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Two new species of *Nothochodaeus* Nikolajev, 2005 from the Himalayan region (Coleoptera: Scarabaeoidea: Ochodaeidae)

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Two new species of *Nothochodaeus* Nikolajev, 2005 from the Himalayan region (Coleoptera: Scarabaeoidea: Ochodaeidae)

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Abstract. *Nothochodaeus yeti* Huchet, **new species**, from Nepal and Sikkim (north India) and *N. martensi* Huchet, **new species**, from Nepal, are described and illustrated (Coleoptera: Scarabaeoidea: Ochodaeidae). A distribution map and an updated catalogue of the Ochodaeidae occurring on the Indian subcontinent are provided.

Key words. Taxonomy, beetle, scarab, Ochodaeinae, Sikkim, Nepal, Asia.

Introduction

Over the last two decades, oriental beetles belonging to the Ochodaeidae, particularly those occupying East and Southeast Asia, have been the topic of extensive taxonomic studies including the description of many new species (Nikolajev 2005, 2009; Ochi et al. 2011, 2013; Masumoto et al. 2013, 2018; Huchet 2014a, b, 2017, 2018, 2019; Paulsen 2014; Huchet and Li 2015; Masumoto and Ochi 2015; Huchet and Keith 2017). By contrast, the fauna of India remains largely unknown and the only recent report of Ochodaeidae originates from a regional survey (Chaudhary and Srivastava 2012). According to current knowledge, the ochodaeid fauna of India includes only four representatives: *Nothochodaeus pictus* (Westwood, 1852), *N. lutescens* (Westwood, 1852) and two species of the genus *Ochodaeus*: *O. deceptor* Arrow, 1907 and *O. pallidus* Arrow, 1907. At the scale of the whole Indian subcontinent, two other species complete this list, namely *O. barbei* Petrovitz, 1972 from northern Bangladesh, and *O. nurestanicus* Nikolajev, 1995 from Afghanistan, but recently recorded from north-western Pakistan (Huchet unpublished data). In addition to the limited number of species, it must be highlighted that a major lack of information occurs in the knowledge of the geographic repartition of the species described by the former authors. In this regard, the mentions of "*India Orientali*" or "*N. India*" are extremely obscure to determine the exact collecting localities of the taxa described by Westwood (1852) and Arrow (1907).

In all likelihood, the Indian subcontinent, due to its geographical location, its diverse orography and microclimates, the great diversity of its biotopes, and finally the specific wealth of the neighboring countries, hosts a greater diversity than that currently known. As a proof of this assumption, the recent study of material from India and Nepal allowed me to find two new species belonging to the genus *Nothochodaeus* Nikolajev, 2005, herein described. Among these new species, *Nothochodaeus yeti* n. sp. is morphologically close to *N. lutescens* (Westwood). Both species appear to be quite distinct from the other members of the genus and might correspond to relict species inhabiting the highlands of the Himalayan massif. In contrast, *N. pictus* (Westwood) and *N. martensi* n. sp. are morphologically similar to the *Nothochodaeus* representatives inhabiting East and Southeast Asia.

Materials and Methods

Specimens and taxonomic material. The specimens described in this study originated from the following institutions and collections: (CDKC): Denis Keith collection, Chartres, France; (CJBH): Jean-Bernard Huchet collection, Bordeaux, France; (CSJP): Stanislav Jakl collection, Prague, Czech Republic; (HEC): Hope Entomological Collections, University Museum, Oxford, United Kingdom; (MNHN) Muséum

national d'Histoire naturelle, Paris, France; (NMPC) National Museum, Prague, Czech Republic; (SMNS): Staatliches Museum für Naturkunde Stuttgart. Label data are presented verbatim, with each label denoted by a letter (a, b, etc.), and each line being separated by a slash.

Genitalia treatment. After removal of the entire abdomen to avoid any damage of the genital parts and other useful features, the genital apparatus was treated with 10% potassium hydroxide solution (KOH) to destroy and remove the unneeded soft tissues, disassociate the aedeagus from the genital segment (urite IX) and reveal the inner copulatory sclerites (named here "endophallites" following the terminology proposed by Génier (2019)) of the endophallus. The cleaned genital parts were then placed in 10% acetic acid to neutralize the effects of the KOH, rinsed with ethanol, and stored in a small glycerol vial pinned under the specimen. Finally, the abdomen was moved back to its original position and maintained in anatomical position using a small drop of hydrosoluble glue.

Illustrations. Digital images of the habitus and genital parts were taken at the Entomology Department (MNHN, Paris) with a Canon E0S 6D digital camera (zoom MP-E 65 mm) mounted on a Kaiser RTx column. The z-stepper was controlled through the focus stacking software Helicon Remote 3.8.6w and images were processed using Helicon focus 7. The digital images were finally imported into Adobe Photoshop CS4 for post-processing, labeling and plate composition.

Taxonomic Treatment

Nothochodaeus yeti Huchet, new species (Fig. 1–11)

Type material. Holotype male (CSJP), labeled: a) pale yellow paper, rectangular, printed: "Sikkim"; b) rectangular, orange paper, printed: "St. Jákl collection / PRAGUE / Czech republic"; c) rectangular, red paper: "TYPE"; d) red paper: "*Nothochodaeus* / *yeti* n. sp. / HOLOTYPE ♂ / J.-B. Huchet det. 2020". Genitalia stored in a small glycerol vial, pinned under the specimen.

Allotype female (MNHN) labeled: a) pale yellow paper, rectangular, printed: "Inde Anglaise / Pedong / Région de / Darjeeling / Chasseurs indigènes / 1934"; b) red paper, printed: "*Nothochodaeus* / *yeti* n. sp. / ALLOTYPE ♀ / J.-B. Huchet det. 2020". Genitalia stored in a small glycerol vial, pinned under the specimen. (Fig. x-y)

One female paratype (NMPC) labeled: a) "NEPAL. Ganesh Himal. / 2 km W Thangjet. / 85°17′E, 28°10′N. / 2300 m. 18.IX.1994. / M. Hreblay & T. Csőván"; b) white label, rectangular: "ex coll. David Král / National Museum / Prague, Czech Republic". One female paratype (NMPC > CJBH) labeled: a) "Nepal Helambu, Mulkharka / - Chisapani 85°27′E / 27°50′N 1800–2500–2200 m / 26 8 97 lg Fadrizi & Ahrens"; b) white label, rectangular: "ex coll. David Král / National Museum / Prague, Czech Republic". One female paratype (SMNS) labeled: a) white label, rectangular: "NEPAL-Expeditionen / Jochen Martens"; b) white label, rectangular: "255 Ilam Dist. Zw. Mai Pok- / hari, Mai Majuwa und Gitang / Khola 2100–1800 m Kulturland / 25 Aug 83, Martens & Daams leg.". One female paratype (CDKC) labeled: "E NEPAL, Hilles env. / 10–16.06.1999 / leg. Patrikeev V."

Diagnosis. This species has the body robust, strongly convex, densely pubescent, roughly unicolored; the head stretched forward in a pointed direction, with a tripartite subpyramidal horn (male), or with two tubercles (female). The underside is chestnut-brown, the legs orange-brown, and the antennae testaceous yellow. The stridulatory peg is present.

Description. Holotype male (Fig. 1, 3, 7, 8, 10, 11). Coleoptera: Scarabaeoidea: Ochodaeidae. **Length:** 10.5 mm (from the apex of the mandibles to the apical part of the tergite VIII). **Width:** 5.4 mm. **Head:** Transverse, sub-hexagonal in outline, the clypeus projected forward, parabolic; clypeal horn subpyramidal, tripartite, π-shaped, resulting from the fusion of two basal tubercles with a small raised transverse anterior keel (Fig. 7a). Surface matte or barely shiny, shortly pubescent, the setae testaceous, obliquely oriented backwards; surface covered with closely spaced granules of heterogeneous size, distant from each other by 1× their diameter on the disc, the granules smaller and tightened on both sides. Posterior part of the vertex with very distinct transverse ripples. Labrum transverse, strongly emarginate and transversely split into two superimposed laminae in the middle front, the lowest edge and sides

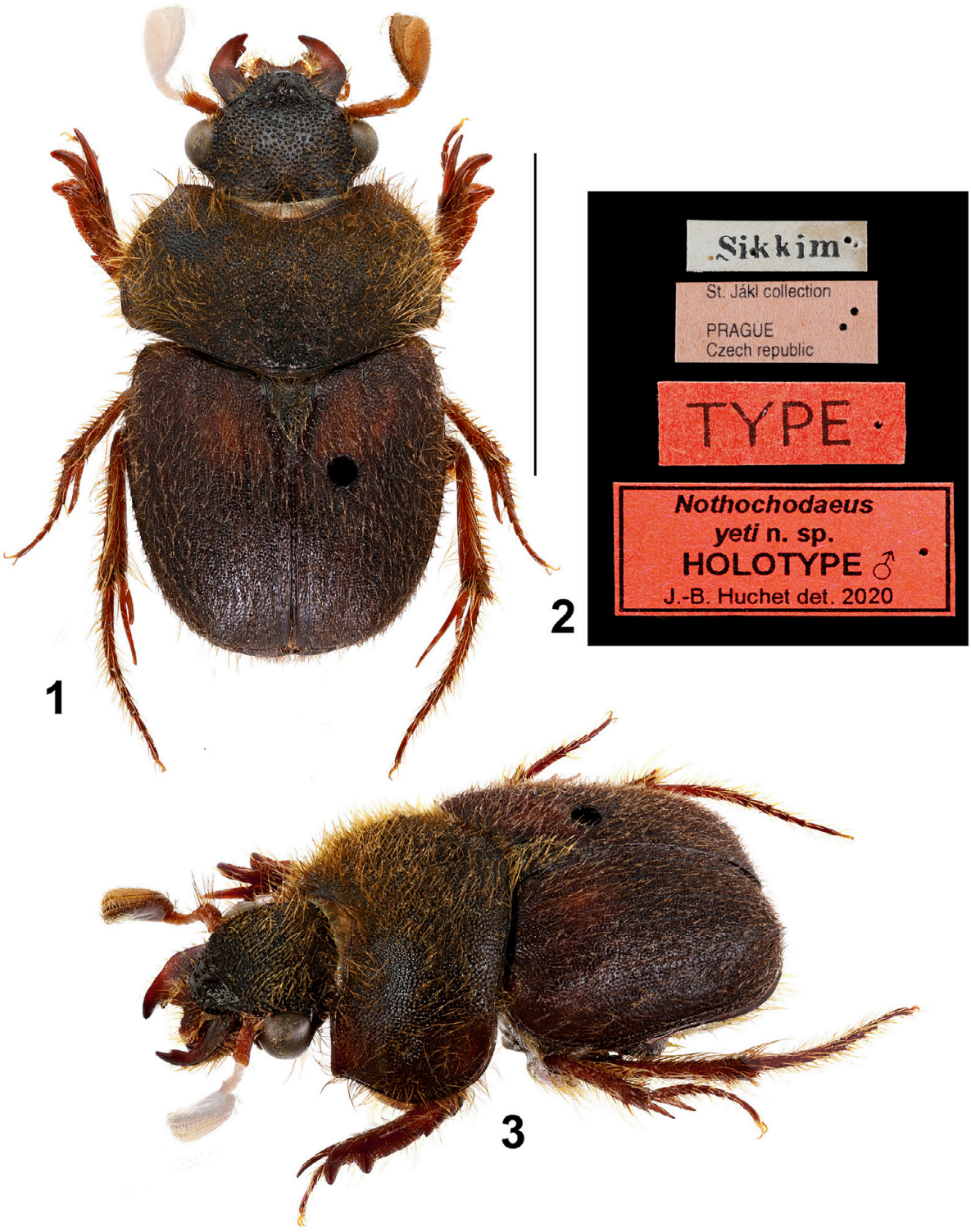
pubescent; both sides of the labrum convex, hyaline, long pubescent. Eyes large, prominent, globose, lacking ventral projection of canthus. Mandibles subequal, falciform, slightly concave dorsally, sharp-edged near the base, the apex and outer edge distinctly darkened; both mandibles 4-dentate on their inner edge (the apical tooth included), the two median teeth (concealed by the labrum in upper view) strongly developed, obliquely oriented forward. Mentum oblong, subtrapezoidal, slightly broader at its base, the sides lowered, the disc slightly concave, without longitudinal furrow. Antenna 10-segmented, 3-antennomere club, testaceous, shiny, the antennal scape very massive, the outer club segment distinctly brightened and shortly pubescent at the upper edge. **Pronotum** transverse, strongly convex, entirely margined, the edge forming a gutter on each side and along the base. Anterior margin deeply emarginate behind the head, with a thin hyaline orange membrane in front. Front angles obtuse, projecting forward, the posterior ones regularly rounded. Pronotal surface strongly granulate; granules shiny, setose, the setae obliquely directed anteriorly; surface slightly shiny, black with reddish sides. **Elytra** transverse, slightly shiny, punctato-striate, the basal third lighter, reddish, entirely margined except for the area in front of the humeral callus; elytral punctation strong and tight consisting of small setose granules on a microreticulate background, the testaceous minute setae oriented backward; elytral striae consisting of sunken medium-sized points, separated by 1× their diameter. Humeral callus present but feebly marked. Scutellum black, triangular elongate, lateral edges finely marginate, surface covered distally with coarse setose punctures turning into small setose granules proximally. **Abdomen** strongly convex with six visible ventrites (III–VIII), its outline entirely margined (in ventral view), with a distinct median longitudinal depression. Surface very shiny, covered by numerous minute setose punctures, roughly separated by 1× their diameter; the sternites lightened, brownish-orange along their front and base edges. Tergite VIII (pygidium) pubescent, the punctation consisting of small close setose granules embedded on a microreticulate background. Tergite VII (propygidium) with trapezoidal interlocking mechanism. Metasternal process slightly convex with a thin median groove; mesocoxae widely separated. Stridulatory peg (sternite VI) barely perceptible, vestigial, in the form of a thin hyaline plate**. Legs:** Protibia tridentate externally, the basal tooth very reduced, with short, acute pollex directed anteriorly; a distinct serrated longitudinal carina originating from the base and extending forward just prior to the insertion of the protarsus. Femur without accessory teeth, surface with two parallel rows of setose punctures. Upper spur of metatibia as long as first metatarsomere. **Genitalia (Fig. 10, 11).** Parameres narrow, widely divergent apically. Endophallus including five serrate endophallites of distinct size and shape, the two larger endophallites (Ep. 1, 2) located at the level of the phallobase (the endophallus being not everted).

Sexual dimorphism. A well distinct tripartite clypeal horn in male, two small transverse tubercles, largely separated, located on the clypeo-frontal line (female); anterior margin of pronotum deeply emarginate (male), evenly convex (female); abdominal sternites in male with a median longitudinal depression.

Etymology. The name is a noun in apposition, in reference to the famous mythical hairy humanoid creature supposed to inhabit the Himalayan mountains.

Distribution. Himalayan region of India (Sikkim) and Nepal (Fig. 17).

Remarks. This new species is morphologically close to *Nothochodaeus lutescens* (Westwood) described from "*India Orientali*". The latter, presumably only known by the holotype (HEC), is very likely a female. Both species differ by the cephalic structures, and notably, in *N. lutescens*, by the clypeus less produced anteriorly and the presence of a well-marked curved transverse clypeal carina distinctly raised, followed by two elongate tubercles obliquely located backwards; the head granulation is denser and distinctly tighter.



Figures 1–3. *Nothochodaeus yeti* Huchet, new species, male holotype. **1)** Habitus, dorsal view (missing left antenna figured with shading). **2)** Labels. **3)** Habitus, laterodorsal view (scale = 5mm).

Figures 4–6. *Nothochodaeus yeti* Huchet, new species, female allotype. **4)** Habitus, dorsal view. **5)** Labels. **6)** Habitus, lateral-dorsal view (scale = 5mm).

Figures 7–9. *Nothochodaeus yeti* Huchet, new species. **7)** Male (holotype), head, dorsal view, inset illustrating the tripartite subpyramidal horn. **8)** Head, ventral view. **9)** Female (allotype), head, dorsal view.

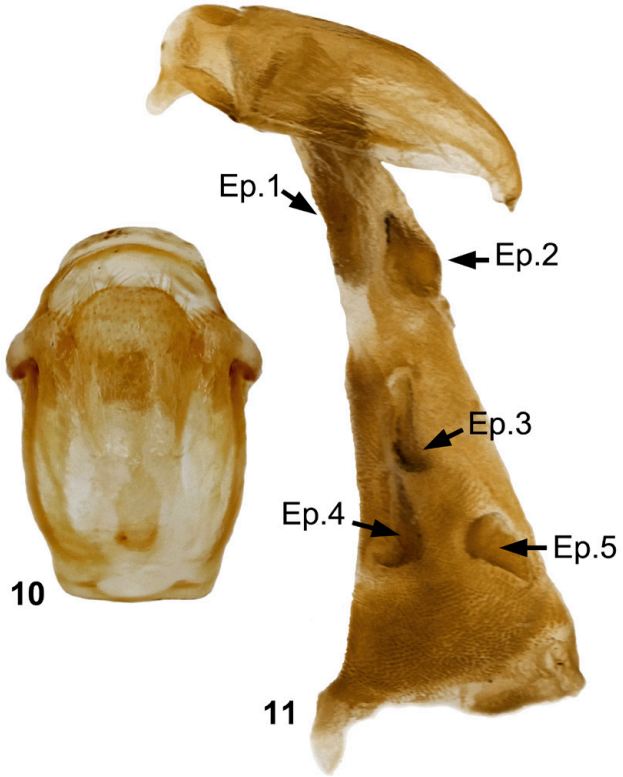


Figure 10–11. *Nothochodaeus yeti* Huchet, new species, male genitalia. **10**) Genital segment (urite IX). **11)** Aedeagus in lateral view, the endophallus not everted (Ep: endophallite).

***Nothochodaeus martensi* Huchet, new species (Fig. 12-14)**

Type material. Holotype female (SMNS), labeled: a) white paper, rectangular, printed: "NEPAL-Expeditionen / Jochen Martens"; b) white paper, rectangular, printed: "373 Taplejung Distr., lower Gun- / sa Khola to Lungthung, open for- / est, bustes, 1650–1870 m, 18 may / 1988, MARTENS & SCHAWALLER"; c) white yellowish paper, rectangular, both handwritten and printed: Ochodaeus / det. SCHEUERN 91"; d) rectangular, red paper: "TYPE"; e) red paper: "*Nothochodaeus* / *martensi* n. sp. / HOLOTYPE ♀ / J.-B. Huchet det. 2020".

Diagnosis. Small-sized species, body short, robust, strongly convex, and densely pubescent. Bicolored, predominantly orange-brown with a darkened median patch on pronotum, and two transverse elytral stripes. Underside and legs orange-brown. The stridulatory peg is present.

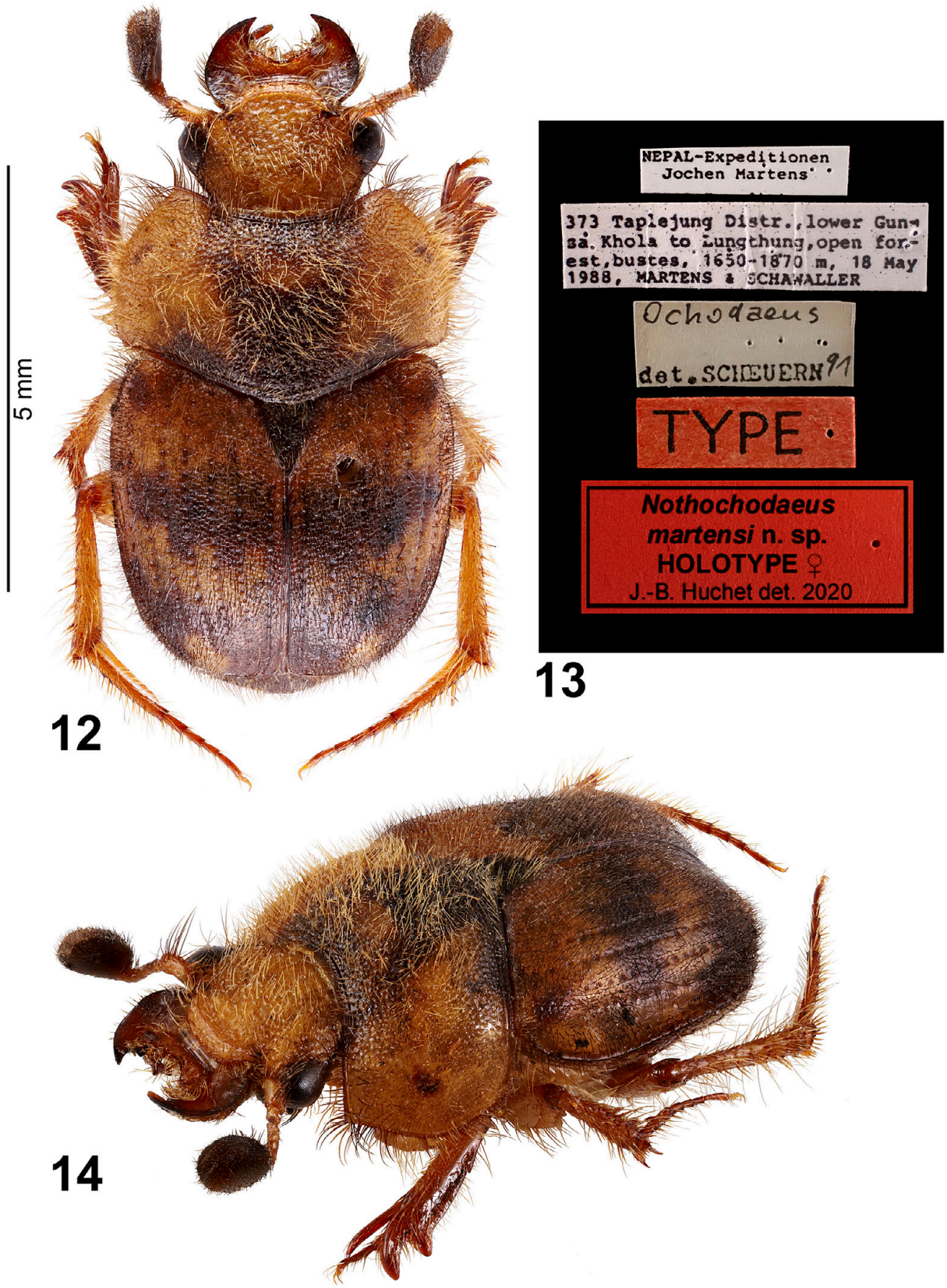
Description. Holotype female (Fig. 12, 14). Coleoptera: Scarabaeoidea: Ochodaeidae. **Length:** 8.2 mm (from the apex of the mandibles to the apical part of the tergite VIII). **Width:** 4.1 mm. **Head: t**ransverse, sub-hexagonal in outline, surface dull, covered with small setose granules separated by 1 to 1.5× their diameter. Clypeus transverse, subtrapezoidal, slightly declivous in front, the anterior margin sublinear, ciliate, with short testaceous bristles oriented forward; clypeal marginal membrane transverse, hyaline, reaching the labrum forward. A strong procurved clypeal carina reaching the anterior angles of the head. Labrum very transverse, widely emarginate and pubescent in front; eyes large, prominent, globose, lacking ventral projection of canthus. Mandibles subequal, falciform, slightly concave dorsally, apically pointed, their outer edge distinctly darkened. Mentum subquadrangular, the anterior margin slightly emarginate in the middle, the disc flat with sparse testaceous setae, tegument microreticulated. Antenna 10-segmented, 3-antennomere club, scape, pedicel, and funicle testaceous, club darkened, reddish-brown, shortly pubescent. **Pronotum** transverse, convex, entirely margined and with long pubescence on edges; front angles obtuse, projecting forward, slightly tilted down, the posterior angles obtusely rounded. Anterior margin slightly emarginate behind the head, with a thin hyaline orange membrane in front. A distinct fovea on both sides, distally darkened. Pronotal surface roughly and densely granulate, the granules setose with long setae; tegument orange-brown, with the exception of a darkened medio-basal transverse patch and a median triangular area, rearward facing top, extending from the anterior margin to the basal edge. **Elytra** transverse, narrower than pronotum, densely pubescent, entirely margined except from the area in front of the humeral callus; punctation of interstriae strong and tight consisting of small setose granules on a microreticulate background, setae distinctly darker than those present on head and pronotum; elytra punctato-striate, striae well impressed, consisting of a single row of sunk punctures separated by 0.5 to 1× their diameter; juxtasutural interstria narrowly margined on its inner edge, orange colored. Elytral tegument orange-brown, a median darkened transverse strip, consisting of staggered spots, extending from interstriae 2 to 7; a second transverse strip at the apical third, complete with the exception of two lighter rounded spots located in the apical declivity. Humeral callus present, well-marked, distinctly darkened. Scutellum black, triangular elongate, surface slightly concave with coarse setose punctures. **Abdomen** convex, shiny, yellowish orange; surface of ventrites with sparse minute setigerous granules on the disc and larger long pubescent granules along the anterior margin of each ventrite; basal edge of each ventrite finely darkened. Tergite VIII (pygidium) pubescent, orange-brown, with the exception of yellowish para-median spots along anterior margin. Tergite VII (propygidium) yellowish, with trapezoidal interlocking mechanism. Metasternal process transverse, flat, with sparse setae on both sides of the median area. Mesocoxae widely separated. Stridulatory peg (sternite VI) present. **Legs:** Protibia tridentate externally, the basal tooth very reduced. Femurs without accessory teeth, their surface with two parallel rows of setose punctures. Upper spur of metatibia as long as the first metatarsomere.

Sexual dimorphism. Unknown.

Etymology. This species is cordially dedicated to Professor Jochen Martens, famous German zoologist, specialist of the biodiversity of the Nepalese and Indian Himalayas.

Distribution. Nepal (Fig. 17).

Remarks. Within the Indian representatives of the genus *Nothochodaeus*, this new species could only



Figures 12–14. *Nothochodaeus martensi* Huchet, new species, female holotype. **12)** Habitus, dorsal view. **13)** Labels. **14)** Habitus, latero-dorsal view.

be morphologically related to *Nothochodaeus pictus* (Westwood), with which it shares substantially the same elytral coloration pattern (presence of two darkened transverse stripes) (Fig. 15, 16). It differs from this species by the pronotum distinctly more transverse (L/W = 1.81; this ratio being of 1.64 in *N. pictus*), coloration of the head and pronotum (head orange colored and pronotum predominantly orange-brown in *N. martensi* while the head, pronotum and underside are completely black with the exception of two orange spots respectively located at the anterior and posterior pronotal angles, extending underside in *N. pictus*); both mandibles distinctly shorter, marginally convex, with a subapical tooth in *N. martensi* (the mandibles more elongated, the 2nd tooth placed medially in *N. pictus*); head with a curved transverse clypeal carina in *N. martensi*, with two distinct clypeal tubercles widely separate in *N. pictus* (this character however, is very likely sexually dimorphic, the holotype of *N. pictus* being not sexed).

Figures 15–16. Habitus *of Nothochodaeus*, in dorsal view, comparison. **15)** *Nothochodaeus pictus* (Westwood), holotype, inset illustrating the original drawing figuring in Westwood (1852). **16)** *Nothochodaeus martensi* Huchet, new species, holotype. (Figure 15: photo courtesy of A. Spooner, Oxford University Museum of Natural History, UK)

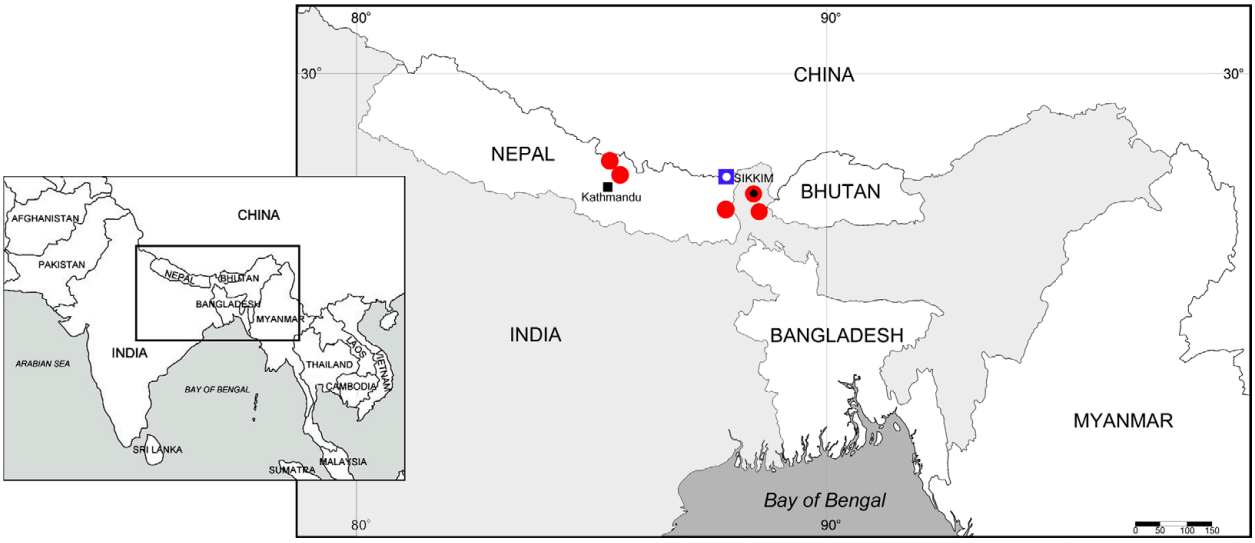


Figure 17. Distribution map of *Nothochodaeus yeti* Huchet, new species (red dots, the type locality with a black spot) and *N. martensi* Huchet, new species (blue square with a white spot) in Northern India (Sikkim) and Nepal.

Catalogue of the Ochodaeidae of the Indian subcontinent

OCHODAEIDAE Mulsant and Rey 1871: 236
Ochodaeinae Mulsant and Rey 1871: 236
Nothochodaeini Nikolajev 2015: 25
***Nothochodaeus* Nikolajev 2005: 219** [= *Notochodaeus* Nikolajev, 2005]

Nothochodaeus lutescens (Westwood, 1852)	[Oriental India]
Nothochodaeus martensi Huchet, **new species**	[Nepal]
Nothochodaeus pictus (Westwood, 1852)	[Oriental India]
Nothochodaeus yeti Huchet, **new species**	[North India (Sikkim), Nepal]

Ochodaeini Mulsant and Rey 1871: 236
***Ochodaeus* Dejean 1821: 56**
= *Ochodaeus* Serville 1825: 360
= *Psephus* Kirby and Spence 1826: 678

Ochodaeus barbei Petrovitz, 1972	[Bangladesh]
Ochodaeus deceptor Arrow, 1907	[India]
Ochodaeus nurestanicus Nikolajev, 1995	[Afghanistan, Pakistan]
Ochodaeus pallidus Arrow, 1907	[India]

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