

RESEARCH PAPER

Taxonomy of the *Lathrobium nomurai* group (Coleoptera: Staphylinidae) from Northern Kyushu, Japan, with descriptions of two new species

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Abstract. Five species of the *Lathrobium nomurai* group are (re)described: *Lathrobium nomurai* Nakane, 1955, *L. fujimotoi* Y. Watanabe, 2001, *L. hikosanense* Y. Watanabe, 1998, *L. yufuense* sp. nov., and *L. denchu* sp. nov. All species inhabit the upper hypogean zone or are found under stones in the northern Kyushu, Japan. Their distribution patterns are discussed and compared to other members of this species group.

Key words. Coleoptera, Staphylinidae, Paederinae, Lathrobiina, taxonomy, new species, redescription, distribution, upper hypogean zone, cave, intraspecific variation, Kyushu, Japan, Palaearctic Region

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Introduction

In Japan, 136 species of the genus *Lathrobium* Gravenhorst, 1802 are currently known (ASSING 2019; ASSING & KURODA 2020; NOZAKI 2020; SENDA 2020, 2022; SATO 2023), most of which are considered to have a low dispersal ability because of their reduced hind wings (ASSING 2019). They are divided into seven species groups based on body size and male sexual characters. The *Lathrobium nomurai* group includes 26 species that occur in Western Honshu, Shikoku, and Kyushu (ASSING & KURODA 2020, WATANABE 2013) and inhabit the upper hypogean zone or are found under stones, unlike other species that inhabit forest leaf litter (WATANABE 1998). In Kyushu, three species of the group are recorded: *L. nomurai* Nakane, 1955, *L. fujimotoi* Y. Watanabe, 2001, and *L. hikosanense* Y. Watanabe, 1998. The *L. nomurai* species group was originally proposed by WATANABE (1998, 2002) and characterized by a large body with the head and elytra being longer than wider or as long as wide, the reddish general coloration, and reduced eyes.

The original description of *Lathrobium nomurai*, from which the species group name is derived, illustrated only sternites VII–IX of male in the ventral view, and omitted its aedeagus (NAKANE 1955). *Lathrobium fujimotoi*

belonging the *L. nomurai* group was described from Mt. Kurodake, near the *L. nomurai* type locality (Tsuruoka-Dô Cave, Saiki-City of Oita Prefecture, Japan), but its aedeagus has not been compared with that of *L. nomurai*. To progress precise classification of this species, it is necessary to reveal the details of morphology of *L. nomurai*. Moreover, although members of this species group have developed an internal sac of aedeagus, their internal sacs were not included in the original descriptions. We found that the shapes and structures vary markedly between the species; hence they would be useful for their classification.

We had opportunity to examine many specimens belonging to the *L. nomurai* group collected from several localities in northern Kyushu. In this paper, we redescribe *L. nomurai* and the aedeagus of *L. fujimotoi* and *L. hikosanense*. Moreover, we describe two new species, *L. yufuense* sp. nov. and *L. denchu* sp. nov., collected, respectively, from Beppu City and Kunisaki City of Oita Prefecture, Japan. These new species are found in the upper hypogean zone and under stones and are considered as the members of the *L. nomurai* group. In addition, the distribution and dispersal patterns of the *L. nomurai* group are discussed based on the shape of the aedeagus.



Materials and methods

The material examined in this paper is deposited in the Kyushu University Museum, Fukuoka (KUM), the Laboratory of Entomology, Tokyo University of Agriculture, Kanagawa (TUA), and the Laboratory of Systematic Entomology, Hokkaido University, Sapporo (SEHU). Holotypes of the two new species are deposited in KUM. The holotype of *Lathrobium nomurai* is deposited in SEHU and *L. fujimotoi* in TUA.

Morphological observations were made using Olympus SZX7 and Nikon ECLIPSE Ci-L microscope. The habitus photographs were taken by Canon MP-E65 mm 1–5×macro lens mounted on a Sony α 7R IV digital camera. These photos were combined by Zerene Stacker (Zerene System LLC) software. The images used in this paper were processed with CLIP STUDIO PAINT Ver. 1.13.2 (CELSYS, Inc.). The map showing the distribution is based on the Digital Topographic Map released by Geospatial Information Authority of Japan and CraftMap (<http://www.craftmap.box-i.net/>).

Dissected parts, such as genitalia and abdominal sternites and tergites, were soaked in 10 % KOH solution and then mounted in Euparal on a small glass plate glued to a small card (MARUYAMA 2004).

Terminology used in this paper follows ASSING (2019), and the “parameral” side is referred to as the “ventral” and opposite side as the “dorsal” in this paper. Abbreviations and measurement definitions are shown as follows:

AL	antennal length;
BL	body length: from the anterior margin of the head without labrum to the apex of the tergite X;
EL	elytral length: from apex of scutellum to posterior margin of the elytra along the suture;
EW	maximum width of left and right elytra combined;
FBL	fore body length: from the anterior margin of the head without labrum to the apex of elytra.
HL	head length; from anterior margin of the head without labrum to posterior of the temple;
HW	maximum width of the head without eyes;
PL	pronotum length: from anterior to posterior margin of the pronotum;
PW	maximum width of pronotum.

Taxonomy

Definition of the *Lathrobium nomurai* group

Diagnosis. Body large (length about 9.0–15.0 mm) for *Lathrobium* species. Coloration light reddish brown to reddish black. Head and elytra longer than wide or as long as wide. Eyes vestigial.

Remarks. The *L. nomurai* group was originally proposed by WATANABE (1998, 2002), and the diagnosis is partially revised in this paper. So far, this species-group is valid only for Japanese species and it has not been verified whether it is monophyletic or not. We compared the characteristics of the *L. nomurai* group in Kyushu, which includes *L. nomurai*, *L. fujimotoi*, *L. hikosanense*, *L. yufuense* sp. nov., and *L. denchu* sp. nov. Our observations revealed that these species share a sclerotized and ringed part of an internal sac of aedeagus and a relatively long prothorax (PL/PW is approximately 1.3). In contrast,

the species of other groups of *Lathrobium* lack a ringed part, and their PL/PW ratios are generally around 1.2 (as determined by our observation). These characteristics are also likely important to diagnose the *L. nomurai* group because other *Lathrobium* species in Japan do not share them. Therefore, further morphological observation covering all members of the *L. nomurai* group and tests of its monophyly are required for the strict definition of this species-group.

Lathrobium nomurai Nakane, 1955

[Japanese name: Ô-kobane-naga-hanekakushi]
(Figs 1, 2, 9)

Type material examined. HOLOTYPE: ♂, Japan: Kyushu, “0000000424 / Sys. Ent / Hokkaido Univ. / Japan [SEHU] // HOLOTYPE / Appended labeled by / ÔHARA / INARI / KANBE / SUZUKI / and / HIRONAGA / 2006 // NAKANE Coll. / SEHU / JAPAN / 1999 // *Lathrobium / nomurai* / Det. T. Nakane 1955 // Tsuruoka-Dô / Saeki / Oita Prf. / 3. X. 1954 / S. Nomura // 45–9 // HOLOTYPE” (SEHU) (Fig. 1B).

Additional material examined. 1 ♂, “[JAPAN]: Oita-ken / Saeki-shi / Kariu / 90 m in alt. / [33.031, 131.895] / 27. X. 2019 / Tsubasa NOZAKI, leg.” (KUM); 1 ♂, “[JAPAN]: Oita-ken / Saeki-shi / Kariu / 90 m in alt. / [33.031, 131.895] / 9. XI. 2019 / Tsubasa NOZAKI, leg.” (KUM); 1 ♂, 1 ♀, “Oita-ken / Tsukumi-shi / Kamiaoe / 9. X. 2007 / T. Miyake leg.” (TUA); 1 ♀, “(Tsuruoka Mine) / Saeki / Oita Pref. / Japan / 23-III-1955 / Coll. S-I. Uéno” (TUA); 1 ♀, “(SAEKI) / Oita / Kyushu / XI–20.1946 / Coll. K. Kutosa” (TUA); 1 ♀, “JAPAN: Ôita Pref. / Saeki-shi / Kadomae / 12. Mar. 2020. / Tainaka” (KUM).

Redescription. BL = 11.0–15.4 mm, FBL = 5.5–5.8 mm (n = 8). Coloration: Body (Fig. 1A) reddish brown, moderately shining; maxillary palpi light red; legs reddish brown but basal part of tibia black or darken; mandible, scutellum, bases of antennomeres I–X black or darken; elytra reddish brown but elytral suture black; abdomen reddish brown, posterior margin of tergite VII and VIII light brownish red; tergite IX and X light red.

Head suborbicular, HL = 1.65–1.80 mm, HW = 1.65–1.95 mm, HW/HL = 1.03, widest at the basal 1/5 of head; frontal area flattened; surface coarsely punctate; punctures sparser on frons and vertex, becoming denser toward posterior and lateral margins, with dark brown setae. Eyes very small, slightly protruding; longitudinal diameter of eye about 1/5 as long as temple in dorsal view. Antennae elongate, AL = 3.85–4.75 mm, AL/HL = 2.56, with whitish yellow setae; antennomere I robust, widest at apical 1/3; antennomere II slightly elongated, shorter than III; antennomeres III–X slightly narrow at base, widening towards apex, successively shorter and narrower toward apical antennomeres but IX and X almost same size; antennomere XI fusiform; relative length of antennomeres as follows: 1.83 : 1.08 : 1.23 : 1.21 : 1.20 : 1.13 : 1.13 : 1.10 : 1.07 : 1.00 : 1.20; relative maximum width of antennomeres as follows: 1.74 : 1.57 : 1.43 : 1.43 : 1.31 : 1.31 : 1.31 : 1.29 : 1.00 : 1.00 : 1.03.

Pronotum oblong-oval, with anterior margin wider than posterior one, PL = 2.00–2.20 mm, PW = 1.51–1.74 mm, PL/PW = 1.29, PL/HL = 1.24, PW/HW = 0.92, widest at apical 1/3; lateral sides of pronotum gently dilated to widest point, thence gradually convergent toward posterior margin; all corners obtusely rounded; disc sparsely covered with coarse and weak punctations except medial

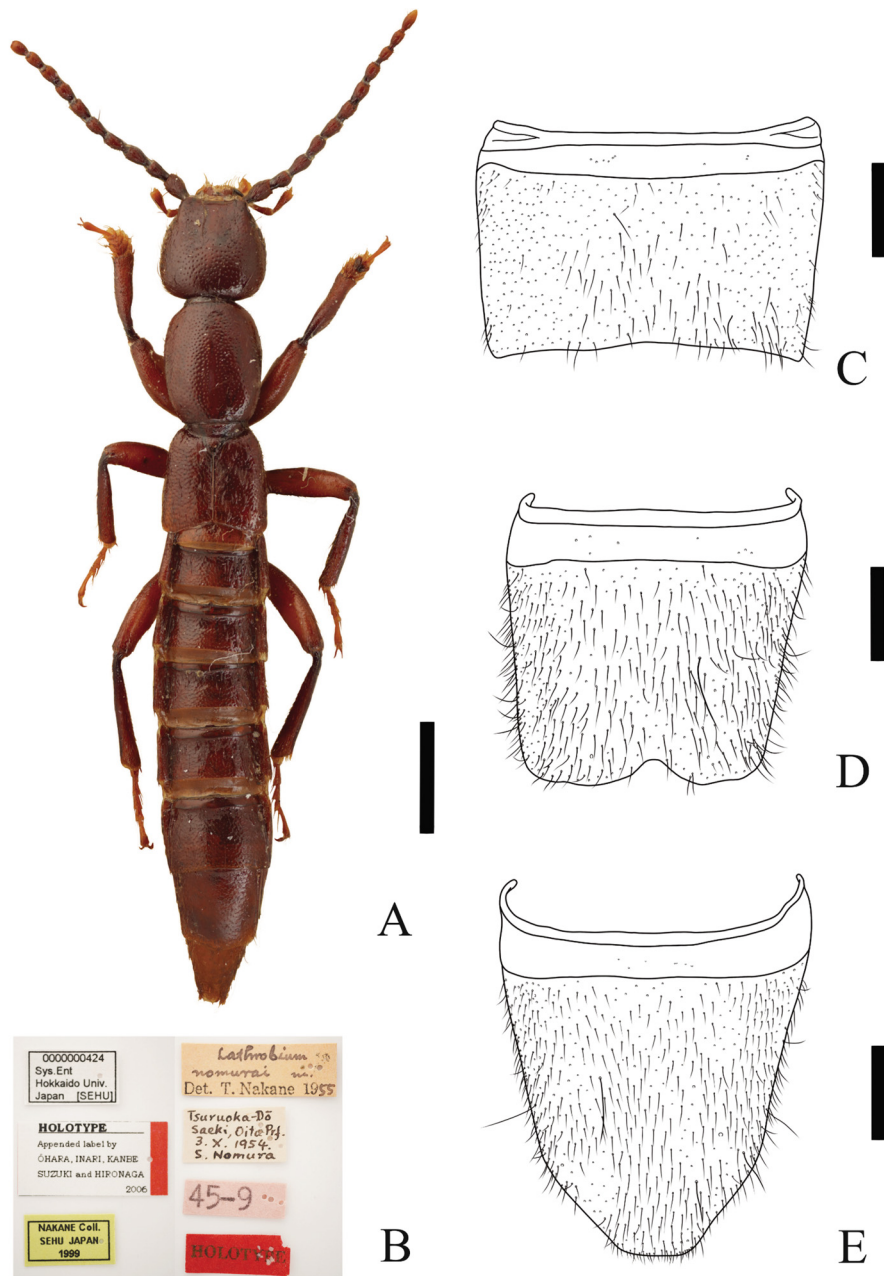


Fig. 1. *Lathrobium nomurai* Nakane, 1955. A – habitus in dorsal view; B – labels of holotype; C – male sternite VII; D – male sternite VIII; E – female sternite VIII. Scale bars = 2.0 mm for A, 0.5 mm for C–E.

longitudinal line; punctures slightly sparser and less than on head, with brownish yellow setae.

Scutellum with sparse punctures. Elytra subtrapezoidal, widened posteriorly, EL = 1.08–1.30 mm, EW = 1.70–1.91 mm, EW/EL = 1.54, EL/PL = 0.56, EW/PW = 1.11; lateral margins almost straight; posterior corners rounded; disc covered with sparse and coarse punctations; punctations denser than on pronotum, with brownish yellow setae. Hind wing completely reduced. Legs with shortened tibiae and tarsi which are covered with golden setae; tarsomeres I–IV of protarsus dilated.

Abdomen elongate, gradually widened from segment III–V, thence contracted to the posterior end; each tergite covered with micropunctations and brownish yellow setae,

distinctly long setae on each side near anterior margin; tergite X as long as posterolateral processes of tergite IX.

Male. Sternite VII (Fig. 1C) transverse, without posteromedian impression, posterior margin almost straight; sternite VIII (Fig. 1D) with posteromedian impression, with sparse setae; posterior margin of sternite VIII slightly asymmetric; sternite IX elongate.

Aedeagus (Figs 2A–C) 2.63 mm long, elongate; basal part of aedeagus with V-shaped impression; ventral process well sclerotized, slightly asymmetrical in ventral view, gradually narrowed toward apical 1/5, strongly narrowed toward apex, curved ventrally from 1/2 to apex; apical part of ventral process slightly curved toward left side in ventral view; apex of ventral process with small

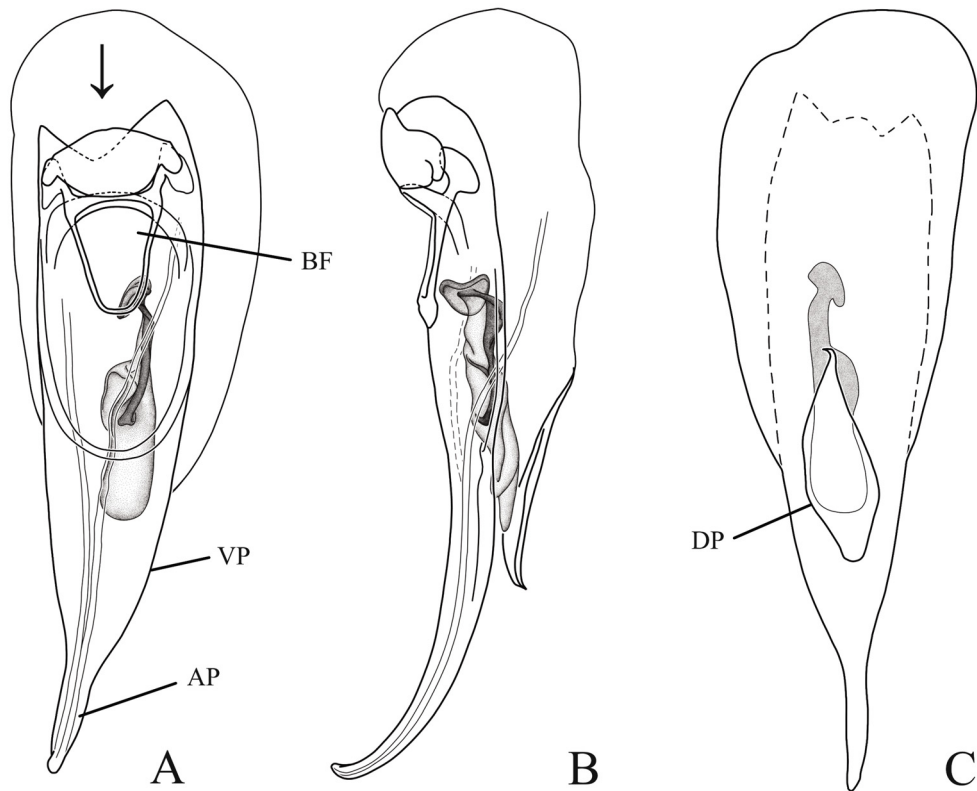


Fig. 2. Male aedeagus of *Lathrobium nomurai* Nakane, 1955: A – ventral view; B – lateral view; C – dorsal view. Scale bar = 0.5 mm. Abbreviations: AP – apical part of ventral process; BF – basal foramen; DP – dorsal plate; VP – ventral process. Black arrow indicates the V-shaped impression of basal margin of aedeagus.

projection; basal and middle parts of ventral process slightly thicker than apex in lateral view; part above basal foramen transverse, with two projections at lateral side; dorsal plate sclerotized, widest at apical 1/4, gradually widened to the widest point at apical 1/4, thus contracted toward apex, with rounded apex; two tubes attached with apex of ventral process in between ventral process and dorsal plate; internal sac with sclerotized structures; ringed part connected with large flattened sac by sclerotized long-narrowed part.

Female. Sternite VIII (Fig. 1E) elongate, densely fringed with numerous setae, post-median margin straight.

Differential diagnosis. This species is similar to *Lathrobium fujimotoi* from Mt. Kurodake, Oita Pref. in general appearance and aedeagal shape. However, this species can be easily distinguished from it by the combination of the following characteristics: 1) lateral side of ventral process of aedeagus straight; 2) internal sac without large sclerotized plate; 3) male sternite VIII slightly asymmetric and smaller than *L. fujimotoi* (in *L. fujimotoi*, each lateral side of ventral process is bulged at basal 1/3, the internal sac has a large sclerotized oval part and sternite VIII is symmetrical and larger).

Biology. Some specimens of this species collected from Kadomae by authors were found in the upper hypogean zone along mountain stream, at an altitude of about 70 m. We dug laterally 20–50 cm up the slope of this locality.

Distribution. Japan (Oita Pref., north of Kyushu).

Remarks. The aedeagus of the holotype is not available for examination. The additional specimens examined here have the characteristics of the antennae and male sternite VIII corresponding to the holotype, and we hence consider them as conspecific with the holotype. Their collection sites are near the type locality (Tsuruoka-Dô Cave, Saiki-City of Oita Prefecture, Japan) and the identical morphology of their aedeagus indicates that they all belong to the same species. Our illustrations of the aedeagus are based on these newly collected specimens.

***Lathrobium fujimotoi* Y. Watanabe, 2001**

[Japanese name: Fujimoto-ô-kobane-naga-hanekakushi]

(Figs 3, 9)

Type material examined. HOLOTYPE: ♂, Japan Kyushu, “Mt. KURODAKE / Shônai-cho / Oita / Kyushu / Japan / Sept. 21st. 1997 / Coll. H. Fujimoto // [HOLOTYPE] / *Lathrobium* (s. str.) *fujimotoi* / Y. Watanabe / 2001” (TUA).

Additional material examined. 1 ♂, “JAPAN: Oita-ken / Asono / Shonai-cho / Yufu-shi / Mt. Kurodake / 16. XI. 2021. / Y. Takagaki”.

Supplementary description. BL = 13.4–14.4 mm, FBL = 5.7–6.6 mm (n = 2). Coloration: Body reddish brown, moderately shining.

Head suborbicular, HL = 1.75–1.90 mm, HW = 1.75–1.85, HW/HL = 0.99, widest at the basal 1/4 of head. Eyes very small, slightly protruding.

Pronotum oblong-oval, with anterior margin wider than posterior one, PL = 2.00–2.23 mm, PW = 1.60–1.75 mm,

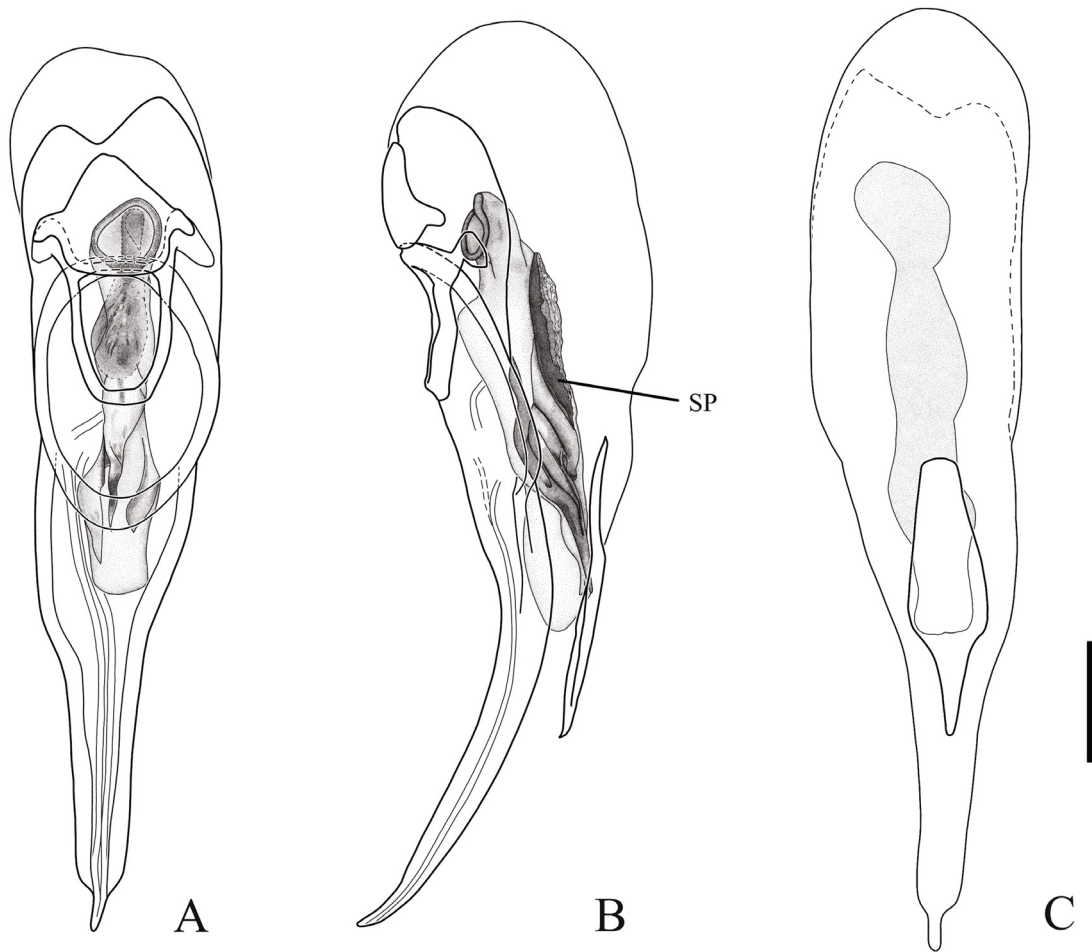


Fig. 3. Male aedeagus of *Lathrobium fujimotoi* Y. Watanabe, 2001: A – ventral view; B – lateral view; C – dorsal view. Scale bar = 0.5 mm. Abbreviation: SP – large sclerotized plate of internal sac.

PL/PW = 1.26, PL/HL = 1.16, PW/HW = 0.93, widest at apical 1/5.

Elytra subtrapezoidal, widened posteriorly, EL = 1.16–1.20 mm, EW = 1.78 mm, EW/EL = 1.51, EL/PL = 0.56, EW/PW = 1.06; lateral margins almost straight; posterior corners rounded. Hind wing completely reduced.

Male. Abdominal sternite VII transverse, with weak posteromedian impression; several setae at posteromedian area grown toward interior; sternite VIII with weak posteromedian impression.

Aedeagus (Figs 3A–C) 3.28 mm long, elongate; basal part of aedeagus with V-shaped impression; ventral process well sclerotized, slightly asymmetrical in ventral view, gradually narrowed toward apical 1/4, strongly narrowed toward apex, curved ventrally from 1/2 to apex; apical part of ventral process straight; apex of ventral process with small projection; basal and middle parts of ventral process slightly thicker than apex in lateral view; each lateral side of ventral process weakly bulged at basal 1/3 area; part above basal foramen almost pentagonal, with two projections at lateral side; dorsal plate sclerotized, widest at apical 1/4, gradually widened to the widest point at apical 1/4, thus strongly

contracted toward apex, with subacute apex; two tubes attached with apex of ventral process in between ventral process and dorsal plate; internal sac large, with sclerotized and ringed part, including large sclerotized plate in dorsal side; sclerotized plate in internal sac with some spine lines dorsally; apical area of internal sac folded in complex way. **Differential diagnosis.** This species is similar to other species of the *L. nomurai* group in general appearance and aedeagus. However, this species can be easily distinguished from them by the combination of the following characteristics: 1) basal part of ventral process with V-shaped impression; 2) internal sac of aedeagus with large, sclerotized plate in dorsal side; 3) each lateral side of ventral process weakly bulged at basal 1/3 area; 4) apex of ventral process with small projection.

Biology. Holotype and additional specimen were collected from the upper hypogean zone and under stones in a deciduous broadleaf forest, at an altitude of about 850 m. **Distribution.** Japan (Oita Pref., north of Kyushu).

Remarks. This species has been reported only from Mt. Kurodake, Oita Pref., Japan. See WATANABE (2001) for a detailed description of the species.

***Lathrobium hikosanense* Y. Watanabe, 1998**[Japanese name: Hikosan- δ -kobane-naga-hanekakushi]
(Figs 4, 9)

Material examined. 1 ♂, “Mt. Hiko / Soeda-Town / FukuokaPref. / [JPN] / 2018. 10. 21. / H. Tanaka leg.” (KUM); 1 ♂, 1 ♀, “[JAPAN]: Fukuoka-ken. / Soeda-machi. / Hikosan. / 8. VI. 2019. / Tsubasa NOZAKI” (KUM); 1 ♂, “JAPAN / Fukuoka-ken / Umi-machi / Mt. Buccho / 25. X. 2015. / Naomichi Tsuji leg.” (KUM); 1 ♂, “JAPAN / Fukuoka-ken / Itoshima-shi / Mt. Iwara-yama (alt. 400 m) / 27. IV. 2014. / Naomichi Tsuji leg.” (KUM); 1 ♂, “JAPAN: Fukuoka-ken / Mizunashi / 15. VII. 2019. / Tanaka” (KUM); 1 ♂, “Mt. Tachibana / Higashi-ku / Fukuoka / Fukuoka Pref. / JAPAN / 6. X. 2022. / Naomichi TSUJI leg.” (KUM); 1 ♂, “Mt. Daisen / Kujyu Oita / 5. Vi. 1983 / S. Nomura” (KUM); 1 ♂, “[JAPAN] / Fukuoka-ken / Kitakyūshū-shi / Kokura-Minami-ku / Hiraodai / 33.769°N / 130.908°E / 22. V. 2021. / S. INOUE” (KUM); 1 ♂ “[JAPAN]: Nagasaki-ken / Isahaya-shi / Kinsenji / [32.9739, 130.0879] / 1. X. 2022. / TANAKA H.” (KUM).

Supplementary description. BL = 11.6–13.9 mm, FBL = 4.9–5.6 mm (n = 10). Coloration: Body reddish brown to reddish black, moderately shining.

Head suborbicular, HL = 1.43–1.68 mm, HW = 1.40–1.65, HW/HL = 0.96, widest at the basal 1/3 of head. Eyes very small, slightly protruding.

Pronotum oblong-oval, with anterior margin wider than posterior one, PL = 1.75–1.95 mm, PW = 1.30–1.50 mm, PL/PW = 1.35, PL/HL = 1.20, PW/HW = 0.92, widest at apical 1/4.

Elytra subtrapezoidal, widened posteriorly, EL = 1.00–1.25 mm, EW = 1.40–1.65 mm, EW/EL = 1.38, EL/PL = 0.59, EW/PW = 1.10; lateral margins almost straight; posterior corners rounded. Hind wing completely reduced.

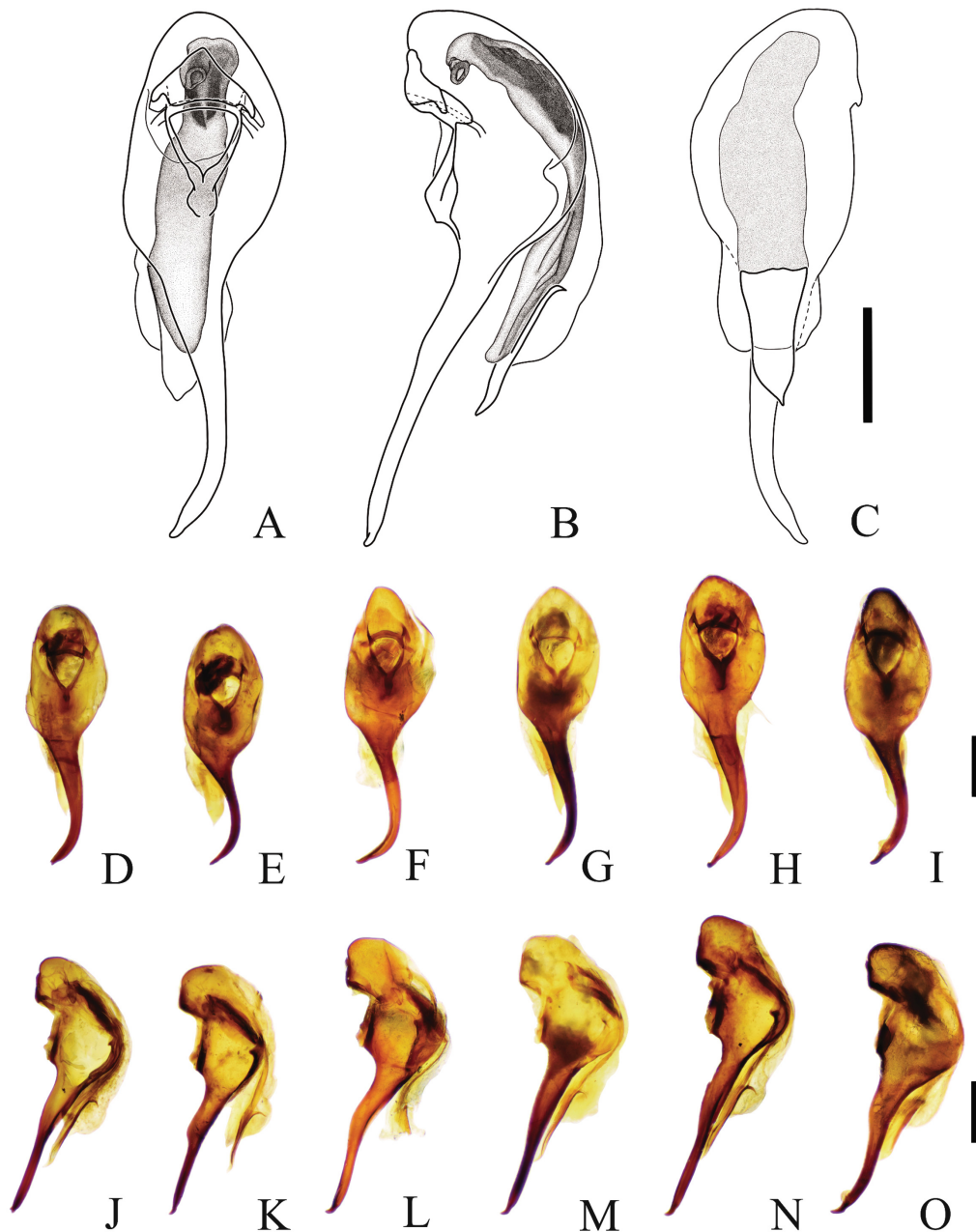


Fig. 4. Male aedeagus of *Lathrobium hikosanense* Y. Watanabe, 1998 in each locality. A–C – Mt. Hiko-san (type locality): A – ventral view; B – lateral view; C – dorsal view. D, J – Mt. Daisen; E, K – Hiraodai; F, L – Mt. Buccho-zan; G, M – Mt. Tachibana-yama; H, N – Mt. Iwara-yama; I, O – Kinsenji Temple. Scale bars = 0.5 mm. Each locality referred to Fig. 9.

Male. Sternite VII transverse, with weak posteromedian impression; sternite VIII with posteromedian impression; each side of posteromedian impression protruded weakly; lateral area of sternite VIII with slightly longer setae than median area.

Aedeagus (Figs 4A–C) 2.27 mm long, oblong; ventral process well sclerotized, asymmetric in ventral view, gradually narrowed toward 1/2, thus gradually narrowed toward apex, curved ventrally from 1/2 to apex; apical part of ventral process elongate, curved toward left side in ventral view; apex of ventral process with small projection; ventral process from basal to about 1/2 of area in ventral view two times thicker than that of apical part; basal and middle parts of ventral process ball-shaped, thicker than apical part in lateral view; part above basal foramen triangular, with two projections at lateral side; surrounding of basal foramen sclerotized; dorsal plate sclerotized, triangular with base at anterior margin, contracted toward apex, with acute apex; internal sac large, with sclerotized and ringed part; basal area of internal sac including two sclerotized long–narrow parts; each sclerotized part formed by gathering some thin plates; middle and apical area of internal sac flattened.

Differential diagnosis. This species is similar to *L. daisensanum* Y. Watanabe, 1998, a member of the *L. nomurai* group described from Mt. Daisen-zan, Kagawa Pref., Shikoku, in general appearance and aedeagal shape. However, this species can be easily distinguished from it by the combination of the following characteristics: 1) dorsal plate of aedeagus triangular with base at anterior margin; 2) apical part of ventral process curved toward left side in ventral view; 3) middle area of ventral process of aedeagus gradually narrowed toward apex (while in *L. daisensanum*, apex of dorsal plate is truncate, apical part of ventral process of aedeagus is straight in ventral view, and middle area of ventral process of aedeagus is strongly narrowed toward apex).

Variation. Size and shape of aedeagus tend to vary by locality (Fig. 4). It can be observed that individuals in the west tend to have larger aedeagus than those in the east. Although tendency cannot be observed, thickness and degree of curvature on apical part of ventral process also vary in each region; the smallest in Hiraodai, Fukuoka Pref. (Figs 4E, K), the largest in Mt. Iwara-yama, Fukuoka Pref. (Figs 4H, N).

Biology. Examined specimens were collected from the upper hypogean zone or under stones. Compared to other species of *L. nomurai* group, this species tends to be found in a shallow ground.

Distribution. Japan (north of Kyushu).

Remarks. This species has been described based on the specimens collected from only Mt. Hiko-san, Fukuoka Pref., Kyushu (WATANABE 1998). This study revealed that this species occurs from Oita Pref. to Nagasaki Pref., and its distribution is wider than other species of the *L. nomurai* group in Kyushu (Fig. 9). In addition, the aedeagus of this species shows a geographic variation in each region (Fig. 4). We consider this variation as intraspecific because it is continuous, and the structures of internal sac are about the same in all examined specimens. See WATANABE (1998) for a detailed description.

Lathrobium yufuense sp. nov.

[Japanese name: Yufu-ô-kobane-naga-hanekakushi]

(Figs 5, 6, 9)

Type material. HOLOTYPE: ♂, Japan: Kyushu, “JPN: Oita-ken / Beppu-shi / Higashiyama / 19. IX. 2021. / Hashizume T. & Nishiya K” (KUM). PARATYPES: 1 ♂, same data as holotype (KUM); 1 ♂ (smaller-sized specimen), 1 ♀, “JAPAN: Oita-ken / Beppu-shi / Mt. Yufudake / 2. X. 2022 / Y. Sato & T. Hashizume” (KUM).

Description. BL = 11.2–13.3 mm, FBL = 4.9–5.5 mm (n = 3). Coloration: Body (Fig. 5A) reddish brown, moderately shining; maxillary palpi light red; legs reddish brown but basal part of tibia black or darken; mandible, scutellum, bases of antennomeres 1–10 black or darken; elytra reddish brown but elytral suture black; abdomen reddish brown, posterior margin of tergite VII and VIII brownish light red; tergite IX and X light red.

Head suborbicular, HL = 1.61–1.68 mm, HW = 1.56–1.78 mm, HW/HL = 1.01, widest at the basal 1/3 of head; frontal area flattened; surface coarsely punctate; punctures sparser on frons and vertex, becoming denser toward posterior and lateral margins, with light brown setae. Eyes very small, slightly protruding; longitudinal diameter of eye about 1/5 as long as temple in dorsal view. Antennae elongate, AL = 3.55–4.20 mm, AL/HL = 2.37, with whitish yellow setae; antennomere I robust, widest at apical 1/4; antennomere II slightly elongated and shorter than III; antennomeres III–X slightly narrow at base and widening towards apex; antennomeres V–IX almost same size; antennomere XI fusiform and narrowest; relative length of antennomeres as follows: 1.98 : 1.02 : 1.35 : 1.19 : 1.08 : 1.08 : 1.08 : 1.08 : 1.00 : 1.23; relative maximum width of antennomeres as follows: 1.63 : 1.25 : 1.25 : 1.38 : 1.25 : 1.25 : 1.25 : 1.13 : 1.13 : 1.00.

Pronotum oblong-oval, with anterior margin wider than posterior one, PL = 1.85–2.10 mm, PW = 1.44–1.60 mm, PL/PW = 1.31, PL/HL = 1.21, PW/HW = 0.92, widest at apical 1/4; lateral sides of pronotum gently dilated to widest point, thence gradually convergent toward posterior margin, almost straight; all corners obtusely rounded; disc sparsely covered with coarse and weak punctations except medial longitudinal line; punctures slightly sparser and less than on head, with brownish yellow setae.

Scutellum with sparse punctures. Elytra subtrapezoidal, widened posteriorly, EL = 1.10–1.22 mm, EW = 1.55–1.75 mm, EW/EL = 1.39, EL/PL = 0.58, EW/PW = 1.09; lateral margins almost straight; posterior corners rounded; disc covered with sparse and coarse punctations, gently shining; punctations denser than on pronotum, with brownish yellow setae. Hind wing completely reduced. Legs with shortened tibiae and tarsi which are covered with golden setae; tarsomeres I–IV of protarsus dilated.

Abdomen elongate, gradually widened from segment III to V, thence contracted to the posterior end; each tergite covered with micropunctations and brownish yellow setae, distinctly long setae on each side near anterior margin; tergite X as long as posterolateral processes of tergite IX.

Male. Sternite VII (Fig. 5C) transverse, with weak posteromedian impression; posterior area of sternite VII with longer setae than in anterior area; sternite VIII (Fig.

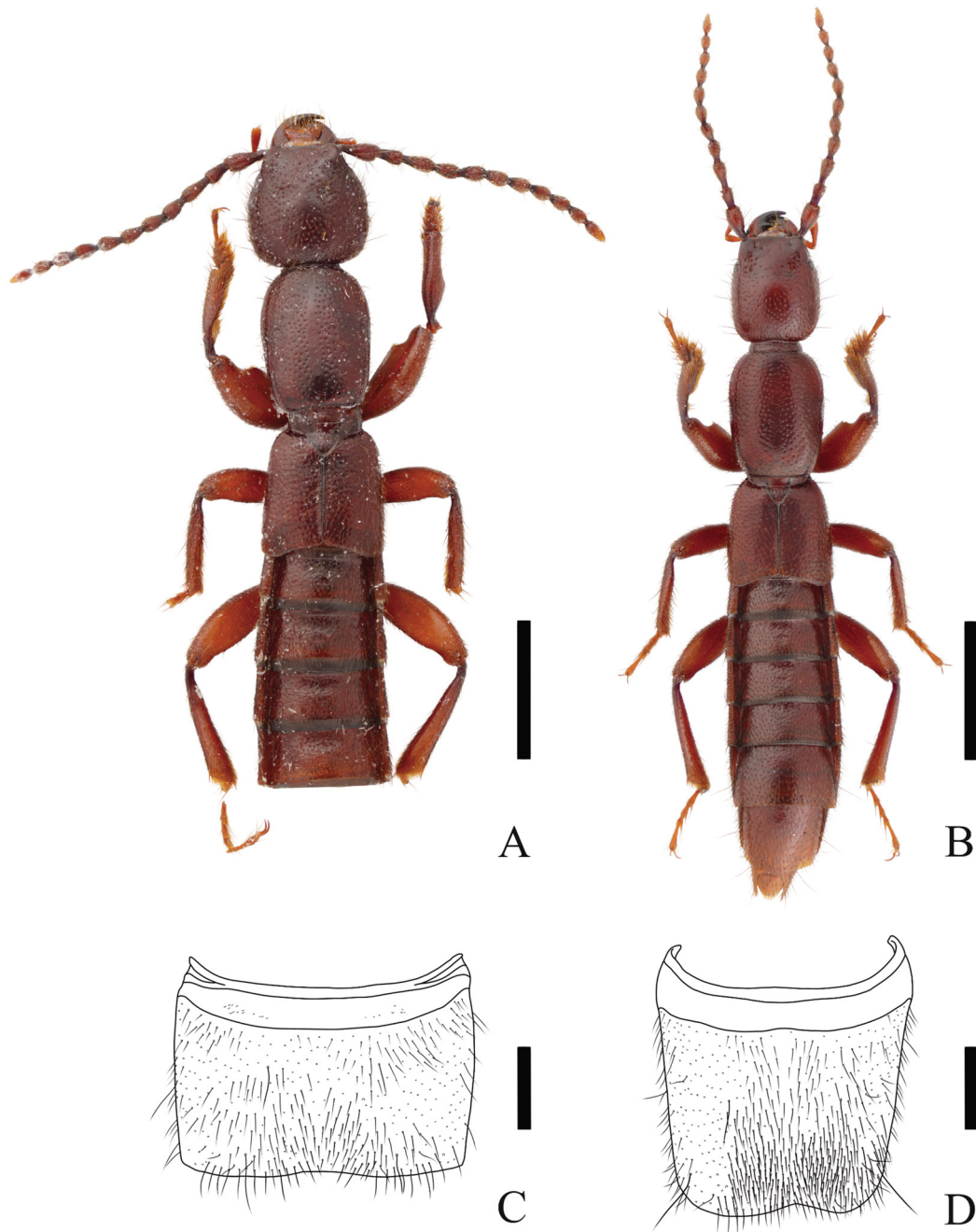


Fig. 5. *Lathrobium yufuense* sp. nov. A – habitus in dorsal view; B – habitus of small-sized specimen in dorsal view; C – male sternite VII; D – male sternite VIII. Scale bars = 2.0 mm for A, B, 0.5 mm for C, D.

5D) with weak right-sided posteromedian impression in ventral view; several thick setae on posterior area; sternite IX elongate.

Aedeagus (Figs 6A–C) 2.21 mm long, oblong; basal part of aedeagus with V-shaped impression; ventral process well sclerotized, asymmetrical in ventral view, gradually narrowed toward apical 1/4, thus strongly narrowed toward apex, curved ventrally from 1/3 to apex; apical part of ventral process slightly curved toward right side in ventral view; apex of ventral process with small projection; basal and middle parts of ventral process slightly thicker than apex in lateral view; part above basal foramen triangular, with two projections at lateral side; dorsal plate sclerotized, widest at apical 1/4, with acute apex, curved dorsally

from basal to its apical 1/2; lateral side from basal part to 1/2 straight, widened at apical 1/4, thus contracted toward apex; two tubes attached with apex of ventral process in between ventral process and dorsal plate; internal sac large, with sclerotized and ringed part; middle area of internal sac folded complexly, with sclerotized bilobate projections; apical area of internal sac flattened.

Female. Sternite VIII elongate and triangular, densely fringed with numerous setae.

Variation. A smaller-sized male specimen has been discovered in this species (Fig. 5B) This specimen has elongated head which has almost straight lateral side rather than suborbicular. Each measurement of this specimen as follows: BL = 12.0 mm, FBL = 4.7 mm, AL = 3.48 mm, HL =

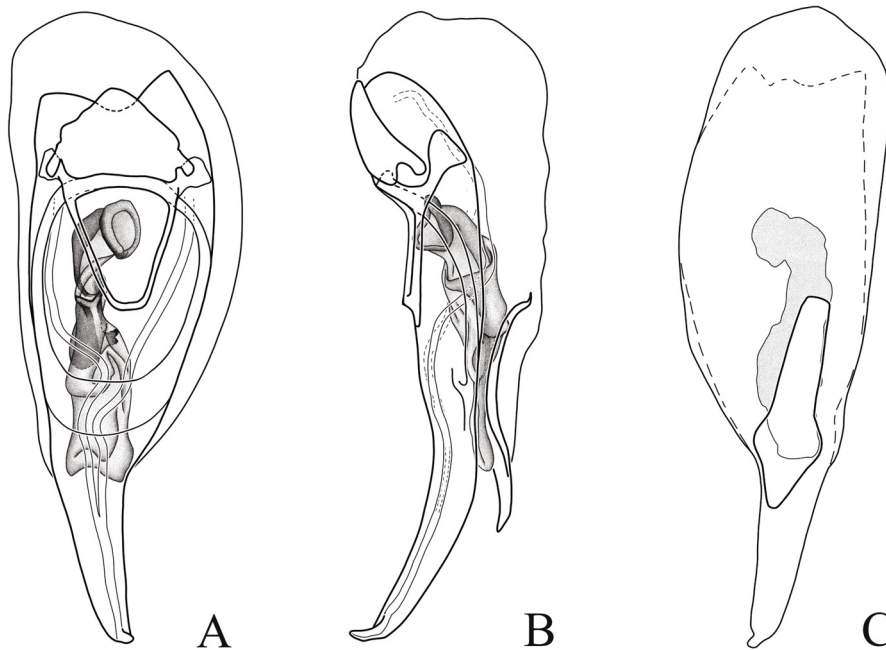


Fig. 6. Male aedeagus of *Lathrobium yufuense* sp. nov. A – ventral view; B – lateral view; C – dorsal view. Scale bar = 0.5 mm.

1.46 mm, HW = 1.25 mm, PL = 1.85 mm, PW = 1.35, EL = 1.08, EW = 1.50. Compared to other specimens, the body of this specimen is smaller sized, but does not differ from the aedeagus of the larger specimen in the structure. Therefore, we consider it conspecific with the holotype and include it to the type series of *L. yufuense* sp. nov.

Differential diagnosis. The new species is similar to *Lathrobium fujimotoi* from Mt. Kurodake near Mt. Yufu-dake, Oita Pref., in general appearance and aedeagal shape. However, the new species can be easily distinguished from *L. fujimotoi* by the combination of the following characteristics: 1) small aedeagus; 2) oblong aedeagus; 3) small and asymmetric male sternite VIII with impression; (in contrast, *L. fujimotoi* has large-sized aedeagus, about 1.5 times longer than that of *L. yufuense* sp. nov., the shape of its aedeagus is elongate; and male sternite VIII is large and symmetric with weak impression).

Etymology. The specific name of new species is derived from the type locality, Mt. Yufu-dake.

Biology. All specimens were collected from only Mt. Yufu-dake and found under stones in a deciduous broadleaf forest, at an altitude of about 1000 m.

Distribution. Japan (Oita Pref., north of Kyushu).

***Lathrobium denchu* sp. nov.**

[Japanese name: Kunisaki-ô-kobane-naga-hanekakushi]
(Figs 7, 8, 9)

Type material. HOLOTYPE: ♂, Japan: Kyushu, “JAPAN: Oita-ken / Kunisaki-shi / Kunisaki-cho / Jôbutsu / 33.587414, 131.6092694 / 19. XI. 2022. / H. Tanaka” (KUM). PARATYPES: 2 ♂♂, same data as holotype (KUM).

Description. BL = 13.3–13.7 mm, FBL = 5.1–5.3 mm (n = 3). Coloration: Body (Fig. 7A) reddish brown or dark brown, moderately shining; maxillary palpi, light red; legs reddish brown but bases of tibia light black or darken; mandible and scutellum black or darken; elytra reddish

brown but suture black; abdomen reddish brown, posterior margin of tergite VII and VIII light brownish red; tergite IX and X light yellowish red.

Head suborbicular, HL = 1.53–1.58 mm, HW = 1.50–1.55 mm, HW/HL = 0.98, widest at the basal 1/3 of head; frontal area flattened; surface coarsely punctate; punctures sparser on frons and vertex, becoming denser toward posterior and lateral margins, with dark brown setae. Eyes small, slightly protruding; longitudinal diameter about 1/4 as long as temple in dorsal view. Antennae elongate, AL = 3.45–3.78 mm, AL/HL = 2.33, with whitish yellow setae; antennomere I robust, widest at apical 1/3; antennomere II slightly elongated, shorter than III; antennomeres III–X long, slightly narrow at base and widening towards apex, successively shorter and narrower toward apical antennomeres but IX and X almost same size; antennomere XI fusiform; relative length of antennomeres as follows: 1.83 : 1.17 : 1.25 : 1.17 : 1.13 : 1.13 : 1.13 : 1.07 : 1.00 : 1.00 : 1.30; relative maximum width of antennomeres as follows: 1.85 : 1.38 : 1.31 : 1.31 : 1.23 : 1.23 : 1.23 : 1.23 : 1.23 : 1.23 : 1.00.

Pronotum elongate, with anterior margin wider than posterior one, PL = 1.90–1.95 mm, PW = 1.35–1.45 mm, PL/PW = 1.36, PL/HL = 1.24, PW/HW = 0.93, widest at apical 1/3; lateral sides of pronotum gently dilated to widest point, thence gradually convergent toward posterior margin; all corners obtusely rounded; disc sparsely covered with coarse and weak punctations except medial longitudinal line; punctures slightly sparser than on head, with brownish yellow setae.

Scutellum with sparse punctures. Elytra subtrapezoidal, widened posteriorly, EL = 1.02–1.13 mm, EW = 1.45–1.55 mm, EW/EL = 1.40, EL/PL = 0.56, EW/PW = 1.07; lateral margins almost straight; posterior corners rounded; disc covered with sparse and coarse punctations; punctations

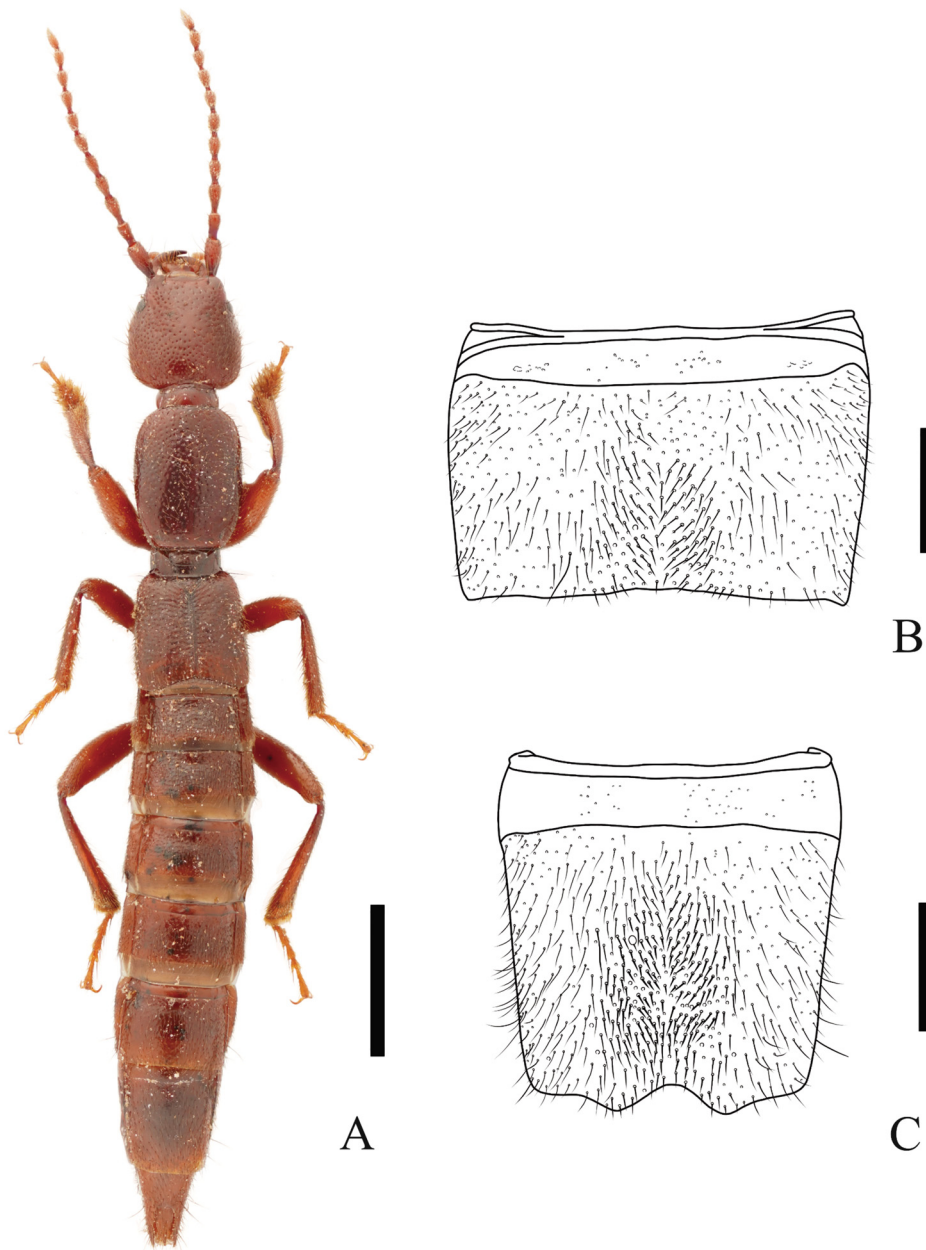


Fig. 7. *Lathrobium denchu* sp. nov. A – habitus in dorsal view; B – male sternite VII; C – male sternite VIII. Scale bars = 2.0 mm for A, 0.5 mm for B, C.

denser than on pronotum, with brownish yellow setae. Hind wing completely reduced. Legs with shortened tibiae and tarsi which are covered with golden setae; tarsomeres I–IV of protarsus dilated.

Abdomen elongate, gradually widened from segment III to V, thence contracted to the posterior end; each tergite covered with micropunctations and brownish yellow setae, distinctly long setae on each side near anterior margin; tergite X as long as posterolateral processes of tergite IX.

Male. Sternite VII (Fig. 7B) transverse; median area of sternite VII with shorter and thicker setae than other areas; sternite VIII (Fig. 7C) square, with posteromedian impression; each side of posteromedian impression protruded weakly; median area of sternite VIII with short-thick setae; sternite IX elongate.

Aedeagus (Figs 8A–C) 3.04 mm long, very elongate; ventral process well sclerotized, asymmetric in ventral

view, straight in lateral view; apical part of ventral process very long and straight, almost same length as the basal and middle parts together; slightly curved toward left side in ventral view; basal and middle parts of ventral process ball-shaped, depressed like hollow in each lateral side at apical 1/4 in ventral view, thicker than apical part in lateral view; part above basal foramen transverse, with two projections at lateral side; surrounding of basal foramen sclerotized; dorsal plate sclerotized, widest at apical 1/4, gradually widened to the widest point at apical 1/4, thus contracted toward apex, with acute apex; internal sac large, with sclerotized and ringed part, twisted about 90 degrees at middle area; apical area of internal sac very flattened.

Female. Unknown.

Differential diagnosis. The new species is similar to *Lathrobium katsumiae* Y. Watanabe & Yoshida, 2007,

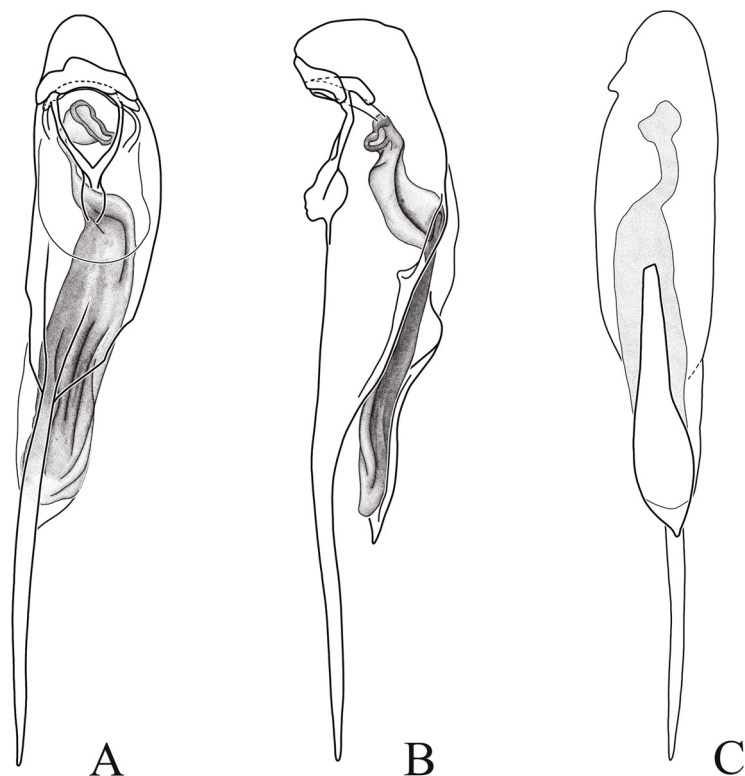


Fig. 8. Male aedeagus of *Lathrobium denchu* sp. nov. A – ventral view; B – lateral view; C – dorsal view. Scale bar = 0.5 mm.

a member of the *L. nomurai* group described from Mt. Rokuro-yama and Ôkawara Kôgen, Tokushima Pref., in general appearance and aedeagal shape. However, the new species can be easily distinguished from it by the combination of the following characteristics: 1) possessing slenderer aedeagus; 2) apical part of ventral process curved left side in ventral view; 3) dorsal plate of aedeagus almost straight (in contrast, *L. katsumiae* has middle area of ventral process slightly extended toward lateral side, apical part of ventral process straight in ventral view, and dorsal plate of aedeagus curved dorsally at basal 1/3).

Etymology. The specific name of new species is dedicated to Mr. Hidekazu Tanaka who collected this species, using his nickname Denchu. Noun in apposition.

Biology. All specimens were collected from the under 10 cm of a heap of rock debris, at an altitude of about 150 m.

Distribution. Japan (Oita Pref., north of Kyushu).

Key to the species of the *Lathrobium nomurai* group of Kyushu, Japan

- 1 Basal margin of aedeagus with V-shaped impression (Fig. 2A). 2
- Basal margin of aedeagus rounded. 4
- 2 Internal sac of aedeagus with large sclerotized plate in dorsal side (Fig. 3B).
..... *L. fujimotoi* Y. Watanabe, 2001
- Internal sac of aedeagus without sclerotized plate in dorsal side. 3
- 3 Apical part of ventral process curved toward right side in ventral view (Fig. 6A). *L. yufuense* sp. nov.

- Apical part of ventral process slightly curved toward left side in ventral view (Fig. 2A).
..... *L. nomurai* Nakane, 1955
- 4 Dorsal plate of aedeagus triangular (Fig. 4C).
..... *L. hikosanense* Y. Watanabe, 1998
- Dorsal plate of aedeagus oblong (Fig. 8C).
..... *L. denchu* sp. nov.

Discussion

Most *Lathrobium* species have a restricted distribution owing to their reduced hind wings and low dispersal ability (ASSING 2019). In particular, the species of the *L. nomurai* group tend to have narrower distributional range. This may possibly be related to their habitat in the upper hypogean zone, such as other arthropods inhabiting the same environment (KOMATSU 2018). The distribution range of the four species treated in this paper, *L. nomurai*, *L. fujimotoi*, *L. yufuense* sp. nov., and *L. denchu* sp. nov., are very small, similar to those of other members of the *L. nomurai* group (Fig. 9). In contrast, *L. hikosanense* of the same species-group occurs across northern Kyushu, from Oita Prefecture to Nagasaki Prefecture, within a range of approximately 180 km (Fig. 9), which is an exceptionally wide distribution compared with other species of the *L. nomurai* group in Japan. This fact might indicate that *L. hikosanense* has a higher dispersal ability despite possessing reduced hind wings and inhabiting the upper hypogean zone. Another hypothesis is that this species may have retained the shape of its aedeagus despite prolonged geographic isolation. Therefore, it would need the

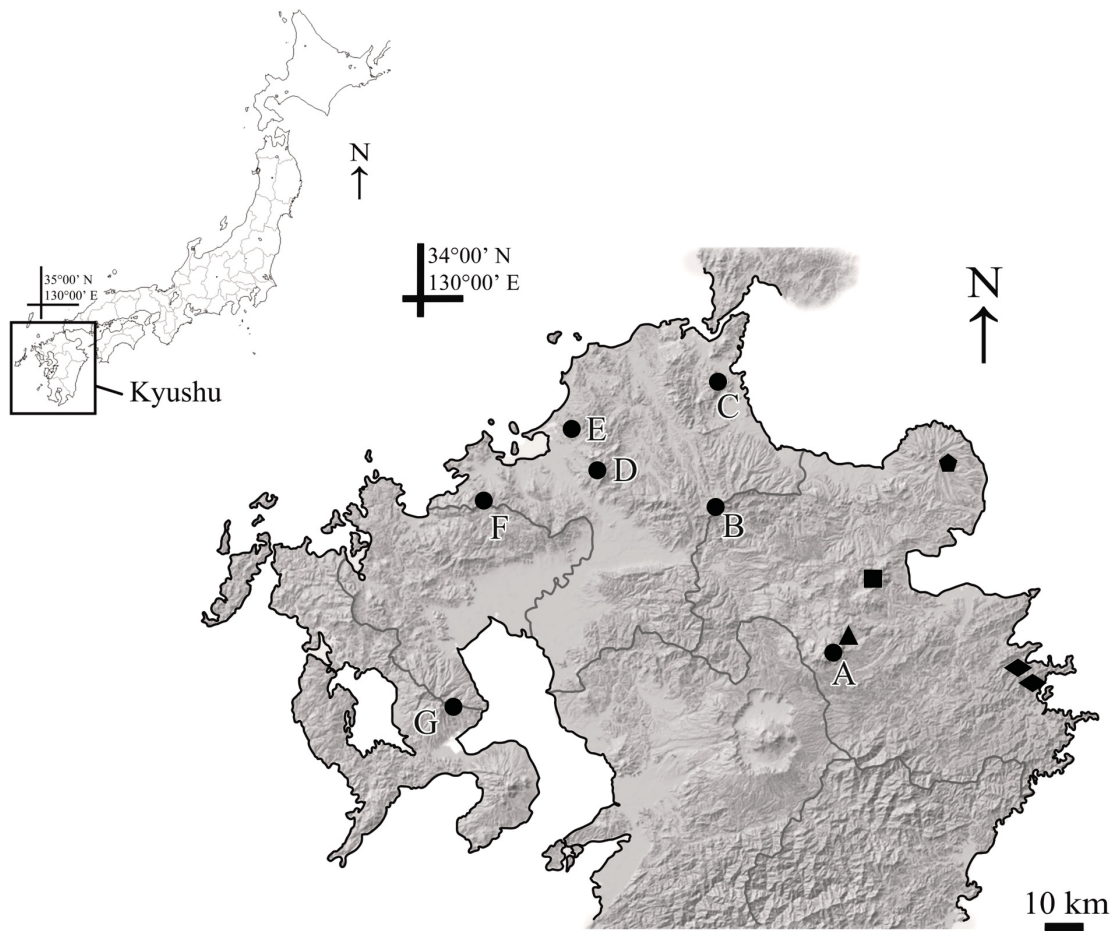


Fig. 9. Map showing the distribution of the *Lathrobium nomurai* group in Kyushu, Japan. Black rhombus – *L. nomurai* Nakane, 1955; black triangle – *L. fujimotoi* Y. Watanabe, 2001; black circle – *L. hikosanense* Y. Watanabe, 1998; black square – *L. yufuense* sp. nov.; black pentagon – *L. denchu* sp. nov.; A–G – localities of *L. hikosanense*: A – Mt. Daisen; B – Mt. Hiko-san (type locality for *L. hikosanense*); C – Hiraodai; D – Mt. Buccho-zan; E – Mt. Tachibana-yama; F – Mt. Iwara-yama; G – Kinsenji Temple.

evaluation of the genetic differences among individuals of this species from various localities to understand its true dispersal ability.

Most species of the *Lathrobium nomurai* group including *L. hikosanense* and *L. denchu* sp. nov. have ball-shaped basal part of aedeagus with long and narrow apical part. Compared to them, *L. nomurai*, *L. fujimotoi*, and *L. yufuense* sp. nov. have distinctive aedeagus characterized by a relatively thin and flat ventral process in lateral view and two tubes attached with apex of ventral process. Therefore, it is suggested that the three species may be closely related to each other, as further supported by the proximity of their distributional range (Fig. 9). Furthermore, the aedeagus of *L. kamezawai* Y. Watanabe, 2005 and *L. sugitense* Assing & Kuroda, 2020, both belonging to the *L. nomurai* group and occurring in western Shikoku, exhibit similarities to those of the three species above, indicating a possible relationship between them. The pattern may be similar to that known for trechine beetles (Carabidae), in which some species distributed in Shikoku are considered to be related to those in Kyushu (UENO & NAITÔ 2008). At present, the localities *L. kamezawai* and *L. sugitense* are isolated from Kyushu by a strait. The similarity in characteristics between those species from Kyushu and Shikoku may be suggested that

land bridges formed between western Shikoku and eastern Kyushu in the past, and then the ancestors of these species dispersed.

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References

- ASSING V. 2019: New species and records of *Lathrobium*, with the first and southernmost record of the genus from Vietnam (Coleoptera: Staphylinidae: Paederinae). *Acta Musei Moraviae, Scientiae Biologicae* **104** (2): 87–107.
- ASSING V. & KURODA K. 2020: A new species of *Lathrobium* from Shikoku, Japan (Coleoptera: Staphylinidae: Paederinae). *Japanese Journal of Systematic Entomology* **26** (2): 301–304.
- KOMATSU T. 2018: Diversity of troglobiontic arthropods in Japan. *TAXA, Proceedings of the Japanese Society of Systematic Zoology* (44): 39–51 (in Japanese, English abstract).
- MARUYAMA M. 2004: A permanent slide pinned under a specimen. *Elytra* **32** (2): 276.
- NAKANE T. 1955: New or little-known Coleoptera from Japan and its adjacent region, XII. *Scientific Reports of the Saikyo University, Natural Science and Living Science* **2** (1): 24–42.
- NOZAKI T. 2020: A new species of the genus *Lathrobium* (Coleoptera: Staphylinidae: Paederinae) from Tsushima Island, Japan. *Japanese Journal of Systematic Entomology* **26** (1): 146–148.
- SATO Y. 2023: Two new species of the genus *Lathrobium* (Coleoptera: Staphylinidae: Paederinae) from Gotô Islands, Japan. *Zootaxa* **5254** (2): 278–286.
- SENDA Y. 2020: A new apterous rove beetle, *Lathrobium hibagon* (Coleoptera: Staphylinidae: Paederinae), from Western Honshu, Japan. *Japanese Journal of Systematic Entomology* **26** (1): 183–189.
- SENDA Y. 2022: New species, new synonym and new records of the genus *Lathrobium* Gravenhorst of Eastern Honshu, Japan (Coleoptera: Staphylinidae: Paederinae). *Japanese Journal of Systematic Entomology* **28** (1): 142–147.
- UÉNO S. & NAITÔ T. 2008: Occurrence of Shikoku representatives of blind Trechines (Coleoptera, Trechinae) originated in Eastern Kyushu, Southwest Japan. *Elytra* **36** (1): 213–225.
- WATANABE Y. 1980: Two new *Lathrobium* (Coleoptera, Staphylinidae) found in limestone caves of Japan. *Journal of the Speleological Society of Japan* **5**: 21–28.
- WATANABE Y. 1991: Four new species of the group of *Lathrobium harimanum* (Coleoptera, Staphylinidae) from Japan. *Bulletin of the National Science Museum Tokyo, Series A* **17** (3): 145–156.
- WATANABE Y. 1998: Five new species of the *Lathrobium* (s. str.) *nomurai* group (Coleoptera, Staphylinidae) from Japan. *Elytra* **26** (1): 85–98.
- WATANABE Y. 2001: Two new species of the group of *Lathrobium nomurai* (Coleoptera, Staphylinidae) from West Japan. *Journal of the Speleological Society of Japan* **26**: 37–43.
- WATANABE Y. 2002: Five new staphylinids of the group of *Lathrobium nomurai* (Coleoptera, Staphylinidae) from Western Honshu, Japan. *Elytra* **30** (2): 439–449.
- WATANABE Y. 2013: Catalogue of Japanese Staphylinidae (Insecta: Coleoptera), Subfamily Paederinae. *Bulletin of the Kyushu University Museum* (11): 150–162.
- WATANABE Y. & YOSHIDA M. 2007: A new species of the group of *Lathrobium nomurai* (Coleoptera, Staphylinidae) from Eastern Shikoku, Japan. *Japanese Journal of Systematic Entomology* **13** (1): 59–62.

