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NOTES ON GEOGRAPHIC DISTRIBUTION

New distribution record and redescription of the little-known Korean endemic ground beetle *Pterostichus apiculatiphallus* Nemoto, 1988 (Coleoptera, Carabidae)

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Abstract. A little-known ground beetle endemic to Korea, *Pterostichus apiculatiphallus* Nemoto, 1988, belonging to the *opacipennis* species group of the subgenus *Nialoe* Tanaka, 1958 (s. l.), is recorded from Mount Sobaeksan based on a single male specimen. This represents the first record of the species outside its type locality (Mount Tabaeksan) and, with *Pterostichus ishikawaioides* Sasakawa, Kim, Kim & Kubota, 2008, constitutes the second record of the *opacipennis* species group from Mount Sobaeksan. Based on the examined specimen, the morphology of *P. apiculatiphallus* is redescribed, and its relationships with closely related species are discussed.

Key words. Endophallus, *Koreonialoe*, *Nialoe*, *opacipennis* species group

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Introduction

Pterostichus apiculatiphallus Nemoto, 1988 is a species of ground beetle endemic to South Korea, belonging to the *opacipennis* species group (= subgenus *Koreonialoe* Park & Kwon, 1996 sensu Yin et al. 2021) of the subgenus *Nialoe* Tanaka, 1958 (s.l., sensu Sasakawa 2021). This species has been collected only from its type locality, Mount Taebaeksan, and is considered one of the rarest *Pterostichus* Bonelli, 1810 species in South Korea (Park and Paik 2001). Currently, the morphology of this species has only been described in the original description (Nemoto 1988), but that description is insufficient. In the subgenus *Nialoe*, to which this species belongs, information on the morphology of the fully everted and inflated endophallus—a membranous inner sac everted from the aedeagus of the male genitalia—is essential for species delimitation and for inferring phylogenetic relationships (Nemoto 1989; Sasakawa 2009; Shiiba 2023). Although the endophallus of *P. apiculatiphallus* was described in the original description, the figures presented suggest that it was not fully inflated (Nemoto 1988: figures 9, 12), and only two structures (lobes α and β sensu Nemoto 1988) were explicitly described. Therefore, a redescription based on an appropriately prepared endophallus is necessary. In addition, the description of external morphology was superficial (Nemoto 1988), and only the relative size of the head to the pronotum and the degree of punctation on the pronotum were briefly mentioned; therefore, a more detailed redescription of external morphology is also needed.

In this study, we report the first record of *P. apiculatiphallus* from outside its type locality, based on a single male specimen collected from Mount Sobaeksan, approximately 45 km west-southwest of Mount Taebaeksan. We redescribe the detailed morphology of this species, including the fully inflated endophallus, based on this specimen.

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Methods

The specimen examined was collected from Mount Sobaeksan, South Korea, using pitfall traps, under an official collecting permit for an international joint study in 2002–2003, headed by JKK and KK (Korea–Japan Basic Scientific Promotion Program No. 11, F01-2001-000-20014-0 to JKK; Japan–Korea Basic Science Cooperation Program to KK). The specimen was preserved as an undissected dried specimen at room temperature until 2005, when it was dissected for endophallus preparation.

The specimen was identified by the morphology of the endophallus, which was everted and fully inflated by injecting toothpaste (White & White; LION, Tokyo, Japan) using an insulin syringe with a pre-attached 29-gauge needle (SS-10M2913; TERUMO, Tokyo, Japan). Terminology of endophallus structures follows Sasakawa et al. (2008). The specimen is preserved in the collection of the Laboratory of Zoology, Department of Science Education, Faculty of Education, Chiba University, Chiba, Japan (CHUJ).

The distribution map was created from CC BY-SA 3.0-licensed files of the Korean Peninsula downloaded from Wikimedia Commons (Wikimedia 2026) using Adobe Photoshop 7.0.

Results

Genus *Pterostichus* Bonelli, 1810

Subgenus *Nialoe* Tanaka, 1958 (s.l.)

About 230 species are currently known (Sasakawa 2025). The absence of setae on the ventral side of tarsomere 5 is regarded as a synapomorphy of this subgenus (Sasakawa 2005). The species are distributed in the Far East around the Sea of Japan.

The *opacipennis* species group

Eighteen species are currently known (Yin et al. 2021). A fully opaque pronotum and elytra are considered synapomorphies of this species group (Sasakawa 2021; Yin et al. 2021). The species are distributed along the Korean Peninsula and adjacent areas, ranging from Primorsky Krai (Russia) in the north to Tsushima Island (Japan) in the south.

***Pterostichus* (*Nialoe*) *apiculatiphallus* Nemoto, 1988**

Pterostichus apiculatiphallus: Nemoto 1988: 42 (original description; subgenus *Nialoe* s.l.; type locality: "Mt. Taebaegsan, 860–1561 m alt., Gang-weon-Do, Korea"); Park and Kwon 1996: 96 (subgenus *Koreonialoe*); Park and Paik (2001): 65 (subgenus *Koreonialoe*); Sasakawa 2021: 209 (subgenus *Nialoe* s.l. or *Koreonialoe*).

Figures 1B, C, 2

New record. KOREA — Gyeongsangbuk-do • Yeongju-si, Mount Sobaeksan, alt. ca. 1300 m; 15–16. VII.2002; K. Kubota, J.-K. Kim, Y. Takami & T. Sota leg.; baited pitfall trap; 1♂, CHUJ_KS_0001.

Identification. The endophallus of *P. apiculatiphallus* was described in its original description by Nemoto (1988). According to that description, *P. apiculatiphallus* can be readily distinguished from all related species by two diagnostic characters: a hooked left preapical lobe (= lobe β seusu Namoto 1988) and the basal fusion of the sclerotized projection (= lobe α seusu Namoto 1988) and the left preapical lobe. The specimen from Mount Sobaeksan exhibits both diagnostic characters. Furthermore, based on Nemoto's (1988) line drawings, the endophallus of *P. apiculatiphallus* has a well-developed swelling on the right lateral side and a developed aggonoporius, both of which were not depicted in related species. These two genital characters most likely correspond to the left preapical lobe and the aggonoporius of the Sobaeksan specimen, respectively. Based on the concordance of these four genital components, we identify the Sobaeksan specimen as *P. apiculatiphallus*.

Redescription. *Measurements.* Body length from mandible apices to elytral end 20.54 mm; body length from anterior margin of labrum to elytral end 18.78 mm; body length from clypeal apex to elytral end 18.16 mm; head length from clypeal apex to neck base 3.45 mm; head width at widest part, measured as distance between apices of eyes, 3.94 mm; head width, measured as distance between eyes at the narrowest part, 3.09 mm; pronotum length along median line 3.71 mm; pronotum width at widest part 4.96 mm; pronotal anterior margin width 3.75 mm; pronotal posterior margin width 3.67 mm; elytral length from scutellum anterior margin to elytral end 11.00 mm; elytral width at widest part 6.21 mm.

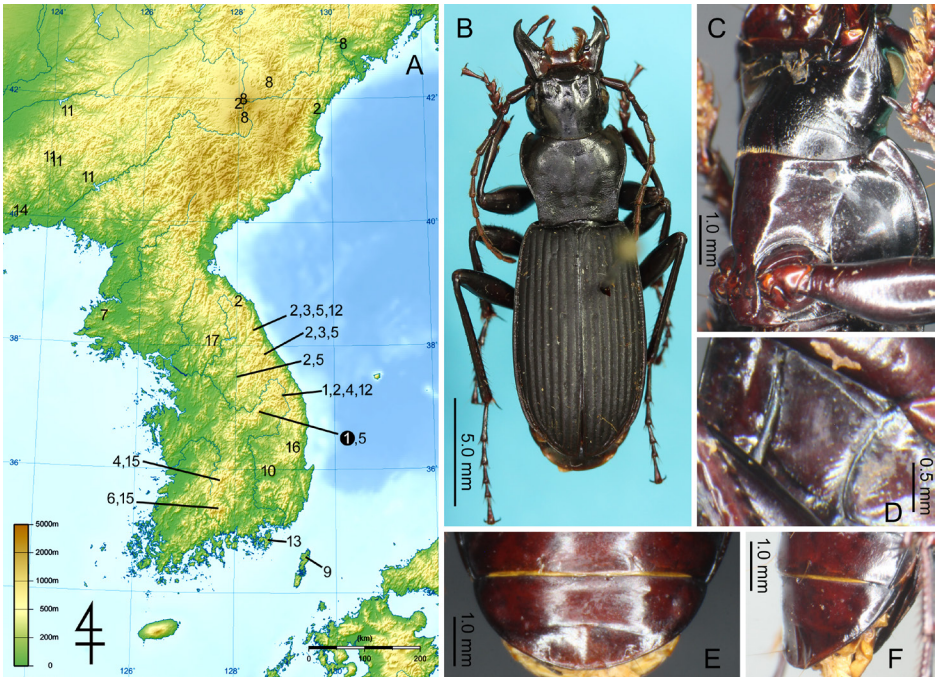

Figure 1. Distribution of the *Pterostichus opacipennis* species group around the Korean Peninsula and habitus of *Pterostichus apiculatiphallus* male from Mount Sobakesan. **A.** Distribution compiled from Sasakawa et al. (2013), Yin et al. (2021), and new record (black circle) (1 = *P. apiculatiphallus* Nemoto; 2 = *P. bellatrix* (Tschitschérine); 3 = *P. bifidiphallus* Nemoto; 4 = *P. ishikawai* Nemoto; 5 = *P. ishikawaioids* Sasakawa, Kim, Kim & Kubota; 6 = *P. jiricola* Sasakawa, Kim, Kim & Kubota; 7 = *P. kuwolsanensis* Li & Zhang; 8 = *P. micropoides* Yin, Shi & Liang; 9 = *P. opacipennis* Jedlička; 10 = *P. palgongsanus* Nemoto; 11 = *P. syleus* Kirschenhofer; 12 = *P. taebaegsanus* Nemoto; 13 = *P. teretis* Park & Kwon; 14 = *P. tetralobatus* Yin, Shi & Liang; 15 = *P. togyusanus* Park & Kwon; 16 = *P. vicinus* Park & Kwon; 17 = *P. woongbii* Park & Kwon). **B.** Dorsal view of habitus. **C.** Left ventrolateral view of head and pronotum. **D.** Metepisternum and surrounding parts on left side. **E.** Ventral view of sternum 7. **F.** Left ventrolateral view of sternum 7.

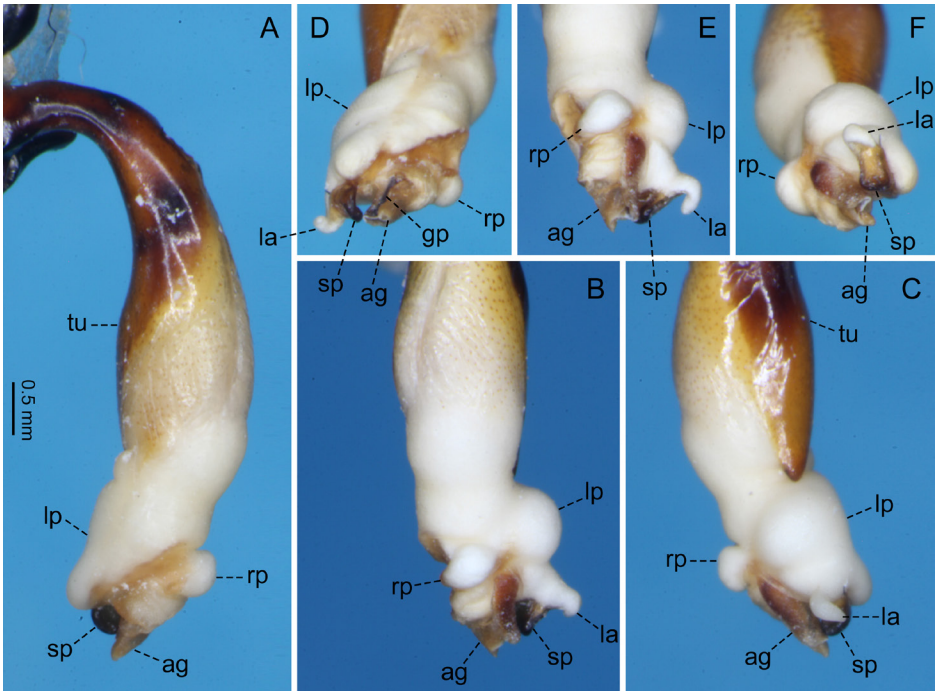

Figure 2. Adeagus with the fully everted and inflated endophallus of *Pterostichus apiculatiphallus* from Mount Sobaeksan. **A.** Left lateral view. **B.** Dorsal view. **C.** Right lateral view. **D.** Left posterior ventrolateral view. **E.** Dorsoposterior view. **F.** Right posterior ventrolateral view. Abbreviations: ag = aggonoporius; gp = gonoporal piece; la = left preapical lobe; lp = left preapical lobe; rp = right preapical lobe; sp = sclerotized projection; tu = tubercle on adeagal ventral side.

Dorsal habitus. Macrocephalic species (Figure 1B). Surfaces of head, pronotum, and elytra black, opaque (Figure 1B). Mouthpart appendages (except for mandibles), antennae, and legs reddish to dark brown; mandibles black except for the basal part, which are reddish brown (Figure 1B, C). Hind wings completely atrophied.

Head large, widest at mid-eye level (Figure 1B). Mandibles long, hooked apex, with left one larger and more hooked than right one; length of the left mandible protruding beyond labrum, measured along its inner margin, more than twice the width of the anterior margin of the labrum; surface wrinkled. Labrum 6-setose, with anterior margin emarginate. Clypeus bisetose. Frontal grooves shallow; surface sparsely punctate. Eyes less convex; their maximum length <0.6 that of antennal segment 1. Tempora swollen; their maximum length slightly longer than that of eyes. Anterior and posterior supraorbital setae both present. Antennal segment 1 with one seta on dorsolateral side; segment 2 with one seta on ventrolateral side; segment 3 with six setae encircling its apical margin; pubescence

(accessory shorter setae) absent on segments 1–3 but present on segments 4–11. Mentum with a pair of paramedial setae; mentum tooth bifid; labial pits distinct. Submentum with two setae on each side. Ventral surface with shallow, irregular, reticulate fissures; lateral sides almost smooth, except for the area near the eyes, which bears longitudinal wrinkles (Figure 1C).

Pronotum cordate, widest slightly behind apical ⅕ (Figure 1B). Anterior margin emarginate at the middle, produced laterally, and emarginate again just before the corners. Anterior angles produced anteriorly. Lateral margin arcuate in apical ⅔, sinuate on basal ⅓; curvature of apical ⅓ stronger than that of basal ⅓. Hind angles almost right-angled, not denticulate. Posterior margin emarginate at middle, slightly produced laterally. Anterotransverse sulcus, median line, and laterobasal impressions present but obscure. Dorsal surface entirely punctate; punctures larger and denser posteriorly. Marginal setae in two pairs, anterior at approximately the widest point of the pronotum and posterior near hind angles.

Elytra long, ovoid, less convex (Figure 1B). Shoulders not denticulate; lateral margin arcuate. Apices rounded, not denticulate. Basal margin distinct. Intervals convex. Parascutellar stria present, with posterior end not connected to stria 1; one setigerous puncture at the anterior end. Two setigerous punctures on interval 3, all near but not adjoining stria 2; anterior puncture slightly behind apical ⅜; posterior puncture almost in posterior ⅓. Eighteen and 20 marginal setigerous punctures on right and left side, respectively.

Thorax and abdomen ventral sides. Prosternal process not bordered at apex (Figure 1C). Surfaces of prosternum and proepisternum smooth (Figure 1C). Mesepisternum sparsely punctate near anterior margin. Metepisternum subquadrate, not elongated; widths of the anterior and posterior margins 1.25 and 1.14 times the length of lateral margin, respectively (Figure 1D). Surfaces of mesosternum, metasternum, and metepisternum, and sterna smooth (Figure 1D–F). Sterna 4–7 with one seta per lateral side (Figure 1E, F). Sternum 7 with a shallow transverse line slightly behind the middle; the line weakly arcuate anteriorly, vanishing near lateral margins; median area along the midline, between transverse line and posterior end of sternum, weakly raised (Figure 1E, F).

Legs. Mesofemur with two setae on the ventral surface along the posterior margin. Metacoxa with two setae; medial seta absent. Metatrochanter without setae. Tarsomere 5 without setae on the ventral side.

Genitalia. Aedeagus with a tubercle on the ventral side at the ostium (Figure 2A). Apical lamella short, with rounded apex (Figure 2C). Endophallus short, almost straight, directed posteriorly (Figure 2A–C). Left preapical lobe large, semi-spherical in the dorsal view (Figure 2B); posterior end protruding with apex widely rounded (Figure 2A, C, D, F). Left apical lobe strongly bent and hook-shaped with apex bending to left in dorsoposterior view (Figure 2E). Sclerotized projection squarish, with longer side approximately 1.5 times length of shorter side (Figure 2F); base, corresponding to shorter side, fused with base of left preapical lobe (Figure 2D–F); the degree of sclerotization not uniform, with distal part being strongly sclerotized (Figure 2F). Right preapical lobe semi-spherical (Figure 2A–F). Aggonoporius developed, protruding posteriorly more than other lobes (Figure 2A–C). Relative sizes of lobes are as follows: left apical lobe < right preapical lobe < left preapical lobe. Left paramere square. Right paramere short, straight, with rounded apex.

Discussion

The discovery of *Pterostichus apiculatiphallus* from Mount Sobaeksan is unsurprising, as Mounts Sobaeksan and Taebaeksan are connected by contiguous forest habitats suitable for the migration of this species (Figure 1A). Our new collection record provides further support for the distinct species status of *P. apiculatiphallus*. Members of the *opacipennis* species group, to which *P. apiculatiphallus* belongs, are morphologically very similar to one another, which has led to debate over whether they represent reproductively isolated species or subspecies of a single species (i.e. geographical races—e.g. Sasakawa et al. 2008, 2013a; Park et al. 2013). In such cases, evidence of sympatric occurrence is particularly valuable, as it provides strong support for reproductive isolation and, consequently, species-level distinction. The Sobaeksan specimen was collected simultaneously with the related species *P. ishikawaioides* (Sasakawa et al. 2008), demonstrating that *P. apiculatiphallus* and *P. ishikawaioides* are not subspecies of a single species but are instead distinct species. Our morphological observations, based on a fully everted and inflated endophallus, revealed a previously overlooked character in *P. apiculatiphallus*: the right preapical lobe. This lobe was neither depicted in Nemoto's (1988) illustration nor mentioned in his morphological description of the species. Nemoto (1988) listed *P. bifidiphallus*

Nemoto, 1988 as the species most similar to *P. apiculatiphallus* externally but did not evaluate its phylogenetic relationship with *P. apiculatiphallus*. Reexaminations of endophallus structures based on fully inflated endophalli have been performed in some other members of the species group (Sasakawa 2005; Sasakawa et al. 2008, 2013b). Based on these studies, *P. apiculatiphallus* is inferred to be most closely related to *P. taebaegsanus* Nemoto, 1988, rather than to *P. bifidiphallus*, because these two species share a hook-shaped left preapical lobe, which is considered a derived character state in the *opacipennis* species group. These findings highlight the importance of re-examining morphology based on a fully everted and inflated endophallus, even in previously described species.

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Additional information

Conflict of interest

The authors declare that no competing interests exist.

Ethical statement

No ethical statement is reported.

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Author contributions

Conceptualization: KS, JLK, JKK, KK. Data curation: KS. Formal analysis: KS. Funding acquisition: JKK, KK. Investigation: JKK, KK. Methodology: KS. Resources: KS. Supervision: KS. Visualization: KS. Project administration: KS. Software: KS. Validation: KS. Writing – original draft: KS. Writing – review and editing: KS, JLK, JKK, KK.

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Data availability

All data that support the findings of this study are available in the main text.

References

Nemoto K (1988) *Pterostichus opacipennis* Jedlička and its allied species of South Korea and Japan (Coleoptera, Carabidae). Bulletin of the Biogeographical Society of Japan 43: 39–45.

Nemoto K (1989) A new species of *Pterostichus* from Amami-Ôshima island, southwest Japan (Coleoptera: Carabidae). Akitu, New Series 106: 1–6.

Park J-K, Kwon Y-J (1996) A new subgenus of the *Pterostichus* from Korea (Coleoptera: Harpalidae). Korean Journal of Entomology 26 (1): 93–103.

Park J-K, Lyu D-P, Park J-Y (2013) Two new species of the genus *Pterostichus* (Coleoptera: Carabidae) from Korea. Journal of Asia-Pacific Entomology 16: 385–388. https://doi.org/10.1016/j.aspen.2013.04.012

Park J-K, Paik J-C (2001) Coleoptera (Carabidae). Economic insects of Korea 12. Insect Koreana Supplement 19: 1–169.

Sasakawa K (2005) Phylogenetic studies of the subgenus *Nialoe* (s. lat.) (Coleoptera, Carabidae, genus *Pterostichus*), part 1: Homology of the component parts of male genitalia and higher phylogeny. Zoological Science 22 (11): 1205–1216. https://doi.org/10.2108/zsj.22.1205

Sasakawa K (2009) *Pterostichus macrogenys* Bates (Coleoptera: Carabidae) and its allied species of northern Japan: descriptions of seven additional species and possible evidence supporting species status. Zoological Studies 48 (2): 262–269.

Sasakawa K (2021) A new species of ground beetle and a revised list of the East Asian endemic subgenus *Nialoe* (s. lat.) (Coleoptera: Carabidae: *Pterostichus*). Oriental Insects 55 (2): 204–215. https://doi.org/10.1080/00305316.2020.1774438

Sasakawa K (2025) Two new subgenera (*Protonialoe* subgen. nov. and *Smilodonialoe* subgen. nov.) of the ground beetle *Pterostichus* Bonelli, 1810 (Coleoptera: Carabidae) from the Far East. Journal of Insect Biodiversity 71 (1): 1–14. https://doi.org/10.12976/jib/2025.71.1.1

Sasakawa K, Kim J-L, Kim J-K, Kubota K (2008) Taxonomic studies of *Pterostichus ishikawai* Nemoto (Coleoptera: Carabidae). Entomological Science 11(2): 173–178. https://doi.org/10.1111/j.1479-8298.2008.00261.x

Sasakawa K, Kim J-L, Kim J-K, Kubota K (2013a) Notes on the ground beetle *Pterostichus togyusanus* (Coleoptera: Carabidae): Phylogenetic evidence for species status and new distribution record. Journal of Asia-Pacific Entomology 16 (4): 429–431. https://doi.org/10.1016/j.aspen.2013.05.003

Sasakawa K, Kim J-L, Kim J-K, Kubota K (2013b) New distribution record of *Pterostichus taebaegsanus* Nemoto, 1988 (Coleoptera: Carabidae). Biogeography 15: 63–65.

Shiiba R (2023) Revision of *Pterostichus* (*Sphodroferonia*) *hisamatsui* Ishida and Shibata and its relatives (Coleoptera: Carabidae) from Shikoku and Kyushu. Japanese Journal of Systematic Entomology 29 (1): 109–137.

Wikimedia (2026) Wikimedia Commons. https://commons.wikimedia.org/wiki/Main_Page. Accessed on: 2026-01-22.

Yin W-Q, Shi H-L, Liang H-B (2021) Revision of the Chinese species of subgenus *Koreonialoe* (Coleoptera: Carabidae: *Pterostichus*), with descriptions of two new species. ZooKeys 1063: 1–21. https://doi.org/10.3897/zookeys.1063.69942