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Taxonomic Revision of the Genera *Pareulype* Herbulot and *Pelurga* Hübner (Lepidoptera, Geometridae) in Korea

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Abstracts: A geometrid genus *Pareulype* Herbulot *sensu* Inoue (1977) is reviewed in Korea. Up to now, two species, *P. taczanowskiaria* (Oberthür) and *P. onoi* Inoue, were known from Korea and these two species were newly combined into another genus *Pelurga* Hübner. One *Pareulype* species, *P. consanguinea* (Butler), is first recognized from Korea throughout the present study. Diagnoses of each genus and species are provided with illustrations of adults and genitalia. Phylogenetic relationship of *Pareulype* and *Pelurga* Hübner is briefly discussed.

Key words: *Pareulype*, *Pelurga*, taxonomy, Korea, new record.

INTRODUCTION

Pareulype Herbulot and *Pelurga* Hübner include middle-sized larentiine moths and spread widely in the Palearctic and northern oriental regions. The genus *Pareulype* was erected with the type species *Geometra berberata* Denis & Shiffermüller and now includes about seven species (Scoble, 1999). The genus *Pelurga* was erected with the type species *Phalaena comitata* Linnaeus and comprises three species (Xue and Zhu, 1999).

It has been suggested that there is no taxonomic relationship between the two genera, *Pareulype* and *Pelurga*, although members of these genera were externally similar. Prout (1914, 1938) noted that *taczanowskiaria* was similar to *Pelurga comitata* in the shape of abdomen, but these species couldn't be placed into one taxonomic group. Scoble (1999) listed *taczanowskiaria* as a species of *Nebula* Bruand since the old combination of this species was *Coenotephria* Prout that is the junior synonym of *Nebula*. Viidalepp (1996) placed the genus *Pareulype* into Rheumapterini with its sister genera such as *Rheumaptera* Hübner, *Hydria* Hübner, and *Triphosa* Stephens, whereas the genera *Pelurga* and *Nebula* were placed under Larentiini and Cidariini, respectively.

Yazaki (1995), in the revision of Nepalese moths, noted the characteristics of the male genitalia of *Pareulype*: relatively short, apically expanded labides, medially ridged costa, well sclerotized sacculus bearing a short process at apex, and a patch of spinular cornuti. He suggested that two species of *Pareulype sensu* Inoue (1977), *onoi* Inoue and *taczanowskiaria* (Oberthür), could be separable from the typical species of *Pareulype* based on the male genitalia. Xue and Zhu (1999) newly combined these two species with *Pelurga* Hübner. These taxonomic changes brought the necessity of phylogenetic analysis of Larentiinae.

The purpose of the present study is to revise the species of *Pareulype sensu* Inoue and report one species, *P. consanguinea* (Butler), new to Korea. In addition, the phylogenetic relationship between *Pareulype* and *Pelurga* is discussed based on external morphology of adult and immatures.

MATERIALS AND METHODS

Moths were examined externally and were dissected for genitalia examination, following the general procedure of Bolte (1990). Nomenclature for adult morphology and genitalia follows Hausmann (2001).

Abbreviations throughout the text are as follows: TL. Type locality; [YG] Yanggang-do, North Korea; [HB] Hamgyungbuk-do, North Korea; [HN] Hamgyungnam-do, North Korea; [GW] Gangwon-do, South Korea; [JN] Jeollanam-do, South Korea; HNHM, Hungarian Natural History Museum, Budapest; MNU, Mokpo National University, Muan; SNHM, Swedish Natural History Museum, Stockholm.

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RESULTS

Pareulype Herbulot, 1951, Revue fr. Lépodopt. 13: 62.

Type species: *Geometra berberata* Denis and Schiffermüller, 1775. TL: (AUSTRIA) Vienna district.

Diagnosis. Moths of *Pareulype* have dark brown or pale brown wings with filiform antennae and are characterized by the thin, blackish band of antemedial line and dark, undulating postmedial line with one or two strong projections at costal part of forewing. In wing venation, there are two areoles in forewing and long, bent mdc (*sensu* Forbes, 1948) in hindwing. The male genitalia are distinguished by the long uncus, the well developed subscaphium, the membranous triangular labidies, the reverse triangular juxta, a pair of patches of hairs at both sides of juxta, the sclerotized costa and sacculus of valva with a distal process, and a patch of spinular cornuti of aedeagus. The female genitalia are distinguished by the simple ostium bursae, the sclerotized ductus bursae with large corpus bursae with a horizontally oriented band-shaped signum. In Korea, only one species of *Pareulype* (*P. consanguinea*) is distributed.

Pareulype consanguinea (Butler) (Figs. 1B, 2B, 2D)*

Anticlea consanguinea Butler, 1878, Ann. Mag. Nat.

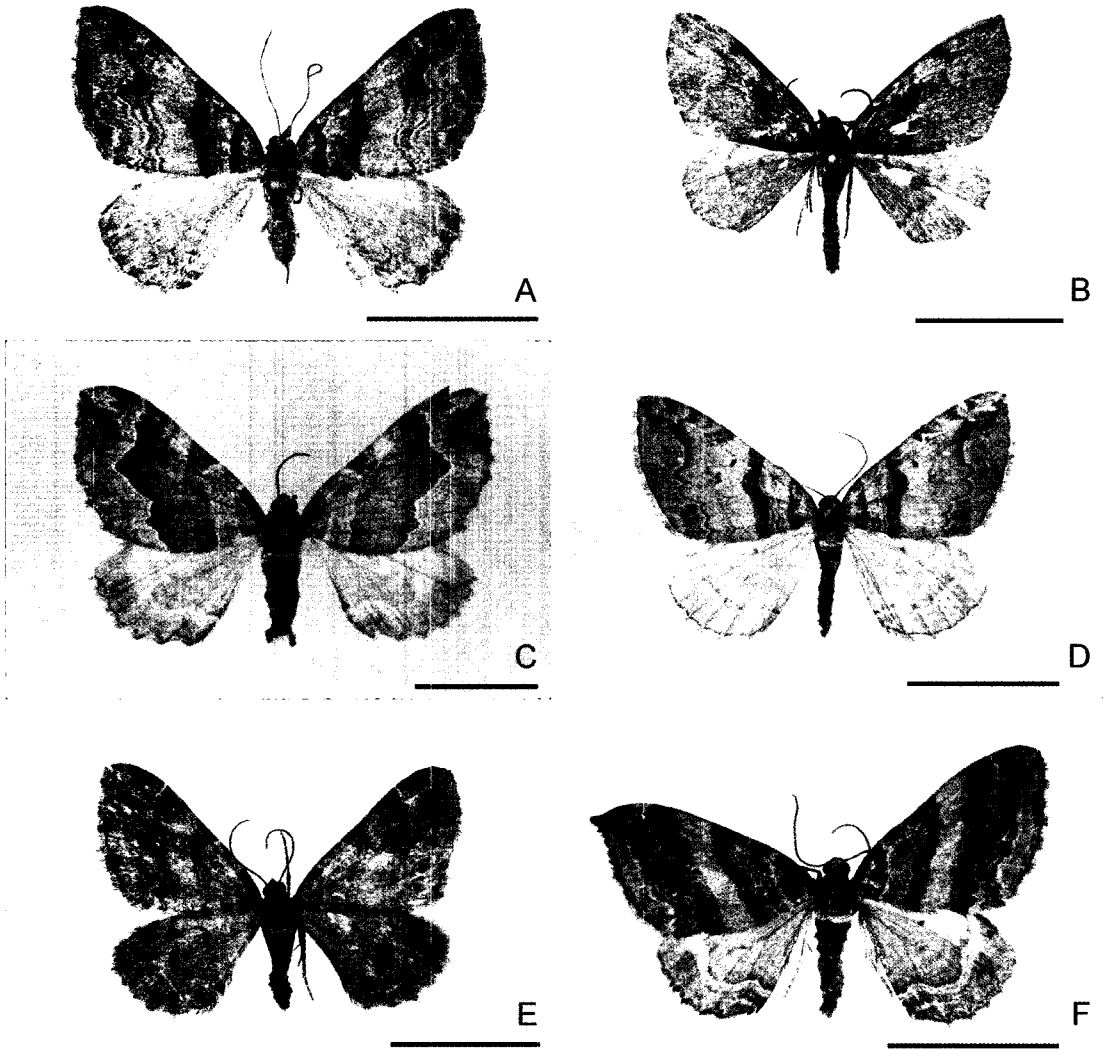

Fig. 1. Adults. A, ♀ *Pareulype berberata* (Denis and Schiffermüller), Hungary. B, ♂ *P. consanguinea* (Butler), Korea. C, ♂ *Pelurga comitata* (Linnaeus), Korea. D, ♂ *P. onoi* (Inoue), Korea. E, ♂ *P. taczanowskiaria* (Oberthür), Korea. F, ♂ *P. taczanowskiaria* (Oberthür), Russia. Scale bars = 10 mm.

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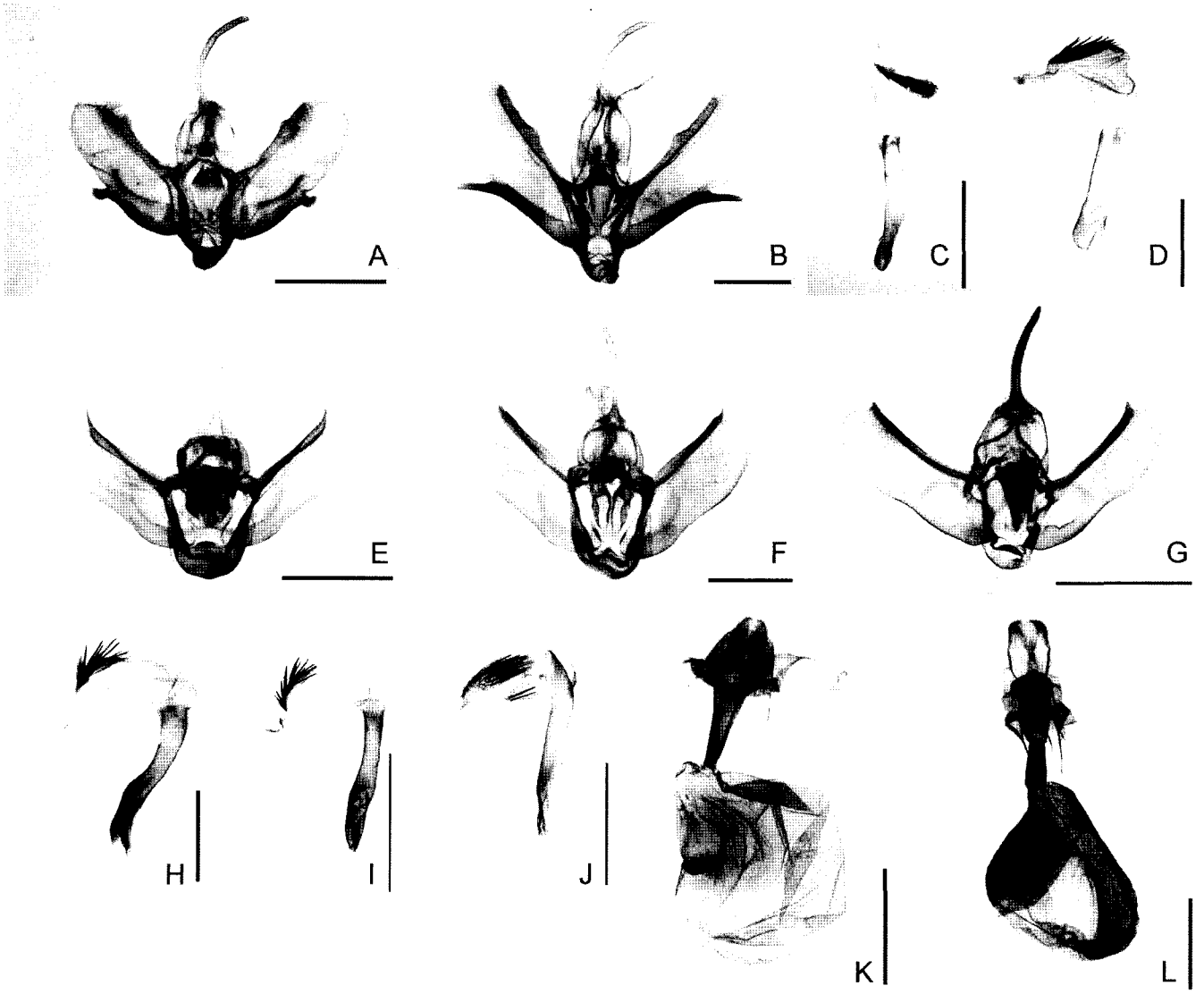

Fig. 2. Male and female genitalia. A, C, K, *Pareulype berberata* (Denis and Schiffermüller). B, D. *P. consanguinea* (Butler). E, H, J, *Pelurga comitata* (Linnaeus). F, I, *P. taczanowskiaria* (Oberthür). G, J, *P. onoi* (Inoue). A, B, E, F, G, Male genital capsule. C, D, H, I, J, Aedeagus with everted vesica. K, L, Female genitalia. Scale bars = 1 mm.

Hist. (5)1: 449. TL: [JAPAN] Hakodate.

Cidaria directaria Graeser, 1890, Berl. ent. Z. 33(2): 268. TL: [RUSSIA] Amurlandes, Raddefka.

Cidaria consanguinea: Prout, 1914: 243.

Cidaria (*Coenotephria*) *consanguinea*: Prout, 1938: 144.

Pareulype consanguinea: Inoue, 1977: 258.

Diagnosis. This species (wingspan 22 mm) is similar to the European sister species, *P. berberata* (Fig. 1) in wing pattern elements, but the width of central fascia is relatively narrower than that of *P. berberata*. In male genitalia, the long uncus, a pair of apically expanded labidies, a pair of patches of large hairs at both sides of juxta, a sclerotized process of costa and sacculus of valva and one patch of large spinular cornuti of aedeagus are distinguishing characters of *P. consanguinea*. The male genitalia of *P. consanguinea* are distinguished from those of *P. berberata* (Fig. 2A, C) in the large hairs at both sides of juxta, the sclerotized costa with a relatively large process and a long sacculus process of valva.

Materials examined. 1 ♂ [JN] Mt. Jiri, JN: Gurye 127° 33' E, 35° 18' N, 1330 m, 17. VIII. 2005. Coll. MNU.

Host plant. Unknown. Its sister species, *P. berberata* feeds on *Berberis* species (Berberidaceae) (Patocka and Turcani, 2005).

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

Remark. This is the first record of occurrence in Korea.

Pelurga Hübner, [1825], Verz. Bekannter Schmett.: 335
Type species. *Phalaena comitata* Linnaeus, 1758. TL: EUROPE.
= *Electra* Stephens, 1829. Nom. Br. Insects: 44.

Diagnosis. Moths of *Pelurga* have relatively thick, slanted central fascia, dark brown apical streak on ochreous (*comitata*) or brown (*onoi* and *taczanowskiaria*) forewing and the rounded middle projection of postmedial line of hindwing (*comitata* and *taczanowskiaria*). There are two areoles of forewing and long, bent mdc (*sensu* Forbes, 1948) of hindwing. The male genitalia are distinguished by the long uncus, the digitate transtilla, a pair of triangular processes on the apical part of juxta, the slender membranous valva, the sclerotized costa with a distal process, and one or two patches of spinular cornuti. The male genitalia can be distinguished from those of the members of *Pareulype* in the shapes of juxta-complex and valva. The female genitalia can be distinguished by the funnel-shaped antrum, the sclerotized ductus bursae and the large corpus bursae with a vertically oriented band-shaped signum. In Korea, three species are known.

Key to species of the genus *Pelurga* in Korea

1. The postmedial line of forewing is medially strongly projected with a single apex ····· *Pelurga comitata* (Linnaeus)
   -The postmedial line of forewing is medially less strongly projected with double apices ····· 2
2. The antemedial line of forewing is transverse, parallel to basal line; the costal part of postmedial line of forewing is strongly projected; postmedial line of hindwing is medially broad and flattened ····· *P. onoi* (Inoue)
   -The antemedial line of forewing is slanted inward; the costal part of postmedial line of forewing is not strongly projected; postmedial line of hindwing is medially roundly projected ····· *P. taczanowskiaria* (Oberthür)

Pelurga comitata (Linnaeus) (Figs. 1A, 2E, H, L)*
Phalaena comitata Linnaeus, 1758, Syst. Nat. (ed. 10) 1: 526.
Larentia comitata: Herz, 1905: 348.
Pelurga comitata: Prout, 1914: 264.

Diagnosis: This species (wingspan 23-28 mm) is distinguished by the strongly projected frons, and ochreous wing with brownish central fascia of forewing. In forewing, the thin band-shaped antemedial line and medially strongly projected postmedial line are distinct. Externally this species is similar to *P. taczanowskiaria*, but can be distinguished by the ochreous wing color. The male genitalia are characterized by the long uncus, the digitate transtilla, a pair of minute triangular process at apical part of juxta, the sclerotized costa with a sharply pointed process of valva, and a patch of large spinular cornuti. The male genitalia are similar to those of *P. taczanowskiaria*, but can be distinguished by the relatively short transtilla and developed apical process of juxta. The female genitalia can be distinguished by the simple sterigmata, the funnel-shaped sclerotized antrum, the sclerotized ductus bursae and the large corpus bursae with a vertically oriented signum.

Previous record: This species had been recorded from the central (GW: Kimwha) and northern part (HB: Musan, Mt. Mudu, HN: Pungso) of the Korean peninsula (Shin, 1996).

Host plant: In Europe, this species feeds on *Chenopodium* and *Atriplex* species (Chenopodiaceae) (Patocka and Turcani, 2005).

Distribution: Widespread in the Palearctic region from Europe to East Asia.

Materials examined: 2♂ [HB] Motojondo (= Mt. Mudu), 31. VII. 1935, leg. Sten Bergman, 1♀ [HB] Motojondo (= Mt. Mudu), 29. VII. 1935, leg. Sten Bergman. Coll. SNHM.

Pelurga taczanowskiaria (Oberthür) (Figs. 1E, F, 2F, I)**
Anticlea taczanowskiaria Oberthür, 1880, Études ent. 5: 54, pl. 9, fig. 8. TL: [RUSSIA] Askold Island.
Cidaria pervagata Christoph, 1881, Bull. Soc. imp. Nat. Moscou, 55(3): 110. TL: [RUSSIA] Raddefka, Vladivostok.
Cidaria taczanowskiaria: Prout, 1914: 242.
Cidaria (*Coenotephria*) *taczanowskiaria*: Prout, 1938: 143.
Pareulype taczanowskiaria: Inoue, 1977: 258.
Nebula taczanowskiaria: Scoble, 1999: 626.
Pelurga taczanowskiaria: Xue and Zhu, 1999: 583.

Diagnosis. This species (wingspan 23 mm) is similar to *P. comitata* in wing pattern elements, but can be distinguished by the dark brown wing color. In male genitalia, the long uncus, a pair of long, digitate transtilla, a pair of minute juxta apical processes, a distal costal process of valva and

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one patch of large spinular cornuti are distinguishing characters. The male genitalia are similar to those of *P. onoi*, but can be distinguished by the long digitate transtilla, the minute juxta apical process and one patch of cornuti of aedeagus.

Previous record. This species has records from northern (Musan, Juul, Yangdok) and central (Mt. Sorak-san) part of the Korean peninsula (Shin, 1996).

Materials examined. 1 ♂ [GW] Mt. Gyebang, GW: Inje, 15-16. VI. 2002. leg. Choi SW. Coll. MNU.

Food plant. *Chenopodium album* (Chenopodiaceae) (Sugi, 1987).

Distribution. Korea, Japan, Mongolia, China, Russian Far East.

Remark. The shape of costal part of postmedial line between Korean specimen (Fig. 1E) and Russian one (Fig. 1F) is different due to variation. The shapes of other wing pattern elements of fore- and hindwing and the male genitalia are identical.

Pelurga onoi (Inoue) (Figs. 1D, 2G, J)*

Pareulype onoi Inoue, 1965, Tinea 7(1): 102, pl. 18, fig. 17. TL: [JAPAN] Hokkiado, Tokachi, Nukabira.

Pelurga onoi: Xue and Zhu, 1999: 584.

Diagnosis. This species (wingspan 29 mm) is similar to *Pareulype berberata* in wing pattern elements, but can be distinguished by the relatively larger wingspan, the wider central fascia and one sharp costa process of postmedial line of forewing. In male genitalia, the long uncus, the low, sclerotized transtilla, a pair of large triangular, juxta apical processes, the slender valva with a distal process of costa, and one large and one small patch of spinular cornuti of aedeagus are distinguishing characters of *P. onoi*. The male genitalia of *P. onoi* are different from those of *P. comitata* in the short transtilla, the relatively short distal process of costa and two patches of cornuti.

Previous record. Two localities from North Korea, Samjiyon and Mt. Paektu, were known (Vojnits *et al.*, 1994).

Materials examined. 1 ♂ [YG] Korea No. 1005, leg. Dr. A. Vojnits et L. Zombori, Ryanggang Province, Samjiyon, 5. VI. 1985. Coll. HNHM.

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

DISCUSSION

The higher classification of the Larentiinae still remains unresolved (Ferguson, 1983; Viidalepp, 1996; Xue and Scoble, 2002). However, few morphological characters are consistently adopted for identifying groups of Larentiinae. One of such characters is the fultura-complex that surrounds aedeagus and is recognized as an apomorphy of Larentiinae (Xue and Scoble, 2002). Similarly, the species of *Pareulype* and those of *Pelurga* are different in the fultura-complex: *Pareulype* have the well-developed labidies and hairy patch at both sides of juxta, while *Pelurga* have the digitate transtilla and the apical process of juxta. Viidalepp (2006) noted that the number of secondary setae on side of ventral proleg of mature larva is different: Rheumapterini (*Pareulype*) have four, while Hydriomenini (*Pelurga*) have more than eight. Patocka and Turcani (2005) drew the pupa of *Pareulype berberta* and *Pelurga comitata* and the former can be distinguished by having three pairs of bristles on the last abdomen, while the latter has no bristle.

Although the wing pattern elements (relatively distinct antemedial line and dentate postmedial line of forewing) and wing venation (two areoles of forewing and long, bent mdc of hindwing) of *Pareulype* and *Pelurga* are similar each other, the morphological characters from male genitalia and immatures separate these groups. Nevertheless, the relationship between tribes such as Rheumapterini and Hydriomenini is still largely unresolved and this needs a more detailed further study.

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