

# New distribution record of genus *Rhyssemus* Mulsant (Coleoptera, Scarabaeidae, Aphodiinae) from South Korea

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*Rhyssemus* Mulsant, 1842, represents one of the largest genera in the tribe Psammodiini, comprising approximately 170 species to date. This group is nearly cosmopolitan, excluding the Neotropical region, with 59 species recorded in the Palearctic region. On the Korean Peninsula, only one species, *Rhyssemus koreanus* Stebnicka, 1980 was recorded from North Korea. In this study, the genus *Rhyssemus* is recorded for the first time with a newly recorded species *Rhyssemus inscitus* (Walker, 1858) from South Korea. Adult specimens were collected from the costal sand dunes in Taean-gun and Jeju island. We herein provide a diagnosis, illustrations of morphological characters, and habitat information. Partial mitochondrial *COI* sequences of the species are also provided for DNA barcoding.

Keywords: dung beetles, Korean fauna, new record, Psammodiini, *Rhyssemus inscitus*

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## INTRODUCTION

*Rhyssemus* Mulsant, 1842, is one of the largest genera in the tribe Psammodiini (Coleoptera, Scarabaeidae, Aphodiinae), and consists of approximately 170 described species worldwide (Schoolmeester, 2024). The group is widely distributed except the Neotropical region, with 59 species recorded in the Palearctic region (Gordon and Cartwright, 1980; Löbl and Löbl, 2016; Minkina and Král, 2018). On the Korean Peninsula, only one species, *Rhyssemus koreanus* Stebnicka, 1980 has been recorded from North Korea (Stebnicka, 1980; NIBR, 2019). After Stebnicka (1980), no additional faunistic or taxonomic studies of this genus have been conducted in the Korean Peninsula, but only recent studies on related taxa (Kim, 2012; Lim and Bae, 2019; Kölkebeck and Yi, 2022; Choi and Lim, 2022).

Member of the group are largely psammophilous and saprophagous, and can be found beneath a thin layer of surface soil near the roots of grasses (Gordon and Cartwright, 1980). Adult individuals are collected using sieving or light traps near sandy soil habitats such as pastures, sand dunes, and burrows of small mammals (Gordon and Cartwright, 1980; Byk and Minkina, 2014; Minkina and Král, 2018). The life history of this group has not been

fully understood (Steiner, 1980).

In this study, we report the genus *Rhyssemus* with a newly recorded species *Rhyssemus inscitus* (Walker) for the first time in South Korea. Diagnosis, illustrations of morphological characters, habitat information, and partial mitochondrial *COI* sequences for the species are provided.

## MATERIALS AND METHODS

Adult individuals were collected using sand sieving at the costal sand dunes in Taean-gun and Jeju island, South Korea (Fig. 1). Specimens were preserved in 80% ethyl alcohol and sorted by taxa in laboratory. Identification with external morphology was conducted under a stereoscopic microscope (model SMZ645, Olympus, Inc., Tokyo, Japan). Male genitalia was placed in 10% KOH solution overnight at room temperature before examination. Photographs were taken using a digital camera (model EOS 6D with MP-E 65 mm Macro lens, Canon, Inc., Tokyo, Japan). The terminology used to describe the morphological characters generally follows Rakovič (1987) and Pittino *et al.* (2013). Specimens are deposited in the following collections:

**KUEM** Korea University Entomological Museum, Seoul

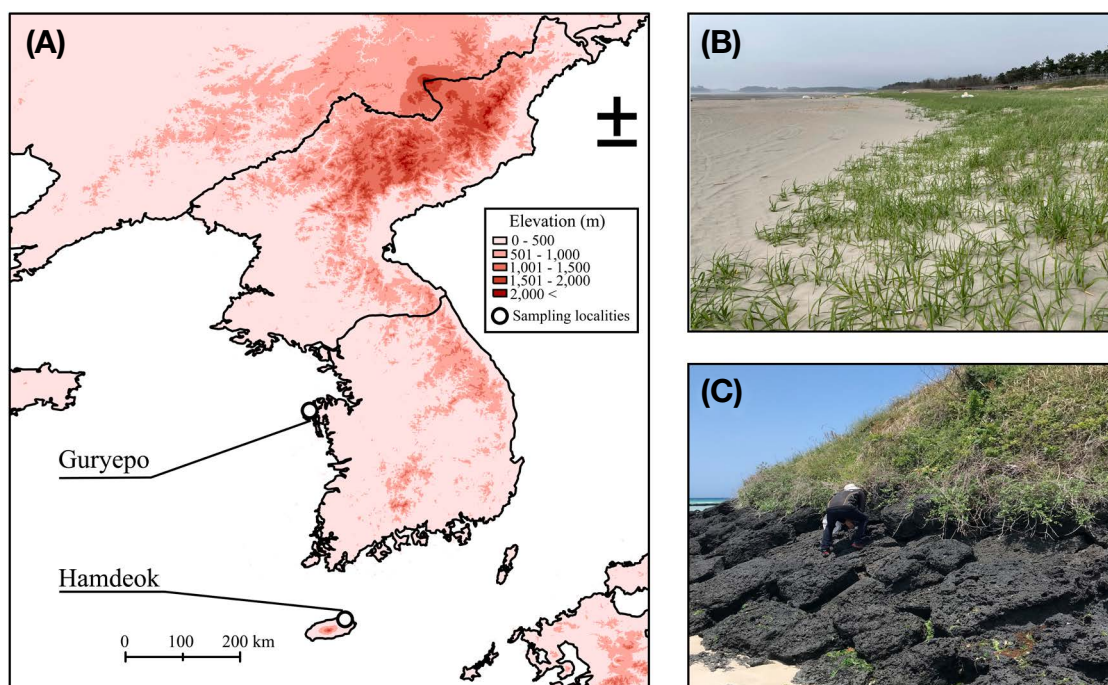


Fig. 1. Distribution and habitats of *Rhyssemus inscitus* in South Korea. (A) distribution; (B) habitat in Guryepo; (C) habitat in Hamdeok.

**NIBR** National Institute of Biological Resources, Incheon

**USNM** United States National Museum, Smithsonian Institution, Washington DC

Total genomic DNA was extracted from the leg muscle of specimen using the DNeasy Blood & Tissue Kit (Qiagen, Hilden, Germany). The primer pair: LCO1490 (5-GGT CAA CAA ATC ATA AAG ATA TTG G-3) and HCO2198 (5-TAA ACT TCA GGG TGA CCA AAA AAT CA-3) was used to amplify 658 bp of partial *COI* sequences (Folmer *et al.*, 1994). *COI* sequences were amplified and sequenced following Lim *et al.* (2024). A total of five new sequences of *R. inscitus* were obtained. Of these, two sequences were obtained from specimens in South Korea, and the remaining three sequences were obtained from specimens in Cambodia and Thailand. All sequences were deposited in GenBank (accession numbers: PP431264–PP431268).

## TAXONOMIC ACCOUNTS

Family Scarabaeidae Latreille, 1807

Subfamily Aphodiinae Leach, 1815

Tribe Psammodiini Mulsant, 1842

Genus *Rhyssemus* Mulsant, 1842

### *Rhyssemus inscitus* (Walker, 1858) (Fig. 2)

몽톡흑줄모래풍뎅이 (신칭)

*Psammodius inscitus* Walker, 1858: 207. Type locality.

Ceylon.

*Rhyssemus tarsalis* Waterhouse, 1876: 115.

*Rhyssemus malasiacus* Lansberge, 1886: 133.

*Rhyssemus insignicollis* Lea, 1923: 12.

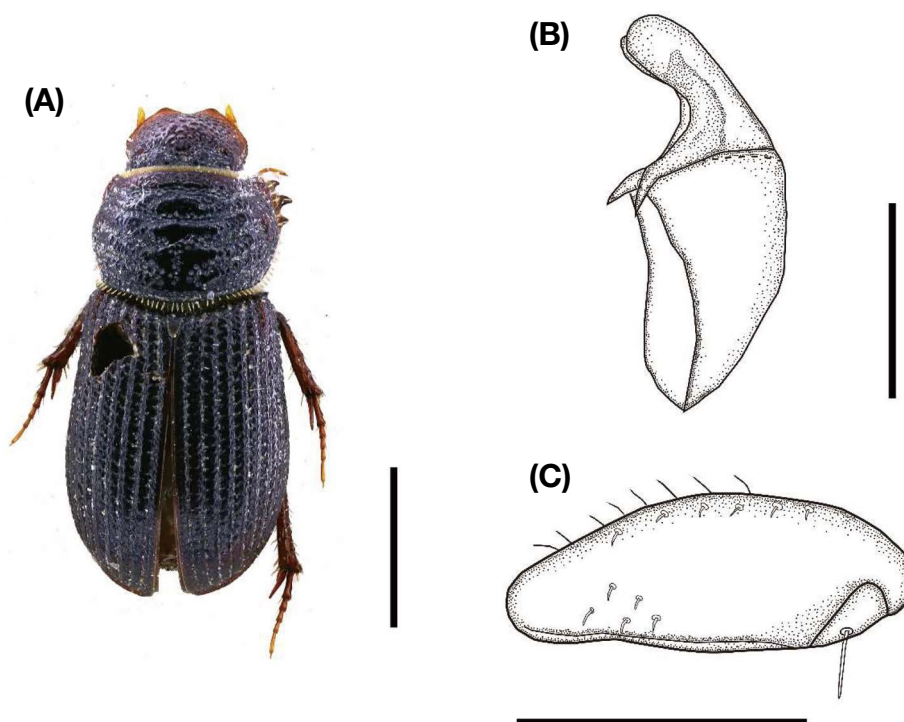
*Rhyssemus australis* Petrovitz, 1963: 40.

*Rhyssemus papuanus* Petrovitz, 1965: 169.

*Rhyssemus mussardi* Petrovitz, 1975: 618.

*Rhyssemus philippineus* Masumoto, 1980: 21.

**Diagnosis.** Body size. ♂ (n=1): BL, 2.95; HL, 0.35; HW, 0.75; PL, 0.78; PW, 1.15; EL, 1.74; EW, 1.3. ♀ (n=1): BL, 3.02; HL, 0.28; HW, 0.76; PL, 0.81; PW, 1.17; EL, 1.89; EW, 1.22. Habitus. body subparallel, slightly dilated behind the middle of elytra, dark brown. Head. convex, granulate; clypeus obtusely dentate on each side of anterior emargination; genae obtusely rounded, protruding more than eyes with few fine setae; head granules moderately coarse, fairly uniform in size and distribution, a pair of vestigial oblique ridges presented posteriorly. Pronotum. convex, nearly 1.4 times as wide as long; six transversal ridges moderately convex, the 1<sup>st</sup> ridge distinct, the 2<sup>nd</sup> to 4<sup>th</sup> ones joining together to form lateral callus with shallow granules; furrows shallowly impressed, minutely granulate or wrinkled, posterior longitudinal furrow interrupt 4<sup>th</sup> to 5<sup>th</sup> ridges; lateral-posterior margins of pronotum crenate, with slightly dilated but apically blunt thick setae. Elytra. convex, subparallel, slightly dilated behind the middle; humeral tooth distinct; stria narrow, shallowly impressed with longitudinal punctures; interstria wide, with two rows of indistinct pearl-like granules, randomly fused between two neighboring granules. Pygidium. two



**Fig. 2.** Male of *Rhyssemus inscitus*. (A) dorsal habitus; (B) genitalia, lateral view; (C) metafemora, ventral view; Scale bars = 1 mm (A), 0.2 mm (B), 0.5 mm (C).

apical pygidial setae present. Legs. metafemora widest at middle, margined posteriorly, setigerous punctate anteriorly and near apically on ventral surface; metatibial upper spur as long as basal metatarsus; basal metatarsus slightly shorter than 2–4<sup>th</sup> joints together. Aedeagus as in Fig. 2.

**Specimens examined.** 1♂ (CSL-21-0386): South Korea, Chungcheongnam-do, Taean-gun, Wonbuk-myeon, Guryepo Campsite, 19.VIII.2021, legs. C. Lim and W.G. Kim [NIBR]; 1♂ (CSL-21-0264): South Korea, Chungcheongnam-do, Taean-gun, Wonbuk-myeon, Guryepo Campsite, 19.VIII.2021, legs. C. Lim and W.G. Lee [KUEM]; 1♀: South Korea, Jeju Island, Jeju-si, Jocheon-eup, Hamdeok Beach, 3.VIII.2021, leg. C. Lim [KUEM].

**Other specimens examined.** 1♂2♀ (CSL-21-0317, 0318): Thailand, Udon Thani Province, Nong Saeng District, Than Ngam Waterfall, 13.VI.2018. leg. C.J. Uy [KU]; 1♀ (CSL-21-0315): Cambodia, Kampong Spueu Province, Dechou Akphivoadth, 3.VIII.2012, leg. Y.J. Bae [KU]. 1ex: Australia, Katherine, 6–10.II.1968. leg. E. Matthews [USNM].

**Distribution.** South Korea (new country record), Australia, Egypt, India, Indonesia, Nepal, Pakistan, Papua New Guinea, The Philippines, Taiwan, Oriental Region, Afro-tropical Region.

**Habitat.** All Korean specimens were collected from sand or loamy sand soils near the roots of herbaceous plants (5–15 cm in depth) within the costal sand dunes. *Tricho-*

*rhyssemus asperlus*, *Psammодиус hangangensis*, and *Leiopsammодиус japonicus* were collected together with *R. inscitus*.

**DNA barcode.** Partial *COI* sequences of two specimens from South Korea and three specimens from the Oriental regions were obtained (accession numbers: PP431264–PP431268). The estimates of genetic divergence (*p*-distance) between the Korean and Oriental group was 1.5% (standard error = 0.4). The estimate of genetic divergence between *R. inscitus* and *R. germanus*, the only available *Rhyssemus* species in GenBank and BOLD Systems (accession numbers: KM443814, KM448164, KM448190, KM450328, KM450806, HQ954340, and HQ954341), was 11.2% (standard error = 1.2).

## CONFLICTS OF INTEREST

The author of this paper has no affiliation with any interests and is solely responsible for the paper.

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## REFERENCES

- Byk, A. and Ł. Minkina. 2014. *Rhyssemus puncticollis* Brown, 1929 (Coleoptera: Scarabaeidae: Aphodiinae: Psammodiini): A New Record for the Fauna of Poland and Latvia. *The Coleopterists Bulletin* 68(3):377-383.
- Choi, J. and C. Lim. 2022. First Record of *Rhyssemus helophoroides* Fairmaire, 1893 (Coleoptera: Scarabaeidae: Aphodiinae) from Korea. *Korean Journal of Applied Entomology* 61(4):601-604.
- Folmer, O., M. Black, W. Hoeh, R. Lutz and R. Vrijenhoek. 1994. DNA primers for amplification of mitochondrial cytochrome c oxidase subunit I from diverse metazoan invertebrates. *Molecular Marine Biology and Biotechnology* 3(5):294-299.
- Gordon, R.D. and O.L. Cartwright. 1980. The Western Hemisphere species of *Rhyssemus* and *Trichiorhyssemus* (Coleoptera: Scarabaeidae). *Smithsonian Contributions to Zoology* 317:1-29.
- Kim, J.I. 2012. Insect fauna of Korea. Volume 12, Number 3. Arthropoda: Insecta: Coleoptera: Scarabaeoidea. *Laparosticti*. Incheon: National Institute of Biological Resources Press. 218 pp.
- Kölkebeck, T. and H. Yi. 2022. New records of Coleoptera in South Korea (Coleoptera: Curculionidae, Derodontidae, Nitidulidae, Melandryidae, Scarabaeidae). *Entomologische Zeitschrift-Schwanfeld* 132(1):33-37.
- Lansberge, Y.W. 1886. Description de quelques Scarabaeides des Indes Néerlandaises appartenant au Musée de Leyde. *Notes from the Leyden Museum* 8:131-137.
- Lea, A.M. 1923. On Australian Aphodiids. *Proceedings of the Royal Society of Victoria* 36:1-20.
- Lim, C., J.H. Kang, B. Bayartogtokh and Y.J. Bae. 2024. Climate change will lead to range shifts and genetic diversity losses of dung beetles in the Gobi Desert and Mongolian Steppe. *Scientific Reports* 14(1):15639.
- Lim, C. and Y.J. Bae. 2019. First Record of *Aphodius (Agrilinus) hasegawai* Nomura et Nakane (Scarabaeidae: Aphodiinae) in Korea. *Entomological Research Bulletin* 35(1):13-16.
- Löbl, I. and D. Löbl. 2016. *Catalogue of Palaearctic Coleoptera. Volume 3: Scarabaeoidea-Scirtoidea-Dascilloidea-Buprestoidea-Byrrhoidea*. Brill Press, Boston. 983 pp.
- Masumoto, K. 1980. Description of a new species of *Rhyssemus* (Scarabaeidae) from the Philippines. *Elytra* 8:21-22.
- Minkina, Ł. and D. Král. 2018. *Rhyssemus transcaucasicus* sp. nov. (Coleoptera: Scarabaeidae: Aphodiinae) from Georgia. *Klapalekiana* 54:61-70.
- Mulsant, E. 1842. *Histoire naturelle des Coléoptères de France. Lamellicornes*. Paris, Lyon:1-623.
- National Institute of Biological Resources. 2019. National Species list of Korea. III. Insects (Hexapoda). Incheon: Designzip Press. 988 pp.
- Petrovitz, R. 1963. Neue Arten der Gattung *Rhyssemus* Mulsant. *Reichenbachia* 2:33-45.
- Petrovitz, R. 1965. Neue Aphodiinae. *Mitteilungen aus dem Zoologischen Museums in Berlin* 41:161-176.
- Petrovitz, R. 1975. Neue Aphodiinae, Hybosorinae, Bolboceirinae and Orphninae. *Revue Suisse de Zoologie* 82:615-624.
- Pittino, R., M. Rakovič. and L. Mencl. 2013. A contribution of knowledge of *Rhyssemus* Mulsant, 1892 species from the Indochinese Subregion with description of a new species from Laos and proposal of two new synonyms (Coleoptera: Aphodiidae: Psammodiinae: Rhyssemini). *Studies and Reports Taxonomical Series* 9(1):193-200.
- Rakovič, M. 1987. A revision of the genus *Odochilus* Harold with remarks on the tribal classification of the subfamily Aphodiinae (Coleoptera, Scarabaeidae). *Acta Entomologica Bohemoslovaca* 84:27-44.
- Schoolmeesters, P. 2024. World Scarabaeidae Database. In: Bánki, O., Roskov, Y., Döring, M., Ower, G., Vandepitte, L., Hobern, D., Remsen, D., Schalk, P., DeWalt, R.E., Ke-ping, M., Miller, J., Orrell, T., Aalbu, R., Adlard, R., Adriaenssens, E.M., Aedo, C., Aescht, E., Akkari, N., Alexander, S. *et al.* (eds.), *Catalogue of Life Checklist (Version 2024-Feb-22)*. <https://doi.org/10.48580/dfqc-38g> (accessed on 2 March 2024).
- Stebnicka, Z. 1980. Scarabaeoidea (Coleoptera) of the Democratic People's Republic of Korea. *Acta Zoologica Cra-coviensia* 24(5):191-298.
- Steiner, W.E. Jr. 1980. Notes on the habitats and distribution of *Rhyssemus scaber* (Coleoptera: Scarabaeidae). *Coleopterists Bulletin* 34:377-378.
- Walker, F. 1858. Characters of some apparently undescribed Ceylon Insects. III. *Annals and Magazine of Natural History* 3(2):202-209.
- Waterhouse, C.O. 1876. New species of Coleoptera from Island of Rodriguez, collected by the Naturalists accompanying the Transit-of-Venus Expedition. *The Annals and Magazine of Natural History* 18:105-121.

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