

First Record of *Rhyparus helophoroides* Fairmaire, 1893 (Coleoptera: Scarabaeidae: Aphodiinae) from Korea

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미기록 작은줄똥풍뎅이(딱정벌레목: 풍뎅이과: 똥풍뎅이아과)의 한반도 보고

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ABSTRACT: The tribe Rhyparini is one of the well-known termitophilous tribes in Aphodiinae. The genus *Rhyparus* has the largest number of species in the tribe Rhyparini, and only one species, *Rhyparus azumai* Nakane, 1956 was recorded in Korea. In this study, we report *Rhyparus helophoroides* Fairmaire, 1893 from Korea for the first time. Diagnosis, photographs of diagnostic characters, key to the Korean *Rhyparus*, and brief ecological information of the species are provided.

Key words: Aphodiinae, Korea, Rhyparini, *Rhyparus helophoroides*, new record

초록: 줄똥풍뎅이속은 호환개미성인 줄똥풍뎅이족에서 가장 많은 종수를 보유하고 있다. 국내에는 광양줄똥풍뎅이 한 종만이 기록되었으나 또 다른 종인 *Rhyparus helophoroides* Fairmaire, 1893를 새로이 발견하여 보고한다. 본 종의 진단형질과 그 사진, 한국산 줄똥풍뎅이속의 검색표의 제시와 함께 생태에 대한 간략한 정보를 제공한다.

검색어: 똥풍뎅이아과, 한국, 줄똥풍뎅이족, 작은줄똥풍뎅이, 미기록

The subfamily Aphodiinae Leach 1815 (Coleoptera: Scarabaeidae), commonly called as small dung beetles, consists of 3200 species within 280 genera in the world (Dellacasa, 1991; Kim, 2012). Most of Aphodiinae species are detritivores, inhabiting various habitats, and some species occur in nest of social insects such as ants and termites (Krikken and Huijbregts 1987; Kim, 2012; Parker, 2016). Among them, Rhyparini Schmidt is a representative tribe known as termitophilous group (Skelley,

2007; Vårdal and Forshage, 2010). This group can be distinguished by carinate dorsal surface, longitudinal costae in pronotum and elytra. Also, bulbous projection with trichomes on elytral apex can be diagnosis character of this tribe, except the genera *Sybacodes* and *Megasybacodes* (Pittino, 2006; Skelley, 2007; Kakizoe et al., 2019).

The genus *Rhyparus* Westwood 1845, one of the 13 subordinate genera from the tribe Rhyparini, comprises 84 species and one subspecies worldwide (Ochi et al., 2021; Schoolmeesters, 2022). The nomenclature history of this genus is complicated and has led to various discussions. In 1843, Westwood proposed this genus, spelled ‘*Ryparus*’, but around the same time,

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Spinola also used identical spelling for a genus of Cleridae (see also Cartwright and Woodruff, 1969; Dellacasa, 1997). According to the effective publication date (Spinola, 1844; Westwood, 1845), Westwood's '*Ryparus*' became junior homonym of Spinola's '*Ryparus*'. Later, Agassiz (1847) emended the spelling of the genus '*Ryparus*' to '*Rhyparus*' for the species *Rhyparus desjardinsii* Westwood. Smith (2006) stated that *Rhyparus*, Agassiz's unjustified emendation, is considered a justified emendation by ICZN 1999 because of its prevailing usage. Therefore, this study accepted current opinion of Smith (2006) for the priority of Westwood rather than Agassiz.

So far, only one species of this genus, *R. azumai* Nakane has been announced in Korea (Choi et al., 2015; Lim and Bae, 2019) which recently elevated to species rank (Ochi et al., 2018). In this study, we record *Rhyparus helophoroides* Fairmaire in Korea for the first time. Diagnosis, photographs of diagnostic characters, key to the Korean *Rhyparus*, and brief ecological information of the species are provided.

Materials and Methods

Materials for the study were collected by white light trap in Jeju Island. Specimen examination was performed under a stereoscopic microscope (Nikon SMZ645). Male genitalia was dissected and placed in 10% KOH solution for 1 hour at 60°C before examination. Photographs were taken using Nikon digital camera (Z7) with 70 mm Macro Lens (Nikon, Inc., Tokyo, Japan). The terminology used in the present study generally follows Krikken and Huijbregts (1987), and Anichtchenko et al. (2021). All materials are deposited in the National Institute of Biological Resources (NIBR; Incheon, South Korea) and Choi's insect collection (CI; Seoul, South Korea).

Taxonomic Accounts

Family Scarabaeidae Latreille, 1802

Subfamily Aphodiinae Leach, 1815 풍뎡이아과

Tribe Rhyparini Schmidt, 1910 줄뎡뎡이족

Genus *Rhyparus* Westwood, 1845 줄뎡뎡이속

Type species: *Rhyparus desjardinsii* Westwood, 1845

***Rhyparus helophoroides* Fairmaire, 1893**

작은줄뎡뎡이(신칭) (Fig. 1)

Rhyparus helophoroides Fairmaire, 1893: 145.

Type locality. Bornéo occ.: Sambas; Java: Simpar et Kemanglen, rés. Tegal.

Diagnosis. Body length 3.5 - 4.0 mm, Body matt blackish brown. Head convex, lateral emargination moderate angular. Pronotum with two obtuse and rounded protrusions in lateral margin, anterior protrusions slightly smaller than median one; punctures irregularly distributed as a whole between the two middle ridges. Elytra elongate with large punctures of two longitudinal rows at each ridge; internal and median caudal indentation connected; external protrusion weakly developed. Aedeagus as in Fig. 1.

Materials examined. [NIBR] 1♂, South Korea, Jeju Island, Seogwipo-si, 20. VII. 2020, leg. M. Kim. [CI] 1♀, South Korea, Jeju Island, Seogwipo-si, 20. VII. 2020, leg. M. Kim; 1♀, South Korea, Jeju Island, Jeju-si, 12 - 14. VII. 2018, leg. J. Choi.

Distribution. Korea (new record), Australia, Bornéo, Indonesia, Japan, Malaysia, New Caledonia, Papua New Guinea, The Philippines, Taiwan, Vanuatu.

Remark. The specific epithet of this species was often erroneously described as '*helephoroides*' (Löbl and Smetana, 2006; Choi et al., 2015). These errors probably came from typographical errors in the past study of Schmidt (1910), which was addressed by Mencl et al. (2013).

Key to The Species of the Genus *Rhyparus* in Korea

1. Body length over 5 mm long. Lateral margin of pronotum with angled anterior protrusions
..... *R. azumai* Nakane 1956
- Body length under 4 mm long. Lateral margin of pronotum with rounded anterior protrusions
..... *R. helophoroides* Fairmaire 1893

Ecology. The ecology of *R. helophoroides* is largely unknown.

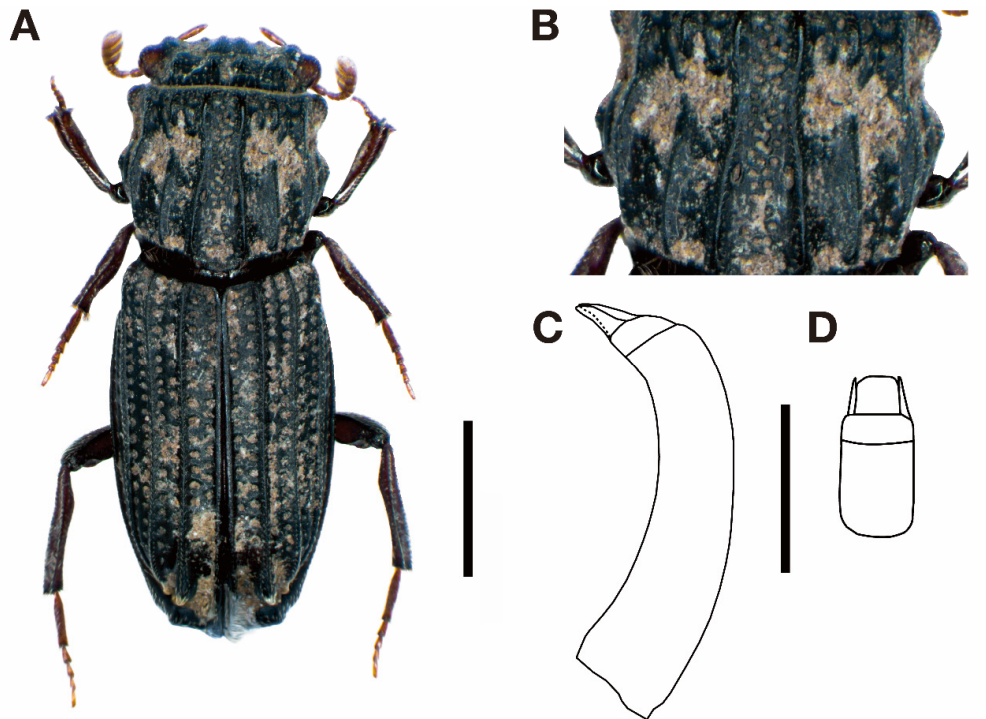


Fig. 1. Diagnostic characters of *Rhyparus helophoroides* Fairmaire, 1893. A. habitus, dorsal view; B. pronotum; C. aedeagus, lateral view; D. aedeagus, dorsal view. Scale bar: A, 1 mm; B - D, 0.5 mm.

This species is mainly collected and observed through light traps, and sometimes collected by sifting leaf litter (Kawai et al., 2005; Okajima and Araya, 2012; Théry and Bordat, 2012). Likewise, in Korea, the species was only collected by light trap. The ecology of another relative species recorded in Korea, *R. azumai*, is also largely unknown in Korea and Japan except that individuals are collected by light trap (Kawai et al., 2005; Choi et al., 2015). So far, only a small number of individuals of both species have been observed in the southern region and Jeju Island in South Korea (Choi et al., 2015; personal observation). Kakizoe and Maruyama (2017) mentioned that *Rhyparus* species inhabiting Japan (including *R. helophoroides* and *R. azumai*) might not termitophile unlike the other Rhyparini species but free-living species. Therefore, it is assumed that the Korean *R. helophoroides* and *R. azumai* also have life cycles that are not closely related to the termites. Further study is needed to understand ecology of *Rhyparus*.

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Statements for Authorship Position & Contribution

Choi, J: Korea University, Student; Designed the research, conducted the experiment and wrote the manuscript
 Lim, C: Korea University, Student in Integrated MS/PhD; Designed the research, conducted the experiment and wrote the manuscript

All authors read and approved the manuscript.

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