

## New Records of Seven *Eupithecia* (Lepidoptera: Geometridae) from Korea

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### ABSTRACT

The genus *Eupithecia* Curtis is the largest taxon in Lepidoptera (more than 1,500 species worldwide) and the adults of the genus are characterized by small in size, cryptically colored grayish and brownish forewing, and indistinct basal, ante- and postmedial transverse lines mostly with a definite discal spot on the forewing. Forty-four species have been reported so far in Korea. Herein, we present the first report on seven species of *Eupithecia*: *Eupithecia rufescens* Butler (1878), *Eupithecia costiconvexa* Inoue (1979), *Eupithecia daemionata* Dietze (1904), *Eupithecia persuastrix* Mironov (1990), *Eupithecia actaeata* Walderdorff (1869), *Eupithecia suboxydata* Staudinger (1897) and *Eupithecia costimacularia* Leech (1897). Diagnosis, descriptions and figures of the available species are provided.

**Keywords:** taxonomy, *Eupithecia*, Larentiinae, new records, Korea

### INTRODUCTION

The genus *Eupithecia* Curtis is one of the most species-rich taxa of Lepidoptera, comprised of more than 1,500 species worldwide (Scoble, 1999). The adults of *Eupithecia* are relatively small in size (wingspan ranges from 12 to 35 mm), have cryptically colored grayish and brownish forewing with regularly fasciated and a definite discal spot and the more weakly fasciated hindwing (Holloway, 1997; Mironov, 2003). Most specimens of the species can rarely be identified by external appearance, requiring dissection of the genitalia for correct identification (Mironov, 2003). The male genitalia of the genus usually can be characterized as membranous, tapering uncus with one or two tips, slender membranous valva often with ventral process, labidies with anterior arms apically digitiform, juxta broadest transversely with two narrow apical lobes, and aedeagus with one or more variously shaped cornuti (Mironov, 2003). The female genitalia usually can be characterized by the membranous papillae anales, ductus bursae with a well-developed colliculum, and corpus bursae covered with numerous signa and different positions of the ductus seminalis (Mironov, 2003).

In Korea, a total of 44 species of *Eupithecia* are recorded (Oh, 1992, 1993; Shin, 1996; Choi and Kim, 2013; Choi,

2014). The purpose of the present study was to report seven new records of the genus. Examination of adults, including the male and female genitalia, is in reference to Scoble (1992). Abbreviations are as follows: TL, type locality; NHRS, Naturhistoriska riksmuseet, Stockholm, Sweden; GW, Gangwon-do; GG, Gyunggi-do; GB, Gyungsanbuk-do; GN, Gyungsangnam-do; JB, Jeollabuk-do; JN, Jeollanam-do; and JJ, Jeju-do.

### SYSTEMATIC ACCOUNTS

Order Lepidoptera Linnaeus, 1758  
Family Geometridae Stephens, 1829  
Subfamily Larentiinae Duponchel, 1845  
Tribe Eupitheciini Tutt, 1896  
Genus *Eupithecia* Curtis, 1825

#### *Eupithecia rufescens* Butler, 1878 (Figs. 1A, 2A–C, G)

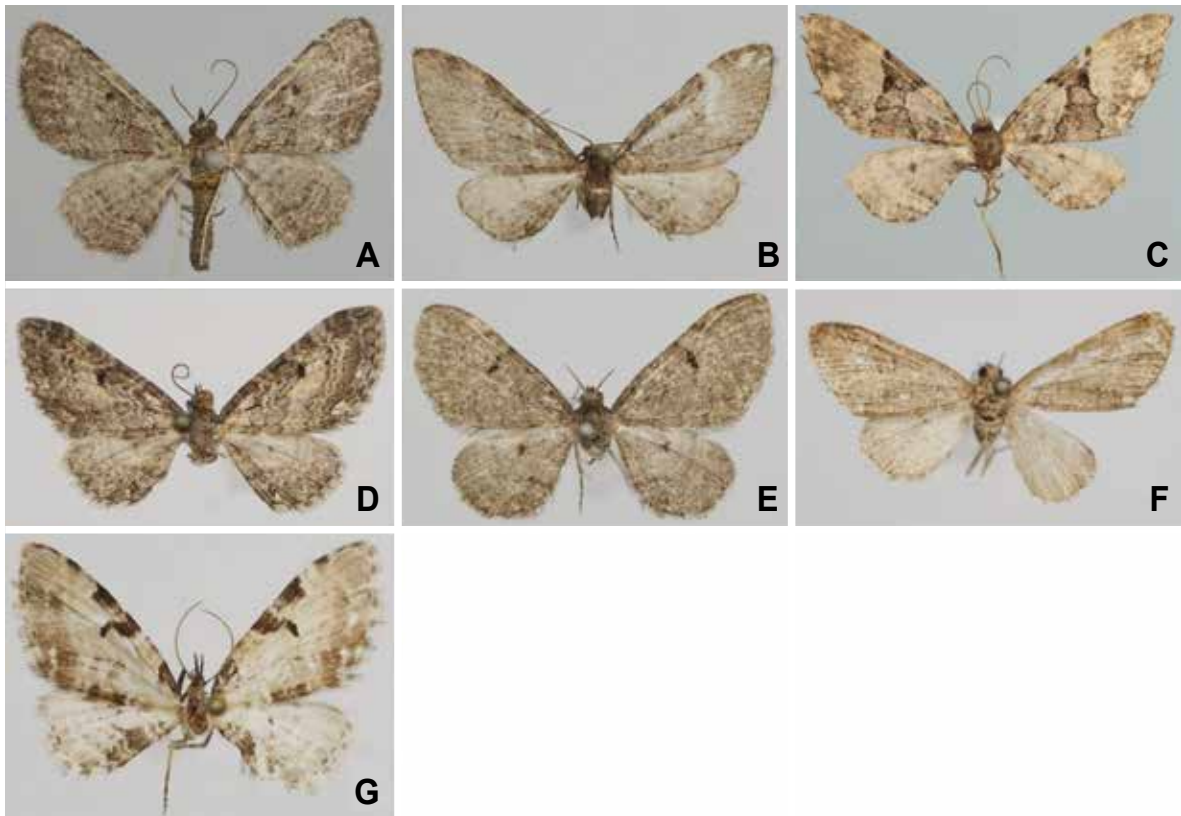
*Eupithecia rufescens* Butler, 1878: 445. TL: Japan, Yokohama.

*Eupithecia larntimima* Vojnits, 1974: 221, figs. 2a–e. TL: China, Prov. Chekiang [Zhejiang], West-Tien-Mu-Shan, 1,600 m.

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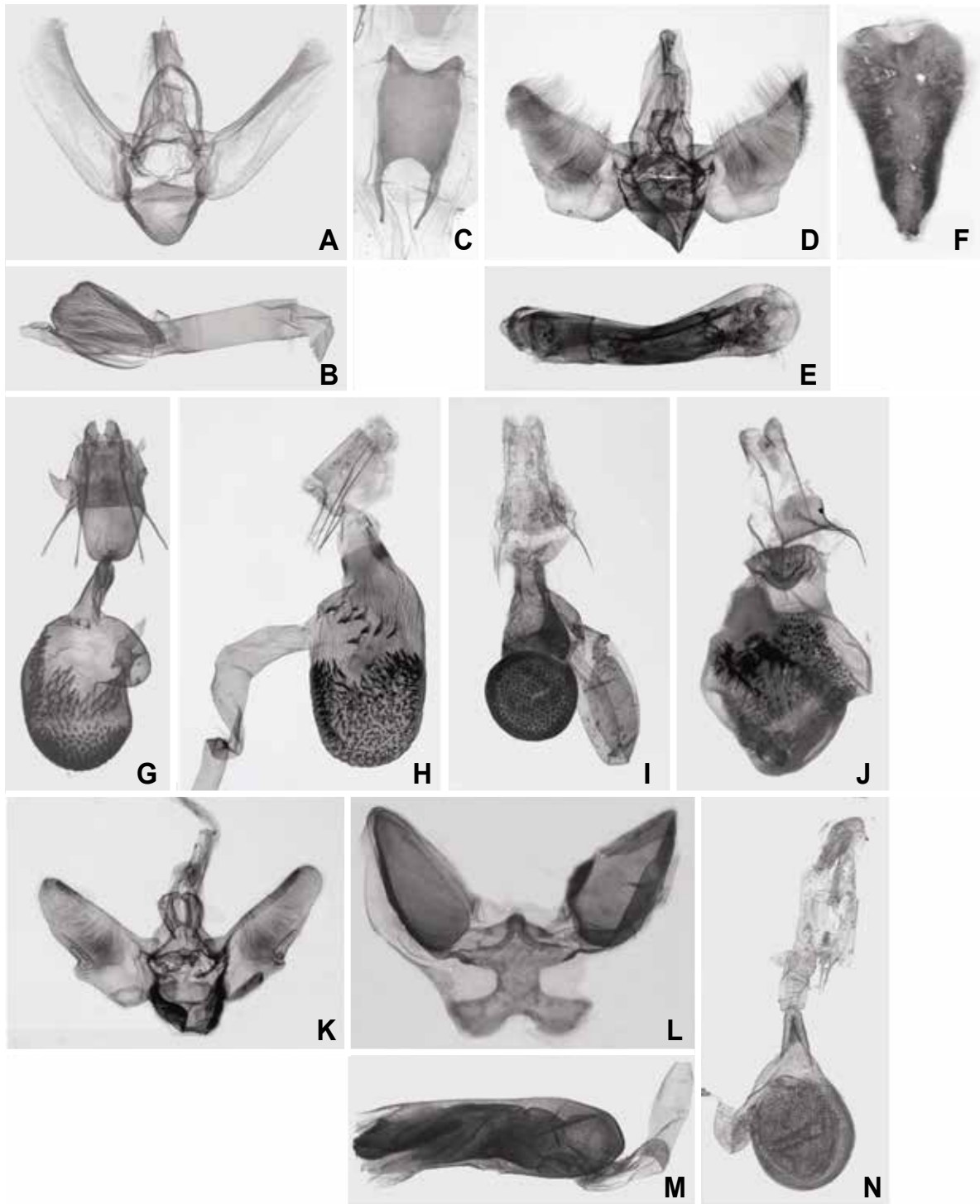
**Fig. 1.** Adults of *Eupithecia* in Korea. A, *E. rufescens*; B, *E. costiconvexa*; C, *E. daemionata*; D, *E. persuatrix*; E, *E. actaeata*; F, *E. suboxydata*; G, *E. costimaculata*.

**Material examined.** South Korea: 1 ♂, GN, Hamyang-gun, Macheon-myon, Mt. Jirisan, 35°21'18"N, 127°38'08"E, 760 m, 7 Jun 2011, Choi SW; 1 ♀, JN, Muan-gun, Chunggye-myon, Bokgil-ri, 34°54'08"N, 126°24'22"E, 21 m, 23 May 2007, Choi SW; 1 ♀, JJ: Jeju, Mt. Hallasan, 33°23'N, 126°28'E, 783 m, 2 Jun 2006, An JS; 2 ♂ 1 ♀, Jeju, Hawondong, Tamra Univ., 29 May 2011, Kim SS.

**Diagnosis.** This species can be characterized by the long projected labial palpi, the pale rusty brown ground color of the fore and hindwings, the dark brownish double undulating postmedial lines and relatively large brownish discal dot on the forewing, and the thick blackish medial lines and postmedial line of the hindwing. This species is similar to *Eupithecia abietaria*, but can be distinguished by the broad central fascia and double undulating postmedial lines of the forewing. The male genitalia can be diagnosed by the long, slender uncus, the large, cone-shaped papillae, the thick digitate anterior arm of the labides, the medially projected saccus, the long, slender valva with long, sclerotized costa, and the minute spinular cornuti of the vesica. The male genitalia of *Eupithecia rufescens* are similar to those of *E. abietaria*, but can be distinguished by the minute cornuti of

the vesica. The female genitalia can be diagnosed by the large, semi-circular antrum, the short ductus bursae with a colliculum, and the large ovate corpus bursae bearing a posterior patch of large spicules and an anterior patch of small spicules. The female genitalia of *Eupithecia rufescens* are similar to those of *E. abietaria*, but can be distinguished by the two closely located patches of spicules of corpus bursae.

**Description.** Wingspan 18–20 mm. Antennae filiform; frons trapezoid, covered with whitish and dark brown scales, which are projected below; labial palpi very long, three times the length of eye diameter, projecting forward, covered with dark brown scales. Body whitish. Forewing: ground color brown; basal line broad, brown, costally projected; antemedial line blackish; postmedial line blackish, costally and medially projected; small, black discal dot on antemedial line; central fascia brownish, costally tinged with white scales; termen dark brown. Hindwing: ground color brown; several straight, blackish basal and antemedial lines; postmedial line blackish, projected costally and medially; discal dot indistinct; termen dark brown. **Male abdomen and genitalia:** Octavals on 8th sternite long, incurved anteriorly, slightly tapered posteriorly and deep medial invagination



**Fig. 2.** Male and female genitalia of *Eupithecia* in Korea. A, D, K, Male genital capsule; C, F, L, Male 8th sternite; B, E, M, Aedeagus; G-J, N, Female genitalia. A-C, G, *E. rufescens*; D-F, *E. costiconvexa*; H, *E. daemionata*; I, *E. persuastrix*; J, *E. actaeata*; K-M, *E. suboxydata*; N, *E. costimacularia*.

with long lateral arm. Uncus long, strongly tapered, not bilobed; long anal tube; tegumen almost equal to length of

vinculum; arm of labides digitiform and apically hairy; juxta with large reniform body, narrow neck, and semi-circular

head; saccus long, medially projected. Valva long, slender, membranous; costa slender, weakly sclerotized; sacculus weakly projected basally. Aedeagus long, rod-shaped; cornuti in the form of minute spinular processes. **Female genitalia:** Papillae anales simple, weakly sclerotized, hairy; apophyses posteriores almost twice the length of apophyses anteriores; antrum broad, semi-circular; ductus bursae short, colliculum present; corpus bursae long, ovate, anterior half filled with large spicules.

**Distribution.** Korea, China (Zhejiang), Japan.

**Host plant:** *Cryptomeria japonica* (Taxodiaceae) (Inoue 1979).

***Eupithecia costiconvexa* Inoue, 1979 (Figs. 1B, 2D–F)**

*Eupithecia costiconvexa* Inoue, 1979: 178, figs. 4J, K, 5I, 11C, 12B. TL: Japan, Kochi Pref., Muroto City, Sakinohama.

**Material examined.** 1♂, South Korea, JJ, Seogwipo, Har-aeri, 33°18'57.0"N, 126°37'09.9"E, 264 m, 9 Jul 2011, Choi SW.

**Diagnosis.** This species can be characterized by the long triangular forewing with broad band-shaped central fascia showing a long blackish discal dot. This species is similar to *Eupithecia clavifera*, but can be distinguished by the transverse central fascia without costal projection of the forewing. The male genitalia can be diagnosed by the short, apically bifurcated uncus, the medially projected saccus, the hairy valva with largely expanded sacculus, and two linear spinular cornuti of the vesica. The male genitalia of *Eupithecia costiconvexa* are similar to those of *E. signigera*, but can be distinguished by the broad sacculus of the valva.

**Description.** Wingspan 20 mm. Antennae filiform; frons slender, covered with whitish and dark brown scales; labial palpi thin, long, twice the length of eye diameter, projecting forward, covered with dark brown scales. Body whitish. Forewing: ground color brown; basal line dark brown, dentate; antemedial and postmedial lines blackish; discal dot small, black, closely located to postmedial line; central fascia brownish, band-shaped; termen light brown. Hindwing: yellowish-white; basal line black; ante- and postmedial lines blackish, slightly projected medially; discal dot small, black; termen with dark brown undulating line. **Male abdomen and genitalia:** Octavals on the 8th sternite long, triangular, incurved anteriorly, strongly tapered posteriorly. Uncus short, apex bifurcated; long anal tube with papillae; tegumen almost equal to the length of vinculum; arm of labides triangular and apically hairy; juxta with large reniform body, narrow neck, and semi-circular head; saccus long, medially projected. Valva long, hairy; costa slender, weakly sclerotized; sacculus with broad basal expansion. Aedeagus

long, rod-shaped; cornuti in the form of two long spinular processes. **Female genitalia:** Not examined.

**Distribution.** Korea, Taiwan, Japan, N. Thailand.

***Eupithecia daemionata* Dietze, 1904 (Figs. 1C, 2H)**

*Eupithecia daemionata* Dietze, 1904: 339, Pl. 3, fig. 9. TL: Japan, Nikko.

**Material examined.** South Korea: 3♀, JN, Gurye-gun, Mt. Jirisan, 35°18'12"N, 127°33'34"E, 1,318 m, 26 May 2007, Choi SW; 1♀, JN, Gurye-gun, Mt. Jirisan, 35°18'02"N, 127°33'10"E, 1,370 m, 22 May 2008, Park M; 1♀, GN, Hamyang-gun, Macheon-myon, Mt. Jirisan, 35°21'18"N, 127°38'08"E, 760 m, 27 Apr 2007, Choi SW.

**Diagnosis.** This species can be characterized by the band-shaped central fascia bearing a costally bent antemedial line and a large black discal dot on the postmedial line of the forewing. This species is similar to *Eupithecia signigera*, but can be distinguished by the relatively broad central fascia with a costal band of the antemedial line of the forewing. The female genitalia can be diagnosed by the long corpus bursae that show a large patch of anterior spicules and linearly located large spicules. The female genitalia of *Eupithecia daemionata* are distinguishable from those of *E. signigera* by the long ovate corpus bursae with lateral opening of the ductus seminalis.

**Description.** Wingspan 17–20 mm. Antennae filiform; frons trapezoid, covered with brown and dark brown scales, slightly projected below; labial palpi covered with brown scales, long, twice the length of eye diameter, projecting well beyond frons. Body covered with brown and dark brown scales. Forewing: ground color brown; basal line thick, brown; antemedial line blackish, costally invaginated; postmedial line blackish, with weak costal invagination; large, black discal dot on postmedial line; central fascia band-shaped; termen dark brown with whitish undulating line. Hindwing: ground color brown; basal and antemedial lines blackish; postmedial line blackish, straight; discal dot small, black; termen dark brown. **Male genitalia:** Not examined. **Female genitalia:** Papillae anales simple, weakly sclerotized; apophyses posteriores almost three times the length of apophyses anteriores; antrum narrow; ductus bursae short, broad, with colliculum present; corpus bursae long, ovate, marked with semi-circular patch of small spicules and one scattered patch of large spicules; ductus seminalis open laterally.

**Distribution.** Korea, China (Shaanxi, Sichuan, Jilin), Taiwan, Russian Far East, Japan.

***Eupithecia persuastrix* Mironov, 1990 (Figs. 1D, 2I)**

*Eupithecia persuastrix* Mironov, 1990: 113. TL: Russia, Primorye Territory, Sutshan, Mt. Tsan-Dynza.

**Material examined.** South Korea: 1 ♀, Gwangju, Mt. Mu-deungsan, 8 Sep 2002, Choi SW; 1 ♀, JN, Muan-gun, Mt. Seungdalsan, 34°54'N, 126°27'E, 22 Sep 2004, Choi SW; 1 ♀, JN, Muan-gun, Bokgil-ri, Chunggye-myon, 34°54'08" N, 126°24'22"E, 21 m, 21 Sep 2008, Choi SW; 1 ♀, JJ, Seogwipo, Tamra Univ., 8 Oct 2009, Kim SS.

**Diagnosis.** This species can be characterized by the evenly curved postmedial line and the white tornal dot on the forewing with a brown anterior half and the rest white and a large black discal dot in the middle. This species is similar to *Eupithecia tripunctaria*, but can be distinguished by the two colored central fascia of the forewing. The female genitalia can be diagnosed by the short and broad ductus bursae and the long corpus bursae showing a small ovate anterior sac and a partly sclerotized triangular posterior sac. The female genitalia of *Eupithecia persuatrix* are distinguishable from those of *E. tripunctaria* by the anterior small ovate corpus bursae filled with dense spicules.

**Description.** Wingspan 19–21 mm. Antennae filiform; frons trapezoid, covered with light brown scales, projected below; labial palpi moderate, almost equal to the length of eye diameter, well projected beyond frons, covered with dark brown scales. Body whitish. Forewing: ground color brown; basal line broad, black, projected costally; antemedial line yellowish-white, with strong costal invagination; postmedial line blackish, projected costally and medially; large, black discal dot on central fascia; inner half of central fascia brownish, with whitish outer half; termen dark brown with yellowish-white undulating line and whitish tornal dot. Hindwing: light brown; basal and antemedial lines light blackish; postmedial line blackish, medially projected; discal dot small, black; termen blackish with yellowish-white undulating line. **Male genitalia:** Not examined. **Female genitalia:** Papillae anales simple, weakly sclerotized, hairy; apophyses posteriores almost twice the length of apophyses anteriores; antrum broad, semi-circular; ductus bursae short, broad, colliculum present; corpus bursae long, anteriorly ovate and densely filled with small spicules, posteriorly sac-shaped, sclerotized with ductus seminalis.

**Distribution.** Korea, Japan, Russian Far East.

***Eupithecia actaeata* Walderdorff, 1869 (Figs. 1E, 2J)**

*Eupithecia actaeata* Walderdorff, 1869: 82. TL: Germany.

*Eupithecia bergunensis* Dietze, 1875: 248, Pl. 2, fig. 1. TL: Switzerland, Kanton Graubünden, Bergün.

*Eupithecia praenubilata* Inoue, 1958: (252), fig. 9; Pl. 34, fig. 22. TL: Japan, Kushiro, Shibechea.

**Material examined.** 1 ♀, South Korea, GW, Hwacheon-gun, Sanae-myon, Mt. Gwangdeoksan, 19 Aug 2011, Kim SS.

**Diagnosis.** This species can be characterized by the dark brown ground color and costally sinuate central fascia and large blackish discal dot of the forewing. This species is similar to *Eupithecia kobayashii*, but can be distinguished by the costally smooth curved postmedial line and large blackish discal dot on the forewing. The female genitalia can be diagnosed by the broad antrum with triangular lamella postvaginalis, the short ductus bursae and the long ovate corpus bursae, marked with a large patch of long and small spicules. The female genitalia of *Eupithecia actaeata* are distinguished from those of *E. tripunctaria* by the small ovate anterior corpus bursae filled with dense spicules.

**Description.** Wingspan 20 mm. Antennae filiform; frons slender, covered with brown scales, slightly projected below; labial palpi covered with brown scales, long, 1.5 times the length of eye diameter, projecting well beyond frons. Body covered with brown and dark brown scales. Forewing: ground color brown; basal line blackish, dentate; antemedial line blackish, costally invaginated; postmedial line blackish, medially projected; large, black discal dot on central fascia; central fascia broad, band-shaped; termen dark brown. Hindwing: ground color brown; basal and antemedial lines blackish; postmedial line blackish, medially projected; discal dot large, black; termen brown. **Male genitalia:** Not examined. **Female genitalia:** Papillae anales simple, weakly sclerotized; apophyses posteriores almost twice the length of apophyses anteriores; antrum broad with triangular lamella postvaginalis; ductus bursae short, broad, colliculum absent; corpus bursae long, ovate, marked with a large patch of long and small spicules; ductus seminalis open laterally.

**Distribution.** Korea, China (Qinghai, Shannxi), Europe, Russia (Urals), Russian Far East, Japan.

**Biology.** Larva found on *Actaea* spp. (Ranunculaceae) (Mironov and Galsworthy, 2014).

**Remarks.** Mironov and Galsworthy (2014) noted the occurrence of this species in Korea without information of locality. Thus, the occurrence information on this species is provided herein.

***Eupithecia suboxydata* Staudinger, 1897 (Figs. 1F, 2K–M)**

*Eupithecia suboxydata* Staudinger, 1897: 112, Pl. 3, fig. 74.

TL: Russia, Vladivostok, Askold, Suifum, Sutschan.

**Material examined.** 1 ♂, North Korea, Shuotsu (Jueul), 2 Jul 1935, Sten Bergman (NHRS).

**Diagnosis.** This species can be characterized by the transverse central fascia with thick dark brown ante- and postmedial lines and large blackish discal dot, and by the dark brown termen with a yellowish-white undulating line of the forewing and dark brown termen of the hindwing. This

species is similar to *Eupithecia subbrunneata*, but can be distinguished by the brownish ground color of the wings, large blackish discal dot of the forewing and dark brown termen of the fore- and hindwings. The male genitalia can be diagnosed by the bifurcated apex of the uncus, medially invaginated saccus, slender valva with large sacculus and the sclerotized plate-like cornutus of the vesica. The male genitalia of *Eupithecia suboxydata* are similar to those of *E. subbrunneata*, but can be distinguished by the broad rectangular sacculus of the valva.

**Description.** Wingspan 21 mm. Antennae filiform; frons trapezoid, covered with yellowish-whitish and brown scales; labial palpi short, almost equal length as eye diameter, covered with brown scales. Body brownish. Forewing: ground color brown; basal line blackish, dentate; antemedial line broad, dark brown; postmedial line broad, dark brown, medially projected; large, black discal dot on central fascia; central fascia with medial lines, projected medially; termen dark brown with yellowish-white undulating line. Hindwing: ground color brown; several dark brownish basal and antemedial lines, almost straight; postmedial line dark brownish, weakly wavy; discal dot large, brown; termen dark brown. **Male abdomen and genitalia:** Octavals on 8th sternite large, anteriorly incurved, posterior medial projection with a pair of large triangular arms. Uncus slender, apex bilobed; long anal tube; tegumen almost equal to the length of vinculum; arm of labides broad digitiform and apically hairy; juxta with large reniform body, narrow neck, and semi-circular head; saccus long, broad, medially invaginated. Valva long, slender, membranous, hairy; costa slender, weakly sclerotized; sacculus basally expanded broadly. Aedeagus long, rod-shaped; cornutus in the form of large sclerotized plate-shaped process. **Female genitalia:** Not examined.

**Distribution.** Korea, China (Xinjiang, Shaanxi, Shanxi, Gansu, Qinghai, Sichuan, Beijing), Russian Siberia, Russian Far East, Kazkhstan, Kirghizstan, Mongolia, Japan.

**Biology.** Larva found on flowers of *Artemisia santolinifolia* (Asteraceae) (Mironov and Galsworthy, 2014).

**Remarks.** Mironov and Galsworthy (2014) noted the occurrence of this species in Korea without information of locality. Thus, the occurrence information on this species is provided herein.

***Eupithecia costimacularia* Leech, 1897 (Figs. 1G, 2N)**

*Eupithecia costimacularia* Leech, 1897: 69. TL: Japan, Yokohama.

**Material examined.** 1 ♀, South Korea, JJ, Jeju, Mt. Hallasan, 33°22'11"N, 126°37'32"E, 636 m, 14 Apr 2007, Choi SW.

**Diagnosis.** This species can be characterized by the long labial palpi and the whitish color of the forewing, as well as the indistinct central fascia of forewing with large blackish markings on the costa, dark brown marking on the dorsum, large discal dot and dark brown termen of the forewing. This species is similar to *Eupithecia insignioides*, but can be distinguished by the whitish color of the wings and large blackish costal markings and brown termen of the forewing. The female genitalia can be diagnosed by the narrow antrum, short and narrow ductus bursae, and pear-shaped corpus bursae with the anterior 2/3 filled with minute spicules. The female genitalia of *Eupithecia costimacularia* are similar to those of *E. insignioides*, but can be distinguished by the smaller sac-shaped corpus bursae.

**Description.** Wingspan 19 mm. Antennae filiform; frons slender, covered with dark brown scales; labial palpi covered with brown scales, long, three times the length of eye diameter, projecting well beyond frons. Body covered with yellowish-white scales. Forewing: light brown; basal part costally marked with a black dot; antemedial line costally broad, blackish, merged with long blackish discal dot, medially indistinct; postmedial line dotted costally with blackish dots, medially indistinct; discal dot large, black; central fascia costally tinged with black dot, medially indistinct, dorsally dark brownish; termen light brown with brown band. Hindwing: whitish; basal and antemedial lines blackish, dorsally tinged with brown scales; postmedial line blackish, medially projected; discal dot small, black; termen light brown. **Male genitalia:** Not examined. **Female genitalia:** Papillae anales simple, weakly sclerotized; apophyses posteriores almost twice the length of apophyses anteriores; antrum narrow; ductus bursae short, narrow, colliculum present; corpus bursae pear-shaped, anterior 2/3 filled with minute spicules; ductus seminalis open laterally.

**Distribution.** Korea, China (Guangxi, Guangdong, Hong Kong), Taiwan, Japan.

## ACKNOWLEDGMENTS

We thank to Dr. Johannes Bergsten (NHRS) for the loan of the specimen. 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).

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Received January 20, 2015  
Revised March 19, 2015  
Accepted March 25, 2015