



## A new and an unrecorded species of the family Psychidae (Lepidoptera) from Korea, with an annotated catalogue

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### ABSTRACT

In this study, a total of nine species of the family Psychidae were recognised from Korea. Among them, *Psyche yeongwolensis* sp. nov. is described as new to science. Also, a species, *Proutia maculatella* Saigusa et Sugimoto, is reported for the first time from Korea. All available material were dissected and illustrated. Also, an annotated catalogue of the family Psychidae from Korea is provided.

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### KEYWORDS

Lepidoptera; Psychidae; new species; new record; Korea


## Introduction

Family Psychidae Boisduval, 1829, so-called bag-worm, is a relatively small group, with less than 1350 described species under 241 genera worldwide (Sobczyk 2011). This family has been systematically placed in the superfamily Tineoidea of the order Lepidoptera, which shows close relationships with Lyonetiidae, Gracillariidae, and Tineidae (Davis and Robinson 1999; Sobczyk 2011). It has been poorly investigated in Korea with only seven known species (Park 1983; Byun et al. 1996, 2009). The family can be distinguished by external and genital characters, wing veins, and other taxonomic characters.

The larvae of the family usually make cases in unique shapes for each species. Most of them do not leave their cases during the larval stage (Park 1983; Holloway et al. 1987; Sugimoto 2009a, 2009b). In addition, males have wings and can fly, whereas females cannot fly as their wings have been reduced during the evolutionary process (Niitsu and Kobayashi 2008). This group of moths is characterised by opposite evolutionary directions between males and females in terms of wing development (Sauter and Hättenschwiler 1991).

In East Asia, a total of 32 species were known from Japan (Hirowatari et al. 2013), 14 species from China (Hua 2005), and 67 species from Russia (Lovtsova 2007), respectively.

In the study, a total of nine species were recognised from Korea, with a new species and a newly recorded species. The purpose of this study is to describe a new species and report a newly recorded species, with a catalogue of Korea, and also to keep updating

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our knowledge of Korean fauna of Psychidae by providing a catalogue of the family Psychidae from Korea.

## Materials and methods

Material examined for the present study are now deposited in the Systematic Entomology Laboratory, Hannam University (SELHNU), Daejeon, Korea. All available genitalia were made on slide glass with Euparal mountant. A Canon 550D camera (Canon, Japan) was used for taking pictures of adults. The digital images for external and genital characters were examined and made with a Pax cam (PAXcam™ Microscope Cameras Co., Chicago) attached to the microscope, Carl Zeiss Axio Imager A1 (Carl Zeiss Ltd., Cambridge).

## Results

Family **PSYCHIDAE** Boisduval, 1829  
**PSYCHIDAE** Boisduval, 1829, p 44.  
 Type genus: *Psyche* Schrank, 1801.

Psychidae exhibits different evolutionary directions between males and females as small or medium-sized moths (Holloway et al. 1987).

The head in the psychids is clothed with rough scales only in primitive genera such as *Ceratosticha*, *Diplodoma* and *Taleporia*, while in many of more specialised genera such as *Eumeta* it is clothed with more or less appressed scales (Saigusa 1961; Sugimoto and Saigusa 2004). The adult female's wings are reduced to brachypterous (micropterous) or are completely obsolete, while adult males have well-developed wings. The mouthparts of the males are in a series of reduction; some genera have all elements of Ditrysian mouthparts including galea (proboscis) and maxillary palpi, while in other genera such as *Eumeta* the mouthparts consist of only a small tubercle representing the labium. Female adults have vestigial mouthparts. The forewing of male psychids has or has not either the discal cell or the intercalary cell. Also, the vein CuP of the forewing is free from any veins, fused with either vein A1+A2 or CuA2. The antennal scape has a long scaled fringe termed a pecten. The posterior area of the female's seventh abdominal segment has a corethrogynae consisting of scales or hairs. In addition, the tegumen and uncus of the male genitalia are fused with each other, and the posterior margin of the dorsum (part of uncus) is represented either by a pair of hooks or ended in a rounded margin without hooks. Also, the males are characterised by the absence of gnathos and juxta and the presence of a transitellar arm from the basal part of the costa of valva (Kozhantshikov 1956; Saigusa 1961; Sugimoto and Saigusa 2004).

The zoogeographical distribution has been verified for Psychidae fauna: 514 species in the Palaearctic region (37%); 309 species in the Afrotropical region (22%); 26 species in the Nearctic region (2%); 81 species in the Neotropical region (6%); 229 species in the Oriental region (16%) (Sobczyk 2011). Thus, most of the species are distributed in the Palaearctic and Afrotropical regions.

## A catalogue of Psychidae in Korea

Subfamily **OIKETICINAE** Herrich-Schäffer, 1847–55: 83

Genus **Acanthopsyche** Heylaerts, 1881: 66, 70.

Type species: *Psyche opacella* Herrich-Schäffer, 1843–55.

***Acanthopsyche nigraplaga*** (Wileman, 1911)

*Oeceticoides nigraplaga* Wileman, 1911: 347. Type locality: Japan, China, India.

*Acanthopsyche nigriplaga* Kozhantshikov, 1956: 334.

### Distribution

Korea, Japan, China, India.

Genus **Eumeta** Walker, 1855: 964.

Type species: *Eumeta layardii* Moore, 1883.

***Eumeta minuscula*** (Butler, 1881)

*Eumeta minuscula* Butler, 1881: 22. Type locality: Japan.

### Distribution

Korea, Japan, China, Malaysia, Thailand, India.

***Eumeta variegata*** (Snellen, 1879)

*Oiketiscus variegatus* Snellen, 1879: 114. Type locality: Indonesia.

*Eumeta japonica* Heylaerts, 1884: 40.

*Eumeta pryeri* Leech, 1888: 598.

*Eumeta sikkima* Moore, 1891: 67.

*Clania sciogramma* Turner, 1914: 247.

*Clania formosicola* Strand, 1915: 12.

*Eumeta javanica* Swinhoe, 1892: 262.

### Distribution

Korea, Japan, China, Taiwan, Nepal, Vietnam, India, Indonesia (Borneo, Java, Sumatra, Sulawesi), Papua New Guinea, Sri Lanka, Solomon Islands, Australia.

Genus **Mahasena** Moore, 1877: 601.

Type species: *Mahasena andamana* Moore, 1877.

***Mahasena aurea*** (Butler, 1881)

*Plateumata aurea* Butler, 1881: 23. Type locality: Japan.

*Mahasena aurea* Dierl, 1968: 13.

### **Distribution**

Korea, Japan, China.

Subfamily **TALEPORIINAE** Herrich-Schäffer, 1857: 58.

Genus ***Kozhantshikovia*** Saigusa, 1961: 303.

Type species: *Kozhantshikovia vernalis* Saigusa, 1961.

***Kozhantshikovia vernalis*** Saigusa, 1961

*Kozhantshikovia vernalis* Saigusa, 1961: 305. Type locality: Japan.

### **Distribution**

Korea, Japan.

Genus ***Taleporia*** Hübner, 1825: 432.

Type species: *Tinea pseudobombycella* Hübner, 1796.

***Taleporia nigropterella*** Saigusa, 1961

*Taleporia nigropterella* Saigusa, 1961: 292. Type locality: Japan.

### **Distribution**

Korea, Japan.

***Taleporia trichopterella*** Saigusa, 1961

*Taleporia trichopterella* Saigusa, 1961: 292. Type locality: Japan.

### **Distribution**

Korea, Japan.

Subfamily **PSYCHINAE** Boisduval, 1840: 44.

Genus ***Proutia*** Tutt, 1899: 211.

Type species: *Psyche betulina* Zeller, 1839.

***Proutia maculatella*** Saigusa and Sugimoto, 2014

*Proutia maculatella* Saigusa and Sugimoto, 2014: 143–152. Type locality: Japan.

**Distribution**

Korea (New record), Japan.

Genus ***Psyche*** Schrank, 1801: 156.

Type species: *Psyche carpini* Schrank, 1802.

***Psyche yeongwolensis*** Byun and Roh sp. nov.

**Distribution**

Korea.

**Description of new species and unrecorded species**

Genus ***Proutia*** Tutt, 1899: 211.

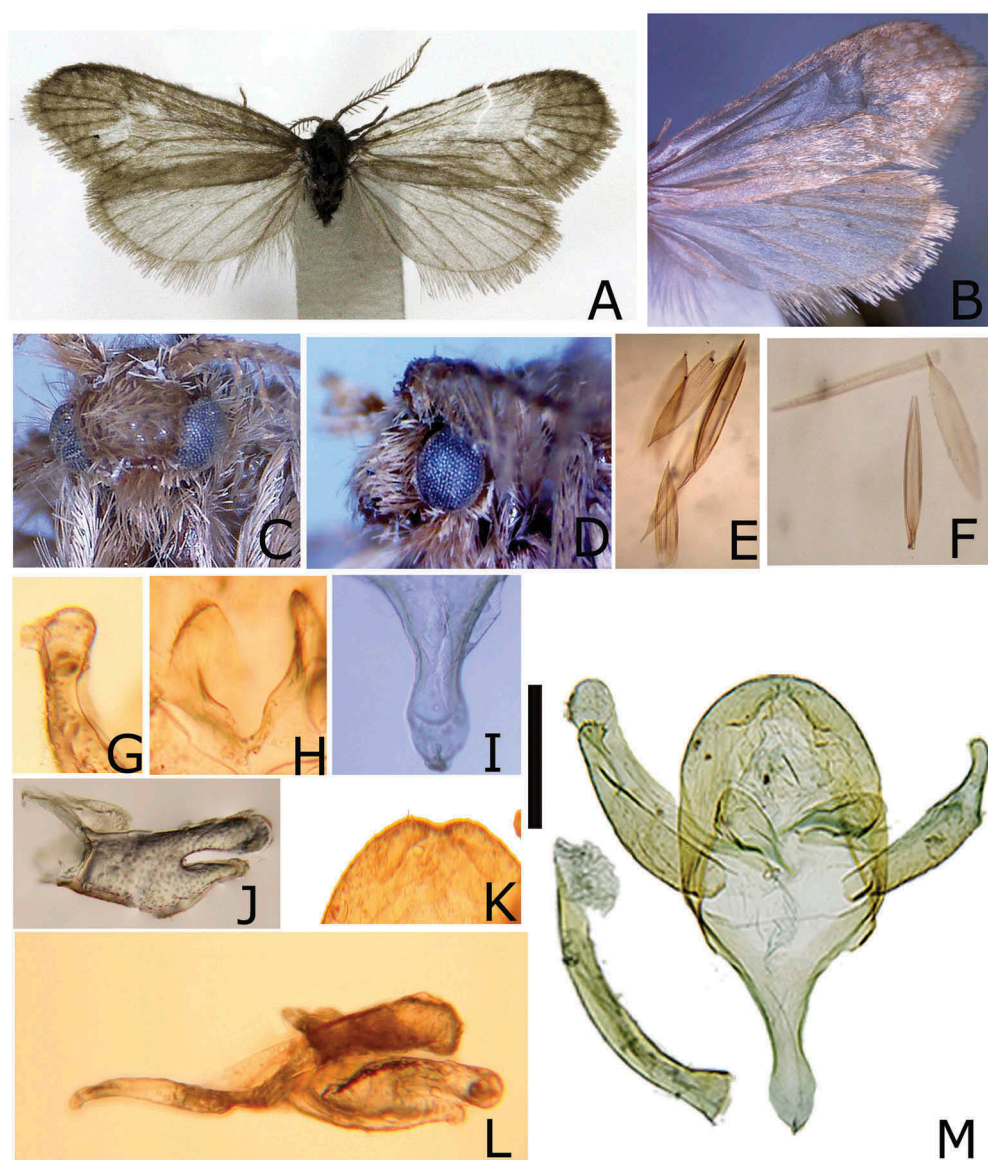
Type species: *Psyche betulina* Zeller, 1839.

***Proutia maculatella*** Saigusa and Sugimoto, 2014  
(Figures 1A–M, 3A)

*Proutia maculatella* Saigusa and Sugimoto, 2014: 143–152. Type locality: Japan.

**Adult** (Figure 1A–F). Wingspan 15 mm; length of head and thorax combined 3.1 mm; length of abdomen 3.6 mm (intersegmental membranes not expanded); lateral length of male genitalia 1.3 mm (Figure 1L); length of aedeagus 0.9 mm. Colouration and vestiture: Head covered in light-brownish shortly hairs on frons, longish light-brown hairs posterior to antennal sockets. Thoracic notum densely covered with brown hairs. Upperside of wings: ground colour whitish between veins and termen margin shortly erect light-brown scales; generally covered light-brown scales; scales (Figure 1E–F) slightly slender, with weakly truncate apical margin usually produced into 2–3 weak rounded laciniation. Hindwing evenly covered with light-grey scales, basal part slightly longish light-grey hairs; scales slender and some scales become narrow towards the end, with arrowhead shape. Underside of wings usually covered brown or grey scales and hairs; forewing covered with similar scales as on upperside; hindwing covered greyish scales. Structure: Head nearly 2/3 as wide as thorax; compound eyes blackish, original form in lateral aspect, head width including eyes is approximately equal to thorax in dorsal aspect; anterior tentorial pits invisible; mouthparts reduced to small labial sclerite holding light-brown hairs basally. Ocelli absent. Antenna basal flagellomeres 18 segmented and bipectinated, slightly longer than 1/3 forewing, length of this antenna nearly 3.6 mm, flagellomeres covered with brownish scales, anterior pectinations almost identical posterior ones; bearing sensory hairs ventrally.

Forewing (Figure 3A) slightly short and slender, nearly isosceles shape; costa practically straight, then gently arched beyond 4/5, apex obtuse and posterior margin gently arched, termen approximately 1/3 as long as costa, gently curved. All veins present without  $A_2$ ; median cell longer than 0.76 times as long as wing, narrow on 1/3 of basal



**Figure 1.** *Proutia maculatella* Saigusa et Sugimoto, male. (A) adult; (B) close-up of right wing; (C) head, frontal view; (D) ditto, lateral view; (E) scales, upperside of forewing; (F) ditto, upperside of hindwing; (G) close-up of cucullus; (H) anellus, dorsal view; (I) close-up of saccus; (J) left valva; (K) dorsum, dorsal view; (L) genitalia, lateral view; (M) ditto, ventral view. Scale bar 0.5 mm.

part, then widened distally, anterodistal and posterodistal corner rectangular;  $R_1$  originated at distal 1/5 of costa;  $R_2$  arising slightly proximal to anterodistal cell;  $R_3$ ,  $R_4$  and  $R_6$  stalked beyond half;  $M_1$  close to lower anterodistal corner; distal margin of median cell rather slightly isosceles triangle;  $M_2+M_3$  arising with short stalk from posterodistal corner of median cell;  $CuA_1$  slightly closer to posterodistal corner than  $CuA_2$ ;  $CuP$ , 1A united and stalked of anal angle. Hindwing subtriangular, costa nearly straight; all veins present;



median cell approximately 1/2 length of hindwing, slightly asymmetrical, gradually dilating apically, posterior portion of the cell much bigger than anterior portion; stem of M simple in median cell;  $R_1$  originated at 1/5 of costal margin,  $R_s$  ending at wing apex;  $M_1$  arising at distal margin of median cell;  $M_2$  and  $M_3$  arising from posterodistal corner of cell;  $CuA_1$  arising at posterodistal corner; stalk of  $CuA_2$  arising at axillary area. Legs shortly covered with scales.

**Male genitalia** (Figure 1G–M). In lateral aspect, dorsum slightly curved dorsally at the middle; saccus very long with 1.3 times as long as height of ring; valva measured from ventroproximal corner to apex of ampulla 1.2 times as long as height of ring; ampulla 0.8 times as long as valva, club-shaped apically; process of harpe 0.6 times as long as ampulla, slightly longer than thick apically. In ventral aspect, gnathos and juxta absent. Valva narrow, proximal part of costa expands inwardly; apical part of valva consists of a claviform. Saccus elongated though expanded inwardly. Aedeagus shortly, slightly bent from basally, as long as 1/3 length of aedeagus.

### Material examined

1♂, Chuncheon, Prov. Gangweon, 26 April 1989, K.T. Park, genitalia slide no. EHNU-53-coll. SELHNU.

### Distribution

Korea, Japan.

Genus *Psyche* Schrank, 1801: 156.

Type species: *Psyche carpini* Schrank, 1802.

*Psyche yeongwolensis* Byun and Roh sp. nov.  
(Figures 2A–K, 3B)

### Type

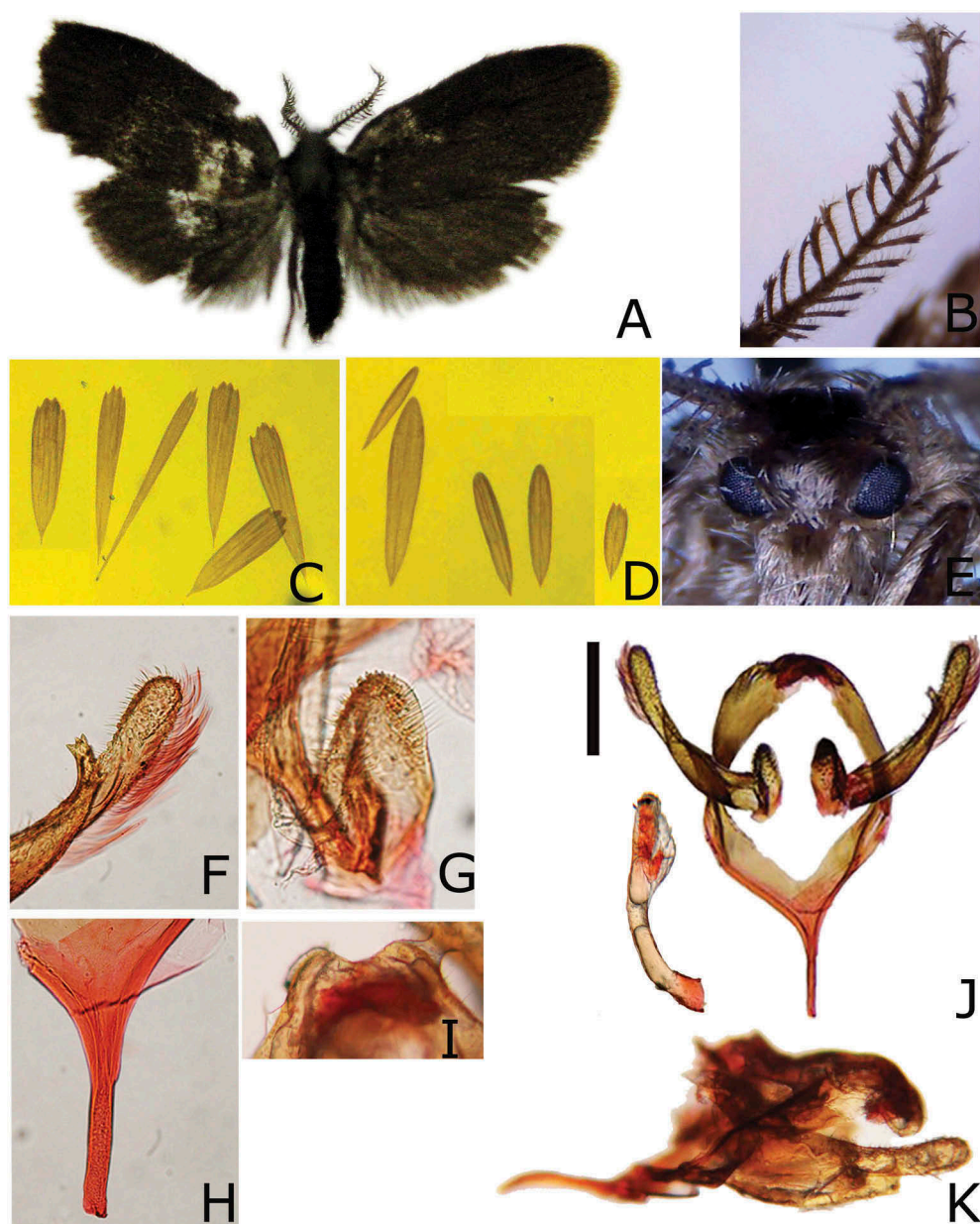
Holotype: 1♂, Yeongwol, GW, 10 April 2008, U.H. Heo, genitalia slide no. EHNU-5006-coll. SELHNU.

### Diagnosis

This species is similar to *P. casta* (Pallas, 1767) superficially, but can be distinguished by the narrow form of saccus of the genitalia and the thin and curved shape of aedeagus, which branches nearly into vertex part. Also this species can be readily differentiated by the forewing, slightly broad blackish-brown wings with nearly rectangular shape.

### Description

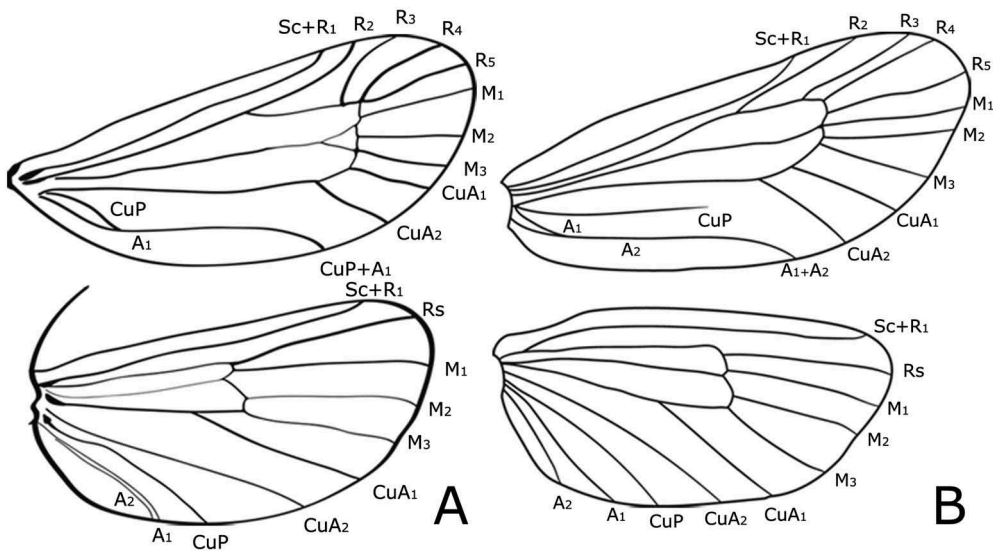
**Adult** (Figure 2A–E). Wingspan 13 mm; length of head and thorax combined 2.5 mm; length of abdomen 3.2 mm (intersegmental membranes not expanded); lateral length of male genitalia 1.1 mm (Figure 2K); length of aedeagus 0.6 mm. Coloration and vestiture: sclerites on head and thorax dark brown. Head covered dark-brownish short hairs dorsally and anteriorly, longish dark-brown hairs posterior to antennal sockets.



**Figure 2.** *Psyche yeongwolensis* sp. nov., male. (A) adult; (B) antenna; dorsal view; (C) scales, upper-side of forewing; (D) ditto, upperside of hindwing; (E) head, frontal view; (F) right valva; (G) anellus, dorsal view; (H) genitalia, dorsal view; (I) close-up of saccus; (J) dorsum, ventral view; (K) genitalia, lateral view. Scale bar 0.5 mm.

Thoracic notum densely covered with shiny blackish-brown hairs. Upperside of wings: ground colour dark brownish, between veins and termen margin short erect reddish brown scales; generally covered scales without transparent part; scales (Figure 2C–D) slightly broad and evenly widened apically, with weakly truncate apical margin usually





**Figure 3.** Wing venation. (A) *Proutia maculatella* Saigusa et Sugimoto; (B) *Psyche yeongwolensis* sp. nov.

produced into 3–4 weak rounded laciniation. Hindwing evenly covered with dark-brown scales, basal part covered with light-brown scales; scales rather slender and evenly widened apically, with rounded stumpy shape. Underside of wings usually covered with dark-brown scales and hairs; forewing covered with similar scales as on upperside; hindwing also covered scales similar to upperside. Structure: Head nearly 1/2 as wide as thorax; compound eyes black, elliptical form in lateral aspect, 0.12 times as wide as head width including eyes in dorsal aspect; anterior tentorial pits more invisible; mouthparts reduced to small labial sclerite bearing light-brown hairs basally. Ocelli absent. Antenna slightly widened medially due to somewhat longer pectinations on middle, basal flagellomeres 17 segmented and bipectinated, length of this antenna roughly 2.7 mm, flagellomeres covered with dark-brownish scales, anterior pectinations longer than posterior ones; bearing long sensory hairs ventrally (Figure 2B).

Forewing (Figure 3B) short and broad, nearly rectangular in shape; costa nearly straight, then gently arched beyond 3/4, apex obtuse and posterior margin gently arched, termen almost 1/2 as long as costa, slightly curved. All veins present; median cell slightly longer than 0.7 times as long as wing, narrow on basal 1/2, then much widened distally, anterodistal and posterodistal corner obtuse;  $R_1$  originated at distal 1/4 of costa;  $R_2$  arising slightly proximal to anterodistal corner of cell;  $R_3$ ,  $R_4$  and  $R_5$  stalked beyond half;  $M_1$  close to posterodistal corner; distal margin of median cell rather slightly concave;  $M_2+M_3$  arising with short stalk from posterodistal corner of median cell;  $CuA_1$  slightly closer to posterodistal corner than  $CuA_2$ ; 1A, 2A united and stalked of anal angle. Hindwing subtriangular, costa slightly arched; all veins present; median cell slightly longer than 1/2 length of hindwing, very symmetrical, gradually dilating apically, posterior portion of the cell longer than anterior portion; stem of M simple in median cell;  $R_1$  arising from distal apex of anterior margin of median cell,  $R_s$  ending at wing apex;  $M_1$  arising from distal margin of median cell;  $M_2$  and  $M_3$  arising

at posterodistal corner of cell;  $CuA_1$  arising from posterodistal corner; stalk of  $CuA_2$  arising at axillary area. Legs smoothly covered with scales. Abdomen covered with broad scales.

**Male genitalia** (Figure 2F–K). In lateral aspect, dorsum slightly curved dorsally at the middle; saccus  $3/4$  as long as height of ring; valva measured from its ventroproximal corner to apex of ampulla 1.5 times as long as height of ring, and 6 times as long as wide; ampulla 0.6 times as long as valva, basally  $3/5$  as wide as valva, softly club-shaped apically; process of harpe 0.5 times as long as ampulla, slightly longer than thick apically; aedeagus 1.6 times as long as height of ring, 10 times as long as thick. In ventral aspect, uncus not represented; gnathos absent; apex of tegument gentle; valva narrow, proximal part of costa expanded inwardly and two parts close to each other looking like transtilla, apical part of valva consists of a dorsal digitate, numerous roundly ended and erect hairs; juxta absent; saccus elongated, narrow basally; aedeagus long, slightly bent from basally, as long as  $1/2$  length of aedeagus.

### Host plant

The larvae of the species were collected on *Disporum viridescens* (Maxim.) Nakai. (Liliaceae) in Jangleung, Yeongweol. However, the host plant needs confirmation in the future.

### Distribution

Korea.

### Etymology

The specific name is derived from the type locality of the new species.

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## Disclosure statement

No potential conflict of interest was reported by the authors.

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