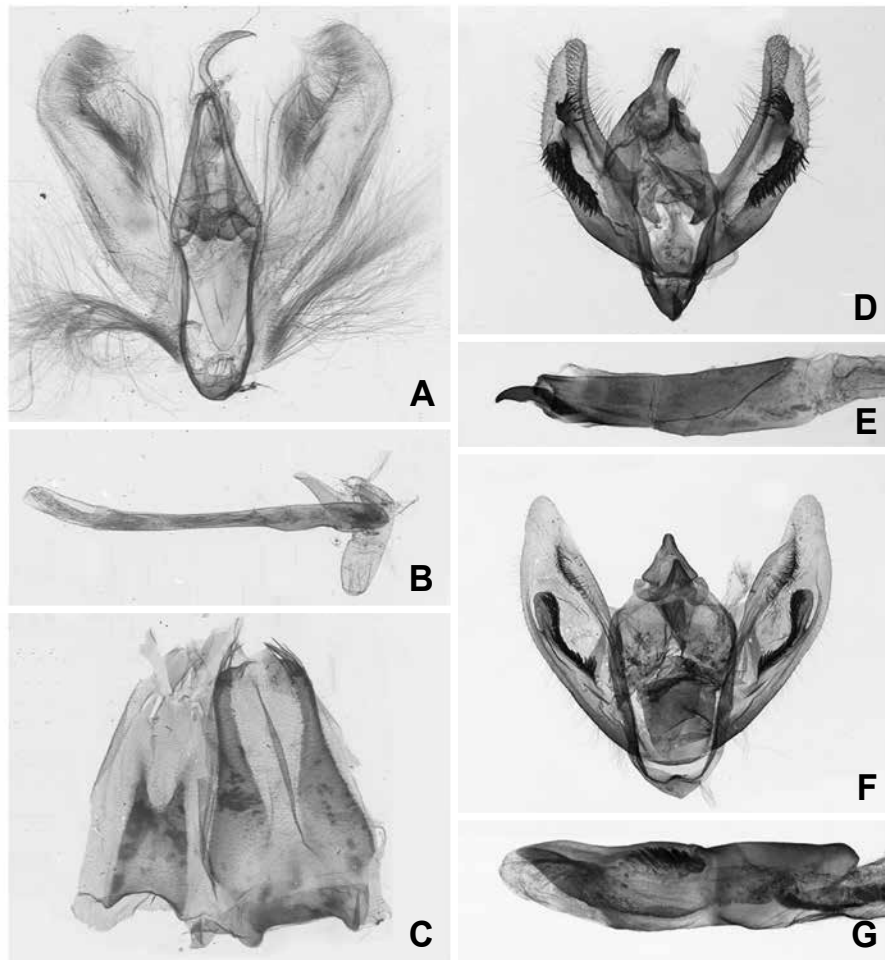


Fig. 2. Male abdomen and genitalia. A, D, E, Genital capsule; B, F, G, Aedeagus; C, Male 8th abdomen. A–C, *Lomographa claripennis* Inoue; D, E, *Arichanna tetrica* (Butler); F, G, *Apocleora rimosa* (Butler).

tegumen and vinculum; the tongue-shaped juxta, the rounded saccus; the long, slender valva with medially expanded costa; and the long, slender aedeagus that lacks a cornutus. The male genitalia of *Lomographa claripennis* is similar to that of *Lomographa nivea*, but can be distinguished by the relatively short uncus, a largely expanded costa; and a long, thin aedeagus. The female genitalia can be identified by a narrow and membranous antrum, a very long and thin ductus bursae, and small ovate corpus bursae bearing minute spicules.

Description. Wingspan 29 mm. Antennae filiform: frons broad, dark brown, and ochreous; labial palpi yellow, short, almost equal to the eye diameter, projecting barely beyond frons. Body covered with white scales. Forewing: white with black scattered dots; basal and medial portion with black scattered scales; postmedial line light black, costally weakly projected, undulating; discal dot small, black. Hind-

wing: whitish with blackish scattered dots; postmedial light black, medially weakly bent; discal dot small, black. **Male genitalia:** Uncus long, bent, apically pointed; socii digitate; gnathos simple, triangular; tegumen almost equal to the length of vinculum; transtilla thick; juxta long and tongue-shaped; saccus short and medially rounded. Valva long, slender, membranous, and hairy; costa medially expanded, dorsally hairy; sacculus slender and weakly projected medially. Aedeagus very long, thin, rod-shaped; cornutus absent. **Female genitalia:** Papillae anales simple, weakly sclerotized, hairy; apophyses posteriores almost twice the length of apophyses anteriores; antrum narrow, membranous; ductus bursae very long, almost three times the diameter of corpus bursae, membranous; corpus bursae ovate, anteriorly filled with minute spicules.

Distribution. Korea, Taiwan, Japan.

Remarks. This species is bivoltine, flying from March to

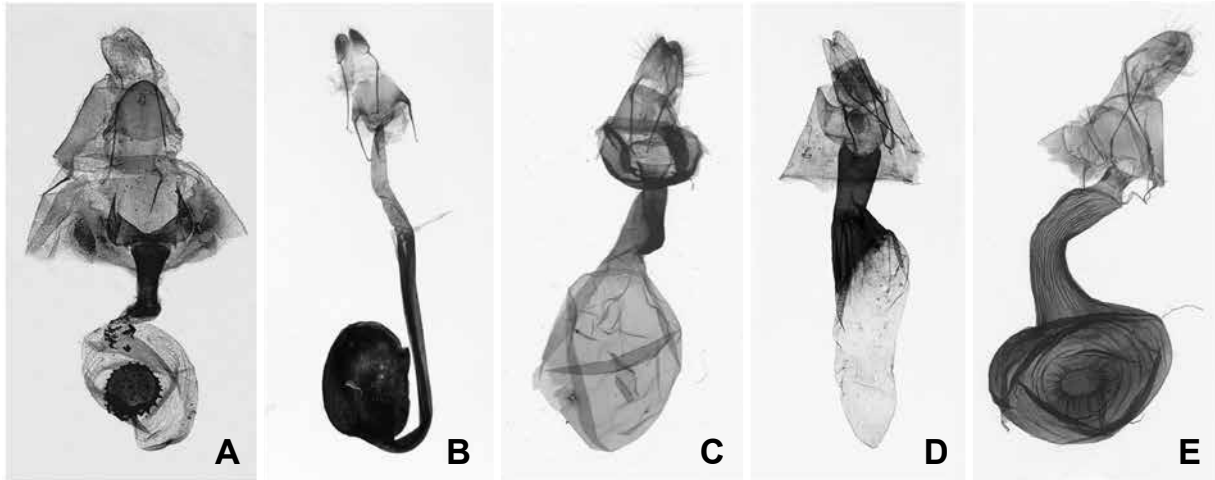


Fig. 3. Female genitalia. A, *Abraxas flavisinuata* Warren; B, *Lomographa claripennis* Inoue; C, *Arichanna tetrica* (Butler); D, *Apocleora rimosa* (Butler); E, *Ourapteryx japonica* Inoue.

May and from July to August. Eight species of *Lomographa* are distributed throughout South Korea, including this newly record *Lomographa claripennis* (Kim et al., 2001).

Genus *Arichanna* Moore, 1868

^{1*} *Arichanna tetrica* (Butler) (Figs. 1C, 2D, E, 3C)

Cidaria tetrica Butler, 1878: 451. TL: Japan, Yokohama.

Arichanna filipjevi Moltrecht, 1933: 182, fig. 2. TL: Russia, Ussuri, Sedanka, near Vladivostok.

Material examined. 1♂ 1♀, Korea, GW, Youngweol-gun, Sesong, Mt. Hambacksan, 5 May 2012, Kim SS.

Diagnosis. This species can be characterized by the grayish ground color of the forewings, thick black transverse ante- and postmedial lines, large blackish discal dot, whitish apical streak on the forewing, and scattered black dots on the whitish hindwing. This species is similar to *Arichanna albomacularia*, but can be distinguished by the thick black transverse ante- and postmedial lines as well as a white line-shaped apical streak on the forewing with a medially projected postmedial line on the forewing. The male genitalia can be identified by a bifid uncus, a strongly projected gnathos; the long, slender valva with long, sclerotized costa, and the strongly projected harpe and saccular arm with spinular processes as well as one strongly sclerotized beak-shaped cornutus of the vesica. The female genitalia can be identified by the partially sclerotized ductus bursae and long ovate corpus bursae with a star-shaped signum.

Description. Wingspan 32 mm. Antennae filiform for both

sexes: frons broad, covered with dark ochreous and brown scales; labial palpi short, brown, length almost equal to the eye diameter, projecting barely beyond frons. Body covered with dark brown and white scales. Forewing: white with black scattered scales; basal part black, slanted; thick, black antemedial line bordered with white line; thick, black postmedial line bordered with white line; central fascia broad; discal dot large, black; subtermen with whitish transverse line, termen black with white apical streak. Hindwing: whitish with black dots; black postmedial line, medially projected; large light black discal dot. **Male genitalia:** Uncus slender, apically bifid; socii with long hairs; gnathos long strongly projected; tegumen length almost equal to that of vinculum; juxta simple, weakly sclerotized; saccus long, medially projected. Valva long, slender, weakly sclerotized; costa slender, sclerotized; sacculus slender and sclerotized with long sclerotized band-shaped process densely covered with long spines; harpe short sclerotized process with long spines. Aedeagus long, rod-shaped; cornutus shaped as long saw-like process. **Female genitalia:** Papillae anales projected, weakly sclerotized, hairy; apophyses posteriores almost three times the length of apophyses anteriores; lamella antevaginalis semi-rounded, sclerotized band; antrum broad; ductus bursae long, partially sclerotized, weakly tapered posteriorly; corpus bursae long and ovate anteriorly with small star-shaped signum.

Distribution. Korea, Japan, Russia (Saghalien, Southeast).

Remarks. This species is univoltine, spring species, flying from April to June in Japan (Sato, 2011). Foodplant is *Viburnum frucatum* (Caprifoliaceae) (Sato, 2011). Three

Korean name: ^{1*}검은무늬가지나방 (신칭)

species of *Arichanna* are distributed throughout Korea, including this newly record *A. tetrica* (Kim et al., 2001).

Genus *Apocleora* Wehrli, 1943

¹* *Apocleora rimosa* (Butler) (Figs. 1D, 2F, G, 3D)

Boarmia rimosa Butler, 1879: 372. TL: Japan, Yokohama.

Material examined. Korea: 3♂ 1♀, GN, Geoje-gun, Dongboo-myon, Guhyun-ri, 27 Jul 2012, Kim SS; 1♂, JN, Goheung-gun, Bongnae-myon, Isl. Oenaro-do, 34°27'50"N, 127°28'06"E, 74 m, 4 Jul 2007, Choi SW.

Diagnosis. This species can be characterized by the brown ground color of the fore- and hindwings, the black slanted ante- and postmedial lines of the forewing, and two black medial lines on the hindwing. This species is similar to *Cleora repulsaria*, but can be distinguished by the strongly slanted, transverse ante- and postmedial lines of the forewing along with the small, blackish discal dot on the hindwing. The male genitalia can be identified by the short, strongly tapered uncus; the large, cone-shaped gnathos; the broad juxta, the medially projected saccus; the long, slender valva with a long, sclerotized linear process of the dorsal portion of the costa; the long button-shaped sclerotized process of the sacculus, and minute spinular cornuti of the vesica. The female genitalia can be identified by a large, semi-circular antrum; the short, strongly sclerotized ductus bursae; and the large tubular corpus bursae with posterior sclerotization.

Description. Wingspan 34 mm. Antennae bipectinate in males and filiform in females: frons slender, dark brown; labial palpi dark brown, moderate in length, almost equal to the eye diameter and barely projected beyond frons. Body covered with dark brown scales. Forewing: brownish with black basal line and costally projected; antemedial line blackish, medially and strongly invaginated; black postmedial line, transverse, and costally projected. Hindwing: brown with dark brown transverse medial line, postmedial line black and weakly undulating, small black discal dot. **Male genitalia:** Uncus short, strongly tapered with rounded apex; socii absent; gnathos well-developed and triangular; tegumen length almost equal to that of vinculum; juxta large body; saccus short and medially projected. Valva long and slender with tapered apex; costa slender, sclerotized, distodorsally with linear sclerotized patch and hairs; sacculus long, sclerotized, distally long button-shaped process covered with short and long spines. Aedeagus long and rod-shaped, cornuti in the form of minute spinular processes. **Female genitalia:** Papillae anales weakly projected and

hairy; apophyses posteriores almost 1.5 times the length of apophyses anteriores; antrum broad and semi-circular; ductus bursae short and strongly sclerotized; corpus bursae long, tubular, posterior partially sclerotized with striations.

Distribution. Korea, Japan.

Remarks. This species was only known in Japan and this record is first one outside of Japan. Its food plant is *Chamaecyparis obtusa* (Curpessaceae) (Sato, 2011). One species of *Apocleora* is distributed in Korea.

Genus *Ourapteryx* Leach, 1814

²* *Ourapteryx japonica* Inoue (Figs. 1E, 3E)

Ourapteryx japonica Inoue, 1993: 87, figs. 7, 8, 14, 15, 17, 18, 20, 21. TL: Japan, Yamanashi Prefecture, Enzan, Yanagisawa Toge (or Pass), 1,500 m.

Material examined. Korea: 1♀, GG, Gwangju, Mt. Tae-whasan, 37°18'N, 127°18'E, 150 m, 24 Jun 2006, Choi SW; 1♀, JN, Muan-gun, Mongtan-myon, Dalsan-ri, 34°54'55"N, 126°27'19"E, 154 m, 24 Jun 2007, Choi SW.

Diagnosis. This species can be characterized by the white ground color of the fore- and hindwings, the dark brown transverse ante- and postmedial lines with a long discal dot on the forewing, and the dark brownish transverse antemedial line as well as a termen that has a sharp white tail with one large dark reddish dot and one small black dot on the hindwing. This species is similar to *Ourapteryx koreana*, but can be distinguished by the weakly medially bent and less slanted antemedial line of the forewing. The female genitalia can be identified by the long, medially bent ductus bursae with parallel striations and large ovate corpus bursae with a large stellate signum. The female genitalia of *Ourapteryx japonica* is similar to that of *Ourapteryx koreana*, but can be distinguished by the shape of the ductus bursae that is anteriorly strongly tapered and the large stellate signum of the corpus bursae.

Description. Wingspan 53 mm. Antennae filiform: frons broad, light yellow; yellow labial palpi, moderate, almost 1.5 times the eye diameter, upturned well beyond frons. Body covered with white scales. Forewing: white; brown, slanted antemedial line; brown, slanted postmedial line; broad central fascia with costally short, transverse brown lines; white termen with short brown lines. Hindwing: whitish; brown, strongly slanted antemedial line; termen with short tail containing one large red dot and one small black dot. **Male genitalia:** Unavailable. **Female genitalia:** Simple papillae anales, weakly sclerotized, hairy, and rounded apex; very long apophyses posteriores almost six times the length of

apophyses anteriores; narrow antrum; ductus bursae long, medially bent, anteriorly strongly tapered, posteriorly with colliculum; corpus bursae large, ovate, signum large, stellate.

Distribution. Korea, Japan.

Remarks. Food plants are *Larix kaempferi*, *Rubus microphyllus* var. *subcrataegifolius* in Japan (Sato, 2011). Five species of *Ourapteryx* are distributed throughout Korea, including this newly record *O. japonica* (Kim et al., 2001).

ACKNOWLEDGMENTS

This study was supported by a grant from the National Institute of Biological Resources (NIBR), funded by the Ministry of Environment (MOE) of the Republic of Korea (NIBR 201401203).

REFERENCES

- Bulter AG, 1879. Descriptions of new species of Lepidoptera from Japan. *Annals and Magazine of Natural History*, 4: 349-374.
- Butler AG, 1878. Descriptions of new species of Heterocera from Japan. *Annals and Magazine of Natural History*, 1: 440-452.
- Choi SW, 2006. Patterns of species description and species richness of geometrid moths (Lepidoptera: Geometridae) on the Korean peninsula. *Zoological Science*, 23:155-160.
- Inoue H, 1942. New and unrecorded Geometriae from Japan. *Transactions of the Kansai Entomological Society*, 12:8-23.
- Inoue H, 1977. Catalogue of the Geometridae of Japan (Lepidoptera). *Bulletin of the Faculty of Domestic Science, Otsuma Women's University*, 13:1-346.
- Inoue H, 1993. On *Ourapteryx persica*-complex, with descriptions of three new species (Geometridae, Ennominae). *Tyo Ga*, 44:81-88.
- Kim SS, Beljaev EA, Oh SH, 2001. Illustrated catalogue of Geometridae in Korea. Korea Research Institute of Bioscience and Biotechnology, Daejeon and Center for Insect Systematics, Chuncheon, pp. 1-278.
- Minet J, Scoble MJ, 1999. The Drepanoid/Geometroid assemblage. In: *Lepidoptera, moths and butterflies. Handbook of Zoology, Vol. IV. Arthropoda: Insecta* (Ed., Kristensen NP). Walter de Gruyter, Berlin, pp. 301-320.
- Moltrecht AK, 1933. Diagnosis of new species of Lepidoptera from Ussuri Territory. *Entomologicheskoe Obozrenie*, 25: 182-183.
- Sato R, 2011. Ennominae. In: *The standard of moths in Japan 1* (Ed., Kishida Y). Gakken Education Publishing, Tokyo, pp. 132-200.
- Scoble MJ, 1992. *The Lepidoptera: form, function and diversity*. Oxford University Press, Oxford, pp. 1-404.
- Sihvonen P, Mutanen M, Kaila L, Brehm G, Hausmann A, Staude HS, 2011. Comprehensive molecular sampling yields a robust phylogeny for geometrid moths (Lepidoptera: Geometridae). *PLoS One*, 6:e20356.
- Warren W, 1894. New genera and species of Geometridae. *Novitates Zoologicae*, 1:366-466.

Received December 22, 2014
Revised April 15, 2015
Accepted April 15, 2015