

***Odontopera aurata* (Lepidoptera: Geometridae), New to Korea**

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ABSTRACT

One ennomine species, *Odontopera aurata* (Prout, 1915) was newly recorded from Korea. *Odontopera aurata*, a species of Ennominae, is characterized by the dark yellowish forewing that shows centrally mottled with blackish dots, weakly slanted and blackish postmedial line, and undulating termen, and the yellowish hindwing with black postmedial line and short discal dot. *Odontopera aurata* is externally indistinguishable from *O. arida* but can be distinguished by the shape of furcal arm of the male genitalia. We provide diagnosis, description of adults and male genitalia, and DNA information.

Keywords: Geometridae, Ennominae, new record, Korea

INTRODUCTION

This paper reports one ennomine species from Korea: *Odontopera aurata* (Prout, 1915). The genus *Odontopera* Stephens, 1831 consists of larger-sized geometrid moths, comprising about 60 species worldwide, predominantly in the Palearctic and Oriental regions (Scoble, 1999; Skou and Sihvonen, 2015). Moths of the genus are characterized by the undulating or concave margin of forewing with the darkened medial area, blackish discal spot, and conspicuous postmedial line (Skou and Sihvonen, 2015). In Korea, two species of *Odontopera* are known, *O. bidentata* (Clerck, 1759) and *O. arida* (Butler, 1878). During the examination of the geometrid specimens collected from the southern islands of Korea, we had found a specimen that was identified as *O. aurata* (Prout). Therefore, we report this species, *O. aurata* for the first time in Korea.

Moths were collected at night using a UV-light bucket trap with a 12 V battery (BioQuip, USA). For male genitalia slide preparation, the specimen was prepared by boiling the abdomen in 10% KOH for approximately 15–20 min. The scales and tissues were removed, stained with Chlorazol black, and mounted on slides in Euparal mountant.

Genomic DNA of *O. aurata* and *O. arida* was extracted from moth legs using the DNeasy Blood and Tissue Ex-

traction Kit (Qiagen, UK) according to the manufacturer's instructions. One mitochondrial DNA marker, cytochrome oxidase subunit I (COI) and two nuclear DNA markers, elongation factor 1 alpha (EF-1 α) and ribosomal protein S5 (RpS5) were selected to compare DNA sequences. DNA amplification was carried out following protocols proposed by Wahlberg and Wheat (2008) and Wahlberg et al. (2016).

We reconstructed a phylogenetic tree of two *Odontopera* species after combining three genes (COI, EF-1 α , and RpS5, a total of 1,786 base pairs) using the Neighbor-Joining method in MEGA version 10.1.7 (Kumar et al., 2018). Genetic distances between species and intraspecific variation are reported as the average pairwise distances with standard deviation (S.D.).

The terminology of the adult characteristics, including the male genitalia, refers to Skou and Sihvonen (2015). All materials have been deposited in the Insect Collection, Department of Environmental Education, Mokpo National University, South Korea (MNU) and at the National Institute of Biological Research, Incheon, South Korea (NIBR) (Appendix 1). Abbreviation is as follows: JN, Jeollanam-do.

SYSTEMATIC ACCOUNTS

Order Lepidoptera Linnaeus, 1758

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Family Geometridae Leach, 1815
Subfamily Ennominae Duponchel, 1845

Genus *Odontopera* Stephens, 1831

Type species: *Phalaena bidentata* Clerck, 1759.

- = *Aethiopodes* Warren, 1902 (TS: *Azelina indecoraria* Walker, 1866)
- = *Caripetodes* Warren, 1895 (TS: *Colotois kametaria* Felder & Rogenhofer, 1875)
- = *Cenoctenucha* Warren, 1897 (TS: *Crocallis similaria* Moore, 1888)
- = *Corotia* Moore, 1868 (TS: *Corotia cervinaria* Moore, 1867)
- = *Lioptilesia* Wehrli, 1936 (TS: *Gonodontis prolita* Wehrli, 1936)
- = *Niphonissa* Butler, 1878 (TS: *Niphonissa arida* Butler, 1878)
- = *Paragonodontis* Wehrli, 1936 (TS: *Gonodontis postobscura* Wehrli, 1936)

¹*Odontopera aurata* (Prout, 1915) (Figs. 1, 2A, 2C)

Material examined. 1 male, Korea: JN: Yeosu, Is. Geomun-do, 34°2'17"N, 127°17'17"E, 28 Sep 2017, Sei-Woong Choi leg. (NIBR specimen no. 120000503075).



Fig. 1. *Odontopera aurata* in Korea. Scale bar=10 mm.

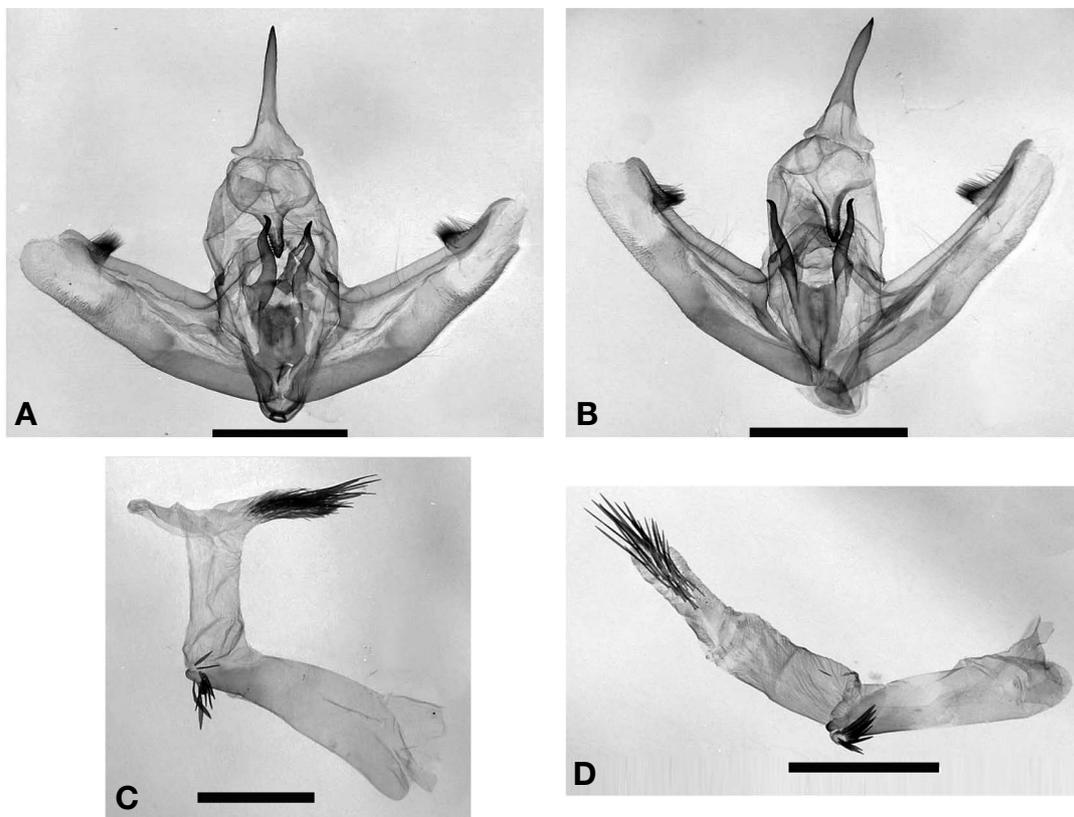


Fig. 2. Male genitalia of *Odontopera aurata* and *O. arida* in Korea. A, C, *O. aurata*; B, D, *O. arida*. Scale bars: A-D=2 mm.

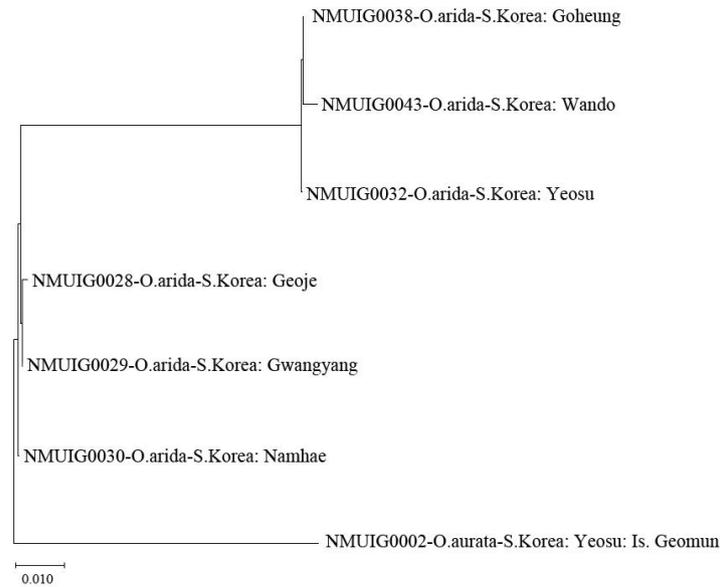


Fig. 3. Neighbor-joining tree of *Odontopera arida* and *O. aurata* from Korea using three combined DNA sequences (COI, EF-1 α , and RpS5, a total of 1,786 base pairs).

Diagnosis. *Odontopera aurata* is externally indistinguishable from *O. arida*: both species show the dark yellowish forewing, mottled with blackish dots, blackish and undulating antemedial line, weakly slanted and blackish postmedial line, and undulating termen, and the yellowish hindwing with black postmedial line and short discal dot. *Odontopera aurata* can be distinguished from *O. arida* by the genitalia examination. The male genitalia of *O. aurata* can be distinguished by the long and strongly tapered uncus, the well-developed gnathos with a sharply pointed medial arm, the long furcal arm, the hairy hump-shaped costa process of valva, and the apical spinular processes and spinular cornuti on the aedeagus. The male genitalia of *O. aurata* (Fig. 2A, C) can be distinguished from those of *O. arida* (Fig. 2B, D) by the medially strongly curved furcal arm and the rectangular juxta.

Description. Wingspan 42 mm. Head. Antennae bipectinate with long pectinations in male; frons broad, mixed with yellowish white and ochreous scales; labial palpi short, about 1.5 times to eye diameter, barely projected beyond frons, mixed with yellowish and ochreous scales. Body with yellowish and ochreous long hairs. Forewing dark yellowish in ground color, mottled with blackish dots; antemedial line brownish, undulating; postmedial line blackish, slanted in right angle; central fascia strongly tapered from costa to dorsum, discal dot indistinct, whitish dot; termen costally undulating, medially projected. Hindwing yellowish in ground color, mottled with blackish dots; discal dot short, blackish; postmedial line costally indistinct, medially and dorsally light blackish and straight; subtermen dorsally more

blackish dots. Male genitalia (Fig. 2A, C): Uncus long, about equal to the length of tegumen, basally broad and strongly tapering, apex sharply pointed; gnathos well developed, medially fused to a long, sclerotized process with dentate distal and medial surfaces; transtilla simple, thin and weakly sclerotized without process; juxta rectangular, sclerotized, furcal arm developed with a pair of long horn-shaped processes; saccus short, rounded. Valva basally relatively broad and tapered to distal part; costa long, slender, distally with a hairy hump-shaped process; sacculus long, ventrally sclerotized, basally straight, medially expanded, distally thin. Aedeagus rod-shaped, apex with several long spinular processes; vesica tubular with a patch of long dense spinular cornuti.

Distribution. Korea and Japan.

Biology. Larvae feed on *Castanea* species (Fagaceae), and *Camellia sinensis* (L.) Kuntze (Theaceae) in Japan (Sato, 2011).

DNA taxonomy. We sequenced 6 specimens of *Odontopera arida* and one specimen of *O. aurata* from Korea (Appendix 1). The intraspecific genetic variation in *O. arida* was 3.73% (± 2.97 S.D.). The genetic distance of three combined DNA sequences between *O. aurata* and *O. arida* was 9.42% (± 3.17 S.D.) (Fig. 3).

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CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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Appendix 1. Taxonomic details for sequenced data of *Odontopera aurata* and *O. arida* from Korea

| Species | Sequence ID | Collecting site and year | GenBank accession No. | Deposition |
|---------------------------|-------------|-------------------------------------|-----------------------|------------|
| <i>Odontopera arida</i> | NMUIG0028 | South Korea: Geoje, 2017 | – | MNU |
| <i>Odontopera arida</i> | NMUIG0029 | South Korea: Gwangyang, 2014 | – | MNU |
| <i>Odontopera arida</i> | NMUIG0030 | South Korea: Namhae, 2020 | – | MNU |
| <i>Odontopera arida</i> + | NMUIG0032 | South Korea: Yeosu, 2009 | – | MNU |
| <i>Odontopera arida</i> + | NMUIG0038 | South Korea: Goheung, 2007 | – | MNU |
| <i>Odontopera arida</i> + | NMUIG0043 | South Korea: Wando, 2009 | – | MNU |
| <i>Odontopera aurata</i> | NMUIG0002 | South Korea: Yeosu Is. Geomun, 2017 | OK501168 | NIBR |

Deposition of specimen. MNU, Mokpo National University, Muan, Jeonnam; NIBR, National Institute of Biological Resources, Incheon.