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A remarkable new species of *Nothochodaeus* Nikolajev
from Sumatra (Coleoptera: Scarabaeoidea: Ochodaeidae)

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A remarkable new species of *Nothochodaeus* Nikolajev from Sumatra (Coleoptera: Scarabaeoidea: Ochodaeidae)

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Abstract. *Nothochodaeus marsupialis* Paulsen, **new species** (Coleoptera: Ochodaeidae), is described from Aceh Province, Indonesia, on the island of Sumatra. The species possesses deep abdominal cavities behind a shield-like central process, as well as rows of conical tubercles laterally on the second and third ventrites. These structures have not been found in any other members of the genus or family.

Key words. Taxonomy, Indonesia, Ochodaeinae, *Ochodaesus*

ZooBank registration. urn:lsid:zoobank.org:pub:EF715309-C998-44F5-987D-02F63DBBF4A7

Introduction

The Southeast Asian genus *Nothochodaeus* Nikolajev (Coleoptera: Ochodaeidae) contains 32 species of often relatively large and striking ochodaeines that have a narrow, trapezoidal elytral closing mechanism on the propygidium (Nikolajev 2005). The group has undergone a rapid increase in the number of described species in the last fifty years; only seven species now placed in *Nothochodaeus* were described before 1968. The genus is distributed from Japan, China, and Nepal south to Indonesia and India (Kurosawa 1968; Masumoto et al. 2013; Ochi et al. 2013; Paulsen 2014; Huchet 2020). In contrast to more typical members of *Ochodaesus* Dejean that are generally unicolorous and morphologically conservative, species of *Nothochodaeus* frequently display complex patterns, expanded first protarsomeres and antennal clubs, and clypeal armature.

Recently, three Philippine *Nothochodaeus* species that were described in the last decade and possess strongly developed, flat-topped clypeal horns (see Huchet 2014, 2017, 2018) were transferred to *Ceratochodaesus* Huchet along with a fourth newly described species (Huchet 2019). Notably, males of species of *Ceratochodaesus* possess large, asymmetrical median keels on the abdomen. No other described species of ochodaeids have such major structural elements associated with the abdomen.

The modifications found on the Sumatran species described here (Fig. 1 and 2) are equally striking but entirely unique from those found in *Ceratochodaesus* species, consisting instead of deep cavities rather than a produced keel (see Fig. 3 and 6). This autapomorphy is approached to a much lesser degree by some species of *Nothochodaeus* studied; *N. decoratus* (Arrow), *N. maruyamai* Ochi et al., and *N. mindanaoensis* Huchet (Fig. 4) which display a row of large tubercles basally on the abdominal ventrites, each with individual pits behind that are located within a basal furrow on the ventrites. In the new species described here, these pits appear to have undergone expansion and connection, the tubercles are much enlarged, and the median third of ventrites 2 and 3 are differentiated and elevated (Fig. 6). These are novel features within *Nothochodaeus*. Many species of *Nothochodaesus* display only small tubercles along the base of the ventrites (see Fig. 5).

Materials and Methods

Specimens and taxonomic material. The following institutions and private collections provided specimens or are designated as the repository for specimens examined in this study.

CJBH Jean-Bernard Huchet Collection, Bordeaux, France

FSCA Florida State Collection of Arthropods, Gainesville, FL, USA (P. Skelley)

MJPC M.J. Paulsen Collection, Lincoln, NE, USA
MZB Museum Zoologi Bogor, Bogor, West Java, Indonesia
ROME Royal Ontario Museum Entomology Collection, Toronto, Canada (B. Hubley)
UNSM University of Nebraska State Museum, Lincoln, NE, USA

Taxonomic Treatment

Nothochodaeini Nikolajev, 2015

Nothochodaeus Nikolajev, 2005

Nothochodaeus marsupialis Paulsen, new species

Figures 1–3, 6

Type material. Holotype male (Fig. 1), MZB, labeled: a) “INDONESIA: Sumatra, Aceh / Gunung Leuser Nat. Pk. / Ketambe Res. Sta. / 9–21 SEP 1989. DC Darling / ROM 893086”; b) “1° rainforest / Young forest, Terrace 3 / closed canopy, 350 m / 3°41’N, 97°39’E / Malaise trap pans”; c) “*Ochodaeus* / sp. / Det. BD Gill 1998 / ROMEnt Spec. No. 27094”; d) on red paper, “*Nothochodaeus / marsupialis* / ♂ Paulsen / HOLOTYPE” (Fig. 2).

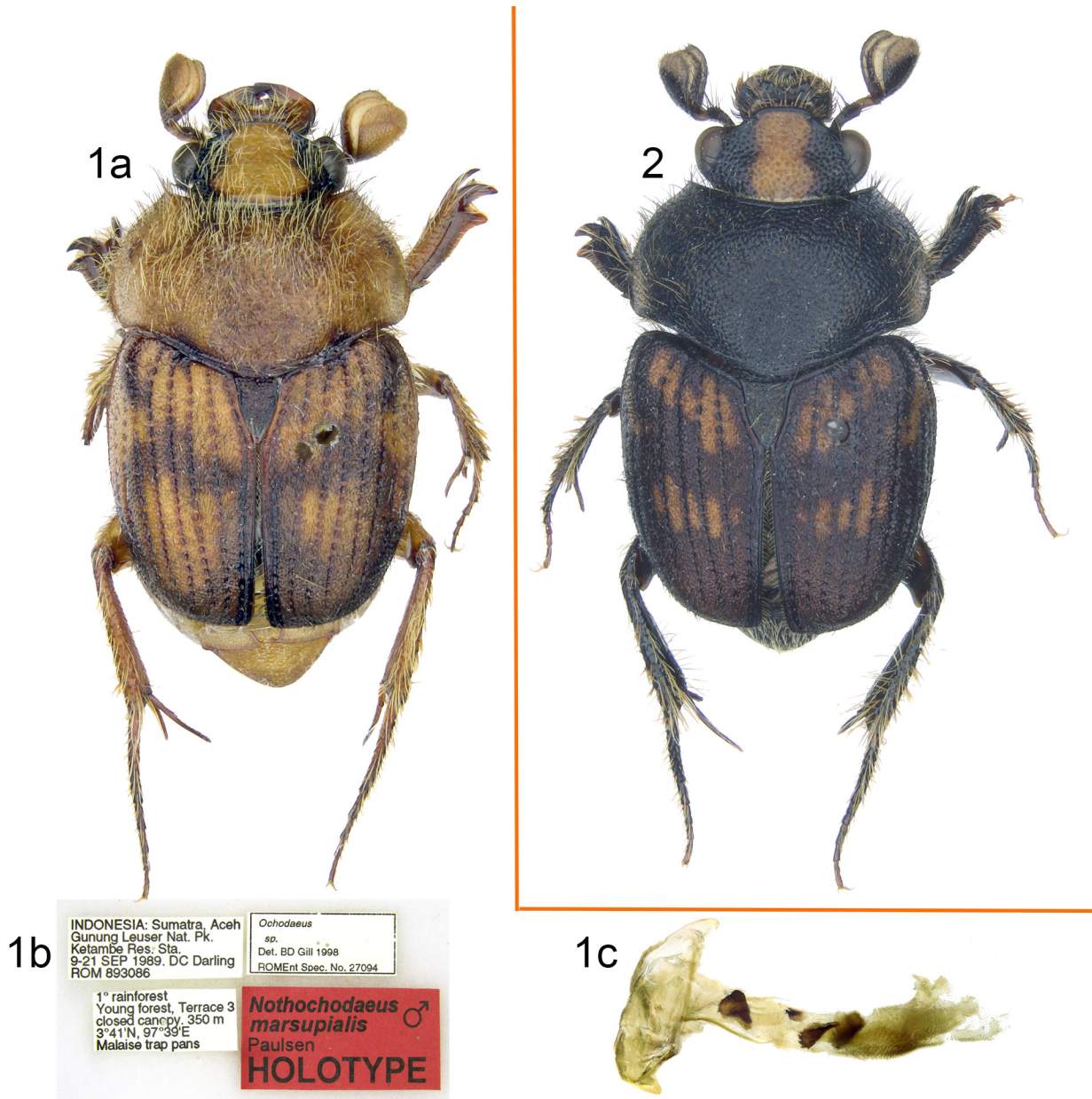
Allotype female, MZB, labeled: a-b) as holotype; c) as holotype, except “No. 27092”; d) on red paper, “*Nothochodaeus / marsupialis* / ♀ Paulsen / ALLOTYPE”.

Two paratype males, one paratype female (ROME) labeled: a-b) as holotype; c) as holotype, except numbers 27089, 27091, or 27093. One paratype male (MJPC), one paratype female (UNSM) labeled: a-b) as holotype; c) as holotype, except numbers 27088 or 27090, respectively. One male (CJBH), three female paratypes (ROM, MZB, MJPC) labeled: “INDONESIA: Sumatra / Aceh, Gunung Leuser Nat. / Pk. Ketambe Res. Sta. / Sep. 1989 IIS 890004 / per DC Darling”; b) “Malaise trap, primary / rainforest, 400m. / Mature forest, Terrace 4 / closed canopy / 3°41’N, 97°39’E”; c) “*Ochodaeus* / sp. / Det. BD Gill 1994 / ROMEnt Spec. No. [3400, 151, 3443, or 3486, respectively]”. One male paratype (MJPC) labeled: “INDONESIA: Sumatra / Aceh, Gunung Leuser Nat. / Pk. Ketambe Res. Sta. / Sept. 22–30 IIS 890003 / 1989 per DC Darling”; b) “Malaise trap, primary / rainforest, 400m. / Mature forest, Terrace 4 / light gap / 3°41’N, 97°39’E”; c) “*Ochodaeus* / sp. / Det. BD Gill 1994 / ROMEnt Spec. No. 126”. Two male (MZB), one female (CJHB) paratypes labeled: “INDONESIA: Sumatra / Aceh, Gunung Leuser Nat. / Pk. Ketambe Res. Sta. / Dec. 1989 IIS 890013 / per DC Darling”; b) “Malaise trap, primary / rainforest, 350–400m. / 3°41’N, 97°39’E”; c) “*Ochodaeus* / sp. / Det. BD Gill 1994 / ROMEnt Spec. No. [399, 3193, or 3236, respectively]”. One female paratype (MZB; Fig. 2) labeled: “INDONESIA: Sumatra / Aceh, Gunung Leuser Nat. / Pk. Ketambe Res. Sta. / Dec. 1989 IIS 890015 / per DC Darling”; b) “Malaise trap, primary / rainforest, 350–400m. / 3°41’N, 97°39’E”; c) “*Ochodaeus* / sp. / Det. BD Gill 1994 / ROMEnt Spec. No. 448”. One female paratype (MJPC) labeled: “INDONESIA: Sumatra / Aceh, Gunung Leuser Nat. / Pk. Ketambe Res. Sta. / Nov. 1989 IIS 890009 / per DC Darling”; b) “Malaise trap, primary / rainforest, 350m. / Young forest, Terrace 3 / light gap / 3°41’N, 97°39’E”; c) “*Ochodaeus* / sp. / Det. BD Gill 1994 / ROMEnt Spec. No. 324”. One female paratype (MJPC) labeled: “INDONESIA: Sumatra / Aceh, Gunung Leuser Nat. / Pk. Ketambe Res. Sta. / Jan. 1990 IIS 900008 / per DC Darling”; b) “Malaise trap, (Dish) / primary rainforest / Mature forest, Terrace 4 / Closed canopy, 400 m. / 3°41’N, 97°39’E”; c) “*Ochodaeus* / sp. / Det. BD Gill 1994 / ROMEnt Spec. No. 814”. One female paratype (FSCA) labeled: a) “INDONESIA: Sumatra, Aceh / Gunung Leuser Nat. Pk. / Ketambe Res. Sta. / 1–31 JAN 1990 per / DC Darling IIS 900002”; b) “1° rainforest / Young forest, Terrace 3 / Light gap, 350 m / 3°41’N, 97°39’E / Malaise trap pans”.

All paratypes (9 ♂, 8 ♀) labeled on yellow paper, “*Nothochodaeus / marsupialis* / [♂ or ♀] Paulsen / PARATYPE”.

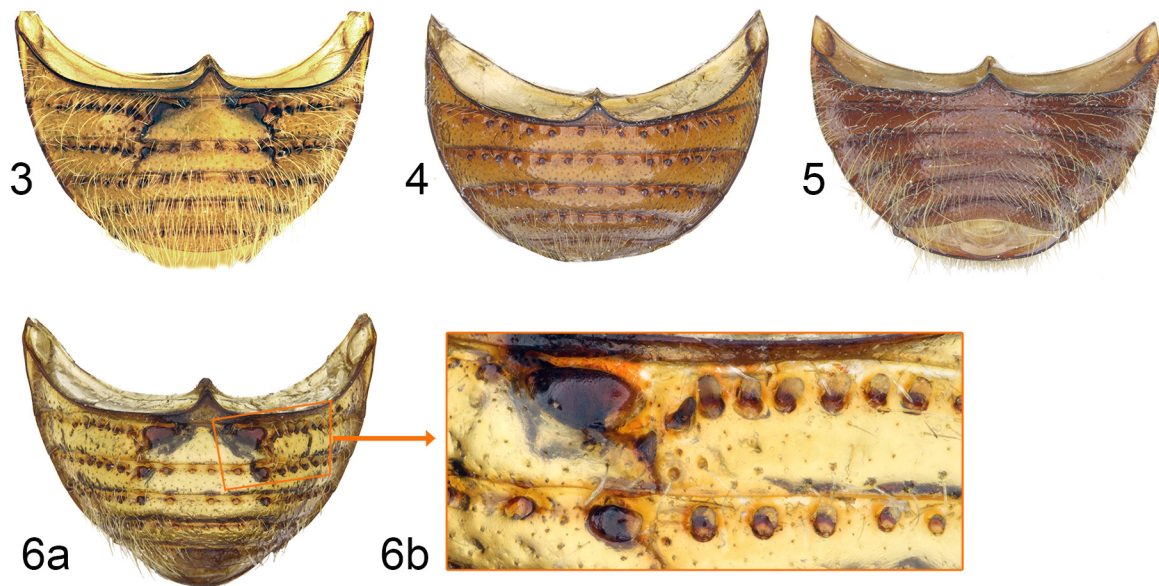
Type locality. Ketambe Research Station, Gunung Leuser National Park, Aceh, Sumatra, Indonesia.

Description. Holotype male (Fig. 1a). Coleoptera: Scarabaeoidea: Ochodaeidae. *Length*: 8.1 mm. *Width*: 4.1 mm. *Color*: Overall color yellowish brown with strong dorsal patterning of darker brown on sides of head, scutellum, elytral humerus, transverse band on elytral disc, and apical elytral band that extends anteriorly along suture and lateral margin; pronotum with weak dorsal pattern consisting of slightly darkened maculations behind eyes; venter more or less uniformly yellowish brown except abdominal tubercles darker at their bases; surface shiny. *Head*:



Figures 1–2. *Nothochodaeus marsupialis*, new species. 1) Holotype male. a) Dorsal habitus. b) Holotype labels. c) Male genitalia, lateral view, with genital capsule at left, parameres at bottom. Cleared internal sac showing toothed sclerites. 2) Female paratype, showing greatest extent of darker patterning.

Surface moderately granulate; granules with seta posteriorly; seta long, testaceous. Eyes large, globose. Antennal club much larger than eye. Mandibles broadly scooped, rounded, apices falcate and with proximal internal tooth on each (appearing bidentate). Frons nearly flat. Clypeus subtrapezoidal, coplanar with frons, disc short (at most $\frac{1}{3}$ as long medially as wide), anterior margin thinly beaded; bead ending in an elevated tubercle on each side. Labrum wider than clypeus, reniform; anterior margin broadly emarginate, appearing serrate. Mentum subrectangular, strongly excavated laterally, lacking median furrow but somewhat emarginate apically between the labial palps. *Pronotum*: Form convex, about 2× wider than long, slightly depressed on each side of base; all margins beaded, anterior margin not regularly concave (modified laterally to receive eyes). Surface densely granulate; granules posteriorly punctate, punctures setose, setae long, testaceous becoming darker on disc. *Elytra*: Form



Figures 3–6. Abdomens showing variation in ventrites of *Nothochodaeus* species. **3)** Holotype male *N. marsupialis*, **new species**, with shield-like modification of ventrites 2 and 3 over deep cavities, and large tubercles at base of ventrites. **4)** *N. mindanaoensis* Huchet, with large tubercles above pits along base of ventrites. **5)** *N. tonkineus* (Balthasar), with only small tubercles. **6)** Female paratype of *N. marsupialis*, **new species**. **a)** Ventrites modified as in holotype. **b)** Detail of left side of ventrites 2 and 3 showing enlarged tubercles and cavity behind shield-like process at median.

convex, relatively short, elytra together about as long as wide. Surface with striae weakly impressed, punctate; strial punctures large, ovoid, shiny, separated by <1 diameter, lacking setae. Intervals densely, irregularly tuberculate; tubercles small, each with posterior seta, setae either testaceous and recumbent or darker, erect. *Legs*: Protibia tridentate externally, basal tooth small, acute and near base; internal side with strong, acute pollex. First tarsomere expanded, flattened, 3× longer than 2nd tarsomere. Profemur lacking apical tooth, but anteroventral margin distinctly serrate. Mesofemur and metafemur lacking apical teeth. *Abdomen*: Ventrites 2 to 5 strongly modified (see Fig. 6); large tubercles arranged along each ventrite near base, each above a pit within transverse furrow, tubercles decreasing in size laterally and posteriorly; tubercles of ventrites 2 and 3 with apices testaceous, apparently tomentose. Median third of ventrites 2 and 3 produced posteriorly, elevated, shield-like, with tubercles restricted to edge but further enlarged, lobate. Ventrite 2 with deep cavities behind each lobed tubercle. Pygidium roughly punctate; punctures shiny, darkened. Stridulatory peg large, triangular. *Male genitalia*: Parameres small, symmetrical, triangular. Internal sac with 4 variably toothed sclerites (Fig. 1c).

Description. Allotype female. *Length*: 8.1 mm. *Width*: 4.1 mm. *Color*: Color and pattern nearly identical to holotype. No obvious sexual dimorphism; structures typically displaying dimorphism in *Nothochodaeus* species such as clypeal shape/armature showing no clear differences.

Paratype variation. The size of most specimens is similar to the holotype or slightly smaller, with only one male distinctly smaller (*Length*: 7.0 mm. *Width*: 3.7 mm). The patterning of the dorsum is often similar to the holotype but can vary to almost completely dark in either sex (Fig. 2). At its most developed, the dark coloration can occupy most of the pronotum (but never extending completely to lateral margin), be strongly expanded on the elytra, as well as having the venter and legs completely dark. Some specimens display yellowish femora but darkened tibiae. The center of the head from clypeus to base remains light yellowish brown in all specimens.

Etymology. The name is a masculine Latin adjective in the nominative singular meaning ‘pouched’ in reference to the unique abdominal cavities.

Distribution. INDONESIA: Sumatra: Aceh: Gunung Leuser National Park.

Also from the same collecting events are three specimens of *N. maruyamai*, a species that was previously known from peninsular Malaysia (Ochi et al. 2013), but is easily separated from the new species by its unicolorous body and simply tuberculate abdomen.

Remarks. It seems most likely, given the proclivities of burrowing scarabaeoids, that the cavities are mycangia related to provisioning larval burrows; however, the ends of the tubercles appear tomentose and are reminiscent of structures present on myrmecophilous/ termitophilous aphodiine scarabs such as *Rhyparus* Westwood. Because the larvae and life histories of ochodaeines are wholly unknown, this topic awaits further study.

Two other species of *Nothochodaeus*, *N. okadai* Ochi et al. and *N. sumatrensis* Ochi et al., previously were known to occur in Sumatra (Ochi et al. 2013). Both of these species were described as having only small granules on the visible abdominal ventrites, as well as an arcuate carinae behind the anterior clypeal margin that is lacking in the new species. In addition to the unique abdominal modifications of *N. marsupialis*, the apparent lack of external sexual dimorphism is unusual within the genus.

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Special thanks to researcher Christopher Darling from the ROME who collected the entire series from 1989 to 1990 and allowed the taxon to be studied and paratypes distributed. Thanks also to Brad Hubley (ROM) for his assistance with loans and during my visit to the ROM to curate their Lucanidae and Ochodaeidae. Thanks to David Hawks (University of California–Riverside) and Brett Ratcliffe (UNSM) for providing reviews of the manuscript.

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