The Meessiidae (Lepidoptera: Tineoidea) of Korea

Seung Jin Roh[1], and Bong-Kyu Byun[2,]*

Abstract

This study reports the discovery of members of the family Meessiidae Căpuşe from Korea. It includes 3 new species of the genus *Eudarcia* Clemens: *E. gwangneungensis* **sp. nov.**, *E. longiphalla* **sp. nov.**, and *E. cornea* **sp. nov.**, and an unrecorded species, *E. orbiculidomus* (Sakai & Saigusa). Adults and genitalia were described, a key to the Meessiidae in Korea and DNA barcodes for precise identification of the species are provided.

Key words: *Eudarcia*; new species; DNA barcode

Resumen

Este estudio informa el descubrimiento de miembros de la familia Meessiidae Căpuşe en Corea. Incluye 3 nuevas especies del género *Eudarcia* Clemens: *E. gwangneungensis* **sp. nov.**, *E. longiphalla* **sp. nov.**, y *E. cornea* **sp. nov.** y una especie no registrada, *E. orbiculidomus* (Sakai y Saigusa). Los adultos y su genitalia son discritos y se proporcionan códigos de barras de ADN para una identificación más precisa de la especie.

Palabras Clave: *Eudarcia*; nuevas especies; código de barras de ADN

The family Meessiidae is placed in the superfamily Tineoidea, suborder Ditrysia, and order Lepidoptera (Regier et al. 2015). Regier et al. (2013) assessed phylogenetic relationships within Lepidoptera, including 38 tineoids, using 19 sequenced genes. They placed most members of Tineidae in Tineidae 1, and the genus *Eudarcia* Clemens, 1860 as Tineidae 2 in separate clades. Recently, a molecular phylogeny and revised classification of Tineoidea (Regier et al. 2015) provided 2 additional tineoid families, Dryadaulidae stat. rev. and Meessiidae stat. rev. The 5 allied revised families (Dryadaulidae, Eriocottidae, Psychidae, Tineidae, and Meessiidae) form the superfamily Tineoidea. Korean Tineoidea has been poorly studied until now; in total, 29 species of Tineidae (Byun et al. 2009; Byun et al. 2014; Lee et al. 2016) and 15 species of Psychidae (Roh & Byun 2016, 2017a, 2017b; Roh et al. 2016, 2018) have been recorded. The family Meessiidae consisted of only 2 genera, *Eudarcia* Clemens, 1860 and *Bathroxena* Meyrick, 1919 (Regier et al. 2015). Regier et al. (2015) diagnosed the family Meessiidae based on the following adult characters: small moths (wingspans 3–12 mm); forewing relatively slender and tapering, venation of hindwing reduced, male genitalia symmetrical, and the long oviscapt of female genitalia with posterior apophyses nearly 3 times longer than the anterior apophyses (Regier et al. 2015; Bidzilya et al. 2016).

The genus *Eudarcia* was based on the type species *Eudarcia simulatricella* Clemens, 1860 (Gaedike 2011, 2015). In total, 72 species of *Eudarcia* have been reported worldwide, and most of these (61 species) are distributed throughout the Palaearctic region (Bidzilya et al. 2016). In Asia, 6 species have been reported currently (Sakai & Saigusa 1999; Xiao & Li 2009; Sakai 2013). Females of *Eudarcia* (8 species) are brachypterous, with degenerate forewings and more or less reduced hindwings (Bidzilya et al. 2016). Members of the *Eudarcia* are known for the case-making habits of larvae. Larvae build their cases by putting together small sand particles, and they feed on crustose lichens (Gaedike & Zerafa 2010; Regier et al. 2015). The larvae are extremely specialized consumers of lichens, and first instars feed on unicellular algae (Zagulajev 1979; Henderickx 1995; Robinson 2009; Gaedike 2015; Bidzilya et al. 2016). In addition, this genus inhabits open biotopes, and their larvae live within cases on vertical lichen-covered surfaces of single large stones, rocks, and artificial constructions. In this study, 3 species (*Eudarcia gwangneungensis* **sp. nov.**, *E. longiphalla* **sp. nov.**, and *E. cornea* **sp. nov.**) are described with 1 unrecorded species, *Eudarcia orbiculidomus* (Sakai & Saigusa, 1999), for the Korean fauna. In this study, the family Meessiidae is reported for the first time in Korea. All available information is presented, including the collection locations, microhabitats, and illustration of adults and their genitalia. DNA barcodes also are provided for precise identification of species.

Materials and Methods

The material examined in this study is preserved in the Systematic Entomology Laboratory, Hannam University, Daejeon, Korea; the Entomological Collection of the Korea National Arboretum, Pocheon, Korea; and the National Institute of Agricultural Sciences, Wanju, Korea. The specimens were dissected and examined after mounting on glass slides. The genitalia and wing venation were examined in 60% euparal solution or dried condition, respectively. Photographs of adults and genitalia were taken using a DFC 495 digital camera (Leica, Wetzlar, Germany) attached to a Leica M205A stereomicroscope (Leica, Wetzlar, Germany).

Terminology and morphological characters of the adult, wing venation, and genitalia follow Sakai and Saigusa (1999), Kristensen (2003), Regier et al. (2015), and Bidzilya et al. (2016) (Figs. 1–4).

Genomic DNA was extracted from the legs of dried specimens, preserved in 100% alcohol, using a Genomic Cell/Tissue Spin Mini

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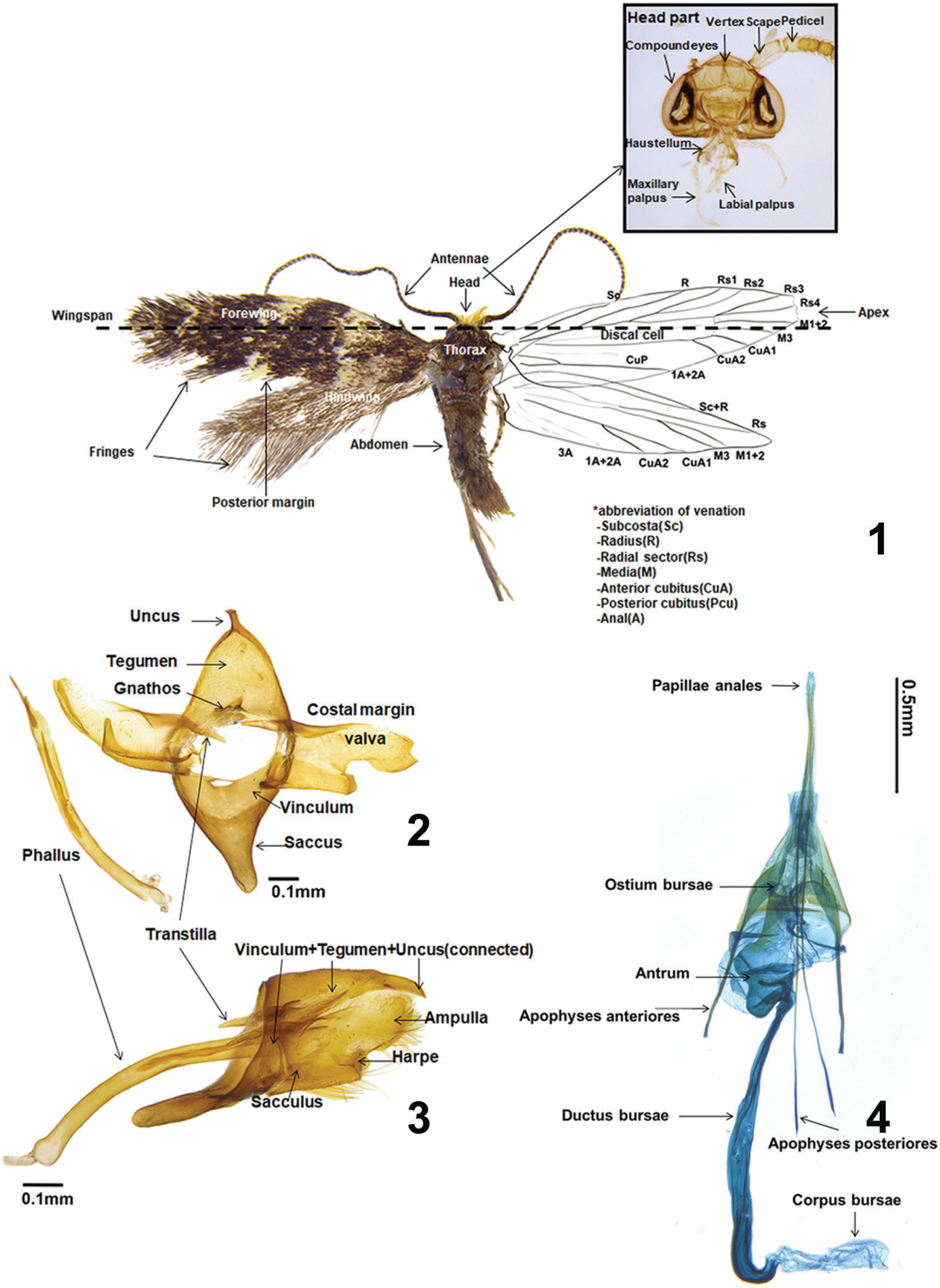


Figs. 1-4. Terminology of morphological characters: (1) male (Kristensen 2003, and Regier et al. 2015); (2) male genitalia, dorso-ventral part (Kristensen 2003, Regier et al. 2015, and Bidzilya et al. 2016); (3) ditto, lateral part (Sakai and Saigusa 1999, and Regier et al. 2015); (4) female (Kristensen 2003).

Kit (Qiagen, Inc., Hilden, Germany), according to the manufacturer's protocol. Nine specimens were sequenced, and the DNA barcode was amplified using the primer pair LepF1, LepR1 (Hebert et al. 2004), and MLepF1, MLepR1 (Hajibabaei et al. 2006). Polymerase chain reaction (PCR) conditions for amplification followed the manufacturer's protocol (Platinum Taq, Invitrogen, Carlsbad City, California, USA). The amplicons were purified using the QIAquick® PCR purification kit (QIAGEN, Inc., Hilden, Germany) and directly sequenced at the Genotech Corporation (Daejeon, Korea) and Macrogen (Seoul, Korea). Contigs were assembled using CodonCode aligner version 2.0.6 (CodonCode Co., Centerville City, Massachussetts, USA). Successful sequences were uploaded to BOLD systems (Project code: KNAEM) (Table 1).

Results

Family Meessiidae Căpuşe, 1966

Meessiinae Căpuşe, 1966: 106. Type genus *Meessia* Hoffmann, 1898.

Genus *Eudarcia* Clemens, 1860

Eudarcia Clemens, 1860: 10. Type species: *Eudarcia simulatricella* Clemens, 1860.

Demobrotis Meyrick, 1893: 555. Type species: *Demobrotis anaglypta* Meyrick, 1893.

Meessia Hofmann, 1898: 227. Type species: *Tinea vinculella* Herrich-Schäffer, 1854.

Leptochersa Meyrick, 1919: 272. Type species: *Leptochersa diarthra* Meyrick, 1919.

Protodarcia Forbes, 1931: 389. Type species: *Protodarcia bicolorella* Forbes, 1931.

Obesoceras Petersen, 1957: 352. Type species: *Tinea granulatella* Herrich-Schäffer, 1854.

Neomeessia Petersen, 1968: 58. Type species: *Neomeessia gracilis* Petersen, 1968.

Brachys Zagulajev, 1979: 314. Type species: *Meessia brachyptera* Passerin d'Entrevès, 1974.

Nigris Zagulajev, 1979: 317. Type species: *Tinea leopoldella* Costa, 1832.

Gallis Zagulajev, 1979: 336. Type species: *Meessia alberti* Amsel, 1957.

Colchiromis Zagulajev, 1979: 361. Type species: *Obesoceras croaticum* Petersen, 1962.

Abchagleris Zagulajev, 1979: 366. Type species: *Obesoceras abchasicum* Zagulajev, 1979.

Haugresis Zagulajev, 1979: 366. Type species: *Obesoceras aureliani* Căpuşe, 1967.

Zagulyaevella Koçak, 1981: 23. A synonym for *Brachys* Zagulajev, 1979.

Pseudobesoceras Gaedike, 1985: 177. Type species: *Tinea holtzi* Rebel, 1902.

Key to the adults of *Eudarcia* in Korea

1. Dark brown transverse stripes present on the forewing (Figs. 5–7) 2

— Forewing without dark brown transverse stripes (Fig. 8); forked veins absent in the forewing (Fig. 24); uncus of male genitalia very bilobed (Fig. 16); ductus seminalis of female genitalia well developed (Fig. 20) . . . . . *E. cornea* Roh & Byun **sp. nov.**

2. Phallus of male genitalia without cornuti (Fig. 12); venation of forewing: Rs1 and Rs2 fused; Rs3 and Rs4 forked at base of 2/5 Rs3 (Fig. 22); antrum weakly developed in the female genitalia (Fig. 18) . . . . . *E. gwangneungensis* Roh & Byun **sp. nov.**

— Male genitalia with cornuti in the phallus (Figs. 10, 14); venation of forewing: Rs1 and Rs2 forked at 1/4 of the base; Rs3 and Rs4 forked at anterior margin of distal corner of discal cell (Figs. 21, 23); antrum of female genitalia well developed (Figs. 17, 19) 3

3. Male genitalia (Figs. 13, 14): valva furcate with digitiform and apical part of ampulla right-angled; uncus partly elongated and hooked; saccus blunt shaped; ductus bursae longer than corpus bursae in the female genitalia (Fig. 19) . . . . . *E. longiphalla* Roh & Byun **sp. nov.**

— Male genitalia (Figs. 9, 10): valva not furcated and apical part of ampulla blunt shaped; uncus part deeply concave and bilobed; saccus elongated downward and very slender; ductus bursae of female genitalia shorter than corpus bursae (Fig. 17) . . . . . *E. orbiculidomus* (Sakai & Saigusa)

Table 1. DNA barcodes were uploaded to BOLD systems in this study.

Scientific name	Country	Sample ID	BIN number	Basepair length
Edarcia orbiculidomus	Korea	KNAEM001-18	BOLD:ADJ8878	427
E. gwangneungensis	Korea	KNAEM003-18	BOLD:ADL7237	658
E. longiphalla	Korea	KNAEM002-18	BOLD:ADL7238	658
E.cornea	Korea	KNAEM004-18	BOLD:ADL7356	658
E.cornea	Korea	KNAEM005-18	″	658
E.cornea	Korea	KNAEM006-18	″	658
E.cornea	Korea	KNAEM007-18	″	658
E.cornea	Korea	KNAEM008-18	″	658
E.cornea	Korea	KNAEM009-18	″	658

Figs. 5-8. Adults: (5) *Eudarcia orbiculidomus* Sakai & Saigusa, male; (6) *E. gwangneungensis* **sp. nov.**, female, paratype; (7) *E. longiphalla* **sp. nov.**, female, paratype; (8) *E. cornea* **sp. nov.**, female, paratype.

Eudarcia orbiculidomus (Sakai & Saigusa, 1999) (Figs. 5, 9, 10, 17, 21, 25)

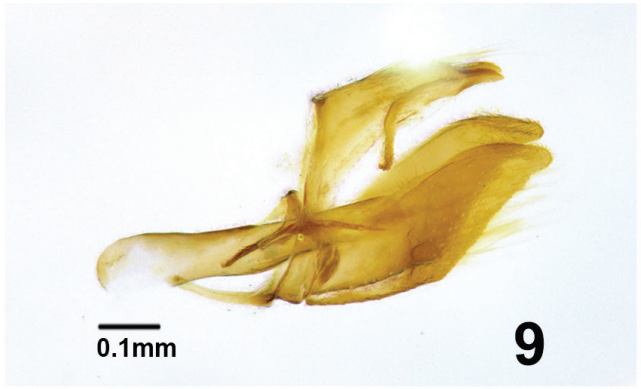
Obesoceras orbiculidomus Sakai & Saigusa, 1999: 405–412. Type locality: Japan.

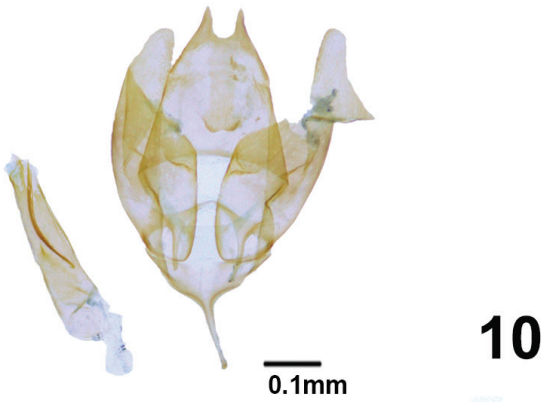
Eudarcia orbiculidomus: Gaedike, 2000: 365; Xiao & Li, 2009: 308; Sakai, 2013: 124.

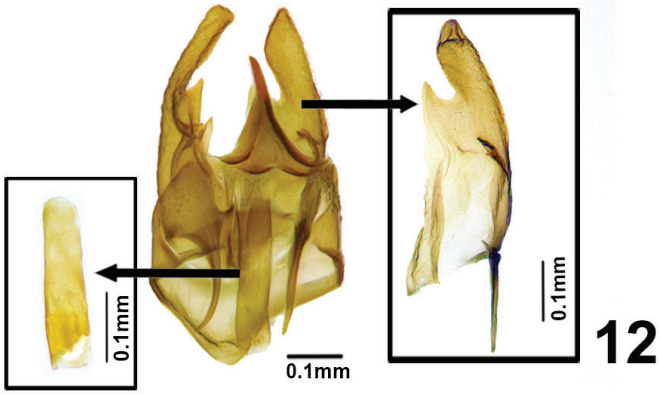
Adult (Figs. 5, 21). Wingspan 7.6 to 8.1 mm. Coloration and vestiture: Vertex of head roughly covered with light yellow hairs. Thoracic notum covered with yellowish scales. Upper side of forewing: ground color light yellow; blackish brown spots present widely. Hindwing covered with grey scales; post-marginal part present with long yellowish white hairs. Structure: head and compound eyes slightly small; ocelli absent. Maxillary palpus covered with light yellow scales, labial palpus drooping and covered with grayish scales. Antennae slightly thick and filiform, longer than 4/5 of the forewing. Forewing: slightly narrow, length/width (L/W) ratio 4.2, costa straight, termen very shortly arched to posterior margin, discal cell 0.66 times as long as forewing; venation (Fig. 21): 7 separate and 2 forked veins originating at the discal cell; accessory and intercalary cell absent; Sc arising near 2/4 of the costa; Rs1 and Rs2 stalked and originating at half of the discal cell; Rs3 and Rs4 separate, Rs4 reaching to the apex; base of M weakly developed; M_1 and M_2 fused, M_{1+2} and M_3 parallel; CuA_1 and CuA_2 originating at posterior margins of the discal cell, either separate and parallel; CuP slightly weak; basal part of 1A + 2A with loop. Hindwing: very narrow, L/W ratio 4.9, and costa straight; Sc + R straight to 1/2 of costa; Rs terminating at apex; base of M weakly developed; M_1 and M_2 fused, M_{1+2} and M_3 originating at distal corner of posterior part of the discal cell; CuP absent; CuA_1 and CuA_2 stalked, 1A + 2A very weak; 3A present. Legs: epiphysis present; covered with light yellowish hairs. Abdomen: coremata of female present; corethrogyne of female absent.

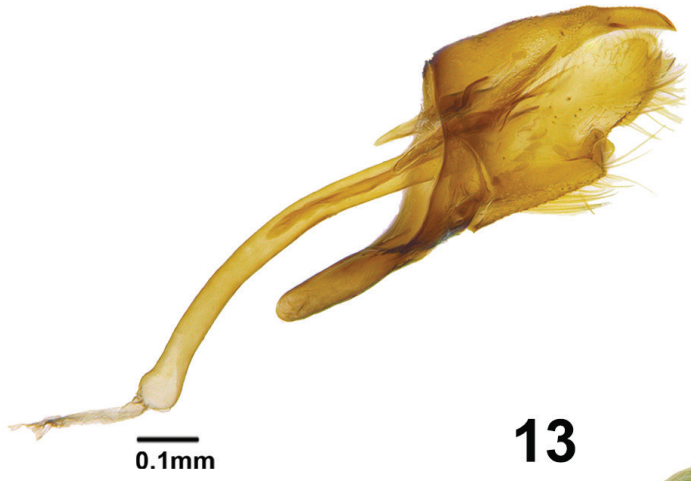
Male genitalia (Figs. 9, 10). Tegumen, vinculum, and uncus fused, uncus part deeply concave and bilobed; dorsal part of uncus present with some setae; gnathos fused with middle of dorsum part (tegument and uncus); vinculum slightly narrow; saccus 0.5 times as long as height of ring and highly slender; valva relatively broad and apex rounded, dorsal margin arched, ventral margin straight and parallel to dorsal margin (lateral view); transtilla narrow at costa of valva and well developed; phallus fairly thick and cylindrical, phallus longer than 1.2 times the height of the ring.

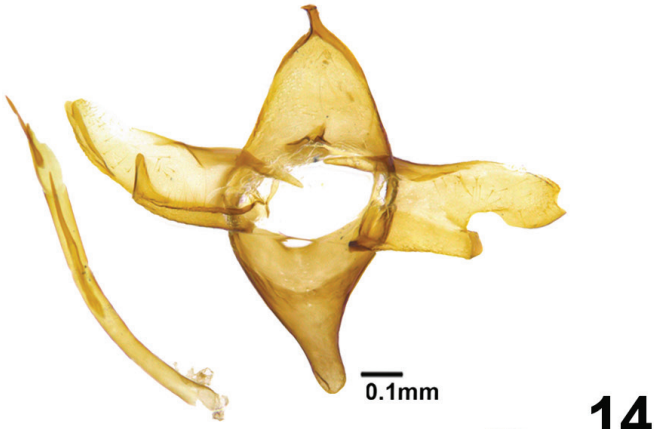
Female genitalia (Fig. 17). Papillae anales slightly narrow with some short satae; apophyses posteriores very slender, apophyses posteriores 2.02 times longer than apophyses anteriores; apophy-

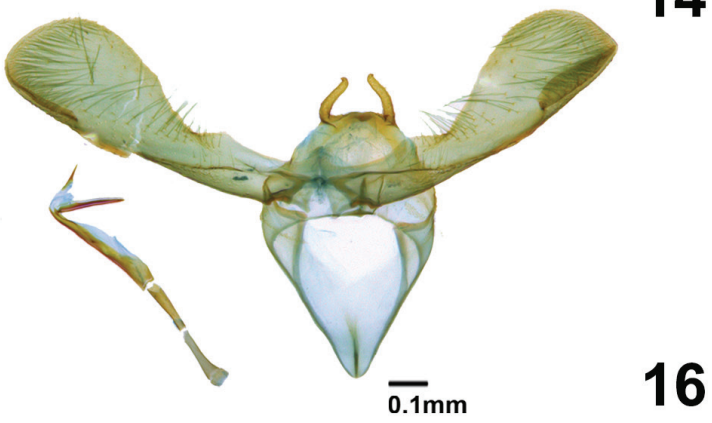




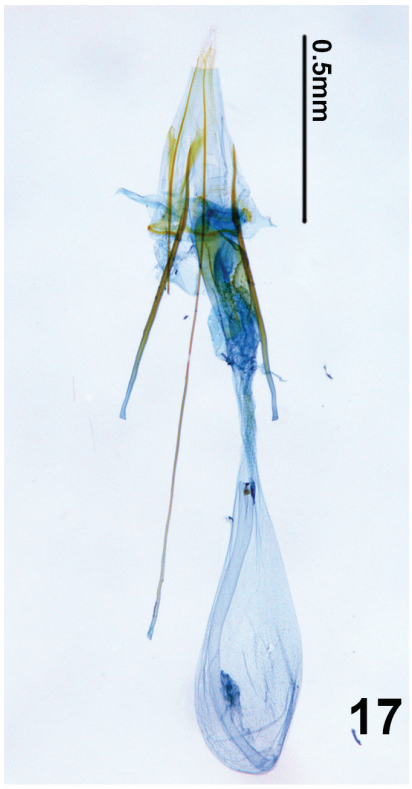


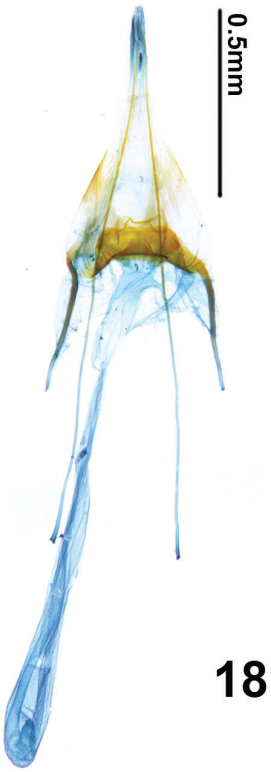


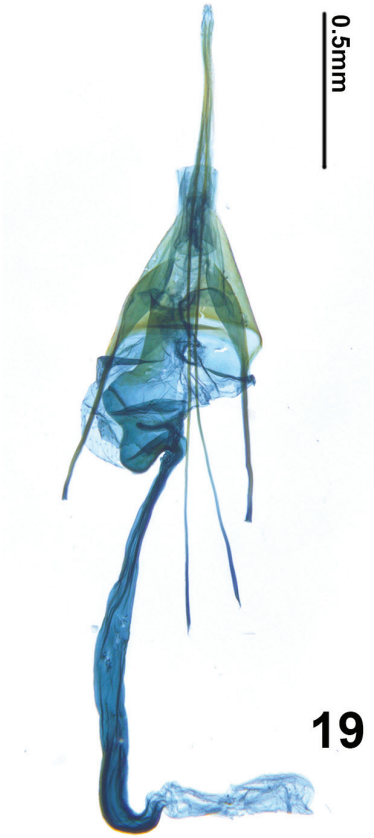


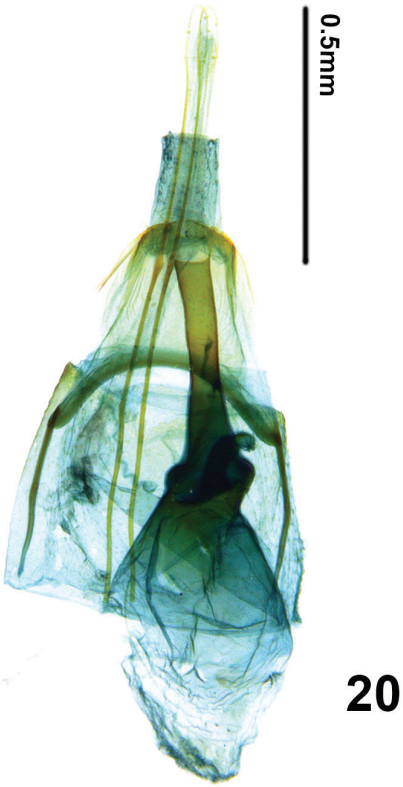


Figs. 9-16. Male genitalia: (9) *Eudarcia orbiculidomus* Sakai & Saigusa (genitalia no. KNAESJ00032), lateral view; (10) ditto, dorso-ventral view; (11) *E. gwangneungensis* **sp. nov.**, holotype (genitalia no. KNAESJ00037), lateral view; (12) ditto, dorso-ventral view; (13) *E. longiphalla* **sp. nov.**, holotype (genitalia no. KNAESJ00036), lateral view; (14) ditto, dorso-ventral view; (15) *E. cornea* **sp. nov.**, paratype (genitalia no. KANES000J28), lateral view; (16) ditto, dorso-ventral view.









Figs. 17-20. Female genitalia: (17) *Eudarcia orbiculidomus* Sakai & Saigusa (genitalia no. KNAESJ00033); (18) *E. gwangneungensis* **sp. nov.**, paratype (genitalia no. KNAESJ00035); (19) *E. longiphalla* **sp. nov.**, paratype (genitalia no. KNAESJ00036); (20) *E. cornea* **sp. nov.**, paratype (genitalia no. KANES000J29).

ses anteriores relatively thick; antrum well developed; ductus bursae narrow and relatively short; corpus bursae slightly long.

Larval case (Fig. 25). Length 5.0 mm. Larvae build their cases using small crustose lichen particles, forming wide oval-shaped cases.

MATERIAL EXAMINED

Two males and 4 females KOREA: Jeju Is., Chuja Is., 33.946011°N, 126.330552°E, collected 15-VII-2015, B.K. Byun, S.J. Roh, D.S. Kim, 2 male genitalia mounted on 80% glycerol solution, 1 female genitalia mounted on 60% euparal solution (genitalia no. KNAESJ00033), venation of wing slide no. KNAEVSJ9, DNA barcode Process ID KNAEM001-18 (BOLD systems BIN. BOLD:ADJ8878) (SEL/HNU); 2 males and 1 female KOREA: Chungcheongnam-do, Seosan-si, 36.711847°N, 126.547016°E, collected 1-V-2015 (larva), emerged 15 to 25-VI-2015, S.J. Roh, B.S. Jeon, D.S. Kim, 1 male mounted on 60% euparal solution (male genitalia no. KNAESJ00032) (SEL/HNU); 3 females KOREA: Gangwon-do, Yeongwol-gun, 37.195550°N, 128.455027°E, collected 6-VI-2015 (larva), emerged 8-VI-2015, S.J Roh, J.H. Jeon, T.H. Yoo (SEL/HNU).

DISTRIBUTION

Korea (new record), Japan, China.

Eudarcia gwangneungensis Roh & Byun, **sp. nov.** (Figs. 6, 11, 12, 18, 22, 26–29)

DIAGNOSIS

Eudarcia gwangneungensis **sp. nov.** is externally similar to *E. dentata* Gaedike, 2000 and *E. prolongata* Xiao & Li, 2009, but a wide light grey ground color of its forewings can be distinguished. The male genitalia of *E. gwangneungensis* are very similar to those of *E. prolongata* and *E. dentate* but the valva is very wide and the ampulla is relatively thick. Moreover, the male genitalia differ by very short saccus, cornuti is absent from the phallus, and transtilla is more slender and similar in shape to a sewing needle. Further, this species can be readily differentiated based on female genitalia; ductus bursae lacks spines and antrum is weakly developed.

DESCRIPTION

Adult (Figs. 6, 22). Wingspan 6.1 to 6.7 mm. Coloration and vestiture: vertex of head roughly covered with short, dark yellow hairs. Thoracic notum covered with dark brown scales. Forewing: ground color light grey and covered with dark brown scales, termen part present with short, light grey hairs. Hindwing covered with brown scales; post-marginal part present with long brownish hairs. Structure: head and compound eyes relatively small; ocelli absent. Mouthparts well developed: galea hooked with longer than 2/3 of labial palpus; maxillary palpus and labial palpus covered with light yellow scales; maxillary palpus 5 segmented; labial palpus 3 segmented. Antennae longer than 4/5 of the forewing with light brown scales, filiform, and with 42 flagellomeres. Forewing: slightly narrow, L/W ratio 3.6, costa straight, termen short and arched to posterior margin, discal cell 0.65 times as long as forewing; 7 separate veins and 1 forked vein originating at the discal cell (Fig. 22); accessory and intercalary cell absent; Sc reaching to 2/5 of the costa; Rs1 and Rs2 fused; Rs3 and Rs4 originating at the anterior margin of distal corner of discal cell and forked at the base of 2/5 Rs3; Rs4 reaching near apex; base of M poorly developed; M_1 and M_2 fused, M_{1+2} and M_3 parallel; CuA_1 and CuA_2 originating at posterior margin of the distal corner of the discal cell; CuP weak; basal part of 1A + 2A looped. Hindwing considerably narrow: L/W ratio 4.3; costa straight; Sc + R straight to 1/2 costa; Rs terminating at apex; base of M weakly developed; M_1 and M_2 fused, M_{1+2} and M_3 stalked; CuP absent; CuA_1 and CuA_2 stalked, 1A + 2A slightly weak; 3A present. Legs: epiphysis present; covered with dark brown hairs. Abdomen: covered with brown scales, coremata of female present and corethrogyne absent.

Male genitalia (Figs. 11, 12). Tegumen, vinculum, and uncus fused, uncus part triangular and considerably elongated; vinculum broadly V-shaped, slightly narrow; saccus very short, 0.34 times as long as the height of the ring; valva slightly broad and ampulla (apex of valva) rounded, harp very short and hooked (lateral view); transtilla considerably slender,straight at costa of valva and well developed; phallus short and thick, cylindrical, longer than 1.75 times the height of the ring.

Female genitalia (Fig. 18). Ovipositor fairly long and narrow; papillae anales slightly narrow; ostium bursae located on anterior margin of sternum VIII, U-shaped; apophyses posteriores very slender, apophyses posteriores 3.3 times longer than apophyses anteriores, apophyses anteriores slightly thick and short; antrum short and weakly developed; ductus bursae narrow, slightly short; corpus bursae narrow and long, well sclerotized.

Larval case (Figs. 26–29). Length 3.9 to 4.1 mm. Larvae build their cases by using small particles of crustose lichens and grains of sand attached on the rock, forming wide oval-shaped cases.

TYPE MATERIAL

HOLOTYPE: 1 male KOREA: Gyeonggi-do, Pocheon-si, Gwangneung-forest, 37.752619°N, 127.585850°E, collected (larva) 20-III-2017, S.J. Roh, Y.M. Shin, emerged (Adult) V-2017, genitalia mounted on 60% euparal solution (genitalia no. KNAESJ00037) (KNAE).

PARATYPES: 1 male and 8 females KOREA: Gyeonggi-do, Pocheon-si, Gwangneung-forest, 37.752619°N, 127.585850°E, collected (larva) 20-III-2017, S.J. Roh, Y.M. Shin, emerged (Adult) V-2017, 1 male whole body mounted on 60% euparal solution (slide no. SJWS001, and genitalia no. KNAESJ00038), 5 female genitalia mounted on 60% euparal solution (genitalia no. KNAESJ00011 KNAESJ00013, KNAESJ00018, KNAESJ00034, and KNAESJ00035), venation of wing slide no. KNAEVSJ5, DNA barcode Process ID KNAEM003-18 (BOLD systems BIN. BOLD:ADL7237) (KNAE).

DISTRIBUTION

Korea.

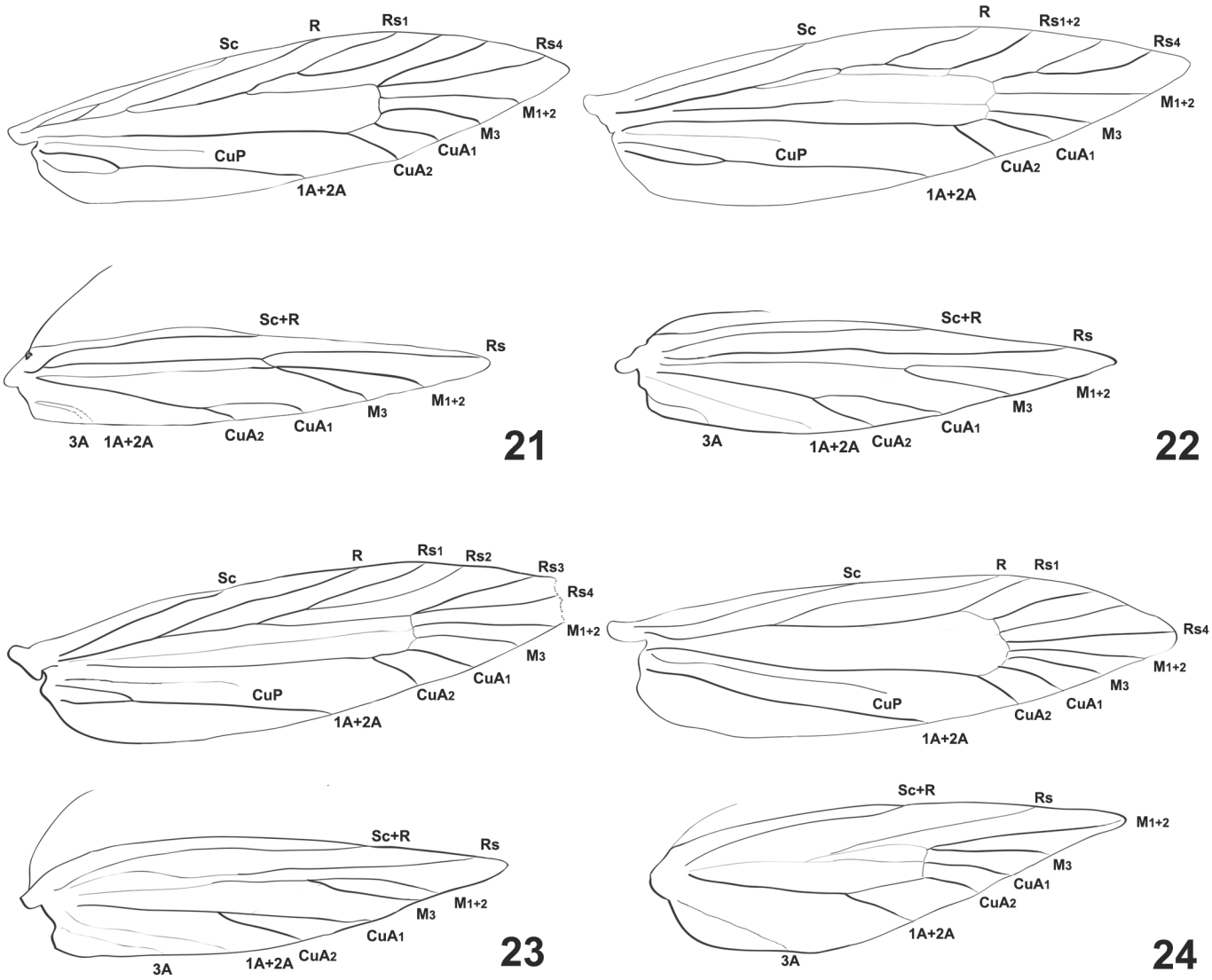
ETYMOLOGY

The specific name is derived from the type locality (Gwangneung forest) of the new species.

Eudarcia longiphalla Roh & Byun, **sp. nov.** (Figs. 7, 13, 14, 19, 23)

DIAGNOSIS

Eudarcia longiphalla **sp. nov.** is externally similar to *E. gwangneungensis* **sp. nov.**, but it can be distinguished by termen margin of forewing without light yellow hairs. The male genitalia are similar to *E. prolongata* Xiao & Li, 2009, but differ from male genitalia in the shorter elongated uncus, and fairly wide uncus and tegumen part. Furthermore, the male genitalia differ from *E. dentate* Gaedike, 2000 and *E. prolongata*. The gnathos is very short and fused with middle of uncus and tegumen part; phallus is relatively slender and long. In addition, this species can be identified readily based on female genitalia; antrum well developed; ductus bursae without spines and very long, relatively small, and very sclerotized.



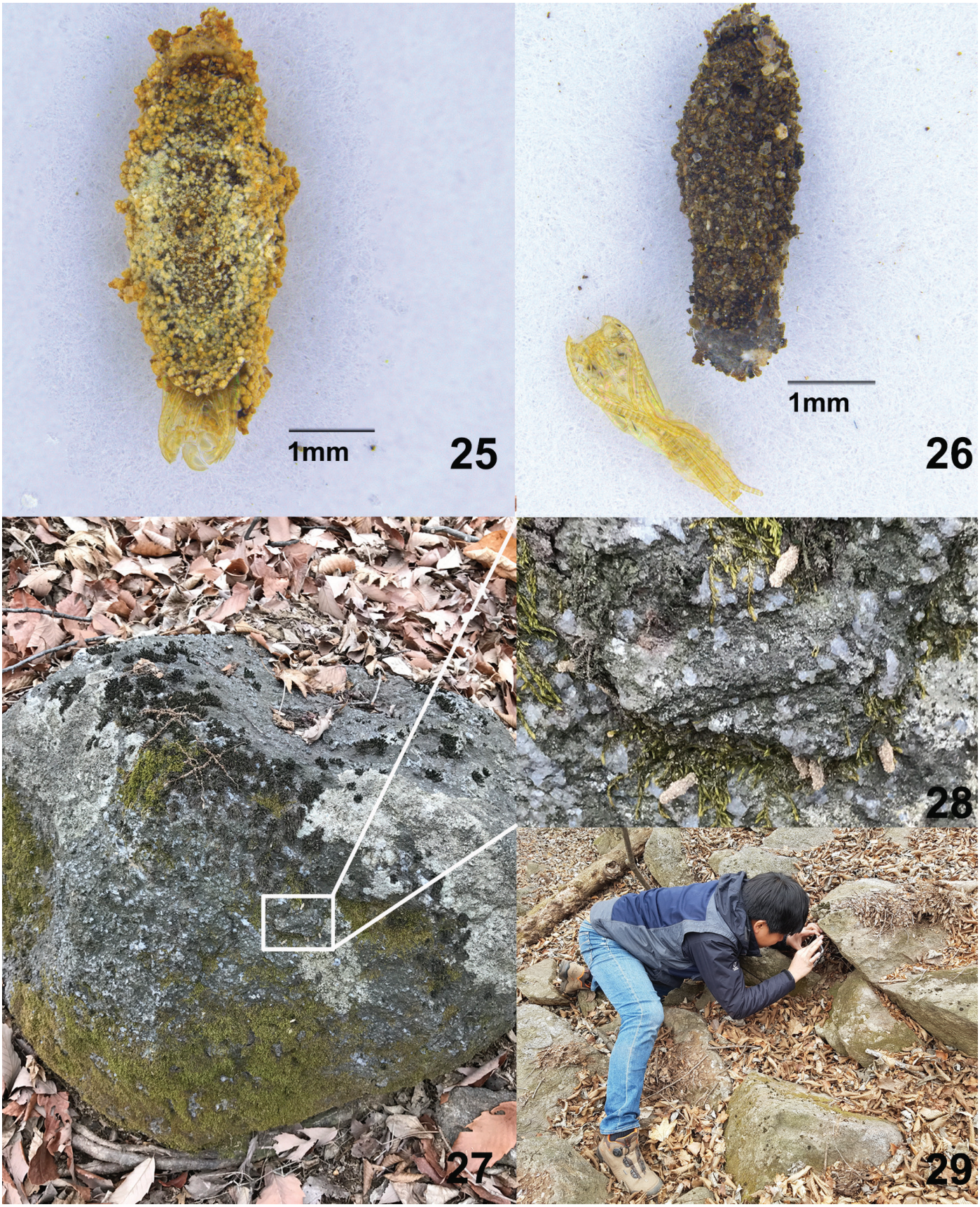
Figs. 21-24. Wing venation: (21) *Eudarcia orbiculidomus* Sakai & Saigusa (slide no. KNAEVSJ9); (22) *E. gwangneungensis* **sp. nov.**, paratype (slide no. KNAEVSJ5); (23) *E. longiphalla* **sp. nov.**, Holotype (slide no. KNAEVSJ6); (24) *E. cornea* **sp. nov.**, paratype (slide no. KNAEVSJ8).

DESCRIPTION

Adult (Figs. 7, 23). Wingspan 10.2 to 10.8 mm. Coloration and vestiture: vertex of head roughly covered with short, light yellow hairs. Thoracic notum covered with shiny, dark brown scales. Forewing: ground color light grey and covered with dark brown scales, short brown hairs present on the termen, post-marginal corner of termen present with light grey hairs. Hindwing covered with light brown scales, post-marginal part present with brown hairs. Structure: head and compound eyes slightly small; ocelli absent. Mouthparts well developed, maxillary palpus and labial palpus covered with light brown scales. Antennae filiform, covered with light brown scales, longer than 4/5 of the forewing. Forewing: slightly narrow, L/W ratio 3.64, costa straight, termen straight or arched to posterior margin, discal cell 0.64 times as long as forewing; 7 separate and 2 forked veins originating at the discal cell (Fig. 23); accessory and intercalary cell absent; Sc reaching to 2/5 of the costa; Rs1 and Rs2 forked at 1/4 of the base; Rs3 and Rs4 forked at anterior margin of distal corner of discal cell; base of M weakly developed; M_1 and M_2 fused, M_{1+2} and M_3 parallel; CuA_1 and CuA_2 originating at posterior margin of distal corner of discal cell; CuP slightly weak; basal part of 1A + 2A looped. Hindwing slightly narrow: L/W ratio 4.16; costa straight; Sc + R straight to 4/5 of the costa; Rs terminating at the apex; base of M weakly developed; M_1 and M_2 fused, M_{1+2} and M_3 forked; CuP absent; CuA_1 and CuA_2 forked, 1A + 2A weak; 3A present but considerably weak. Legs: epiphysis present; covered with light brown hairs. Abdomen: covered with brown scales; corethrogyne absent.

Male genitalia (Figs. 13, 14). Tegumen, vinculum, and uncus fused with slightly wide triangular shape; uncus very short, elongated, hooked; vinculum V-shaped; saccus elongated downward, slightly thick, 0.86 times as long as the height of the ring; valva wide; ampulla (apex of valva) rounded and apical part hooked; harp relatively short and blunt (lateral view); transtilla slender, slightly short and well developed; phallus long and slender, cylindrical, longer than 2.66 times the height of the ring, cornuti present with 2 spines.

Female genitalia (Fig. 19). Ovipositor very long and narrow; papillae anales narrow, some short satae at apex; ostium bursae located at anterior margin of sternum VIII, slightly narrowed bell-shaped; apophyses posteriores very thin, 2.7 times longer than apophyses anteriores; basal part of apophyses anteriores thick and slightly short; antrum wide and well developed; ductus bursae narrow and very long; corpus bursae narrow and well sclerotized.



Figs. 25-29. Microhabitat and larval cases with pupal exuviae: (25) *Eudarcia orbiculidomus* Sakai & Saigusa, larval case with pupal exuviae; (26) *E. gwangneungensis* **sp. nov.**, ditto; (27) Microhabitat of *E. gwangneungensis* **sp. nov.** (Korea, Gyeonggi-do, Pocheon-si, Gwangneung-forest, 20 Mar 2017); (28) ditto, close up; (29) ditto, scene of collection.

Larval case. Unknown.

TYPE MATERIAL

HOLOTYPE 1 male KOREA: Chungcheongbuk-do, Mungyeong-si, Mt. Sobaeksan, 37.825569°N, 128.379191°E, collected 17-VII-2001, legend unknown, male genitalia mounted on 60% euparal solution (genitalia no. KNAESJ00036), venation of wing slide no. KNAEVSJ6 (NAS).

PARATYPES 4 females KOREA: Gangwon-do, Donghae-si, Mt. Dutasan, 37.274175°N, 129.904444°E, collected 16-VII-2001, J.Y. Choi, G.M. Kwon, H.W. Byun, female genitalia mounted on 60% euparal solution (genitalia no. KNAESJ00012, KNAESJ00030, KNAESJ00031), venation of wing slide no. KNAEVSJ7 (NAS); 1 female KOREA: Chungcheongnam-do, Dangjin-gun, myeoncheon-eup, 36.817777°N, 126.666225°E, collected 11-VI-2016, S.J. Roh, B.S. Jeon, T.H. Yoo, female genitalia mounted on 60% euparal solution (genitalia no. KNAESJ00009), DNA barcode Process ID KNAEM002-18 (BOLD systems BIN. BOLD:ADL7238) (SEL/HNU).

DISTRIBUTION

Korea.

ETYMOLOGY

The specific name is derived from the Latin word longi (meaning "long") and the Greek word phallus, referring to the male genitalia characters.

Eudarcia cornea Roh & Byun, **sp. nov.** (Figs. 8, 15, 16, 20, 24)

DIAGNOSIS

Eudarcia cornea **sp. nov.** is externally similar to *E. gwangneungensis* **sp. nov.** and *E. longiphalla* **sp. nov.**, but it can be distinguished by wide dark brown scales on forewings. The male genitalia are similar to those of *E. orbiculidomus* Sakai & Saigusa, 1999, but the uncus is markedly elongated, and valva is very wide and spinose. Furthermore, the male genitalia differ from *E. dentata* Gaedike, 2000, and *E. similidentata* Xiao & Li, 2009, by cornuti elongated to 2 spines on the apex of the phallus; vinculum broadly V-shaped. In addition, female *E. cornea* can be differentiated based on the wide eighth abdominal segment, elongated antrum, relatively thick ductus bursae, and well-developed ductus seminalis.

DESCRIPTION

Adult (Figs. 8, 24). Wingspan 6.3 to 7.1 mm. Coloration and vestiture: vertex of head roughly clothed with pale yellow hairs. Thoracic notum covered with dark brown scales. Forewing: ground color creamy white, widely covered with dark brown scales; short creamy-white hairs present on the termen. Hindwing covered with light brown scales and brown hairs present on the post-marginal part. Structure: head and compound eyes slightly large; ocelli absent. Mouthparts well developed, maxillary palpus and labial palpus covered with light brown scales, but black scales cover on 1 to 2 segments of maxillary palpus. Antennae filiform, covered with light brown scales. Forewing: slightly narrow, L/W ratio 4.38, costa straight, termen arched in the apex to posterior margin, discal cell 0.66 times as long as the forewings; 7 separate and forked veins absent in the discal cell (Fig. 24); accessory and intercalary cell absent; Sc reaching to 2/5 of the costa; Rs3 and Rs4 stalked at anterior margin of distal corner of discal cell; Rs4 reaching apex; base of M weak; M_1 and M_2 fused; CuA_1 and CuA_2 originating at posterior margin of distal corner of discal cell; basal part of 1A + 2A looped. Hindwing short and narrow: L/W ratio 3.37; costa straight; Sc + R reaching to 3/5 of the costa; Rs terminating at 4/5 of the costa; base of M weak; M_1 and M_2 fused, M_{1+2} reaching apex, M_{1+2} and M_3 forked; CuP absent; CuA_1 and CuA_2 parallel, 1A + 2A slightly developed; 3A present, but weak. Legs covered with light brown hairs. Abdomen: covered with brown scales, corethrogyne absent.

Male genitalia (Figs. 15, 16). Tegumen, vinculum, and uncus fused, slightly narrow; uncus short, elongated into 2 parts; vinculum broadly V-shaped; saccus short and narrowed downward, 0.79 times as long as the height of the ring; valva very wide, club-shaped (lateral view), costa of valva rounded in the apical part, spinose; transtilla short and hooked; phallus long and slender, longer than 2.32 times the height of the ring; cornuti elongated into 2 spines on the apex of the phallus.

Female genitalia (Fig. 20). Ovipositor slightly long and narrow; papillae anales narrow, some short satae at the apical part; eighth abdominal segment wide; ostium bursa bell-shaped; apophyses posteriores thin and long, 3.6 times longer than apophyses anteriores, thick in the basal part; antrum elongated; ductus bursae slightly thick and short; corpus bursae wide and well sclerotized.

Larval case. Unknown.

TYPE MATERIAL

HOLOTYPE 1 male KOREA: Incheon, Ongjin-gun, Baengnyeong Is., 37.941388°N, 124.662247°E, collected 7-VII-2015, S.Y. Park, Y.M. Shin, J.W. Nam, male genitalia mounted on 80% glycerol solution (genitalia no. KNAESJ00027), DNA barcode Process ID KNAEM009-18 (BOLD systems BIN. BOLD:ADL7356) (KNAE).

PARATYPES 2 males and 3 females KOREA: Incheon, Ongjin-gun, Baengnyeong Is., 37.941388°N, 124.662247°E, collected 7-VII-2015, S.Y. Park, Y.M. Shin, J.W. Nam, 1 male genitalia mounted on 60% euparal solution (genitalia no. KANES000J28), 2 females genitalia mounted on 60% euparal solution (genitalia no. KNAESJ00026, KNAESJ00029), venation of wing slide no. KNAEVSJ8, 2 males and 3 females DNA barcode Process ID KNAEM004-18, KNAEM005-18, KNAEM006-18, KNAEM007-18, KNAEM008-18 (BOLD systems BIN. BOLD:ADL7356) (KNAE).

DISTRIBUTION

Korea.

ETYMOLOGY

The specific name is derived from the Latin word corneus (meaning "horn"), referring to the uncus part of male genitalia characters.

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