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Study on the genus *Onitis* (Coleoptera: Scarabaeidae: Scarabaeinae) of the Indian Subcontinent, with three new species from India

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Abstract. Three new species of *Onitis* Fabricius, 1798 are described: *Onitis bhomorensis* sp. nov. from Assam (Northeast India), *O. kethai* sp. nov. and *O. visthara* sp. nov. from Karnataka (South India). *Onitis bordati* Cambefort, 1988 is recorded for the first time for the Indian subcontinent, from Meghalaya, India. Thus, the number of species of *Onitis* from the subcontinent has been raised to 20 and that of the Oriental region to 26. Illustrated identification keys to all the species of the genus *Onitis* from the Indian subcontinent are provided with distributional details and maps. Lectotype and paralectotypes designated for *Onitis philemon* Fabricius, 1801. Descriptions are provided for aedeagus of seventeen species of *Onitis*, as well as images of type specimens for nine species from their respective repositories. Distribution maps are provided for the species of *Onitis* of the Indian subcontinent.

Keywords. Basal fovea, dung beetles, Onitini, new species, new distribution.

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Introduction

The Old-World dung beetle genus *Onitis* (Coleoptera: Scarabaeidae: Scarabaeinae: Onitini) has 176 species known from the world. Globally, their distribution extends beyond Africa to the Palaearctic and Oriental region (Davis *et al.* 2002, 2008) with 142 species from the Afrotropical region, 23 from the Oriental and 26 from the Palaearctic region (Schoolmeesters 2024). Additionally, some species were introduced to the Australasian region (Bornemissza 1960, 1976). All species of this genus are tunnellers and the males of most species possess forelegs which are long, slender and curved, usually with teeth or spines, the function of which is unclear, probably for holding the female while mating. Within the genus, colour, morphological characteristics such as the sculptures on the head, punctuation of the exoskeleton; shape of the legs in male and the protrusions on it are used to differentiate species (Arrow 1931; Janssens 1937; Hanski & Cambefort 1991; Davis *et al.* 2008; Scholtz *et al.* 2009).

History of genus *Onitis* Fabricius (1798) of the Oriental region

The genus *Onitis* was first established by Fabricius (1798). Latreille (1810) subsequently designated *Scarabaeus sphinx* Fabricius, 1775 as the type species. Many later authors have considered *Scarabaeus inuus* Fabricius, 1781 (current valid name: *Onitis sphinx* (Fabricius, 1775) as the type species of *Onitis* (Arrow 1931; Janssens 1937; Balthasar 1963; Bezděk & Krell 2006), but Branco (2007) reassigned the valid type to *Scarabaeus sphinx* Olivier, 1789. This species is a junior primary homonym of *Scarabaeus sphinx* Fabricius, 1775 and senior synonym of *Onitis belial* Fabricius, 1798, which is its current valid name.

In the taxonomic history of Oriental *Onitis* the contributions of Lansberge (1875), Péringuey (1901), Boucomont (1914), Boucomont & Gillet (1921), Arrow (1931), Janssens (1937) and Balthasar (1963) are significant. The genus *Onitis* has undergone comprehensive monographic treatment by various authors (Lansberge 1875; Arrow 1931; Janssens 1937; Balthasar 1963). The initial monographic revision of the genus was conducted by Lansberge in 1875, in which he documented 61 species. However, the most comprehensive work concerning the Onitini tribe is Janssens' monumental revision from 1937. In this work, he classified the 113 species of the genus *Onitis* into 20 distinct groups, with eight of these groups and 21 species being identified in the Oriental region. Following the seminal work by Janssens' (1937), subsequent taxonomic studies on *Onitis* species have been conducted by Biswas (1980), Cambefort (1988), and Ochi & Kon (1996), resulting in further refinements to the classification. In 1875, Lansberge established the genus *Cheironitis*, the only other genus within the tribe Onitini known from the Oriental region. The important features which distinguish the genus *Onitis* from *Cheironitis* are the smaller scutellum and the absence of tarsi in both sexes. In species of *Cheironitis* the tarsi are present in the female and the scutellum is large.

The phylogenetic analyses of Scarabaeinae, using morphological (Philips *et al.* 2004) and molecular characters (Villaba *et al.* 2002; Ocampo & Hawks 2006; Monaghan *et al.* 2007) have shown that the tribe is monophyletic and is sister to the clade Onthophagini + Oniticellini. This has been verified in the study by Tarasov & Dimitrov (2016). The aedeagus of Scarabaeinae has been used for differentiating the species in many reviews and revisions as it provides taxonomically useful characters for distinguishing species (Janssens 1937; Binaghi *et al.* 1969; Zunino 1978, 1979, 1985; Zunino & Halffter 1987; Martin-Piera 1987; Ochi & Kon 1996; Ziani & Gudenzi 2001; Price 2005; Medina *et al.* 2013).

In the present paper, we have reviewed all the known species of the genus *Onitis* from the Indian subcontinent. Three new species, *Onitis bhomorensis* sp. nov., *O. kethai* sp. nov., and *O. visthara* sp. nov., are described. With the first report of *O. bordati* Cambefort, 1988 from India the distribution range of this species is extended to include the Indian subcontinent.

Material and methods

Study area

The Indian subcontinent in geological terms refers to a landmass that drifted in the north-eastern direction from the ancient Gondwana landmass and collided with the Eurasian plate (Jones 2011). It includes six countries of South Asia: India, Pakistan, Bangladesh, Sri Lanka, Nepal and Bhutan (Brewster & Mayrhofer 2012).

Material examined

This study was largely based on 1260 specimens of *Onitis* collected between 1998 and 2021. The collected specimens were curated and deposited in the ATREE Insect Museum, Bangalore (AIMB) and the holotypes for the new species described were deposited at the National Bureau of Agricultural Insect Resources, Bangalore (NBAIR). The exact locations and date of collection for each species are listed under their description with the new distribution records for the states of India. The distributional

details for species of *Onitis* and maps (Figs 17–20) were prepared using the data sourced from available literature and also the locations where they were collected during our field visit.

Type materials of species of *Onitis* in the Coleoptera collections at the Natural History Museum, London, UK and the Zoological Survey of India, Kolkata were physically examined and photographed. High resolution images of the type and non-type specimens of different species of *Onitis* from collections at different museums across the world were studied when the specimens were not physically accessible.

The authors have sourced specimens or high-resolution images from the following museum collections, with the concerned authority names in parenthesis.

AIMB	=	ATREE Insect Museum, Bangalore, Karnataka, India
BMNH	=	Natural History Museum (formerly British Museum of Natural History), London, United Kingdom (Maxwell Barclay)
IRSNB	=	Institut royal des Sciences naturelles de Belgique, Brussels, Belgium (Wouter Dekoninck)
MfN	=	Museum für Naturkunde, Leibniz-Gemeinschaft, Berlin, Germany (Johannes Frisch)
MNHN	=	Muséum national d'histoire naturelle, Paris, France (Olivier Montreuil and Antoine Mantilleri)
NBAIR	=	National Bureau of Agricultural Insect Resources, Bangalore, Karnataka, India
NHMW	=	Naturhistorisches Museum Wien, Vienna, Austria (Harald Schillhammer)
SNSD	=	Senckenberg Natural History Collections, Dresden, Germany (Klaus-Dieter Klass)
ZMUC	=	Zoological Museum (Natural History Museum of Denmark), University of Copenhagen, Denmark (Alexey Solodovnikov)
ZMUK	=	Zoological Museum of Kiel University, Kiel, Germany (Michael Kuhlmann)
ZSIM	=	Zoological Survey of India, Kolkata, India (K Venkataraman, Kailash Chandra)

Collection, preservation and preparation of the specimens

Specimens were collected from open cow dung baited traps, light traps and hand-picked from other herbivore dung. The beetles were preserved in 95% alcohol in the field, brought to the laboratory and prepared for taxonomic studies. The specimens were pinned, dried, labelled and identified to species and stored in insect boxes withunit trays at AIMB. The measurements were taken with a micrometer fixed to a Leica MZ6 binocular stereozoom microscope and a digital Vernier calliper.

Preparation of aedeagus

The specimens were relaxed using a mixture of benzene, acetone and alcohol in the ratio 10:45:45. The aedeagus was extracted through the opening of the pygidium using a pair of forceps, mounted on tip of card points and measured.

Photography of specimens

High-resolution images highlighting the taxonomically important features of the beetles such as pronotum, head, clypeus, pygidium and metasternum were acquired using a Canon 70D camera with a Canon EF 100 mm macro lens or a Keyence VHX-6000 Digital Microscope. Aedeagi were photographed using a Canon MP-E 65 mm macro lens. While using a Canon camera, the specimens were illuminated using a light box and a Canon MT-24EX macro–Twin Lite flash along with reflectors. An automated Stackshot rail was used to take a series of images and the final hyper-focal image was obtained by stacking the multiple images using CombineZM stacking software. The images were edited using Photoshop CC to remove the artefacts and the scale was added on the images using ImageJ software. Image plates were also prepared using Photoshop.

Identification of species

Identifications were carried out using the keys in Arrow (1931), Janssens (1937) and Balthasar (1963). The detailed morphology was studied using the original descriptions. For distinguishing those species which are difficult to identify using external morphology, the characteristics of the aedeagus (male genitalia) have been studied.

Abbreviations

Details of abbreviations for measurements are as follows. All measurements are in mm.

BW = Body width (maximal distance between lateral elytral margins).
EL = Elytral length (elytral suture length).
HL = Head length (medial length of head).
HW = Head width (maximal distance between external margins of genae).
PL = Pronotal length (medial length of pronotum).
PW = Pronotal width (maximal width of pronotum).
TL = Total body length (distance from apex of clypeus to tip of pygidium).

Aedeagus measurements (in mm)

BpB = Breadth of parameres base (width of parameres at the base in dorsal view).
BpT = Breadth of parameres tip (width of parameres at the tip in dorsal view).
BP = Breadth of phallobase (broadest width of the phallobase in lateral view).
Lp = Length of parameres (distance from the point of articulation with phallobase to the tip).
LP = Length of phallobase (distance from base of phallobase to the point of articulation with parameres).

Results

Taxonomy

Class Insecta Linnaeus, 1758
Order Coleoptera Linnaeus, 1758
Family Scarabaeidae Latreille, 1802
Subfamily Scarabaeinae Latreille, 1802
Tribe Onitini Laporte, 1840

Genus ***Onitis*** Fabricius, 1798

Key to species of *Onitis* Fabricius, 1798 from the Indian subcontinent

The following key is based on external morphological characters and can be used to identify both male and female adults of *Onitis*. For the convenience of identification, we have retained the groups suggested by Janssens (1937). The keys have been modified from the identification keys to the species provided by Arrow (1931) and Balthasar (1963).

1. Head with frontal carina interrupted medially, with tubercle placed adjoining the carina; clypeus always with a short or long transverse carina 2
– Head with frontal carina uninterrupted or entire, with tubercle behind or absent; clypeal carina feebly expressed..... 13

2. Body completely black or dark brown (**GROUP I**) 3
– Body metallic, with coppery or green tinge..... 6

3. Pronotum minutely punctured (Fig. 5E–F) 4
– Pronotum strongly punctured (Fig. 14A–B) 5

4. Metasternal shield in male with deep transverse excavation in the middle; without an anterior longitudinal groove ..... ***O. excavatus*** Arrow, 1931 (Figs 5E, 6A–D, 18)
– Metasternal shield without transverse excavation in the middle, with an anterior longitudinal groove ..... ***O. falcatus*** (Wulfen, 1786) (Figs 5F, 6E–H, 18)

5. Pygidium with a median longitudinal groove; protibia with a rudimentary spur before the extremity (Fig. 16A) ..... ***O. bhomorensis*** sp. nov. (Figs 2, 6I–L, 9A, 14A, 15A, 16A, 17)
– Pygidium without a median longitudinal groove; protibia without a rudimentary spur (Fig. 16B) ..... ***O. punctatostriatus*** Janssens, 1937 (Figs 6M–P, 9B, 10F, 14B, 15B, 16B, 19)

6. Vertex covered with granules or highly raspy punctuation; clypeal carina closer to the frontal carina than to the clypeal margin (Fig. 9A–F) (**GROUP II**) 7
– Vertex covered with punctures and never rough or granular; clypeal carina midway between clypeal margin and frontal carina (Figs 1A, 10D) (**GROUP III**) 12

7. Metasternum longitudinally grooved anteriorly (Fig. 12F) 8
– Metasternum not grooved anteriorly (Fig. 1B) 11

8. Pronotum without a smooth median longitudinal line; genae smooth, inconspicuously punctured (Fig. 14C–D); male profemur not toothed 9
– Pronotum with a smooth median longitudinal line; genae sparingly granular (Fig. 14E–F); male profemur toothed 10

9. Clypeus granular in male and rugose in female (Figs 9D, 14D), pronotum strongly and unevenly punctured ..... ***O. philemon*** Fabricius, 1801 (Figs 8E–H, 9D, 10E, 14D, 15D, 16D, 19)
– Clypeus rugulose in both sexes; pronotum strongly and closely punctured (Figs 9C, 14C) ..... ***O. kethai*** sp. nov. (Figs 7, 8A–D, 9C, 14C, 15C, 16C, 18)

10. Lateral margin of pronotum feebly curved; front angles of pronotum blunt (Figs 9F, 14F); mid-femur in male with a tooth near the middle of its posterior edge, another at the extremity (Fig. 16F) ..... ***O. singhalensis*** Lansberge, 1875 (Figs 8I–L, 9F, 12A, 14F, 15F, 16F, 19)
– Lateral margin of pronotum strongly curved; front angles of pronotum sharp (Figs 9E, 14E); mid femur in male without a tooth near the middle of the posterior edge, the extremity with a sharp tooth on the lower edge and a blunt one above (Fig. 16E) ..... ***O. visthara*** sp. nov. (Figs 8M–P, 9E, 12E–F, 14E, 15E, 16E, 20)

11. Frontal carina narrowly interrupted; pygidium smooth with minute punctures ..... ***O. virens*** Lansberge, 1875 (Figs 12D, 13E–H, 20)
– Frontal carina widely interrupted; pygidium opaque with imperceptible punctures ..... ***O. subopacus*** Arrow, 1931 (Figs 12C, 13A–D, 20)

12. Pronotal anterior angles not extended, blunt; male protibia with 3–4 teeth on the inferomedial ridge ..... ***O. naviauxi*** Cambefort, 1988 (Figs 4E–F, 10D, 19)
– Pronotal anterior angles slightly extended, sharp; male protibia with 6–7 teeth on the inferomedial ridge (Fig. 1C) ..... ***O. assamensis*** Biswas, 1980 (Figs 1, 4A–D, 17)

13. Pygidium covered with short or long hair (**GROUP VII**) 14
– Pygidium not covered with hair or setae 17

14. Clypeus elliptical; head not tuberculate; elytral intervals slightly carinate in the middle ..... ***O. feae*** Felsche, 1907 (Figs 10A, 11E–H, 18)
– Clypeus truncate or excised; head tuberculate; elytral intervals convex 15

15. Clypeal margin deeply excised with an obtuse angle; frontal carina with a small gap ..... ***O. brahma*** Lansberge, 1875 (Figs 5B, 17)
– Clypeal margin not deeply excised; frontal carina entire 16

16. Hair on the pygidium short; elytral interval angularly elevated along middle with fine close punctures ..... ***O. crassus*** Sharp, 1875 (Figs 5D, 18)
– Hair on the pygidium long; elytral interval flat with feeble punctures ..... ***O. castaneus*** Redtenbacher, 1848 (Figs 5C, 11A–D, 17)

17. Clypeal carina present 18
– Clypeal carina absent 19

18. First, third and fifth inter-striae of the elytra not much convex; elytra dark, metasternal shield smooth behind, with a median groove (**GROUP V**) ..... ***O. lama*** Lansberge, 1875 (Figs 10C, 11I–L, 19)
– First, third, and fifth inter-striae distinctly convex; elytra yellow with some intervals green; metasternal shield punctured behind, without a median groove (**GROUP XIV**) ..... ***O. humerosus*** (Pallas, 1771) (Figs 10B, 18)

19. Pronotum covered with close granules (**GROUP IX**) ..... ***O. bordati*** Cambefort, 1988 (Figs 3, 4G–J, 5A, 17)
– Pronotum covered with strong punctures (**GROUP XVIII**) ..... ***O. siva*** Gillet, 1911 (Figs 4K–N, 12B, 20)

Onitis assamensis Biswas, 1980
Figs 1, 4A–D, 17

Onitis assamensis Biswas, 1980: 339 (original description).

Onitis assamensis – Gupta *et al.* 2015: 1037 (checklist). — Schoolmeesters 2022 (online catalogue).

Differential diagnosis

Onitis assamensis and *O. naviauxi* differ from each other in the number of teeth on the anteriomedian ridge of the protibia in the male. Clypeal carina short in male of *O. assamensis* and *O. naviauxi* while it is longer in female; clypeus in female pointed in both species; metasternal shield hairy in males and smooth in females. In the original description of *O. assamensis* the frontal carina is considered entire, but on observing the specimen in detail, it is confirmed that it is interrupted due to the placement of tubercle on it. The teeth on the infero-internal ridge in the profemur is a very prominent character of the species and the arrangement of teeth, their number and size may vary with individuals. In a specimen we collected, an extra small tooth was present near the femoro-tibial joint on one of the fore legs.

Material examined

Holotype

INDIA • ♀; Assam, Kaziranga National Park; 21 Dec. 1972; A.K. Ghosh leg.; from rhinoceros dung; ZSIM Regd. No. A1/4397.

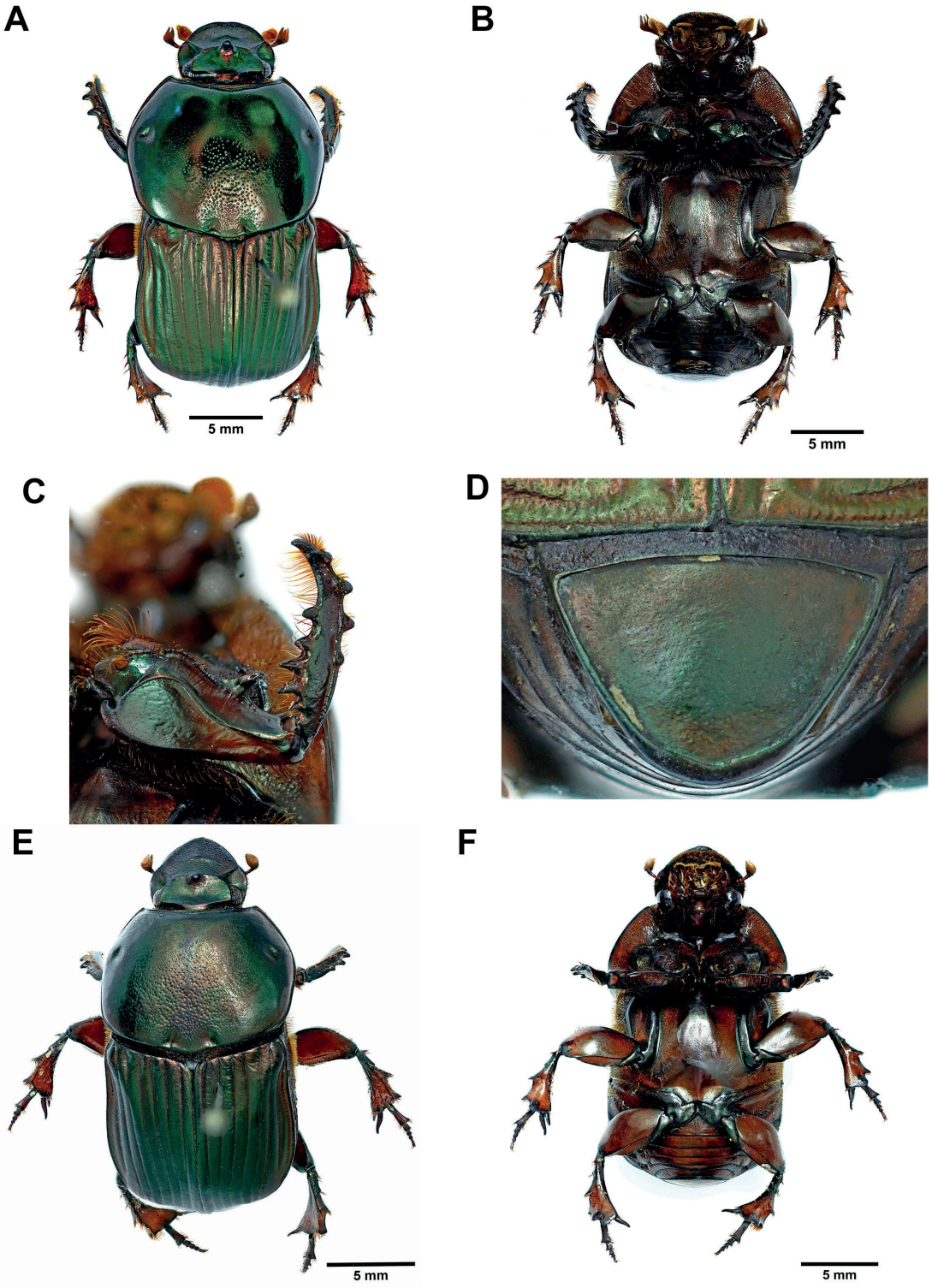

Fig. 1. *Onitis assamensis* Biswas, 1980, ♂ (A–D), AIMB/Co/Sc1000001; ♀ (E–F), AIMB/Co/Sc1000009. **A**. Habitus, dorsal view. **B**. Habitus, ventral view. **C**. Protibia. **D**. Pygidium. **E**. Habitus, dorsal view. **F**. Habitus, ventral view. (Images: AIMB)

Additional material (15 specimens)

INDIA • 8 ♂♂, 7 ♀♀; Assam, Kaziranga National Park; 21 May 2019; Priyadarsanan Dharma Rajan & Karimbumkara Seena Narayanan leg.; hand–picked, rhinoceros dung; AIMB AIMB/Co/Sc1000001 to 1000015.

Description

Measurements (in mm). TL = 21.5–24.8; BW = 10.7–12.5; PL = 8.5–11; PW = 10.5–13.5; EL = 10.5–12.5; HL = 5–6; HW = 5.5–6.8.

Male

Body shiny green or bronzy, broadly oval. Head rounded, clypeus straight in the middle anteriorly, finely rugose with scattered punctures; clypeal carina short, rugose behind; frontal carina almost straight, narrowly interrupted in the middle by the placement of a strong conical blunt tubercle; vertex sparsely punctured, elevated towards the eyes with a depression in the middle devoid of any punctures. Pronotum with small, close dense punctures between the basal foveae, punctures larger and less close anterior to the foveae, finer and sparse anteriorly and at the sides; basal foveae oval, deep, connected by a bordered base; scutellum triangular visibly large. Elytra broadly curved at the sides; striae deep, broader at the base, narrow and smooth towards the tip; elytral intervals smooth without punctures, sutural interval slightly convex. Pygidium margined, lesser sheen, imperceptibly punctured. Metasternal shield with minute punctures, front angles with minute granules and fine yellow hairs; sides of metasternum with reddish hairs, densely granular. Fore legs with rows of reddish long hairs or setae on the ridges; a strong curved tooth on the anteromedian ridge of profemur with a minute oblique denticle near the base; protibia with four distantly placed external teeth, the infero-medial ridge with 6–7 teeth, small proximally and stouter distally; mid femur unarmed; hind femur with a strong curved lateral tooth towards the apex.

Aedeagus (in mm) (Fig. 4A–D). LP = 3.6, Lp = 2.86; BP = 1.86, BpB = 1.43, BpT = 0.71. Phallobase longer than parameres, broader at base and further tapers, becomes blunt and slightly curved at the tip. Phallobase slightly broader at the base.

Female

Body greenish, broadly oval, not very convex; head sub triangular, frontal carina entire with a tubercle. Clypeal carina long and curved placed almost midway between the clypeal margin and the frontal carina; clypeus parabolic, rugulose. Pronotum strongly and closely punctured; front angles sharp; basal foveae rounded. Elytra: dull, striae shallow and broad, intervals flat, not perceptibly punctate. Ventral surface: metasternum flat, smooth with two deep pits behind and a shallow longitudinal groove between; sides of metasternum closely granular and hairy. Pygidium without hair, slightly shining and coarse; legs unarmed.

Distribution

India: Assam (Biswas 1980; Gupta *et al.* 2015; Schoolmeesters 2022).

Remarks

A single female specimen of *O. assamensis* was collected by Biswas (1980) from rhinoceros dung and described as the holotype. During our visit to Kaziranga National Park, we have collected 15 specimens of the species of which eight were males and seven females. The rarity of the species mentioned by Biswas can be attributed to the winter in December when he had made the collection. The species was common and active in May (pre-monsoon), when we collected them at the same location. We have described the male of *Onitis assamensis* which had never previously been discovered or described.

Onitis bhomorensis sp. nov.
urn:lsid:zoobank.org:act:7D70D754-D82E-4BCA-A3C9-D42645B4F708
Figs 2, 6I–L, 9A, 14A, 15A, 16A, 17

Differential diagnosis

Onitis bhomorensis sp. nov. is assigned to Group I as its body is completely black and the frontal carina is interrupted. It is similar to *O. punctatostriatus* in having broad elytral striae. It differs from the latter in the nature of pronotal punctures which are stronger in *O. bhomorensis* than in *O. punctatostriatus*; basal foveae are more spaced in the former than the latter; metasternal shield slightly convex, granular anteriorly with reddish hairs in *O. bhomorensis* while in *O. punctatostriatus* it is flat in the middle, with a weak longitudinal groove and with smooth scattered punctures. Clypeal margin truncated, straight in the middle in the former, while it is slightly reflexed in the latter. The presence of a median groove on the pygidium and the rudimentary spur on the protibia make it different from all other Oriental *Onitis* species. *Onitis bhomorensis*, is compared with *O. assamensis*, a species described from a nearby locality as that of the former by Biswas (1980) based on a single specimen. *O. bhomorensis* is smaller and the body is reddish black, while *O. assamensis* is greenish. The frontal carina is entire with a tubercle in the former while the carina is interrupted in the latter. The protibia of *O. bhomorensis* is with a rudimentary spur and the pygidium is with a vertical groove, both these characters are absent in *O. assamensis*.

Etymology

Named after the bridge "Kolia Bhomora" across Brahmaputra – the widest river in India, near which the type specimen was collected.

Material examined

Holotype

INDIA • ♀; Assam, Tezpur, Kolia bhomora; 10 Oct. 2012; 26°34′56.66″ N, 92°51′52.65″ E; elev. 74 m a.s.l.; Karimbumkara Seena Narayanan leg.; hand-picked, cattle dung; NBAIR, Bangalore; NIM/NBAIR/COL/ONIT/H-271023A.

Description

Measurements (in mm). TL = 18; BW = 10; PL = 7; PW = 11; EL = 10; HL = 5; HW = 5.1.

Male (holotype)

Body narrow, elongate oval, reddish black, not very shining, slightly convex. Antennae red with the club reddish yellow, legs reddish black; body devoid of setae on the dorsal side, ventral side covered with reddish hairs except on the middle of metasternum and the abdominal sclerites. Head shining with the clypeus truncate (Fig. 9A), almost straight anteriorly and at the sides, strongly rugose; clypeal carina present, slightly elevated and curved. The frontal carina is broadly interrupted in the middle with a blunt conical tubercle behind. The vertex punctuation granular, closer in the middle and scattered at the sides appears rugose behind the tubercle. Genae smooth, curved, extended slightly outwards and upwards anteriorly; inner margin slightly elevated and continues behind as a posterior carina. Pronotum moderately convex, sides smoothly margined, except the base which is slightly angulate in the middle; with strong close punctures, closer between the basal foveae; uneven in the middle; deeper and closer anteriorly. Pronotal front angles not very sharp, almost right-angled, the sides straight anteriorly, rounded in the middle, bisinuate behind; hind angles obsolete. A pair of deep basal foveae present at the base on either side of the middle separated by twice its length. Lateral foveae smooth with small punctures in the periphery. Elytra finely and broadly striate, striae devoid of punctures; intervals flat, opaque; sutural interval convex, shining with visible fine scattered punctures. The lateral carinae straight, with minute visible punctures. Pygidium (Fig. 2F) without hair or setae, slightly shining with imperceptible scattered

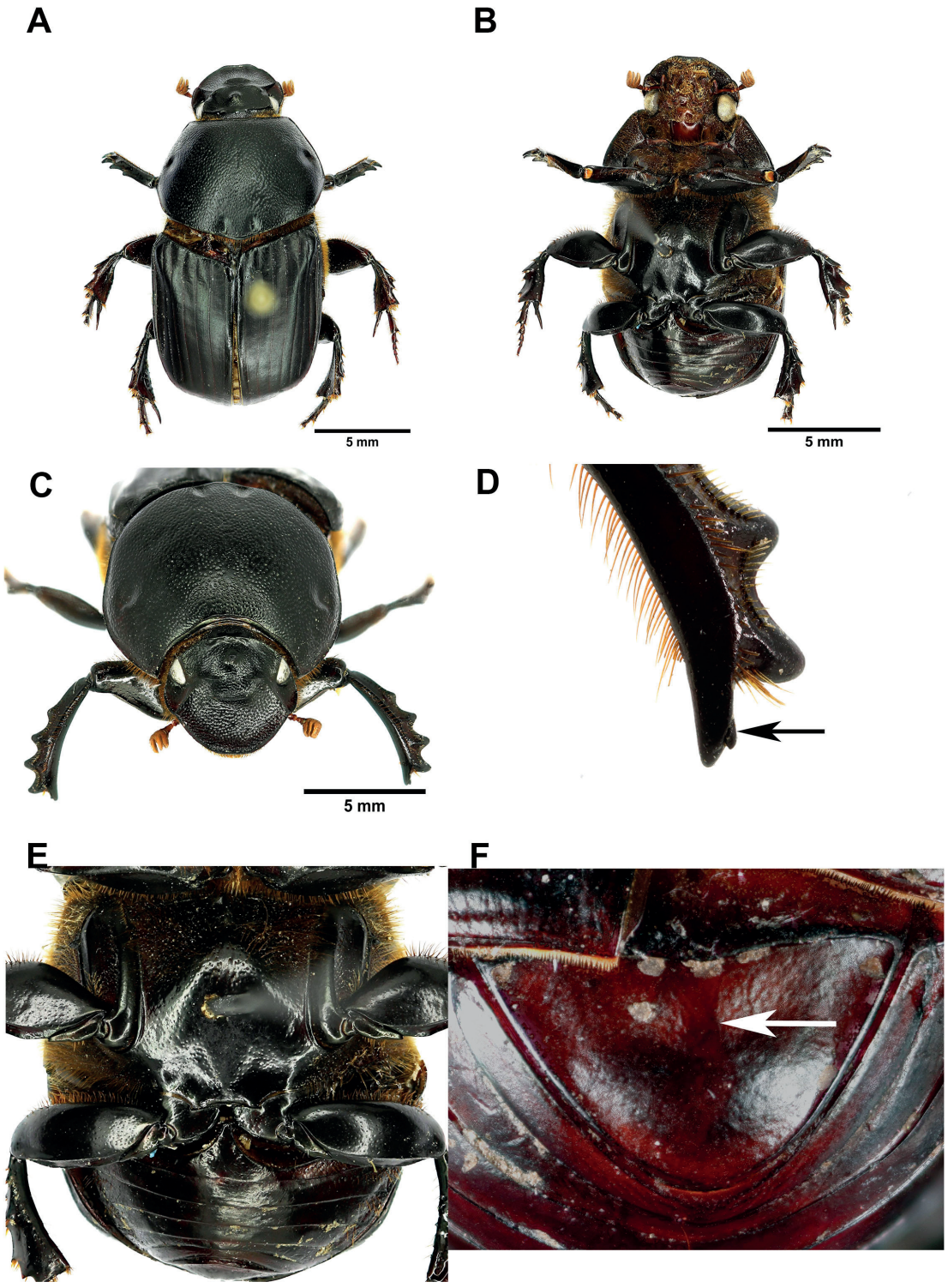

Fig. 2. *Onitis bhomorensis* sp. nov., holotype, ♂, NIM/NBAIR/COL/ONIT/H-271023A. **A**. Habitus, dorsal view. **B**. Habitus, ventral view. **C**. Head and prontum. **D**. Protibia, arrow showing rudimentary spur. **E**. Metasternum. **F**. Pygidium, arrow showing longitudinal groove. (Images: AIMB).

punctures. A smooth median longitudinal groove extending from base to almost the middle is present. Metasternal shield shining, (Fig. 2E) with minute punctures in the middle; anterior part of the metasternal shield slightly convex, with uneven granules and reddish hairs. Sides of the metasternum closely and evenly granular, covered with smooth short reddish hairs. Protibia slender, bears four external teeth, the tip not very long or curved, with a rudimentary spur near the tip (Figs 2D, 16A); teeth short, triangular, placed almost equidistantly. The inner margins of femur and tibia fringed. Femur without protrusion on any of the legs.

Aedeagus (in mm) (Fig. 6I–L). LP = 3, Lp = 2.5; BP = 1.4, BpB = 0.7, BpT = 0.4. Parameres almost same length as phallobase, broader at the base and further tapers become slender and slightly curved at the tip. Phallobase slightly broader at the base.

Female

Unknown.

Habitat

The specimen was collected from cattle dung on the river bed of the Brahmaputra, where the vegetation is dry seasonal grasslands, typical of Brahmaputra flood plains dominated by *Ziziphus jujuba* trees.

Onitis bordati Cambefort, 1988
Figs 3, 4G–J, 5A, 17

Onitis bordati Cambefort, 1988: 190 (original description).

Onitis bordati – Kabakov & Napolov 1999: 70 (distribution). — Hanboonsong *et al.* 1999: 466 (distribution). — Hanboonsong & Masumoto 2000. — 103, 108 (key, distribution). — Schoolmeesters 2022 (online catalogue).

Differential diagnosis

Onitis bordati belongs to Group IX and it resembles species of Group XVIII in having an uninterrupted frontal carina. It resembles *O. siva*, in the absence of clypeal carina and differs from it in the pronotum being densely granular.

Material examined

Holotype

VIETNAM • ♂; Djiring, Annam; 11°35′ N, 108°05′ E; Coll. H. Perrot; Coll. P. Bordat leg.; Y. Cambefort det. 1987; MNHN, EC1187.

Additional material (8 specimens)

THAILAND • ♀; "Prov. TAK Region de UMPHANG VI; 1 Jun. 1991–6 Jun. 1991; Y. CAMBEFORT det. 1992"; MNHN, EC1185.

INDIA • 2 ♂♂, 5 ♀♀; Meghalaya, Nongkhyllem; 25°54′56.51″ N, 91°46′4.55″ E; elev. 269 m a.s.l.; 20 May 2012; Karimbumkara Seena Narayanan & Rajkamal Goswami leg.; hand-picked, elephant dung; AIMB/Co/Sc1000016 to 1000022.

Description

Measurements (in mm). TL = 23.5–32; BW = 11.5–15.5; PL = 9–12; PW = 11.5–15.5; EL = 11.5–15; HL = 6–9; HW = 7–8.5.

Male (Fig. 5A)

Body including legs and antennae reddish black, except the antennal club which is reddish yellow; moderately shining, elongate oval, slightly convex, devoid of any setae on the dorsal surface except at the lower margin of the elytra where a few scattered setae are present. Head with clypeus elongate, strongly rounded, slightly reflexed anteriorly, clypeal carina absent; genae strongly curved, extended outwards and upwards anteriorly, with fine granules; vertex significantly depressed, bordered behind, finely, densely granulate. Pronotum smoothly margined on all sides, the sides of pronotum straight anteriorly, slightly sinuate behind; front angles sharp, obtuse, hind angles obsolete; base angulate in the middle; basal foveae shallow, deeper towards the base, with small ovate granules both within and between them; rows of spindle shaped granules present around the foveae which are not very close, closer and longer in the middle of the pronotum, squamiform and closer anteriorly, the granules smaller, ovate, not very close in the lateral margins; a trace of longitudinal groove extends as a slight depression from the front of the foveae to the front margin of the pronotum; lateral foveae with fine close ovate granules; scutellum very small. Elytra finely striate, striae not perceptibly punctured; intervals flat, opaque, with scattered imperceptible punctures. The sutural interval slightly convex, shining with visible fine scattered punctures; the 5th interval with minute, close, slightly rugose punctures. The lateral carina of the elytra sharp. Pygidium without any hair or setae, opaque, rugose with minute scattered granules.

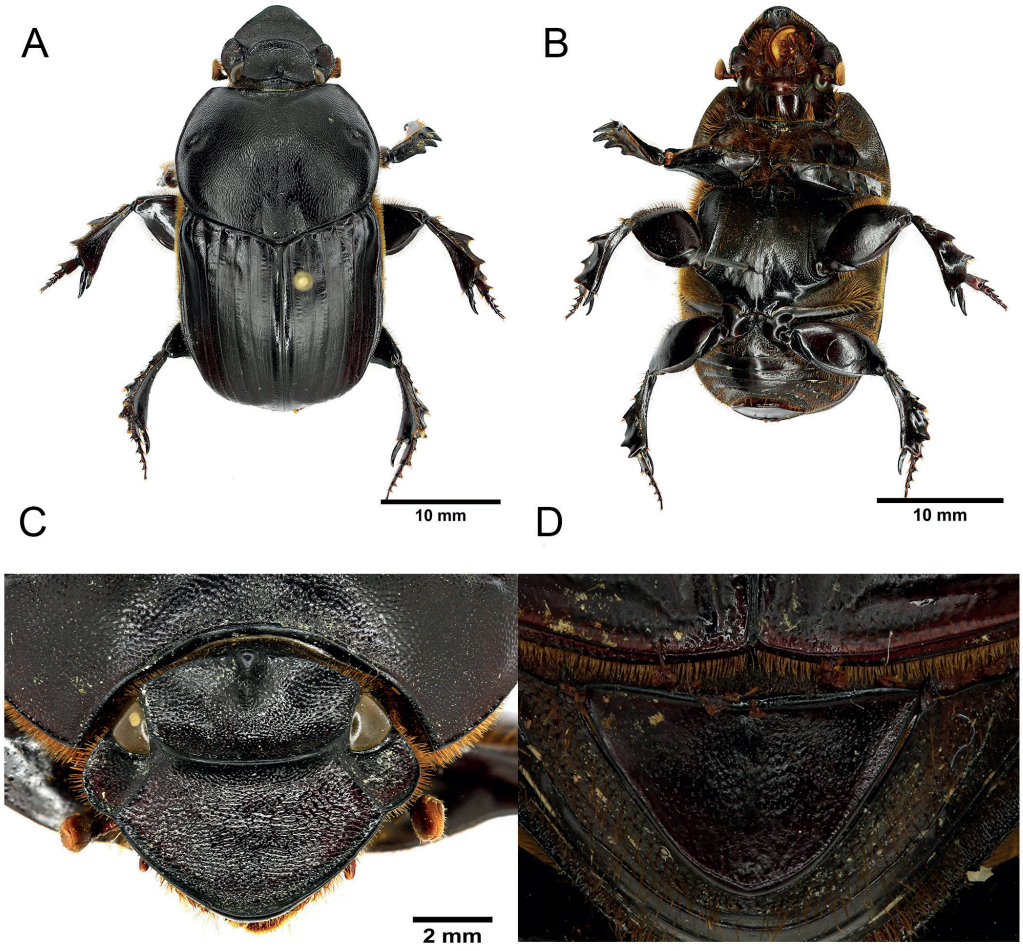

Fig. 3. *Onitis bordati* Cambefort, 1988, ♀, AIMB/Co/Sc1000018. **A**. Habitus, dorsal view. **B**. Habitus, ventral view. **C**. Head, dorsal view. **D**. Pygidium. (Images: AIMB).

Metasternal shield closely granular and densely hairy at the sides, less granular and hairy in the middle, smooth with imperceptible granules anteriorly and at the base. Sides of the metasternum finely, closely and evenly granular with dense hairs; the hairs shorter than those on the shield. Front legs elongate, tibia slender, strongly curved towards the end with the tip produced into a finger-like process, terminal spur absent, teeth short and triangular; lower side of protibia bears a tooth almost halfway from the base, a shorter one near the base and another short sharper one between these two, the inner side serrate. A tuft of short setae is present in an oval groove near the base of profemur, the upper margins of the legs fringed. The mesofemur is with a sharp tooth just beyond the middle of the lower edge, the hind femur without any teeth. The femoral teeth may not be prominent in minor males.

Aedeagus (in mm) (Fig. 4G–J). LP=3.5–4.5, Lp=4.5–5; BP=2, BpB=1.5, BpT=0.5. Phallobase straight. Parameres longer than the phallobase, broader at the base and further tapers and bluntly curved above at the tip.

Female (Fig. 3A–D)

Body oval, not as convex as male; clypeus elongate, strongly elliptical, slightly reflexed anteriorly, closely rugose. The posterior carina curved inwards, with a laterally compressed conical tubercle in the middle behind. Pygidium more shining than in male, rugose with imperceptible scattered granules. Profemur not toothed, tuft of short setae near the base absent. Protibia with an articulated terminal spur; teeth blunt, closer to each other than in male.

Distribution

India: Meghalaya, other countries: Vietnam, Thailand (Hanboonsong *et al.* 1999; Kabakov & Napolov 1999; Hanboonsong & Masumoto 2000; Schoolmeesters 2022).

Habitat

In India, this species was collected from bamboo dominated secondary forest near Nonkhyllem Wildlife Sanctuary, Meghalaya.

Remarks

Cambefort (1988) did not describe the female of *Onitis bordati*, but a female of the species deposited at MNHN was determined by Cambefort (1992) (https://shorturl.at/v4Dlr). In this paper, we provide a description for the female of *O. bordati* as Hanboonsong & Masumoto (2000) mentioned only some morphological characters. This is a new distribution record of the species from India and the Indian subcontinent.

Onitis brahma Lansberge, 1875
Figs 5B, 17

Onitis brahma Lansberge, 1875: 142 (original description).

Onitis brahma – Preudhomme De Borre 1881: 41 (catalogue). — Arrow 1931: 399 (keys, description). — Janssens 1937: 74 (revision). — Balthasar 1963: 45 (monograph). — Chandra 2000: 360 (distribution). — Chandra & Ahirwar 2005: 149 (distribution); 2007: 286 (distribution). — Sewak 2009b: 61 (distribution, diagnosis). — Chandra *et al.* 2011: 66 (distribution). — Chandra & Gupta 2012b: 817 (distribution). — Karimbumkara & Rajan 2013: 174 (distribution). — Gupta *et al.* 2014: 230 (distribution); 2015: 1034 (key, distribution, description). — Schoolmeesters 2022 (online catalogue).

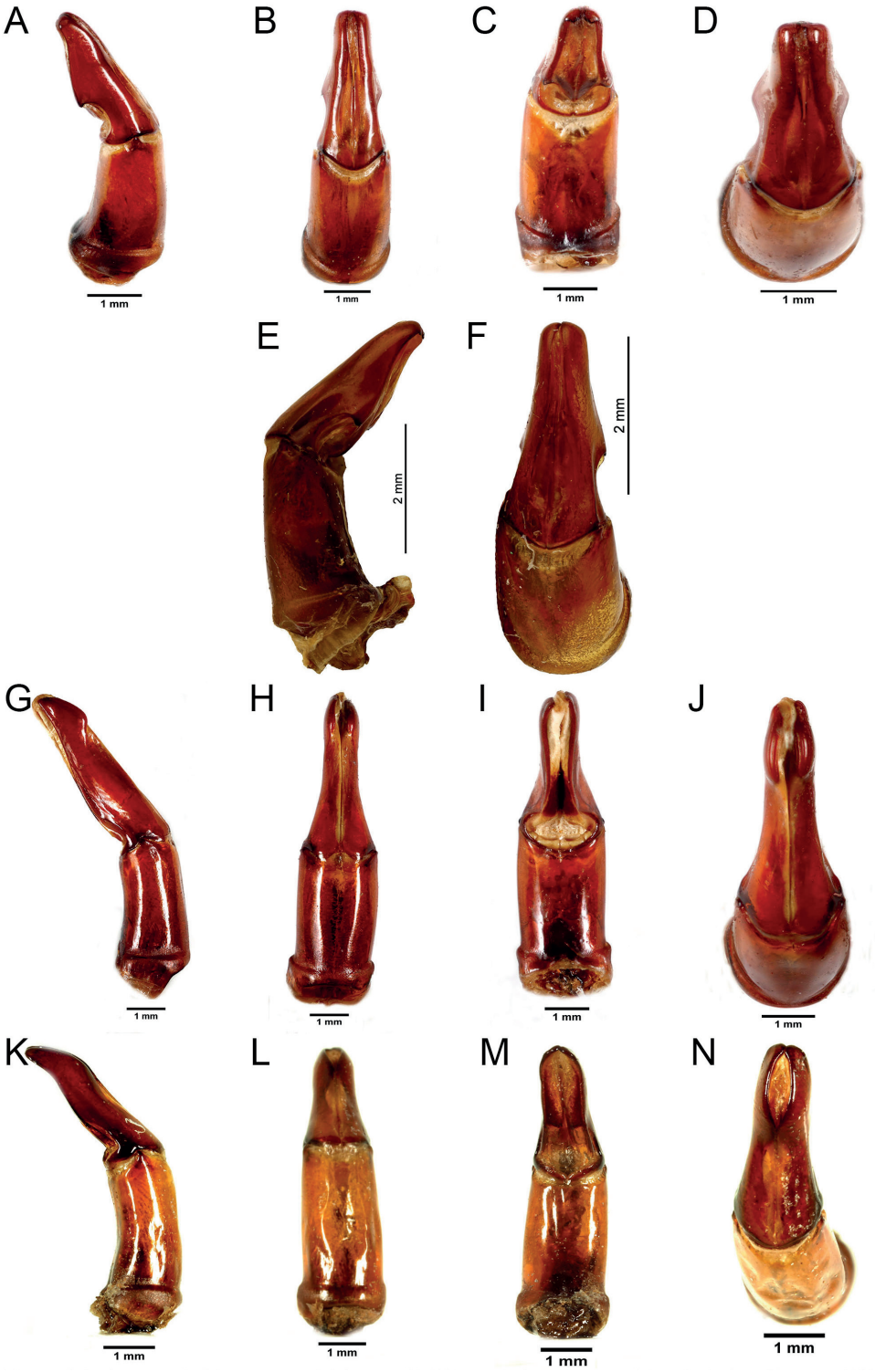

Fig. 4. A–D. *Onitis assamensis* Biswas, 1980, Aedeagus, lateral, dorsal, ventral and apical views, AIMB/Co/Sc1000001 (images: AIMB). **E–F**. *O. naviauxi* Cambefort, 1988, lateral and dorsal views, MNHN EC4807, (images: Antoine Mantilleri, MNHN). **G–J**. *O. bordati* Cambefort, 1988, aedeagus; lateral, dorsal, ventral and apical views, AIMB/Co/Sc1000016, (images AIMB). **K–N**. *O. siva* Gillet, 1911, aedagus, lateral, dorsal, ventral and apical views, AIMB/Co/Sc1000704, (images: AIMB).

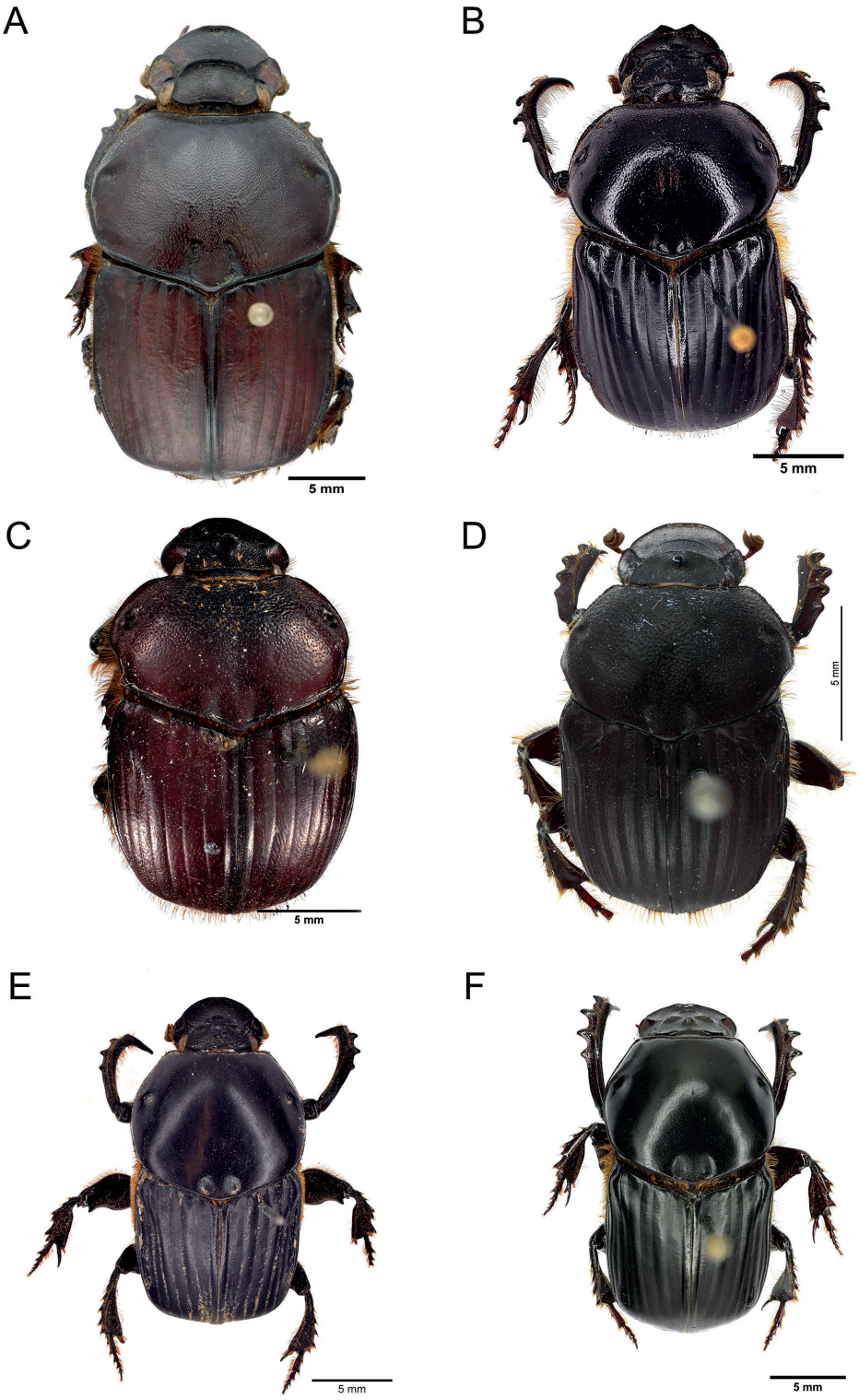

Fig. 5. A. *Onitis bordati* Cambefort, 1988, holotype, ♂, MNHN EC1187, (image: Antoine Mantilleri, MNHN). **B**. *O. brahma* Lansberge, 1875, ♂, BMNH (E) 1237157, (image: BMNH). **C**. *O.castaneus* Redtenbacher, 1848, syntype, (image: Harald Schillhammer, NHMW). **D**. *O. crassus* Sharp, 1875, holotype, ♂, MNHN EC4813, (image: Antoine Mantilleri, MNHN). **E**. *O. excavatus* Arrow, 1931, lectotype, ♂, BMNH (E) 1237173, (image: BMNH). **F**. *O. falcatus* (Wulfen, 1786), ♂, AIMB/Co/Sc1000070, (image: AIMB).

Differential diagnosis

Onitis brahma belongs to Group VII and is closer to *O. crassus* and *O. castaneus* in having a hairy pygidium and punctured pronotum but differs from both in having an interrupted frontal carina and strongly excised clypeus.

Material examined

Holotype

INDIA • ♂; "Mniszech, Ex-Musaeo Van Lansberge, Muséum Paris ex Coll. R. Oberthür 1952, A. Janssens vid., 1936: *Onitis brahma* Lansb.", MNHN EC4809.

Additional material (4 specimens)

INDIA • ♂, ♀; Dharwar, Bombay, "H. Swale. 1913–117", BMNH (E) 1237157, BMNH (E) 1237158 • ♂, ♀; Nerbuda Survey, Barra, Bewa State, 8 Mar. 1927; 2700 ft a.s.l.; ZSIM.

Description

Measurements (in mm). TL = 21–26; BW = 11–13.5.

Male

Black or dark brown; clypeus shining, not closely granulate; clypeal margin strongly reflexed, excised in the middle; head finely granulate; frontal carina interrupted in the middle; pronotum shining, pronotum rugose anteriorly and punctured behind; elytra deeply striate, intervals convex, unpunctured, not shining; pygidium sparingly punctured; scanty hairs on pygidium long; metasternum with close reddish hairs, a raised longitudinal ridge in the middle; fore legs elongate, femur bears a blunt anterior process near the extremity, tibia slender, strongly curved towards the tip, armed with four external teeth, a very sharp tooth beneath, before the middle and a long incurved terminal process; mesofemur with a sharp tooth near the middle of its lower edge; hind femur with a sharp outwardly directed tooth at its upper edge near the base and a blunt lobe before middle of the lower edge.

Female

Clypeus more densely granular, not shining; pronotum closely rugose on major part.

Distribution

India: Andhra Pradesh, Chhattisgarh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan, Tamil Nadu (Chandra 2000; Chandra & Ahirwar 2005, 2007; Sewak 2009b; Chandra & Gupta 2012b; Karimbumkara & Rajan 2013; Gupta *et al.* 2014, 2015; Schoolmeesters 2022).

Onitis castaneus Kollar, 1844
Figs 5C, 11A–D, 17

Onitis castaneus Kollar, 1844: 517 (original description).

Onitis castaneus – Lansberge 1875: 144 (revision). — Arrow 1931: 398 (keys, description). — Balthasar 1935: 92 (monograph); 1963: 46 (monograph). — Janssens 1937: 74 (revision). — Chandra 2000: 360 (distribution). — Mittal 2005: 46 (list). — Bezděk & Krell 2006: 159 (describing author, year correction). — Chandra & Ahirwar 2007: 287 (distribution). — Sewak 2009b: 61 (distribution, diagnosis). — Singh *et al.* 2010: 1394 (distribution). — Gupta *et al.* 2015: 1037 (checklist). — Bezděk 2016: 179 (describing author, year correction, distribution). — Ghosh *et al.* 2020: 238 (distribution). — Schoolmeesters 2022 (online catalogue).

Differential diagnosis

Onitis castaneus is similar to *O. brahma* and *O. crassus* in having a hairy pygidium and it differs from them in having tubercle on the clypeo-frontal carina while the tubercle is placed behind the clypeo-frontal carina in both the latter species. It differs from *O. brahma* in the frontal carina being entire; the clypeal margin being straight while the carina is interrupted and the clypeal margin is slightly excised in *O. brahma*. *Onitis castaneus* differs from *O. crassus* in having longer hairs on the pygidium while the latter has short setae.

Material examined

Syntype (3 specimens)
INDIA • ♂, 2 ♀♀; "Kaschmir, Hügel"; NHMW.

Additional material (17 specimens)
INDIA • ♂; "Kheri Forest, U.P. India., Jan' 16 HGC; H.G. Champion Coll., B.M. 1953-156.; *Onitis castaneus*, Redt. G. J. Arrow det."; BMNH (E) 1237151 • ♀; "Gazighat, Multan Div. Punjab, 15. 2. 28., C.F.C. Beeson; ex coll. Dehradun, B.M. 1928-472., ex Cattle dung;" BMNH (E) 1237152 • ♀; "Pilani, Rajasthan; 1957; Coll: H.L. Khandu, Det: T. G. Vazirani"; ZSIM • 10 ♂♂, 4 ♀♀; Assam, Tezpur, under Kolia bhomora bridge; hand-picked, cattle dung; 19 Dec. 2018; Rajkamal Goswami leg.; AIMB/Co/Sc1000023 to 1000036.

Description

Measurements (in mm). TL=16–19; BW=9.5–12; PL=6.5–7.5; PW=9–11; EL=8.5–10; HL=4.5–5.5; HW=5–6.

Male

Dark chestnut brown; head with strongly elevated frontal carina acuminate in the middle; clypeal margin strongly reflexed, straight in the middle, with long transverse arcuate carina, frontal carina straight, rugulose in front, with tubercle behind; vertex strongly excavated; pronotum unevenly punctured, strongly rugulose anteriorly, tuberculate between the basal foveae; front angles rather blunt, deep basal foveae closely placed; elytra opaque, finely striate, intervals flat, feebly punctured; pygidium sparsely hairy; metasternum closely tuberculate, hairy with a longitudinal median groove; front legs long, slender, strongly curved, armed with four short teeth externally, profemur with a strong oblique spine near the middle of anterior edge, middle tibia with two strong processes at its outer edge.

Aedeagus (in mm) (Fig. 11A–D). LP=3.03, Lp=2.78; BP=1.32, BpB=1.07, BpT=0.43. Parameres shorter than phallobase, dorsal side of parameres straight at the base, tip broader and curved and tip blunt.

Female

Protibia short, broad bearing four strong external teeth; clypeus more rounded in the middle than male; frontal tubercle more prominent.

Distribution

India: Arunachal Pradesh, Assam, Bihar, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Madhya Pradesh, Meghalaya, Punjab, Rajasthan, Uttarakhand, Uttar Pradesh, West Bengal. Other countries: Nepal; Pakistan (Chandra 2000; Mittal 2005; Bezděk & Krell 2006; Chandra & Ahirwar 2007; Sewak 2009b; Singh *et al.* 2010; Gupta *et al.* 2015; Bezděk 2016; Ghosh *et al.* 2020; Schoolmeesters 2022).

Onitis crassus Sharp, 1875
Figs 5D, 18

Onitis crassus Sharp, 1875: 48 (original description).

Onitis crassus – Arrow 1931: 400 (keys and description). — Janssens 1937: 73 (revision). — Balthasar 1963: 45 (monograph). — Chandra 2000: 360 (distribution); 2008: 176 (distribution). — Bezděk & Krell 2006: 159 (distribution). — Chandra & Ahirwar 2007: 287 (distribution). — Chandra *et al.* 2012b: 29 (distribution). — Siddiqui *et al.* 2014: 299 (distribution). — Ali *et al.* 2015: 4 (distribution). — Gupta *et al.* 2015: 1037 (checklist). — Bezděk 2016: 179 (distribution).

Onitis vischnu – Preudhomme de Borre 1881: xxxix (synonymised by Arrow 1931). — Schoolmeesters 2022 (online catalogue).

Differential diagnosis

Onitis crassus is closer to *O. castaneus* in having hairy pygidium and uninterrupted clypeo-frontal carina but differs from the latter in having short scanty setae on the pygidium; frontal tubercle being placed behind the carina while in *O. castaneus* it is placed on the carina and the anterior margin of clypeus being gently excised in the middle while in the latter it is reflexed and straight. See diagnosis of *O. brahma*.

Type material examined

Holotype

INDIA • ♀; "*Onitis crassus* Type D.S.; Ex. Musaeo D. Sharp 1890, G. J. Arrow vid. 1928, A. Janssens vid., 1936: *Onitis crassus* Sharp; Holotype (Red Label)"; MNHN EC4813.

Additional material examined (4 specimens)

INDIA • ♂; "Determined from description G.J.A. *Onitis Vischnu*, de Borre; *Onitis Vischnu* de Borre, Compared with type G.J.A., 6745, 7030"; BMNH (E) 1237163 • ♀; "Dehra Dun Coll. B.M. 1931–2., River Suswa, Dehradun, U.P. C. Beeson. XI.'30; Cattle dung on sand"; BMNH (E) 1237164 • ♂; "A, Janssens vid. 1936: *ONITIS crassus* Sharp; *Onitis crassus* Shp. Revis. Arrow 1926; *Onitis crassus* Shp. Compared with type G.J.A.; cf. Ann. Soc. Ent. Belg. Xxv, 1881, C.R. p. 39; Ex-Typis de Vischnu Borre; det: Predhomme Borre, *Onitis Vischnu* Borre; *O. Vishnu*, Reiche, India, 3050, Coll. J. Thomson" • ♀; same collection data as for preceding; IRSNB.

Description

Measurements (in mm). TL = 15.5–21; BW = 9–10.5.

Male

Black; clypeus rugulose, anterior margin strongly elevated; gently excised in the middle; frontal carina entire, curved, with a tubercle behind; pronotum strongly and closely punctured, rugose anteriorly; elytra finely striate, intervals angularly elevated along the middle, finely, fairly closely punctured; pygidium opaque, rugulose with short setae; metasternal shield smooth, shining, feebly, sparsely punctured, sides of metasternum rugosely punctured, with long hairs; front legs elongate with a blunt process on its trochanter; hind femur with a hooked process at the middle of its lower edge.

Female

Clypeal margin scarcely excised in the middle; protibia broad with four blunt teeth and an articulated spur.

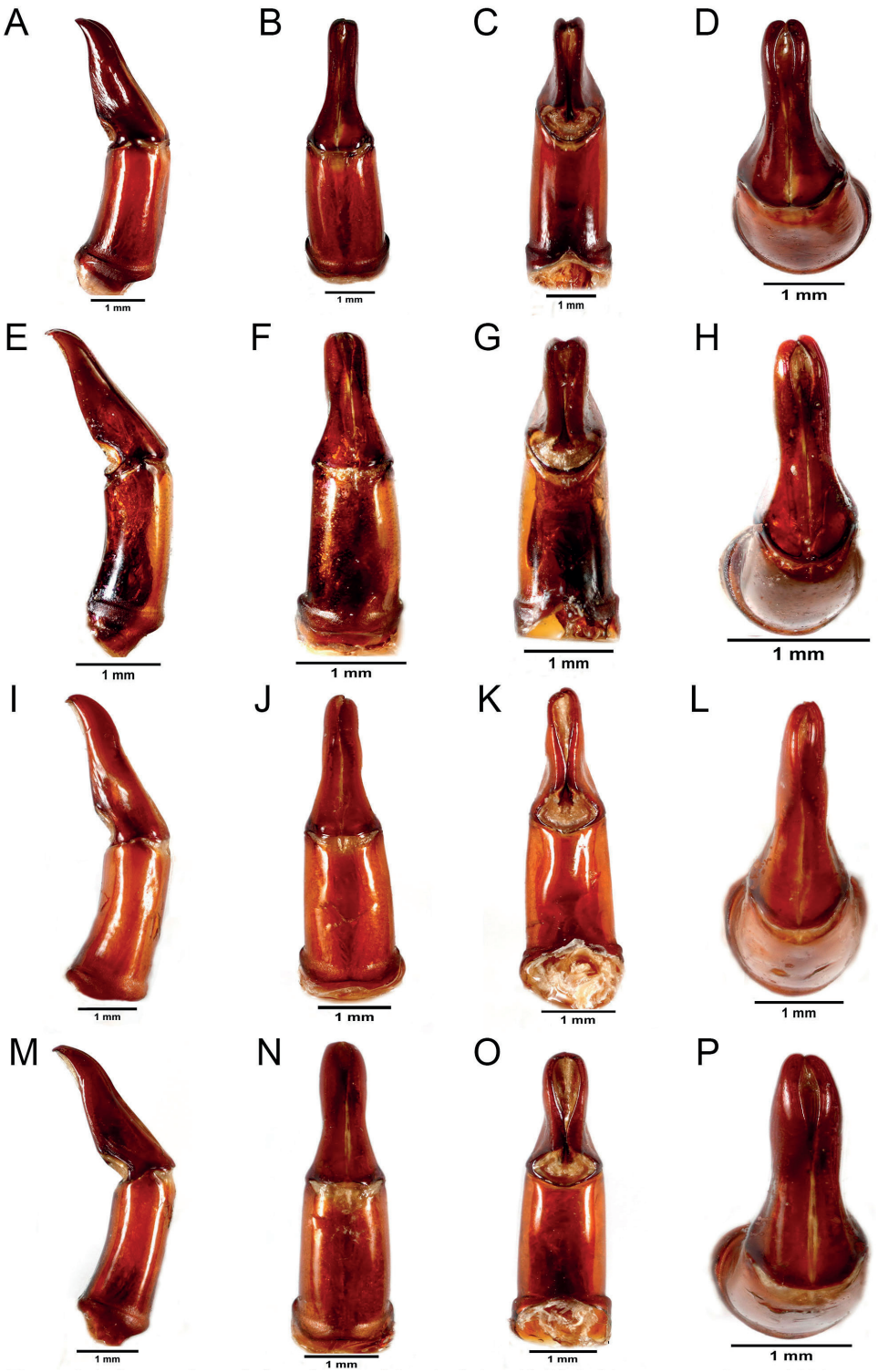

Fig. 6. Aedeagus, lateral, dorsal, ventral and apical views. **A**–**D**. *Onitis excavatus* Arrow, 1931, AIMB/Co/Sc1000037. **E**–**H**. *O. falcatus* (Wulfen, 1786), AIMB/Co/Sc1000070. **I**–**L**. *O. bhomorensis* sp. nov., NIM/NBAIR/COL/ONIT/H-271023A. **M**–**P**. *O. punctatostriatus* Janssens, 1937, AIMB/Co/Sc1000492. (Images: AIMB).

Distribution

India: Madhya Pradesh, Punjab, Uttarakhand, Uttar Pradesh. Other countries: Nepal; Pakistan (Chandra 2000; Bezděk & Krell 2006; Chandra & Ahirwar 2007; Chandra 2008; Chandra *et al.* 2012b; Siddiqui *et al.* 2014; Ali *et al.* 2015; Gupta *et al.* 2015; Bezděk 2016; Schoolmeesters 2022).

Onitis excavatus Arrow, 1931
Figs 5E, 6A–D, 18

Onitis excavatus Arrow, 1931: 391 (original description).

Onitis excavatus – Balthasar 1935: 93 (monograph); 1963: 37 (monograph). — Janssens 1937: 50 (revision); 1938: 2 (notes). — Biswas & Chatterjee 1985: 158 (distribution). — Mittal 2005: 46 (list). — Bezdek & Krell 2006: 159 (distribution). — Chandra *et al.* 2012a: 52 (distribution). — Siddiqui *et al.* 2014: 300 (distribution). — Gupta *et al.* 2015: 1037 (checklist). — Bezděk 2016: 179 (distribution). — Schoolmeesters 2022 (online catalogue).

Differential diagnosis

Onitis excavatus closely resembles *O. falcatus*, both placed in Group I. These two species are similar as the pronotum is smooth or sparingly punctured, and the former differs from the latter in having larger and broader body, a deep transverse excavation behind the middle of the metasternum and presence of strong sharp teeth at the extremity of mesofemur in male.

Type material examined

Lectotype

MYANMAR • ♂; "Tenasserim, Atkinson Coll.92–3, near *O. Ludekingi,* Lansb., but quite diff. by sculptures, *Onitis excavates* male Arr., M.E. Bacchus det. 1975"; BMNH (E) 1237173.

Additional material examined (29 specimens)

INDIA • 2 ♂♂, 5 ♀♀; Arunachal Pradesh, Pakke; 27°14′17.73″ N, 93°32′14.28″ E; elev. 877 m a.s.l.; hand-picked from elephant dung; 24 Sep. 2018; Priyadarsanan Dharma Rajan and team leg.; AIMB/Co/Sc1000037 to 1000044 • ♂, ♀; Arunachal Pradesh, Sibuk; 28°21′43.7184″ N, 95°15′57.1968″ E; elev. 956 m a.s.l.; 3 Oct. 2018; hand-picked from cow dung; Harsha Malhotra and team leg.; AIMB/Co/Sc1000045 to 1000046 • ♀; Arunachal Pradesh, community forest, Pasighat, Rani Village; 27°31′27.138″ N, 27°31′27.138″ E; elev. 1557 m a.s.l.; 9 Oct. 2018; hand-picked from donkey dung; Harsha Malhotra and team leg.; AIMB/Co/Sc1000047 • ♀; Arunachal Pradesh, Ziro, Talley Valley; 27°31′23.4984″ N, 93°50′22.0308″ E; elev. 1532 m a.s.l.; 10 Oct. 2018; hand-picked from cow dung; Harsha Malhotra and team leg.; AIMB/Co/Sc1000048 • ♂; Arunachal Pradesh, Sangri, Mobu; 27°14′1.5324″ N, 93°31′58.8576″ E; elev. 805 m a.s.l.; 18 Oct. 2018; hand-picked from mithun dung; Harsha Malhotra and team leg.; AIMB/Co/Sc1000049 • ♀; Arunachal Pradesh, Seijosa, Pakke Tiger Reserve; 26°56′56.2596″ N, 92°59′4.3764″ E; elev. 164 m a.s.l.; 23 Sep. 2018; hand-picked from elephant dung; Harsha Malhotra and team leg.; AIMB/Co/Sc1000050 • 6 ♂♂, 4 ♀♀; Arunachal Pradesh, Seijosa, Pakke Tiger Reserve; 26°56′31.128″ N, 92°58′17.76″ E; elev. 190 m; 24 Sep. 2018; hand-picked from elephant dung; Harsha Malhotra and team leg.; AIMB/Co/Sc1000051 to 1000060 • ♂; Arunachal Pradesh, Pasighat, Rani village; 27°58′6.0276″ N, 95°19′12.5328″ E; elev. 135 m a.s.l.; 29 Sep. 2018; hand-picked from cow dung; Harsha Malhotra and team leg.; AIMB/Co/Sc1000061 • ♂, ♀; Arunachal Pradesh, Pasighat, Rani village; 27°58′12.9324″ N, 95°19′20.5284″ E; elev. 125 m a.s.l.; 30 Sep. 2018; cow dung; Harsha Malhotra and team leg.; AIMB/Co/Sc1000061 to 1000062 • ♀; Nagaland, Mon District, Singphan Elephant Reserve; 25 Apr. 2021; hand-picked from cow dung; Seena Narayanan Karimbumkara and team leg.; AIMB/Co/Sc1000063.

Description

Measurements (in mm). TL = 19–25; BW = 13.

Male

Black, shining, elytra and pygidium subopaque; clypeus short, elliptical, moderately closely and finely rugulose; frontal carina widely interrupted in the middle, a short transverse clypeal carina anteriorly, a small tubercle behind, vertex irregularly granular; pronotum very smooth with irregular minute punctures anteriorly, longitudinal groove absent; elytra finely striate with 1st, 3rd and 5th intervals elevated, narrower, rest of the intervals flat; pygidium smooth, unpunctured; metasternum with very deep transverse excavation in the middle, metasternal shield thickly hairy anteriorly, smooth, shining behind; protibia elongate with a serrate carina upon anterior half beneath, four short external teeth and a sharp incurved terminal process; mesofemur with a rounded lobe in the middle of hind edge, two sharp teeth near extremity above and one beneath; trochanters of hind legs acutely produced.

Aedeagus (in mm) (Fig. 6A–D). LP = 3.03, Lp = 2.93; BP = 1.5, BpB = 1.14, BpT = 0.46. Parameres shorter than phallobase, straight above and slightly curved outwards below and hooked slightly at the tip.

Female

Legs simple, frontal carina slightly diagonal; punctation of the pronotum heavier and denser, elytral striae deeper than in male; metasternum without transverse pit.

Distribution

India: Arunachal Pradesh, Assam, Himachal Pradesh, Meghalaya, Nagaland, Uttarakhand, Uttar Pradesh. Other countries: China; Myanmar; Nepal; Pakistan; Taiwan; Thailand; Vietnam (Biswas & Chatterjee 1985; Mittal 2005; Bezděk & Krell 2006; Chandra *et al.* 2012a; Siddiqui *et al.* 2014; Ali *et al.* 2015; Gupta *et al.* 2015; Bezděk 2016; Schoolmeesters 2022).

Onitis falcatus (Wulfen, 1786)
Figs 5F, 6H, 18

Scarabaeus falcatus Wulfen, 1786: 14 (original description).
Onitis himaleyicus Redtenbacher, 1844: 518 (synonym).
Onitis kiuchii Masumoto 1995: 88 (synonym).

Onitis falcatus – Lansberge 1875: 126 (monograph). — Boucomont & Gillet: 1921: 17 (distribution). — Arrow 1931: 392 (key and description). — Balthasar 1935: 93 (monograph); 1963: 33 (monograph). — Janssens 1937: 44 (revision). — Paulian 1945: 142 (revision). — Biswas & Chatterjee 1985: 158 (distribution); 1991: 260 (distribution). — Chandra 2000: 360 (distribution); 2005: 150 (distribution). — Mittal 2005: 46 (list). — Rajan 2006: 108 (key, distribution). — Bezděk & Krell 2006: 159 (distribution). — Chandra & Ahirwar 2007: 276 (distributional). — Sewak 2009a: 36 (diagnosis, distribution); 2009b: 58 (diagnosis and distribution). — Singh *et al.* 2010: 1395 (distribution). — Sabu *et al.* 2011: 34 (list). — Chandra *et al.* 2012a: 52 (distribution). — Karimbumkara & Rajan 2013: 174 (distribution). — Gupta *et al.* 2015: 1037 (checklist). — Bezděk 2016: 179 (distribution). — Ghosh *et al.* 2020 (distribution). — Schoolmeesters 2022 (online catalogue).

Differential diagnosis

Onitis falcatus is similar to *O. excavatus* in having a minutely punctured pronotum but differs in the nature of rugosity on the clypeus, the presence of longitudinal groove on the pronotum and also in the shape of the body. (Also see remarks under *Onitis excavatus.*)

Type material examined

Syntypes (2 specimens)
INDIA • 2 ♀♀; "*O. himaleyicus*; TYPUS (Red card); Hugel: 170; Himaleyicus K. Redt."; Kashmir; specimen number not assigned; NHMW.

Additional material examined (125 specimens)
INDIA • ♂, ♀; "Darjiling, Singla, 1500 ft, Lord Carmichael's collection, May 1913"; ZSIM • 27 ♂♂, 16 ♀♀; Karnataka, BRT Tiger Reserve: Gombegallu evergreen forest; 6 Jun. 1999; 11°55′54.6 N, 77°11′3.48″ E; AIMB/Co/Sc1000064 to 1000106 • 6 ♂♂, 5 ♀♀; Karnataka, BRT Tiger Reserve: Kanneri moist deciduous forest; 28 May 1999; 11°53′43.62″ N, 77°8′9.48″ E; open cow dung bait traps; Priyadarsanan Dharma Rajan leg.; AIMB/Co/Sc1000107 to 1000117 • ♀; Karnataka, BRT Tiger Reserve: Purani dry deciduous forest; 18 May 1999; 12°1′55.2″ N, 77°7′52.68″ E; open cow dung bait traps; Priyadarsanan Dharma Rajan leg.; AIMB/Co/Sc1000118 • 9 ♂♂, 7 ♀♀; Karnataka, BRT Tiger Reserve: Honnametti Shola; Apr. 1998; 11°53′26.52″ N, 77°12′4.98″ E; open cow dung bait traps; Priyadarsanan Dharma Rajan leg.; AIMB/Co/Sc1000119 to 1000134 • 13 ♂♂, 5 ♀♀; Karnataka, BRT Tiger Reserve: Gummane Shola; May 1998; 12°1′10.2″ N, 77°10′30.66″ E; open cow dung bait traps; Priyadarsanan Dharma Rajan leg.; AIMB/Co/Sc1000135 to 1000152 • 2 ♂♂, ♀; Kerala, Wayanad, arecanut plantation; 14 Nov. 2010; open cow dung bait trap; Nisha, P. V. leg.; AIMB/Co/Sc1000153 to 1000155 • 4 ♂♂, 3 ♀♀; Kerala, Shendurney Wildlife Sanctuary, grassland; 8 May 2009; 08°51′41.8″ N, 77°08′00.5″ E; open cow dung bait traps; Kishore A. leg.; AIMB/Co/Sc1000156 to 1000162 • ♂, ♀; Kerala, Shendurney Wildlife Sanctuary, degraded forests; 3 Dec. 2009; 08°55′05.6″ N, 77°05′44.7″ E; open cow dung bait traps; Kishore A. leg.; AIMB/Co/Sc1000163 to 1000164 • ♂, Kerala, Shendurney Wildlife Sanctuary, rubber plantation; 5 May 2009; 08°51′41.8″ N, 77°08′00.5″ E; open cow dung bait traps; Kishore A. leg.; AIMB/Co/Sc1000165 • ♀; Kerala, Shendurney Wildlife Sanctuary, teak plantations; 8 Oct. 2008; open cow dung bait traps; Seena Narayanan Karimbumkara leg.; AIMB/Co/Sc1000166 • ♀; Mizoram, Pasighat, Kawlbem, Lengteng Wildlife Sanctuary; 23°52′16.6404″ N, 93°18′22.2408″ E; elev. 1500 m a.s.l.; 14 Apr. 2019; cow dung baited pitfall trap; Harsha Malhotra and team leg.; AIMB/Co/Sc1000167 • 5 ♂♂, 3 ♀♀; Arunachal Pradesh, agricultural field, Rani Village; 27°58′10.6068″ N, 95°19′26.1156″ E; elev. 131 m a.s.l.; 30 Sep. 2018; hand-picked from cow dung; Harsha Malhotra and team leg.; AIMB/Co/Sc1000168 to 1000175 • ♂, ♀; Arunachal Pradesh, community forest, Pasighat, Rani Village; 27°58′9.0156″ N, 95°19′18.9804″ E; elev. 133 m a.s.l.; 30 Sep. 2018; cow dung baited pitfall trap; Harsha Malhotra and team leg.; AIMB/Co/Sc1000176 to 1000177 • ♂; Arunachal Pradesh, Darak/Larmuk Pottom forest, West Siang; 28°12′12.6576″ N, 94°35′45.546″ E; elev. 434 m a.s.l.; 18 Nov. 2019, mithun dung baited pitfall; Harsha Malhotra and team leg.; AIMB/Co/Sc1000178 • 3 ♂♂, 2 ♀♀; Arunachal Pradesh, Kaying forest, West Siang; 15 Nov. 2019; cow dung, Harsha Malhotra and team leg.; AIMB/Co/Sc1000179 to 1000183 • ♀; Nagaland, Bongkolong village, near Intanki National Park, open ground; 15 Apr. 2021; hand-picked from cow dung; Seena Narayanan Karimbumkara leg.; AIMB/Co/Sc1000184.

MALAYSIA • ♀; "PERAK, F.M.S., Sep. 1907, Coll.; Ex. F.M.S. Museum., B.M. 1955–354; *Onitis falcatus* J. Gillet det. Wulf. 1923, S.E. Asia"; BMNH (E) 1237166.

Description

Measurements: TL: 16–23 mm; BW: 8–12 mm.

Male
Black, smooth, shining; clypeus elliptical, feebly excised in middle, moderately closely, finely rugulose; frontal carina widely interrupted, a short clypeal carina; pronotum finely and sparsely punctured without a median groove; elytra finely striate, 1st, 3rd and 5th intervals raised, striae very shallow, irregular punctures on sutural intervals; pygidium opaque, smooth, unpunctured; metasternal shield smooth,

feebly punctured, hairy anteriorly; protibia elongate with two or three minute teeth before the middle of the lower surface, a sharp incurved terminal process, a minute tooth near the end of the lower edge of the mesofemur.

Aedeagus (in mm) (Fig. 6E–H). LP=2, Lp=1.75; BP=1, BpB=0.5, BpT=0.25. Parameres shorter than phallobase, straight above and slightly curved below and hooked at the tip.

Female

Pronotum with stronger punctures; protibia uniformly curved with an articulated spur at the tip.

Distribution

India: Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Gujarat, Haryana, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Puducherry, Punjab, Rajasthan, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh, New Delhi, West Bengal. Other countries: Bangladesh; Bhutan; Cambodia; China; Laos; Myanmar; Malay Peninsula; Nepal; Pakistan; Philippines; Taiwan; Thailand; Vietnam (Biswas & Chatterjee 1985; Chandra 2000; Mittal 2005; Rajan 2006; Bezděk & Krell 2006; Chandra & Ahirwar 2007; Sewak 2009a, 2009b; Singh *et al.* 2010; Sabu *et al.* 2011; Chandra *et al.* 2012a; Karimbumkara & Rajan 2013; Gupta *et al.* 2015; Bezděk 2016; Ghosh *et al.* 2020; Schoolmeesters 2022).

Onitis feae Felsche, 1907

Figs 10A, 11E–H, 18

Onitis feae Felsche, 1907: 293 (original description).

Onitis feae – Boucomont & Gillet 1921: 17, 18 (distribution). — Arrow 1931: 397 (key, description). — Janssens 1937: 75 (revision). — Paulian 1945: 141(revision). — Singh *et al.* 2010: 1395 (list). — Gupta *et al.* 2015: 1037 (checklist). — Bezděk 2016: 179 (distribution). — Schoolmeesters 2022 (online catalogue).

Differential diagnosis

Onitis feae is distinct in having an elliptical clypeus and a sharply elevated frontal carina which is complete.

Type material examined

Cotype

MYANMAR • ♂; "Asciuii Cheba, 1200-1300 m, L. Fea. 1–88; Co-Typus (red label); Coll. C. Felsche, Kauf 20, 1918; Staatl. Museum für Tierkunde Dresden; SNSD".

Additional material examined (111 specimens)

INDIA • ♂; Meghalaya, Shillong, village near Northeast Hill University (NEHU); 31 Oct. 2012; Seena Narayanan Karimbumkara leg.; AIMB/Co/Sc1000185 • 2 ♂♂, ♀; Arunachal Pradesh, Mobu; 27°14′17.7324″ N, 93°32′14.28″ E; elev. 876 m a.s.l.; 19 Oct. 2018; hand-picked, mithun dung; Priyadarsanan Dharma Rajan and team leg.; AIMB/Co/Sc1000186 to 1000188 • 6 ♂♂, 5 ♀♀; Arunachal Pradesh, Aalong; 28°8′36.384″ N, 94°49′33.34″ E; elev. 317 m a.s.l.; 14 Nov. 2019; hand-picked, mithun dung; Sneha Haridas and team leg.; AIMB/Co/Sc1000189-1000199 • 13 ♂♂, 12 ♀♀; Arunachal Pradesh, West Siang, Aalong forest; 28°8′33.882″ N, 94°49′36.1848″ E; elev. 359 m a.s.l.; 14 Nov. 2019; cow dung baited pitfall trap; Sneha Haridas and team leg.; AIMB/Co/Sc1000200 to 1000224 • 17 ♂♂, 22 ♀♀; Arunachal Pradesh, West Siang, Kaying forest; 28°24′35.8668″ N, 94°41′51.4896″ E;

elev. 376 m a.s.l.; 15 Nov. 2019; cow dung baited pitfall trap; Sneha Haridas and team leg.; AIMB/Co/Sc1000225 to 1000263 • 10 ♂♂, 15 ♀♀; Arunachal Pradesh, West Siang, Darak/Larmuk Pottom forest; 28°12′17.568″ N, 94°35′49.3008″ E; elev. 489 m a.s.l.; 18 Nov. 2019; mithun dung baited pitfall trap; Sneha Haridas and team leg.; AIMB/Co/Sc1000264 to 1000288 • 2 ♂♂, 2 ♀♀; Arunachal Pradesh, Boru Raksap/Yardi Rabe Supse Wildlife Sanctuary; 28°15′56.1132″ N, 94°34′58.008″ E; elev. 529 m a.s.l.; 24 Nov. 2019; mithun dung baited pitfall trap; Sneha Haridas and team leg.; AIMB/Co/Sc1000289 to 1000292.

LAOS • ♀; "Xieng Khouang, 8.i.1919; R.V. de Salvaza; Indo-China, B.M. 1924-315; BMNH (E) 1237162, Southeast Asia".

MYANMAR • ♂; "ex Mus. Calcutta, B.M. 1930–1. Man Hpat, N. Tawngpeng, N. Shan States, Upper Burma, 11-ii-15., 4600 ft.; J. Coggin Brown; in dung; Southeast Asia;" BMNH (E) 1237161 • ♀; "Loi, Tawng Kyan, Tawng, N. Shan States, Upper Burma • ♂; Tawng Peng, Pansai, N.Shan States, Upper Burma, 4660 ft.".

Description

Measurements (in mm). TL = 15–20.5; BW = 8.5–11.5.

Male

Black, subopaque; head, lower surface and legs dark red; pygidium lower surface and fringe of elytra with reddish hairs; body oval, compact, convex; clypeus elliptical, finely, closely rugulose; forehead rugosely punctured with sharply elevated carina; clypeal carina short, transverse, slightly curved; vertex with a short transverse curved carina before carinate posterior margin of head; pronotum strongly, closely punctured, with feeble median groove, base margined, basal foveae very deep, space between them finely rugose; elytra very convex, opaque, finely striate with intervals carinate along middle; pygidium feebly rugulose, thinly clothed with erect, long reddish hairs; metasternum granular, broadly grooved in the middle; abdomen hairy at sides, smooth in the middle; profemur with sharp tooth near middle of front edge; protibia with finely serrate carina beneath and a tooth near base; middle coxa toothed at its posterior end.

Aedeagus (in mm) (Fig. 11E–H). LP = 2.86, Lp = 2.68; BP = 1.25, BpB = 1.07, BpT = 0.36. Phallobase and parameres almost of same size; parameres straight above and slightly curved below with the tips blunt and rounded.

Female

Clypeus extended and reflexed anteriorly, slightly notched; no sharp tooth on underside of protibia and profemur.

Distribution

India: Assam, Arunachal Pradesh, Meghalaya, Mizoram; Other countries: China; Laos; Myanmar; Thailand (Singh *et al.* 2010; Gupta *et al.* 2015; Bezděk 2016; Schoolmeesters 2022).

Onitis humerosus (Pallas, 1771)
Figs 10B, 18

Scarabaeus humerosus Pallas, 1771: 462 (original description).
Scarabaeus menalcas Pallas, 1781: 4.
Onitis chevrolati Lucas 1846: pl. 23.
Onitis humerosus violaceus Sahlberg, 1913: 119.

*Onitis humerosus viridipenni*s Mikšić, 1950: 165–167.
Onitis humerosus violaceipennis Mikšić, 1950: 165–167.
Onitis humerosus cupripennis Balthasar, 1963: 48.

Scarabaeus humerosus – Castelnau 1840: 89 (natural history). — Lansberge 1875: 116 (monograph). — Bedel 1892: 268, 271 (revision). — Reitter 1892: 97 (keys). — Arrow 1931: 390 (identification key, description). — Porta 1932: 414 (distribution). — Balthasar 1935: 91 (monograph); 1963: 47 (monograph). — Janssens 1937: 91 (revision). — Hashmi & Tashfeen 1992 (distribution). — Awal 2006: 170 (distribution). — Bai 2006: 391 (identification key). — Bezděk & Krell 2006: 159 (distribution, synonyms). — Bunalski *et al.* 2014: 156 (list of species). — Siddhiqui *et al.* 2014: 300 (distribution). — Bezděk 2016: 179 (distribution, synonyms). — Bunalski *et al.* 2016: 36 (distribution). — Montreuil 2017: 265 (distribution). — Schoolmeesters 2022 (online catalogue).

Differential diagnosis

Onitis humerosus is a very distinct species having bright yellow elytra with longitudinal green lines upon elevated sutures.

Type material examined

Syntypes (5 specimens)

RUSSIA • 3 ♂♂, 2 ♀♀; "*Scarabaeus menalcas*; MfN Janssens det. as *Onitis humerosus*in 1938; Hist.-Coll. (Coleoptera), Nr. 26753, *Onitis menalcas* Pallas, 1781, Russia austr., Bob., Zool. Mus. Berlin; Red Label: SYNTYPUS, *Scarabaeus menalcas* Pallas, 1781, labelled by MNHUB 2007"; MfN.

Additional material examined (7 specimens)

ISRAEL • ♂; "*Onitis humerosus* Pallas, Mid. East; Jerusalem, G.R. Crotch., Nevinson Coll., 1918-14"; BMNH (E) 1237143 • ♀; "*Onitis humerosus* Pallas, Mid. East; Pascoe, Coll. 93–60;" BMNH (E) 1237144.

Description

Measurements (in mm). TL = 12.5–18.5; BW = 7–10.

Male

Bright metallic green, coppery, indigo-blue or violet, the elytra bright yellow with four narrow longitudinal green lines on the elevated 1st, 3rd and 5th intervals, pale intervals with light metallic lustre; body oval, convex, not very shining; head closely covered with fine tubercles; clypeus parabolic, rugose with yellow setae, clypeal carina curved, elevated, near to clypeal margin; frontal carina entire with a tubercle behind; pronotum metallic green, unevenly punctured posteriorly, front angles granular, basal foveae deep, close with granules anteriorly; elytra finely striate with sutural, 3rd and 5th intervals elevated, shining, finely punctured, the other intervals opaque, scarcely punctured; pygidium shining, finely, sparsely granular; metasternum with a longitudinal groove, metasternal shield broad, granular and thinly covered with hairs anteriorly, sparingly punctured behind, sides of metasternum closely granular and hairy; protibia elongated, slender with a strong tooth at the middle of the lower surface; hind femur with a very strong hooked tooth near the middle of its upper edge.

Female

Clypeal carina long, curved, space between the carina and front margin covered with long yellow, close-lying hairs; legs short, stout, protibia with four strong teeth and an articulated spur.

Distribution

Afghanistan; Albania; Armenia; China; Cyprus; Georgia; Iran; Israel; Jordan; Kazakhstan; Kyrgyzstan; Lebanon; Pakistan; Russia; Syria; Tajikistan; Turkey; Turkmenistan; Uzbekistan (Hashmi & Tashfeen 1992; Awal 2006; Bezděk & Krell 2006; Siddhiqui *et al.* 2014; Bezděk 2016; Bunalski *et al.* 2016; Montreuil 2017; Schoolmeesters 2022).

Onitis kethai sp. nov.
urn:lsid:zoobank.org:act:C3F62D8F-89D9-4034-A209-382401D8B861
Figs 7, 8A–D, 9C, 14C, 15C, 16C, 18

Differential diagnosis

Onitis kethai sp. nov. can be easily distinguished from *O. philemon* in having stronger and more closely placed punctures on the pronotum; genae smoothly rounded in *O. kethai*, while strongly rounded in *O. philemon*, both inconspicuously punctured. The clypeus is rugulose in *O. kethai* (Fig. 9C); while in *O. philemon* it is granular in male (Fig. 9D) and rugose in female. *Onitis singhalensis* differs from both these species in having strong rounded granules on clypeus and head while the genae are sparingly granular (Fig. 9F). In *O. kethai* the space between the clypeal carina, frontal carina and the tubercle behind is strongly rugose, while in *O. philemon* and *O. singhalensis* it is granular. Differences were also observed on comparing the aedeagus of *O. kethai* (Fig. 8A–D), *O. philemon* (Fig. 8E–H) and *O. singhalensis* (Fig. 8I–L).

Etymology

Named in memory of our field assistant, the late Mr Ketha Gowda who assisted PDR in many of his field trips and helped in sampling dung beetles and other insects.

Type material examined

Holotype

INDIA • ♂; Karnataka, Biligiri Rangaswamy temple Tiger Reserve, Honnametti shola; 11°54′7.68″ N, 77°11′33.84″ E; open cow dung bait trap; 10 May 1998, Priyadarsanan Dharma Rajan leg.; specimen deposited at NBAIR, NIM/NBAIR/COL/ONIT/H-271023B.

Paratypes (13 specimens)

INDIA • 8 ♂♂, 5 ♀♀; Karnataka, Biligiri Rangaswamy temple Tiger Reserve, Honnametti shola; 11°54′7.68″ N, 77°11′33.84″ E; open cow dung bait trap; 10 May 1998; Priyadarsanan Dharma Rajan leg.; AIMB/Co/Sc1000293 to 1000305.

Description

Measurements (in mm). TL = 11.5–15; BW = 6–7.5; PL = 4–6; PW = 6–8; EL = 6.5–8; HL = 3–3.5; HW = 3–4.5.

Male (holotype)

Body, elytra, head, legs, antenna and mouthparts reddish, elytra red with a tinge of metallic green; oval, slightly convex. Head (Fig. 9C) closely granular with some rugosity, hind part almost smooth; clypeus parabolic, rugulose, margin slightly reflexed; with a feeble emargination in the middle, separated from the vertex by an interrupted frontal carina with a short curved clypeal carina and a blunt tubercle behind; genae with scattered imperceptible punctures. Pronotum (Fig. 14C) strongly and closely punctured in the middle, less closely at the sides, more strongly and closely pitted anteriorly, with a very slight median line starting above the basal impression, extending almost

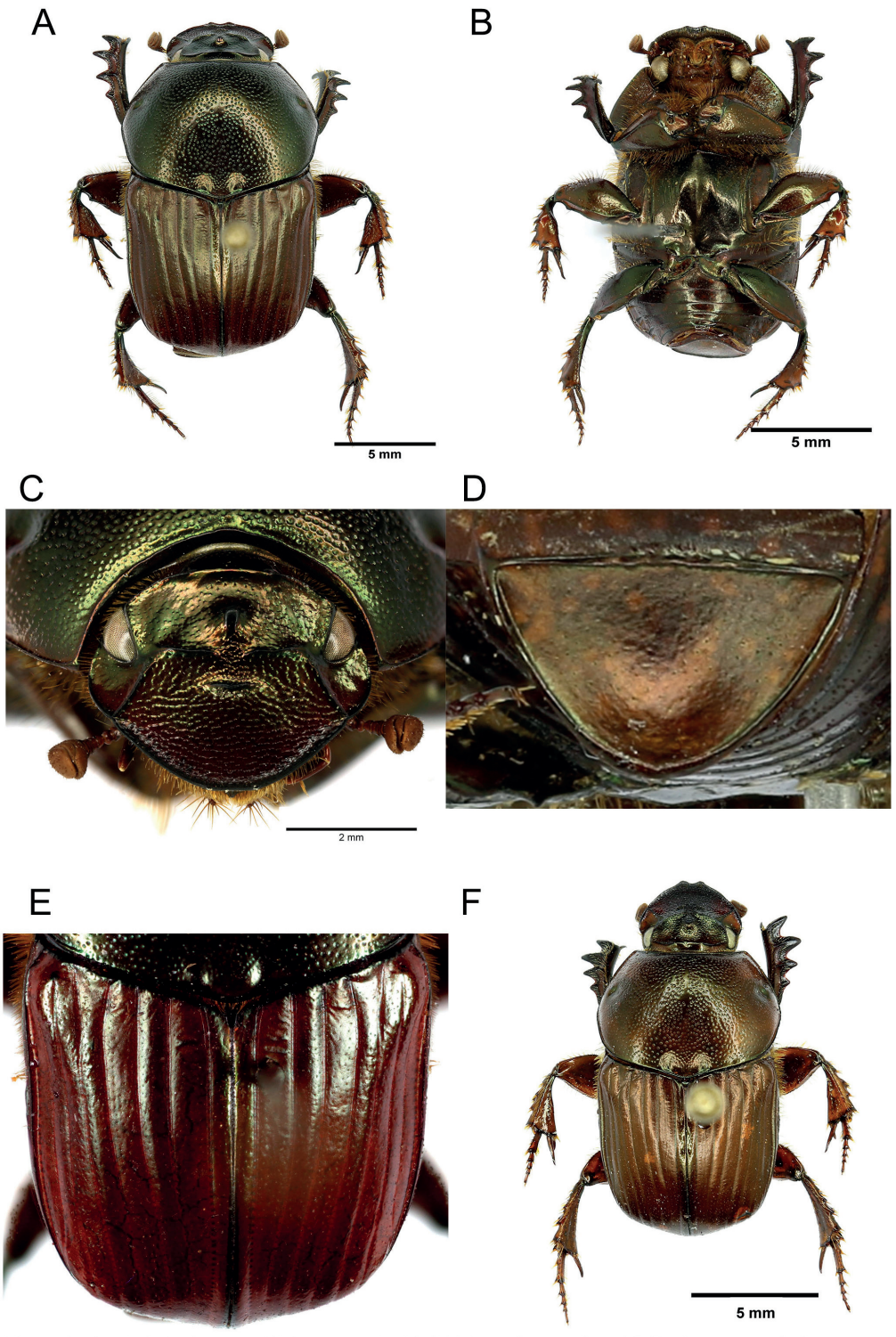

Fig. 7. *Onitis kethai* sp. nov. **A–E**. Holotype, ♂, NIM/NBAIR/COL/ONIT/H-271023B. **A**. Habitus, dorsal view. **B**. Habitus, ventral view. **C**. Head, dorsal view. **D**. Pygidium. **E**. Elytra. **F**. Paratype, ♀, habitus, dorsal view. (Images: AIMB).

up to the anterior margin as thin smooth area; anterior sides of pronotum slightly curved, strongly rounded in the middle, bisinuate behind; front angles sharp, base bluntly angulate in the middle; basal fovea deep near the base with imperceptible punctures in circular rows at the periphery**.** Elytra strongly striate, striae without punctures, elytral intervals finely and sparsely punctured with the 1st, 3rd and the 5th intervals convex, sutural interval shining while the rest opaque. Pygidium not shining, imperceptibly punctured**.** Metasternum with deep broad longitudinal groove in the front, metasternal shield imperceptibly punctured, with scattered aciculate punctures at the sides anteriorly; sides of the metasternum granular and thinly covered with long hairs. Protibia slightly curved with four strong external teeth and a sharp process at the tip, profemur not toothed; mesofemur (Fig. 16C) plain and curved near the tibial joint where it forms a sharp tooth-like process on both upper and lower ridges; hind trochanter slightly toothed.

Aedeagus (in mm) (Fig. 8A–D). LP = 2.5, Lp = 2.2; BP = 1.3, BpB = 1, BpT = 0.5. Phallobase longer than parameres. Parameres slightly sinuate near the base, curved inwards anteriorly and hooked at the tip.

Female

Clypeus closely rugose; protibia with four strong teeth and an articulated spur; no protrusions on the legs.

Habitat

The collections were made in the cloud forests of Honnametti in Biligiri Rangaswamy Temple Tiger Reserve, Karnataka, India.

Onitis lama Lansberge, 1875
Figs 10C, 11I–L, 19

Onitis lama Lansberge, 1875: 53, 123 (original description).

Onitis lama – Preudhomme De Borre 1881: 40 (catalogue). — Arrow 1931: 389 (key and description). — Balthasar 1935: 88 (monograph); 1963: 44 (monograph). — Janssens 1937: 72 (revision). — Mittal 2005: 46 (distribution). — Bezděk & Krell 2006: 159 (distribution). — Sewak 2009a: 36 (diagnosis, distribution); 2009b: 58 (diagnosis, distribution). — Thakare *et al.* 2012: 78 (distribution). — Siddiqui *et al.* 2014: 300 (distribution). — Gupta *et al.* 2015: 1037 (checklist). — Bezděk 2016: 179 (distribution). — Ghosh *et al.* 2020: 238 (distribution). — Schoolmeesters 2022 (online catalogue).

Differential diagnosis

Onitis lama is the sole member of Group V (Janssens 1937). It has an uninterrupted frontal carina, and a short clypeal carina.

Type material examined

Syntypes (2 specimens)

INDIA • 2 "♂♂; "*Lama* Lansb. India bor. Typus, Ex-Musaeo Van Lansberge, Museum Paris ex Coll. R. Oberthur, A. Janssens vid., 1936: *Onitis lama* Lansb. 1875, Type, Syntype; Polsky, Himalaya, *O. lama* typ. Lansbrg., Ex musaeo E. Harold, Museum Paris ex Coll. R. Oberthur, A. Janssens vid., 1936: *Onitis lama* Lansb., 1875, Syntype"; MNHN EC4810–EC4811.

Additional material examined (9 specimens)

INDIA • ♂; "Punjab, Nevinson Coll. 1918-14"; BMNH (E) 1237147 • ♀; "Uttarakhand, Kumaon, W. Almora, India. H.G.C., H.G. Champion Coll., B.M. 1953-156., *Onitis lama,* Lansb., G.J. Arrow

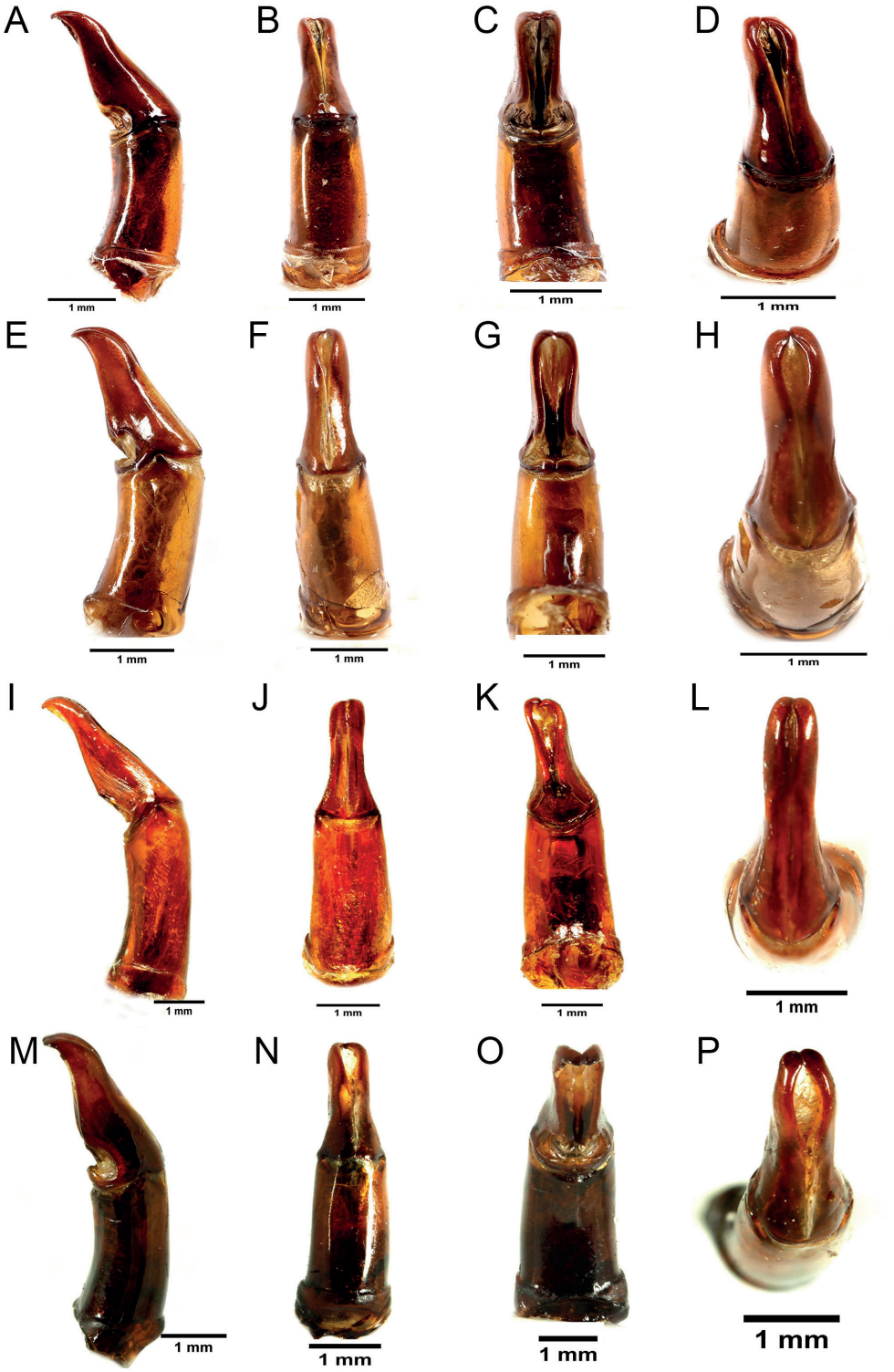

Fig. 8. Aedeagus, lateral, dorsal, ventral and apical views. **A**–**D**. *Onitis kethai* sp. nov., NIM/NBAIR/COL/ONIT/H-271023B. **E**–**H**. *O. philemon* Fabricius, 1801, AIMB/Co/Sc1000317. **I**–**L**. *O. singhalensis* Lansberge, 1875, AIMB/Co/Sc1000684. **M**–**P**. *O. visthara* sp. nov., NIM/NBAIR/COL/ONIT/H-271023C. (Images: AIMB).

det."; BMNH (E) 1237148 • ♂; "*Onitis lama*, Det. J.J.E. Gillet; ZSIM • 2 ♂♂, 2 ♀♀; Tamil Nadu, Tirunelveli, Radhapuram"; open cow dung bait trap, 20 Dec. 2016, Chian leg.; AIMB/Co/Sc1000306 to 1000309.

Description

Measurements (in mm). TL = 19–24, BW = 11–13.

Male

Black, shining; head with an entire, strongly elevated, slightly arcuate frontal carina, clypeal carina short, curved, closer to clypeal margin; pronotum distinctly, moderately closely punctured anteriorly and extremely minutely behind; front angles blunt, sides strongly rounded, base completely margined and lobed between basal foveae; elytra with fine striae, smooth intervals, sutural intervals with few scattered punctures, posterior edge with short fringe of erect yellow hairs; pygidium smooth, opaque with very minute scanty punctures**;** metasternum with a narrow longitudinal groove, metasternal shield smooth in the middle and behind, flat and fairly strongly punctured anteriorly and sides, the sides of the metasternum densely punctured and hairy. Clypeus deeply excised in the middle, not very closely rugulose; posterior part of head very finely and sparsely punctured; profemur with a very sharp oblique tooth beyond the middle of its lower edge, protibia elongate, armed with four short external teeth, a strong sharp tooth on the lower face before the middle and three or four minute tubercles and an incurved apical process, hind femur rather long, straight with a tooth near the end of the lower edge, trochanter little produced at the tip and hind tibia finely serrate along its inner edge.

Aedeagus (in mm) (Fig. 11I– L). LP = 3.035, Lp = 2.57; BP = 1.43, BpB = 0.93, BpT = 0.36. Phallobase longer than parameres which are blunt, slightly sinuate near the base, curved inwards anteriorly and hooked at the tip.

Female

Clypeus closely rugulose, its front margin entire and slightly truncate, pronotum more strongly punctured anteriorly than male, protibia broad, armed with four blunt external teeth and a small articulated terminal spur.

Distribution

India: Andhra Pradesh, Gujarat, Haryana, Himachal Pradesh, Maharashtra, Punjab, Rajasthan, Tamil Nadu, Uttarakhand, Uttar Pradesh. Other countries: Nepal, Pakistan (Mittal 2005; Bezděk & Krell 2006; Sewak 2009a, 2009b; Thakare *et al.* 2012; Siddiqui *et al.* 2014; Gupta *et al.* 2015; Bezděk 2016; Ghosh *et al.* 2020; Schoolmeesters 2022).

Onitis naviauxi Cambefort, 1988
Figs 4E–F, 10D, 19

Onitis naviauxi Cambefort, 1988: 189 (original description).

Onitis naviauxi – Bezděk & Krell 2006: 159 (distribution). — Bezděk 2016: 179 (distribution). — Schoolmeesters 2022 (online catalogue).

Differential diagnosis

Cambefort (1988) classified *Onitis naviauxi* in Group III of Janssens (1937). It is similar to *O. assamensis* in having vertex with punctures and clypeal carina being placed away from vertex. It is distinct from the

latter in having shorter clypeal carina and the male protibia having 3–4 teeth on the inferomedial ridge, while in *O. assamensis* there are 6–7 teeth.

Type material examined (based on images)

Holotype

NEPAL • ♂; "*Onitis naviauxi* n. sp. Y. Cambefort det. 1987, Nepal: Sauraha. Alt. 150, 19.4.82 RN"; MNHN EC4807.

Paratype

NEPAL • ♀; "*Onitis naviauxi* n. sp.Y. Cambefort det. 1987, Nepal: Sauraha. Alt. 150, 19.4.82 RN"; MNHN EC4808.

Description

Measurements (in mm). TL = 20–25. BW = 10–12.

Male

Bronzy green, shining; head rounded, slightly flattened anteriorly; clypeus with fine, sparse punctuation, slightly rugose behind; clypeal carina present, short; frontal carina narrowly interrupted in the middle, with a fairly strong sharp tubercle behind; vertex with smooth punctures; pronotum with simple, strong and dense punctures on the disc, finer, more sparse anteriorly, almost imperceptible at the sides; base not bordered, basal foveae round and placed apart; scutellum very small; elytra smooth, striae broad, not very deep, intervals minutely and sparsely punctured; pygidium convex, very minutely punctured; metasternal shield with shallow longitudinal groove, sparse fine long hairs, the sides granulate anteriorly. Clypeus reflexed, straight in the middle. Profemur with a strong tooth on the antero-median ridge, protibia short, tridentate on the infero-internal ridge, median femur unarmed, tibia toothed on the dorsal side, posterior femur with a strong tooth on the ridge below, directed towards the back, tibia bilobed at the apex.

Aedeagus (Fig. 4E–F). Parameres shorter than the phallobase, phallobase cylindrical, slightly curved; parameres straight above and curved below, largely notched on the underside.

Female

Similar to male but more elongated head, clypeus parabolic, not much reflexed, rugose; with confluent transverse rugulosity behind the clypeal carina; vertex as in the male, with simple, very sparse punctuation; metasternum with well-marked narrow groove; legs not toothed.

Distribution

Nepal (Cambefort 1988; Bezděk & Krell 2006; Bezděk 2016; Schoolmeesters 2022).

Onitis philemon Fabricius, 1801
Figs 8E–H, 9D, 10E, 14D, 15D, 16D, 19

Onitis philemon Fabricius, 1801: 3 (original description).
Onitis distinctus Lansberge, 1875: 138 (synonym).
Onitis minor Lansberge, 1875: 139 (synonym).

Onitis philemon – Bates 1891: 10 (list). — Arrow 1931: 393 (key, description). — Balthasar 1935: 95 (monograph); 1963: 41 (monograph). — Janssens 1937: 53 (revision). — Paulian 1945: 144 (revision). — Biswas & Chatterjee 1991: 260 (distribution). — Chandra 2000: 360 (distribution); 2005: 150 (distribution); 2009a: 81 (list, distribution). — Mittal 2005: 46 (list). — Chandra & Ahirwar

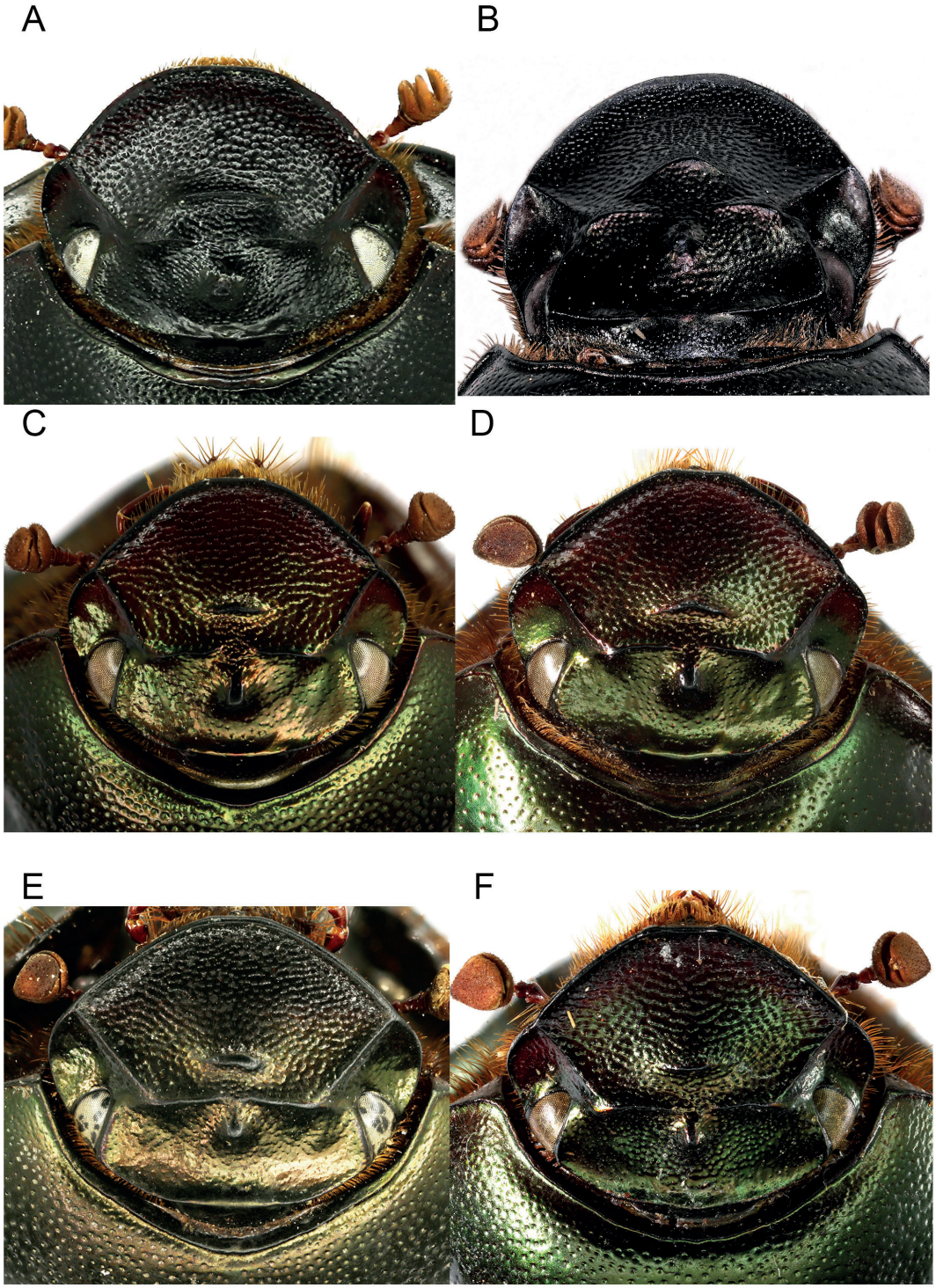

Fig. 9. Head of male specimens. **A**. *Onitis bhomorensis* sp. nov., holotype, NIM/NBAIR/COL/ONIT/H-271023A. **B**. *O. punctatostriatus* Janssens, 1937, AIMB/Co/Sc1000492 . **C**. *O. kethai* sp. nov., holotype, NIM/NBAIR/COL/ONIT/H-271023B. **D**. *O. philemon* Fabricius, 1801, AIMB/Co/Sc1000317. **E**. *O. visthara* sp. nov., holotype, NIM/NBAIR/COL/ONIT/H-271023C. **F**. *O. singhalensis* Lansberge, 1875, AIMB/Co/Sc1000684. (Images: AIMB).

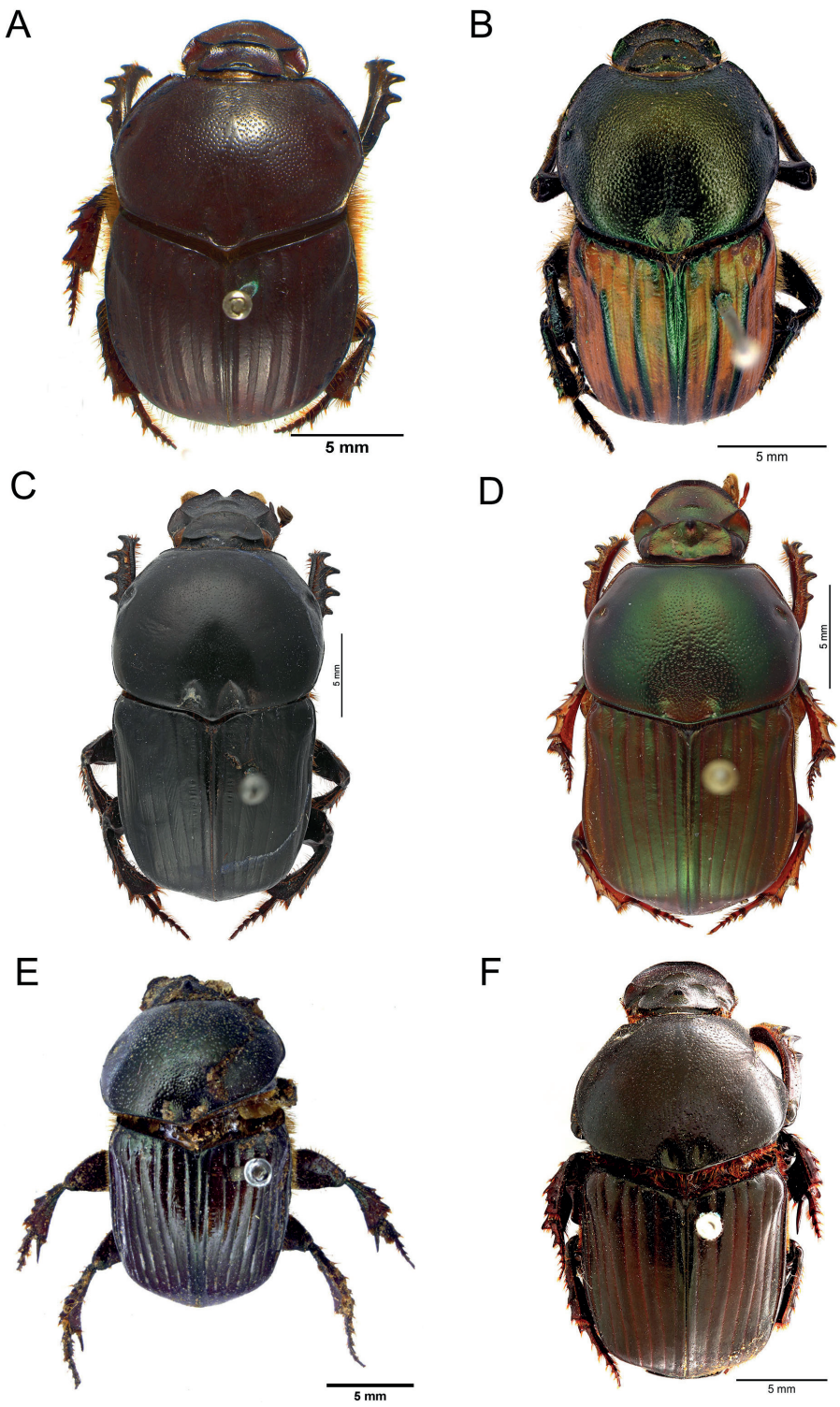

Fig. 10. A. *Onitis feae* Felsche, 1907, cotype, (image: Olaf Jäger, SNSD). **B**. *O. humerosus* (Pallas, 1771), BMNH (E) 1237143, (image: BMNH). **C**. *O. lama* Lansberge, 1875, syntype, ♂, MNHN EC4810, (image: Antoine Mantilleri, MNHN). **D**. *O. naviauxi* Cambefort, 1988, holotype, ♂, MNHN EC4807, (image: Antoine Mantilleri, MNHN). **E**. *O. philemon* Fabricius, 1801, lectotype, ZMUK Fabricius 003706, (image: Alexey Solodovnikov, ZMUC). **F**. *O. punctatostriatus* Janssens, 1937, holotype, ♂, (image: Jonathan Brecko, IRSNB).

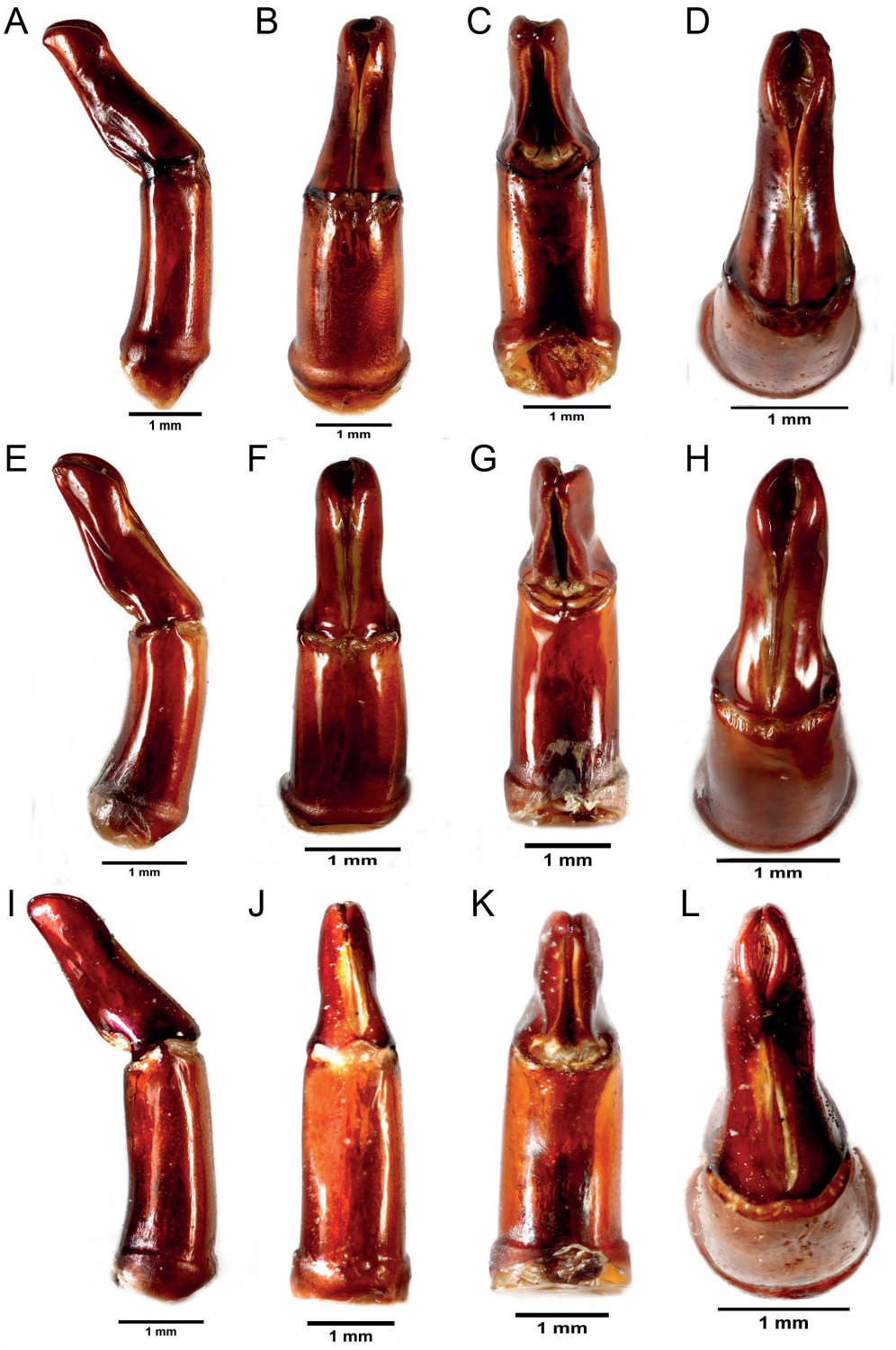

Fig. 11. Aedeagus, lateral, dorsal, ventral and apical views. **A**–**D**. *Onitis castaneus* Kollar, 1844, AIMB/Co/Sc1000027. **E**–**H**. *O. feae* Felsche, 1907, AIMB/Co/Sc1000188. **I**–**L**. *O. lama* Lansberge, 1875, AIMB/Co/Sc1000307. (Images: AIMB).

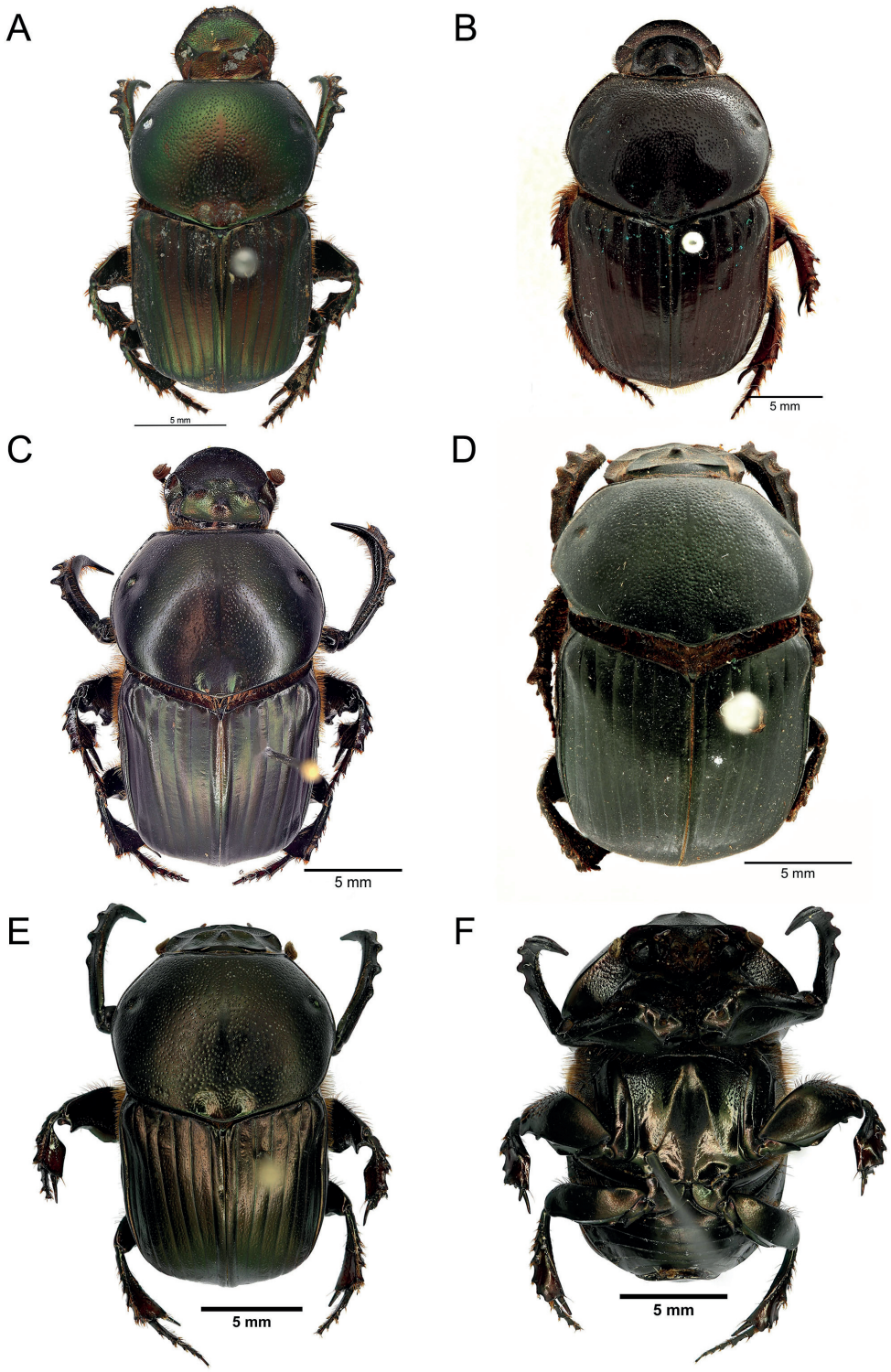

Fig. 12. A. *Onitis singhalensis* Lansberge, 1875, holotype, ♂, MNHN EC4812, (image: Antoine Mantilleri, MNHN.) **B**. *Onitis siva* Gillet, 1911, holotype, ♀, (image: Jonathan Brecko, IRSNB). **C**. *O. subopacus* Arrow, 1931, holotype, ♂, BMNH(E)1237174, (image: BMNH). **D**. *O.virens* Lansberge, 1875, paralectotype, ♂, (image: Jonathan Brecko, IRSNB). **E–F** *Onitis visthara* sp. nov., holotype, ♂, NIM/NBAIR/COL/ONIT/H-271023C (images: AIMB). **E**. Habitus, dorsal view. **F**. Habitus, ventral view.

2005: 149 (distribution). — Bezděk & Krell 2006: 159 (distribution). — Sewak 2009a: 37 (key, distribution, diagnosis); 2009b: 59 (key, distribution, diagnosis). — Sabu *et al.* 2011: 34 (list). — Chandra *et al.* 2011: 66 (distribution). — Chandra & Gupta 2011: 274 (distribution); 2012a: 889 (distribution); 2013a: 348 (distribution, diagnosis). — Chandra *et al.* 2012a: 52 (list and distribution); 2012b: 33 (distribution). — Thakare *et al.* 2012: 78 (list and distribution). — Karimbumkara & Rajan 2013: 174 (list and distribution). — Chandra & Gupta 2013a: 348 (distribution); 2013b: 4667 (distribution). — Gupta *et al.* 2014: 229 (distribution); 2015: 1030 (key, distribution, diagnosis). — Bezděk 2016: 179 (distribution). — Ghosh *et al.* 2020: 238 (distribution). — Schoolmeesters 2022 (online catalogue).

Differential diagnosis

Onitis philemon is smaller in size than *O. singhalensis* and resembles the latter in the presence of a broad deep longitudinal groove on the metasternum anteriorly and the scarcely punctured pygidium. It differs from the latter in the clypeal sculptures and the absence of a tooth on the profemur of males. In *O. singhalensis* the basal pronotal foveae are rounded and closer than in *O. philemon* (compare Fig. 15D, F) and the pronotum is with a smooth longitudinal median line which extends to the front margin, while the median line is absent in *O. philemon* (compare Fig. 14D, F).

Type material examined

Lectotype

UNKNOWN TYPE LOCALITY • "*Philemon*"; ZMUK Fabricius 003706; Karimbumkara, S.N. des. 2024; ZMUK 003706.

Paralectotypes

UNKNOWN TYPE LOCALITY • 2 specimens; "*Philemon*"; ZMUK Fabricius 003707, ZMUK Fabricius 003708; Karimbumkara, S.N. des. 2024; ZMUK 003707–003708.

Remarks

In the original description of this species, collection data of the type material are not provided. The Historical Fabricius collections, earlier kept at ZMUC and recently transferred to ZMUK, has three specimens with a simple label '*Philemon*' that matches the original description, which were designated as syntypes of *Onitis philemon*. One of these specimens with code ZMUK Fabricius 003706 is now designated as lectotype and two other specimens' ZMUK Fabricius 003707 and ZMUK Fabricius 003708, are designated as paralectotypes.

Additional material examined (185 specimens)

INDIA • ♂; No label, ZSIM; Karnataka, BRT Tiger Reserve • 42 ♂♂, 26 ♀♀; Budipadaga Scrub; 11°50′16.8″ N, 77°4′39.18″ E; 12 Jan. 2000; AIMB/Co/Sc1000310 to 1000377 • 16 ♂♂, 10 ♀♀; Gombegallu Evergreen forest; N 11°55′54.6″, 77°11′3.48″ E; 30 March 2000; AIMB/Co/Sc1000378 to 1000403 • 15 ♂♂, 12 ♀♀; Kanneri moist deciduous forest; 11°53′43.62″ N, 77°8′9.48″ E; 22 Dec. 1999; AIMB/Co/Sc1000404 to 1000430 • 19 ♂♂, 25 ♀♀; Purani dry deciduous forest; 12°1′55.2″ N, 77°7′52.68″ E; 11 May 1999; AIMB/Co/Sc1000431 to 1000474, cattle dung baited trap; Priyadarsanan Dharma Rajan leg. • ♂, ♀; Karnataka, Nagarhole National Park, Core moist deciduous forest; 12°1′13.8″ N, 76°6′14.76″ E; cattle dung baited trap; Priyadarsanan Dharma Rajan leg.; AIMB/Co/Sc1000475 to 1000476 • 2 ♂♂, 2 ♀♀; Kerala, Shendurney Wildlife Sanctuary; Rockwood grassland; 08°51′41.8″ N, 77°08′00.5″ E; elev. 839 m a.s.l.; 8 May 2009; open cow dung bait traps; Seena Narayanan Karimbumkara leg.; AIMB/Co/Sc1000477 to 1000480 • ♂; Tamil Nadu; Thirunelveli pasture land, Peikulam; 13 Jan. 2016 • ♂; Radhapuram; 2 Apr. 2016; AIMB/Co/Sc1000481 to 1000482 • 3 ♂♂, 3 ♀♀; Radhapuram; 20 Dec. 2016, cow dung baited pitfall trap; Chian leg.; AIMB/Co/Sc1000483 to 1000488 • ♂; Arunachal Pradesh, Pasighat, community forest, Rani Village; 27°58′12.9324″ N, 95°19′20.5284″ E; elev. 125 m a.s.l.; 30 Sep. 2018; cow dung baited pitfall trap; AIMB/Co/Sc1000489 • ♀; community forest, Rani Village; 27°58′10.6068″ N, 95°19′26.1156″ E;

elev. 131 m a.s.l.; 30 Sep. 2018; cow dung baited pitfall trap; Harsha Malhotra and team leg.; AIMB/Co/Sc1000490 • ♀; Nagaland, Bongkolong village, near Intanki National Park, open ground; 15 Apr. 2021; hand-picked from cow dung; Seena Narayanan Karimbumkara leg.; AIMB/Co/Sc1000491.

Description

Measurements (in mm). TL = 14–19, BW = 7.5–10.5.

Male

Green, coppery or bronzy black, moderately shining, oval; clypeus (Fig. 9D) parabolic with a feeble emargination in the middle, fine elongate granules giving it a rugulose appearance; frontal carina interrupted in the middle, a curved clypeal carina anteriorly and a conical tubercle behind, genae rather smooth; pronotum (Fig. 14D) fairly strongly, closely but unevenly punctured without well marked median line, front angles not very sharp, hind angles obsolete; elytra moderately strongly striate, intervals finely and sparsely punctured; pygidium and metasternal shield feebly and sparsely punctured; sides of metasternum densely granulate and hairy. Clypeus with smooth minute granules giving it a rugose appearance; front tibia curved at the anterior tip, mid-femur with a sharp tooth near the end of lower edge, mid-tibia (Fig. 16D) slender at base abruptly dilated near the middle, hind trochanter slightly toothed beneath.

Aedeagus (in mm) (Fig. 8E–H). LP = 1.5, Lp = 1.5; BP = 1, BpB = 0.5, BpT = 0.25. Phallobase slightly longer than parameres. Parameres almost straight above, curved below and at the tip, with a curved

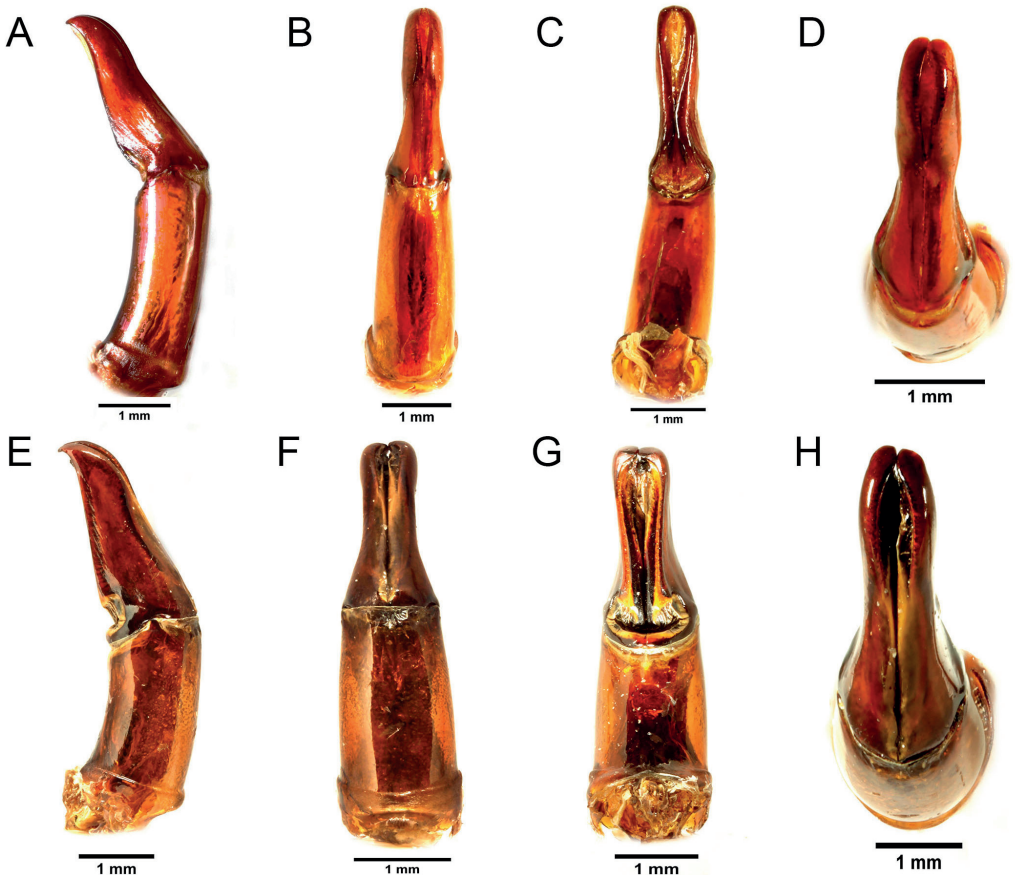

Fig. 13. Aedeagus, lateral, dorsal, ventral and apical views. **A–D**. *Onitis subopacus* Arrow, 1931, AIMB/Co/Sc1000711. **E–H**. *O. virens* Lansberge, 1875, AIMB/Co/Sc1000765. (Images: AIMB).

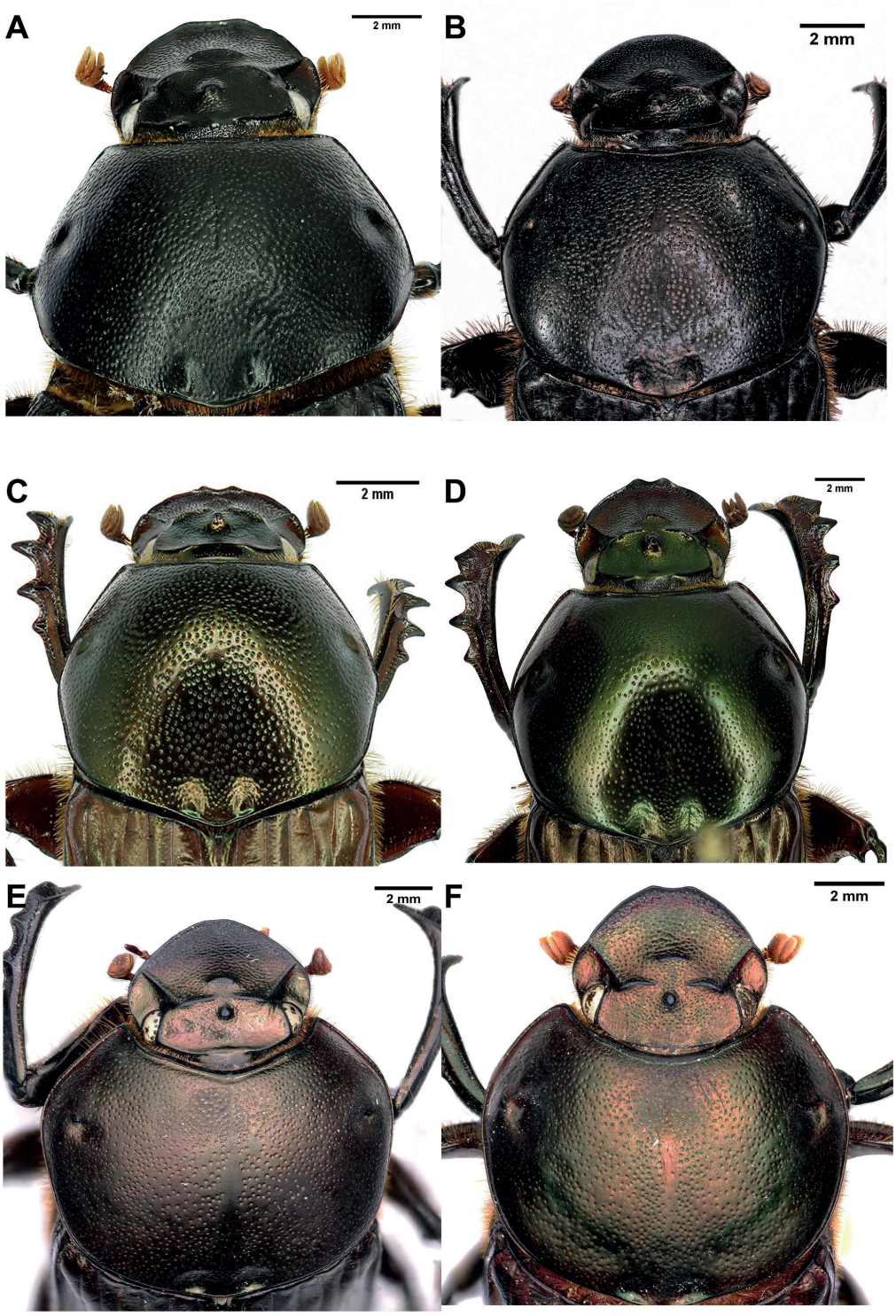

Fig. 14. Pronotum of male specimens. **A**. *Onitis bhomorensis* sp. nov., holotype, NIM/NBAIR/COL/ONIT/H-271023A. **B**. *O. punctatostriatus* Janssens, 1937, AIMB/Co/Sc1000492. **C**. *O. kethai* sp. nov., holotype, NIM/NBAIR/COL/ONIT/H-271023B. **D**. *O. philemon* Fabricius, 1801, AIMB/Co/Sc1000317. **E**. *O.visthara* sp. nov., holotype, NIM/NBAIR/COL/ONIT/H-271023C. **F**. *O. singhalensis* Lansberge, 1875, AIMB/Co/Sc1000684. (Images: AIMB).

opening on the ventral side near the base. The margin of this opening where the parameres meet is broader in the middle.

Female

Clypeus closely rugose; protibia broad, narrow with four strong teeth and an articulated spur.

Distribution

India: Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Gujarat, Haryana, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Nagaland, New Delhi, Odisha, Punjab, Rajasthan, Tamil Nadu, Tripura, Uttar Pradesh, Uttarakhand and West Bengal. Other countries: China, Laos, Nepal, Pakistan, Sri Lanka, Taiwan, Thailand and Vietnam (Chandra 2000, 2005, 2009a; Chandra & Ahirwar 2005; Sewak 2009a, 2009b; Sabu *et al.* 2011; Chandra & Gupta 2012a, 2012b; Chandra *et al.* 2012a, 2012b; Thakare *et al.* 2012; Karimbumkara & Rajan 2013; Chandra & Gupta 2013a, 2013b; Gupta *et al.* 2014, 2015; Ghosh *et al.* 2020; Schoolmeesters 2022).

Onitis punctatostriatus Janssens, 1937
Figs 6M–P, 9B, 10F, 14B, 15B, 16B, 19

Onitis punctatostriatus Janssens 1937: 19 (original description).

Onitis punctatostriatus – Balthasar 1963: 35 (monograph). — Bezděk & Krell 2006: 159 (distribution). — Siddiqui *et. al.* 2014: 300 (distribution). — Gupta *et al.* 2015: 1037 (list). — Bezděk 2016: 179 (distribution). — Schoolmeesters 2022 (online catalogue).

Differential diagnosis

Onitis punctatostriatus is similar to *O. subopacus* in having frontal carina broadly interrupted and the metasternum smooth and shining behind with scattered punctures. It differs from the latter in having deep and broad elytral striae and the pronotum being strongly ocellate punctured. This species is reported for the first time from the state of Assam in northeastern India.

Type material examined

Holotype

INDIA • ♂; "Darjeeling 1904, R.P. Verschraeghen, cf. Mem. Mus. Hist. Nat. Belg., 2: Serie, fasc. 11, 1937, p. 48, Ex. Typis, A. Janssens rev., 1936: *Onitis punctatostriatus* Janss., J. J. Gillet det., vend."; IRSNB.

Paratype

INDIA • ♀; "*Onitis spinipes* Drury R.M.H.N. Belg. 10. 640, *spinipes* Drury; J. Gillet det. 1923, Ex-Typis"; label data same as for male; IRSNB.

Additional material studied (10 specimens)

INDIA • 2 ♂♂, 2 ♀♀; Assam, Majuli Island; hand-picked, cow dung; Rajkamal Goswami leg.; AIMB/Co/Sc1000492 to 1000495 • ♂; Arunachal Pradesh, Pasighat, community forest, Rani Village; 27°58′8.8644″ N, 95°19′17.1804″ E; elev. 127 m a.s.l.; 30 Sep. 2018; cow dung baited pitfall trap; AIMB/Co/Sc1000496 • ♀; community forest, Rani Village; 27°58′10.6068″ N, 95°19′26.1156″ E; elev. 131 m a.s.l.; 30 Sep. 2018; cow dung; baited pitfall trap; AIMB/Co/Sc1000497 • ♂, 2 ♀♀; community forest, Rani Village; 27°58′8.8644″ N, 95°19′17.1804″ E; elev. 127 m a.s.l.; 29 Sep. 2018; hand-picked from cow dung, Harsha Malhotra and team leg.; AIMB/Co/Sc1000498 to 1000500 • ♀; Tripura, Trishna Wildlife Sanctuary, South Tripura; 23°16′39.9216″ N,

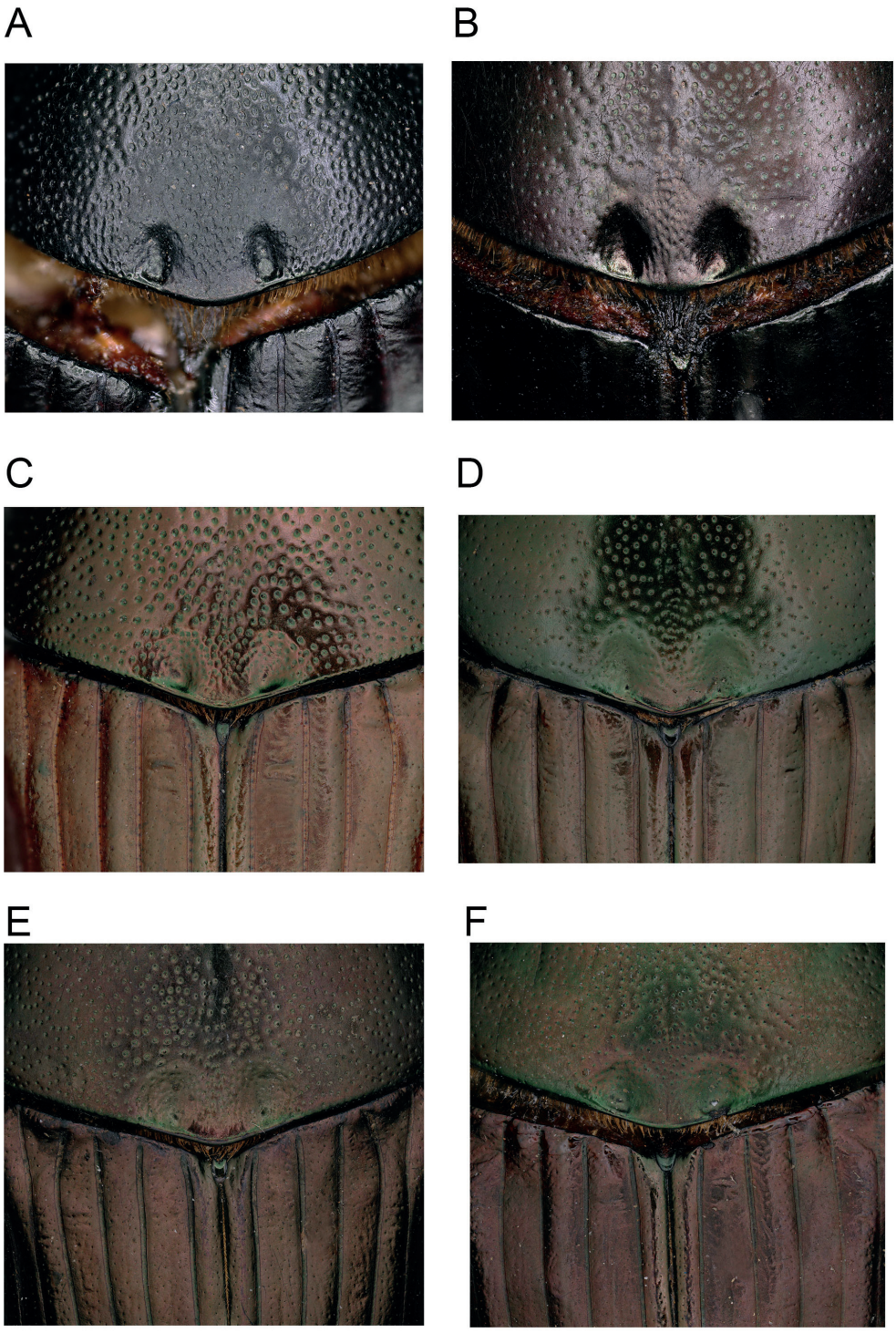

Fig. 15. Pronotal basal foveae of male specimens. **A**. *Onitis bhomorensis* sp. nov., holotype, NIM/NBAIR/COL/ONIT/H-271023A. **B**. *O. punctatostriatus* Janssens, 1937, AIMB/Co/Sc1000492. **C**. *O. kethai* sp. nov., holotype, NIM/NBAIR/COL/ONIT/H-271023B. **D**. *O. philemon* Fabricius, 1801, AIMB/Co/Sc1000317. **E**. *O. visthara* sp. nov., holotype, NIM/NBAIR/COL/ONIT/H-271023C. **F.** *O. singhalensis* Lansberge, 1875, AIMB/Co/Sc1000684. (Images: AIMB).

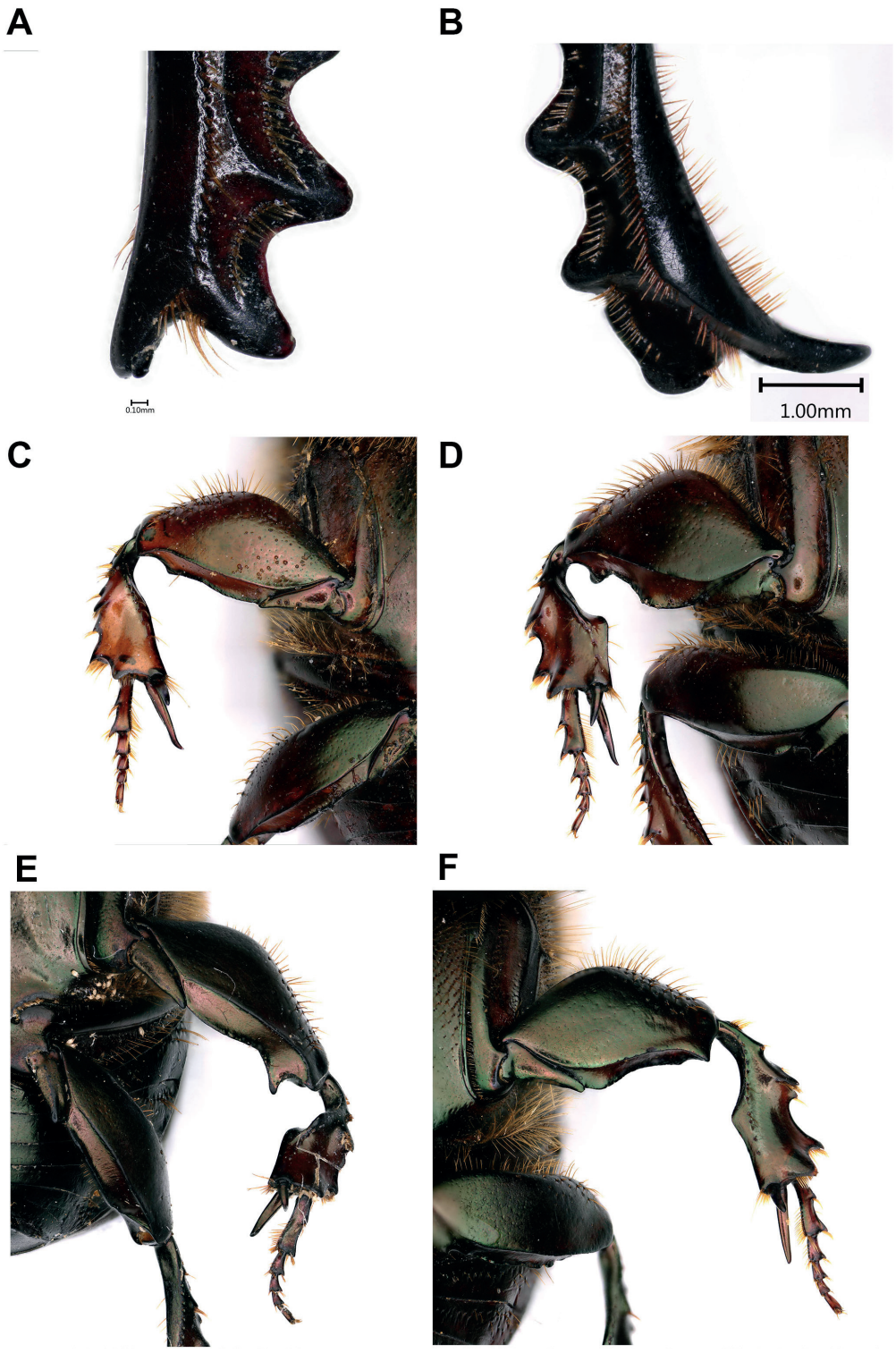

Fig 16. A. Protibia of *Onitis bhomorensis* sp. nov. showing the position of spur, NIM/NBAIR/COL/ONIT/H-271023A. **B**. Anterior tip of protibia of *O. punctatostriatus* Janssens, 1937, AIMB/Co/Sc1000492. **C**. Mid-leg of *O. kethai* sp. nov, NIM/NBAIR/COL/ONIT/H-271023B. **D**. Mid-leg of *O. philemon* Fabricius, 1801, AIMB/Co/Sc1000317. **E**. Mid-leg of *O. visthara* sp. nov, NIM/NBAIR/COL/ONIT/H-271023C. **F**. Mid-leg of *O. singhalensis* Lansberge, AIMB/Co/Sc1000684. (Images: AIMB).

91°24′16.3152″ E; Forest, 18 Feb. 2019; cow dung baited pitfall trap; Harsha Malhotra and team leg.; AIMB/Co/Sc1000501.

Description

Measurements (in mm). TL = 17.5–23; BW = 9–12.5.

Male

Black or reddish black, moderately shining; clypeal margin slightly reflexed; frontal carina broadly interrupted in the middle with an anterior short curved clypeal carina and transverse tubercle behind; pronotum strongly punctate anteriorly, basal foveae rounded, closer, lateral borders of pronotum slightly concave before anterior angles; elytral striae broad, shallow, interval imperceptibly punctured; pygidium flat, opaque; metasternum flat in the middle with an anterior weak longitudinal groove, metasternal shield smooth with scattered punctures, sides of the metasternum punctured with long rusty hairs. Clypeus evenly rugulose, pronotum with a broad smooth longitudinal median line, mid legs toothed, trochanters of mid leg long while that of hind legs serrated.

Aedeagus (in mm) (Fig. 6M–P). LP = 3, Lp = 2.5; BP = 1.25, BpB = 0.5, BpT = 0.4.Parameres longer than the phallobase, symmetrical, straight above, rounded beneath and curved at the tip.

Female

Clypeus parabolic, closely rugose, pronotal punctures stronger and closer than in male, protibia with four strong teeth.

Distribution

India: Arunachal Pradesh, Assam, Tripura, West Bengal. Other countries: Pakistan (Bezděk & Krell 2006; Siddiqui *et al.* 2014; Gupta *et al.* 2015; Bezděk 2016; Schoolmeesters 2022).

Onitis singhalensis Lansberge, 1875
Figs 8I–L, 9F, 12A, 14F, 15F, 16F, 19

Onitis singhalensis Lansberge, 1875: 140 (original description).

Onitis singhalensis – Arrow 1931: 394 (key, description). — Janssens 1937: 53 (revision). — Balthasar 1963: 40 (monograph). — Biswas & Chatterjee 1986b: 94 (distribution). — Chandra 2009a: 81 (distribution). — Sewak 2009b: 59 (key, diagnosis, distribution). — Sabu *et al.* 2011: 34 (list). — Karimbumkara & Rajan 2013: 175 (distribution). — Siddiqui *et al.* 2014: 300 (distribution). — Gupta *et al.* 2015: 1037 (list, distribution). — Schoolmeesters 2022 (online catalogue).

Differential diagnosis

The clypeus and vertex of *Onitis singhalensis* have close granules, giving the clypeus a rugose appearance. *Onitis singhalensis* is closer to *O. philemon*, *O. kethai* sp. nov. and *O. visthara* sp. nov. but differs in the nature of the granules on the head and also the size. See remarks under *O. philemon*, *O. kethai* and *O. visthara*.

Type material examined

Holotype

SRI LANKA • ♂; "Ceylon, singhalensis typ. Lansbrg., ex-Musaeo E Harold, A. Janssens vid., 1936 *Onitis singhalensis* Lansb., Type," MNHN EC4812.

Additional material examined (204 specimens)

INDIA • ♂; "Nilgiri Hills., H. L. Andrewes., Andrewes Bequest., B.M. 1922–221]"; (BMNH (E) 1237145 • ♀; South India"; (BMNH (E) 1237146) • 20 ♂♂, 5 ♀♀; Karnataka, Biligiri Rangaswamy Tiger Reserve, Budipadaga Scrub; 11°50′16.8″ N, 77°4′39.18″ E; 14 May 1999; AIMB/Co/Sc1000502 to 1000526 • 2♂♂, 1♀♀; Gombegallu evergreen forest; 11°55′54.6″ N, 77°11′3.48″ E; 30 March 2000; AIMB/Co/Sc1000527 to 1000558 • 17 ♂♂, 10 ♀♀; Kanneri moist deciduous forest; 11°53′43.62″ N, 77°8′9.48″ E; 22 Dec. 1999; AIMB/Co/Sc1000559 to 1000585 • 19 ♂♂, 7 ♀♀; Purani dry deciduous forest; 12°1′55.2″ N, 77°7′52.68″ E; 11 May 1999; AIMB/Co/Sc1000586 to 1000611 • 22 ♂♂, 15 ♀♀; Honnametti Shola; 11°53′26.52″ N, 77°12′4.98″ E; Apr. 1998; AIMB/Co/Sc1000612 to 1000648 • 16 ♂♂, 9 ♀♀; Gummane Shola 12°1′10.2″ N, 77°10′30.66″ E; May 1998; open cow dung baited trap; Priyadarsanan Dharma Rajan leg.; AIMB/Co/Sc1000649 to 1000673 • ♂, ♀; Karnataka, Nagarhole National Park, Core moist deciduous forest; 12°1′13.8″ N, 76°6′14.76″ E; AIMB/Co/Sc1000674 to 1000675 • 2 ♂♂, ♀; Hebbala moist deciduous forest; 12°9′22.68″ N, 76°6′51.84″ E; AIMB/Co/Sc1000676 to 1000678 • ♂, 2 ♀♀; Sungathakatte dry deciduous forest; 11°58′27.12″ N, 76°11′8.16″ E; open cow dung baited trap; Priyadarsanan Dharma Rajan leg.; AIMB/Co/Sc1000679 to 1000681 • 5 ♂♂, 8 ♀♀; Kerala, Shendurney Wildlife Sanctuary, Rockwood grassland; 08°51′41.8″ N, 77°08′00.5″ E; elev. 839 m a.s.l.; 8 May 2009; AIMB/Co/Sc1000682 to 1000694 • 2 ♂♂; Kattilappara moist deciduous forest; 08°54′54.7″ N, 77°06′28.7″ E; elev. 185 m a.s.l.; 3 Dec. 2009; AIMB/Co/Sc1000695 to 1000696 • 2 ♂♂, 2 ♀♀; Kattilapara degraded forest; 08°55′05.6″ N, 77°05′44.7″ E; elev. 207 m a.s.l.; 3 Dec. 2009; open cow dung baited trap; AIMB/Co/Sc1000696 to 1000699 • 2 ♂♂, ♀; Kattilappara teak plantation; 08°55′22.9″ N, 77°05′39.2″ E; elev. 144 m a.s.l.; 3 Dec. 2009; open cow dung bait trap; Seena Narayanan Karimbumkara leg.; AIMB/Co/Sc1000700 to 1000702.

Description

Measurements (in mm). TL = 16–23, BW = 9–12.

Male

Coppery or greenish coppery, not very shining, elongate oval; head closely granular, clypeal margin slightly bidentate in the middle, clypeofrontal carina interrupted in the middle with an anterior short clypeal carina and a conical tubercle immediately behind; pronotum fairly strongly and unevenly punctured and with a smooth median line, lateral margin feebly curved anteriorly, bisinuate behind, front angle blunt, hind angle obsolete, base strongly rounded; elytra moderately strongly striate with intervals very minutely punctured; pygidium scarcely perceptibly punctured; metasternal shield strongly longitudinally grooved in the middle anteriorly, smooth below, granular and hairy at the sides, sides of the metasternum closely granular and hairy. Profemur with a sharp tooth towards the end of its anterior edge, mid femur and hind trochanter also toothed.

Aedeagus (in mm) (Fig. 8I–L). LP = 3.5, Lp = 2.75; BP = 1.25, BpB = 0.75, BpT = 0.5. Phallobase longer than the parameres. The base of the parameres is straight near the phallobase, forms an angle at one third of its length, is straight anteriorly and curves at the tip.

Female

Clypeus longer, rugulose; protibia broad and armed with four external teeth and an articulated spur.

Distribution

India: Gujarat, Karnataka; Kerala, Rajasthan, Tamil Nadu. Other countries: Sri Lanka; Pakistan, Nepal (Biswas & Chatterjee 1986; Chandra 2009a; Sewak 2009a, 2009b; Sabu *et al.* 2011; Karimbumkara & Rajan 2013; Siddiqui *et al.* 2014; Gupta *et al.* 2015; Schoolmeesters 2022).

Onitis siva Gillet, 1911
(Figs 4K–N, 12B, 20

Onitis siva Gillet, 1911: 313 (original description).

Onitis siva – Arrow 1931: 388 (key, description). — Janssens 1937: 109 (revision). — Balthasar 1963: 53 (monograph). — Rajan 2006: 108 (list, key, diagnosis, distribution). — Chandra 2009a: 81 (distribution). — Sewak 2009a: 35 (key, diagnosis, distribution); 2009b: 58 (key, diagnosis, distribution). — Sabu *et al.* 2011: 34 (list). — Karimbumkara & Rajan 2013: 175 (list). — Gupta *et al.* 2015: 1037 (list, distribution). — Schoolmeesters 2022 (online catalogue).

Differential diagnosis

Onitis siva belongs to Group XVIII. It is closer to *O. bordati* which is the nearest group member in having an uninterrupted frontal carina and the absence of clypeal carina. *Onitis siva* is easily distinguishable by the strongly punctured pronotum whereas in the latter it is granular.

Type material examined

Holotype
INDIA • ♀; "Travancore; A Janssens vid., 1936: *Onitis siva* Gillet, J.J. Gillet set., vend. *Onitis siva,* Gillet RMHN. Belg. 10.640, cf. Ann. Soc. Ent. Belg. LV. 1911, 313; Type, Wallardi (Travancore) R.D. Favre, 5.9.1903"; IRSNB.

Additional material examined (10 specimens)
INDIA • ♂; "Nilgiri Hills, H.L. Andrewes., 3000 ft., *Onitis siva* male, Gillet"; BMNH(E) 1237159 • ♂; Karnataka, Biligiri Rangaswamy Tiger Reserve, Budipadaga scrub; N 11°50′16.8″, 77°4′39.18″ E; 14 May 1999; open cattle dung baited trap; Priyadarsanan Dharma Rajan leg.; AIMB/Co/Sc1000703 • ♂; Karnataka, Nagarhole National Park, core moist deciduous forest; 12°1′13.8″ N, 76°6′14.76″ E; AIMB/Co/Sc1000704 • 2 ♂♂, 2 ♀♀; Hebbala moist deciduous forest; 12°9′22.68″ N, 76°6′51.84″ E; AIMB/Co/Sc1000705 to 1000708 • ♂, ♀; Sungathakatte Dry Deciduous forest; 11°58′27.12″ N, 76°11′8.16″E; open cattle dung baited trap; Priyadarsanan Dharma Rajan leg.; AIMB/Co/Sc1000709 to 1000710.

NEPAL • ♀; "Chitwan, Tiger Tops. 150m.; 24 Oct. 1983; K.K. Gurung; Rhinoceros dung; Brit. Mus. 1984. 19"; BMNH(E) 1237160.

Description

Measurements (in mm). TL = 22.5–31.5; BW = 12.5–16.

Male
Black or deep reddish-black, not very shining, elongate-oval, moderately convex; clypeus almost semi-circular, finely and densely rugose, clypeal carina absent; frontal carina strongly elevated and curved; pronotum with a trace of longitudinal median groove posteriorly, strongly and unevenly punctured, punctures confluent anteriorly, minutely granular near lateral margins, basal foveae elongate and close; pygidium flat, indistinctly punctate; metasternum densely hairy at sides and less densely in middle, base with a small smooth but moderately punctured area. Pronotal punctures not strong and even; front legs elongate, femur with very strong spine in the middle of anterior edge, mid and hind femur also toothed.

Aedeagus (in mm) (Fig. 4K–N). LP = 4.5, Lp = 3.5; BP = 2, BpB = 1, BpT = 0.5. Phallobase distinctly longer than parameres. Parameres curved inwards, rounded and blunt at the tip.

Female

Pronotal punctures stronger and closer than in males; median elevation of posterior marginal carina of the head broader and stronger than in male, protibia straight, front femora without teeth.

Distribution

India: Arunachal Pradesh, Karnataka, Kerala, Gujarat, Rajasthan, Tamil Nadu, Uttar Pradesh (Rajan 2006; Chandra 2009a; Sewak 2009a, 2009b; Sabu *et al.* 2011; Karimbumkara & Rajan 2013; Gupta *et al.* 2015; Schoolmeesters 2022).

Onitis subopacus Arrow, 1931
Figs 12C, 13A–D, 20

Onitis subopacus Arrow, 1931: 395 (original description).

Onitis subopacus – Balthasar 1935: 94 (monograph); 1963: 53 (monograph). — Janssens 1937: 51 (revision). — Biswas & Chatterjee 1986a: 67 (distribution). — Chandra 2000: 360 (distribution); 2005: 150 (distribution). — Mittal 2005: 46 (list). — Chandra & Ahirwar 2005: 149 (distribution). — Bezděk & Krell 2006: 159 (distribution). — Sabu *et al.* 2006: 5 (list); 2011: 34 (list). — Chandra & Ahirwar 2007: 276 (distribution). — Sewak 2009b: 60 (key, diagnosis, distribution). — Thakare *et al.* 2012: 75 (distribution). — Chandra & Gupta 2011: 274 (distribution); 2012a: 889 (list) Chandra *et al.* 2012a: 52 (list); 2012b: 33 (distribution). — Chandra & Gupta 2013a: 349 (diagnosis, distribution); 2013b: 4667 (distribution). — Chandra *et al.* 2011: 67 (distribution). — Gupta *et al.* 2014: 230 (distribution); 2015: 1037 (list, distribution). — Siddiqui *et al.* 2014: 300 (distribution). — Bezděk 2016: 179 (distribution). — Ghosh *et al.* 2020: 239 (distribution). — Schoolmeesters 2022 (online catalogue).

Onitis philemon – Lansberge (nec Fabricius) 1875: 133. — Boucomont 1914: 336 (distribution). — Boucomont & Gillet 1921: 19 (distribution).

Differential diagnosis

Onitis subopacus belongs to Group III and closely resembles *O. virens* of the same group but differs in that the former has a less strongly punctured pronotum and broadly interrupted frontal carina.

Type material examined

Holotype

SRI LANKA • ♂; "Kalupahani, Haldumulle Ceylon, 1904–171, *Onitis subopacus* type, Arrow (aedeagus point-mounted and attached with specimen)"; BMNH (E) 1237174.

Additional material examined (39 specimens)

INDIA • ♀; "Kashmir; Haran Pltn. 5500, Sindh Valley, 18.v.1928, C.F.C. Beeson; ex. coll., Dehradun, B.M. 1928-472; *Onitis subopacus* co-type, Arrow"; BMNH(E) 1237175 • ♂; "Roorkee, Arrow Collection, Det. G.J. Arrow" ; ZSIM • ♀; ZSIM • 4 ♂♂, 2 ♀♀; Kerala, Shendurney Wildlife Sanctuary, Rockwood grassland; 08°51′41.8″ N, 77°08′00.5″ E; elev. 839 m a.s.l.; 8 May 2009; open cow dung bait traps; Seena Narayanan Karimbumkara leg.; AIMB/Co/Sc1000711 to 1000716 • ♀; Kerala, Shendurney Wildlife Sanctuary, Kattilappara evergreen forest; 08°54′45.6″ N, 77°05′45.3″ E; elev. 566 ft, 4 Dec. 2009; AIMB/Co/Sc1000717 • 2 ♂♂, 5 ♀♀; Kerala, Shendurney Wildlife Sanctuary; Kattilappara moist deciduous forest; 08°54′54.7″ N, 77°06′28.7″ E; elev. 185 m a.s.l.; 3 Dec. 2009; open cow dung bait traps; Seena Narayanan Karimbumkara leg.; AIMB/Co/Sc1000718 to 1000724 • 9 ♂♂, 6 ♀♀; Kerala, Shendurney Wildlife Sanctuary, Kattilapara degraded forest; 08°55′05.6″ N, 77°05′44.7″ E; elev. 207 m a.s.l.; 3 Dec. 2009; open cow dung bait traps; Seena Narayanan Karimbumkara leg.; AIMB/Co/Sc1000725 to 1000738 • ♂; Kerala, Shendurney Wildlife

Sanctuary, Pandimotta montane evergreen; 08°49′39.1″ N, 77°13′01.9″ E; elev. 1234 m a.s.l.; 29 Nov. 2009; open cow dung bait traps; Seena Narayanan Karimbumkara leg.; AIMB/Co/Sc1000739 • ♂; Karnataka, Nagarhole National Park, Sungathakatte dry deciduous forest; 11°58′27.12″ N, 76°11′8.16″ E; open cow dung bait traps; Priyadarsanan Dharma Rajan leg.; AIMB/Co/Sc1000740 • ♀; Sarathi Nulla dry deciduous forest; 12°3′48.24″ N, 76°10′40.8″ E; open cattle dung baited trap; Priyadarsanan Dharma Rajan leg.; AIMB/Co/Sc1000741 • ♀; Tripura, Eden of Bison, South Tripura, forest; 18 Feb. 2019; hand-picked from cow dung; Harsha Malhotra leg.; AIMB/Co/Sc1000742 • 2 ♂♂, ♀; Nagaland, Singphan Elephant Reserve, Forest; 24 Apr. 2021; hand-picked from cow dung; Seena Narayanan Karimbumkara leg.; AIMB/Co/Sc1000743 to 1000745.

Description

Measurements (in mm). TL = 16–23, BW = 8–12.

Male

Black with a slight metallic lustre; clypeus elliptical, rugulose, vertex granular, more shining; frontal carina widely interrupted in the middle with a conical tubercle behind and a curved clypeal carina in front; pronotum not strongly but rather closely punctured, with an incomplete smooth median longitudinal line, basal foveae deep; pygidium opaque scarcely punctured; elytra finely striate with sutural, 3rd and 5th intervals slightly convex; metasternal shield smooth and shining, the front angles and sides of metasternum closely clothed with reddish hairs. Protibia toothed, mid femur lobed near middle with tooth on posterior edge, trochanter of the hind leg sharply toothed.

Aedeagus (in mm) (Fig. 13A–D). LP = 3, Lp = 2.5; BP = 1.25, BpB = 0.5, BpT = 0.4. Phallobase longer than parameres. Parameres curved outwards at the base and then curved inwards with the tip pointed.

Female

Protibia toothed, middle and hind legs not toothed.

Distribution

India: Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Nagaland, New Delhi, Punjab, Rajasthan, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh, West Bengal. Other countries: Afghanistan, Bangladesh, Cambodia, China, Indonesia, Malay Peninsula, Myanmar, Nepal, Pakistan, Sri Lanka, Thailand, Vietnam. (Biswas & Chatterjee 1986a; Chandra 2000, 2005; Chandra & Ahirwar 2005, 2007; Bezděk & Krell 2006; Sabu *et al.* 2006, 2011; Sewak 2009b; Thakare *et al.* 2012; Chandra & Gupta 2012a, 2013a, 2013b; Chandra *et al.* 2012a, 2012b; Siddiqui *et al.* 2014; Gupta *et al.* 2014, 2015; Bezděk 2016; Ghosh *et al.* 2020; Schoolmeesters 2022).

Onitis virens Lansberge, 1875
Figs 12D, 13E–H, 20

Onitis virens Lansberge, 1875: 135 (original description).
Onitis amplectens Lansberge, 1875: 136.

Onitis virens – Boucomont & Gillet 1921: 19 (distribution). — Arrow 1931: 396 (key, description). — Balthasar 1935: 52 (monograph); 1963: 40 (monograph). — Paulian 1945: 144 (revision). — Biswas & Chatterjee 1991: 260 (distribution). — Chandra 2000: 360 (distribution). — Mittal 2005: 46 (list). — Chandra & Ahirwar 2005: 149 (distribution); 2007: 276 (distribution). — Bezděk & Krell 2006: 159 (distribution). — Sewak 2009a: 60 (key, diagnosis, distribution), 2009b: 60 (key, diagnosis, distribution). — Sabu *et al.* 2011: 34 (list). — Chandra *et al.* 2012a: 52 (distribution).

— Karimbumkara & Rajan 2013: 175 (list). — Gupta *et al.* 2015: 1037 (list, distribution). — Siddiqui *et al.* 2014: 301 (distribution). — Bezděk 2016: 180 (distribution). — Ghosh *et al.* 2020: 239 (distribution). — Schoolmeesters 2022 (online catalogue).

Differential diagnosis

Onitis virens belongs to Group III and closely resembles *O. subopacus* of the same group but differs from the latter in having a strongly punctured pronotum and clypeo-frontal carina which is narrowly interrupted.

Also see remarks under *Onitis subopacus*.

Type material examined

Syntypes

UNKNOWN TYPE LOCALTY • ♀; *"Onitis virens* Lansb., G. J. Arrow det.; A. Janssens vid., 1936: *ONITIS virens* Lansb.; Syntype; det Van Lansberge. *Onitis amplectens* Lansb.; *Amplectens* Type Lsb. Mercara; *Onitis virens* Lansb. Révis. Arrow 1927; Ex-Typis de *amplectens* Lansb.; Collection E. Candeze: 109"; IRSNB • ♀; "A. Janssens vid., 1936: *ONITIS virens* Lansb.; cf. Ann. Soc. Ent. Belg. Xviii. 1875, p.135; Syntype; Ex-Typis de amplectens Lansb.; Amplectens Ind br Lansb.; Det. Van Lansberge *Onitis amplectens* Lansb.; Collection E. Candeze"; IRSNB.

Additional material examined (47 specimens)

INDIA • ♂; "*Onitis virens* Lansb., Compared with type, G.J.A."; BMNH(E) 1237153 • ♀; "Gopaldhara, Rungbong Vall., Sikkim, H. Stevens., 1916-218; BMNH(E) 1237154" • ♂; "Nerbuda Survey, Harai, Bewa State, 2700 ft.; 23 Feb. 1927" • ♀; ZSIM • 2 ♂♂, 2 ♀♀; Karnataka, Biligiri Rangaswamy Tiger Reserve, Budipadaga scrub; 11°50′16.8″ N, 77°4′39.18″ E; 14 May 1999; open cow dung bait traps; Priyadarsanan Dharma Rajan leg.; AIMB/Co/Sc1000746 to 1000749 • 8 ♂♂, 5 ♀♀; Kanneri moist deciduous forest; 11°53′43.62″ N, 77°8′9.48″ E; 22 Dec. 1999; open cow dung bait traps; Priyadarsanan Dharma Rajan leg.; AIMB/Co/Sc1000750 to 1000762 • 2 ♂♂, Purani dry deciduous forest; 12°1′55.2″ N, 77°7′52.68″ E; 11 May 1999; open cow dung bait traps; Priyadarsanan Dharma Rajan leg.; AIMB/Co/Sc1000763 to 1000764 • ♂; Kerala, Shendurney Wildlife Sanctuary, Kattilapara degraded forest; 08°55′05.6″ N, 77°05′44.7″ E; elev. 207 m a.s.l.; 3 Dec. 2009; open cow dung bait traps; Seena Narayanan Karimbumkara leg.; AIMB/Co/Sc1000765 • 2 ♂♂, 2 ♀♀; Arunachal Pradesh, Pasighat, community forest, Rani Village; 27°58′8.8644″ N, 95°19′17.1804″ E; elev. 127 m a.s.l.; 30 Sep. 2018; cow dung baited pitfall trap; Harsha Malhotra and team leg.; AIMB/Co/Sc1000766 to 1000769 • 6 ♂♂, 9 ♀♀; agricultural field, Rani Village; 27°58′10.6068″ N, 95°19′26.1156″ E, elev. 131 m a.s.l.; 30 Sep. 2018; hand-picked from cow dung; Harsha Malhotra and team leg.; AIMB/Co/Sc1000770 to 1000784 • ♂, 2 ♀♀; community forest, Rani Village; 27°58′9.0156″ N, 95°19′18.9804″ E; elev. 133 m a.s.l.; 30 Sep. 2018; cow dung baited pitfall trap; Harsha Malhotra and team leg.; AIMB/Co/Sc1000785 to 1000787 • ♀; Nagaland, Bongkolong village, near Intanki National Park, open ground; 15 Apr. 2021; hand-picked from cow dung; Seena Narayanan Karimbumkara leg.; AIMB/Co/Sc1000788.

Description

Measurements (in mm). TL = 17–23, BW = 9.5–13.

Male

Black with a very feeble metallic lustre; clypeus elliptical, margin entire, closely and finely rugulose, vertex rugulose and more shining, frontal carina interrupted by a very short medial gap, with a conical tubercle behind and an anterior short transverse clypeal carina; pronotum fairly closely and strongly punctured, with an anterior narrow smooth median line and slight narrow groove behind; elytra finely striate with intervals flat and imperceptibly punctured, the sutural interval slightly elevated and shining; pygidium flat, smooth and feebly punctured; metasternal shield smooth and shining behind, front angles and sides of metasternum clothed with red hairs. Protibia slender, curved, mid femur and hind trochanter toothed.

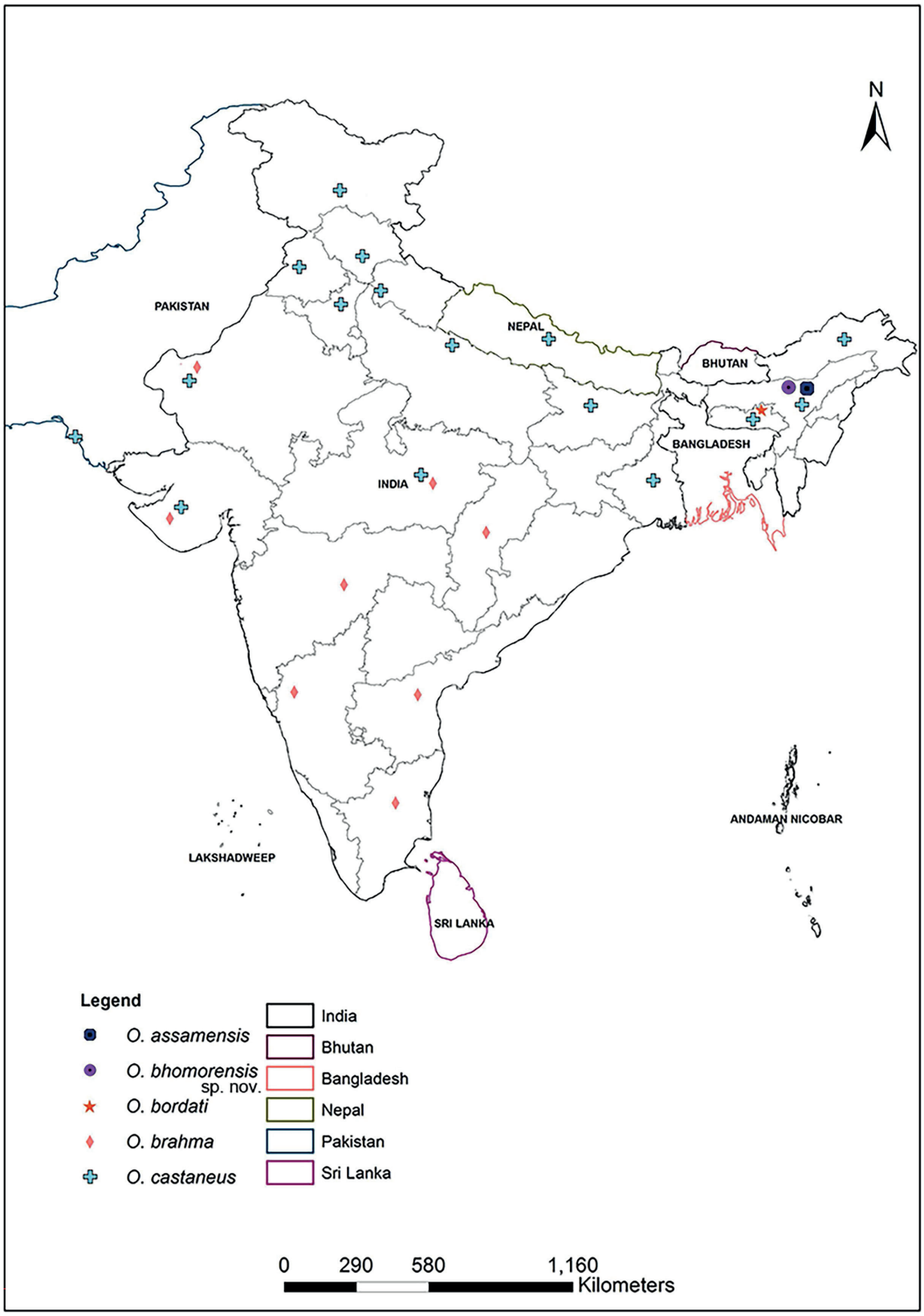

Fig. 17. Map showing the distribution of *Onitis assamensis* Biswas, 1980; *O. bhomorensis* sp. nov.; *O. bordati* Cambefort, 1988; *O. brahma* Lansberge, 1875 and *O. castaneus* Redtenbacher, 1848 in the Indian Subcontinent.

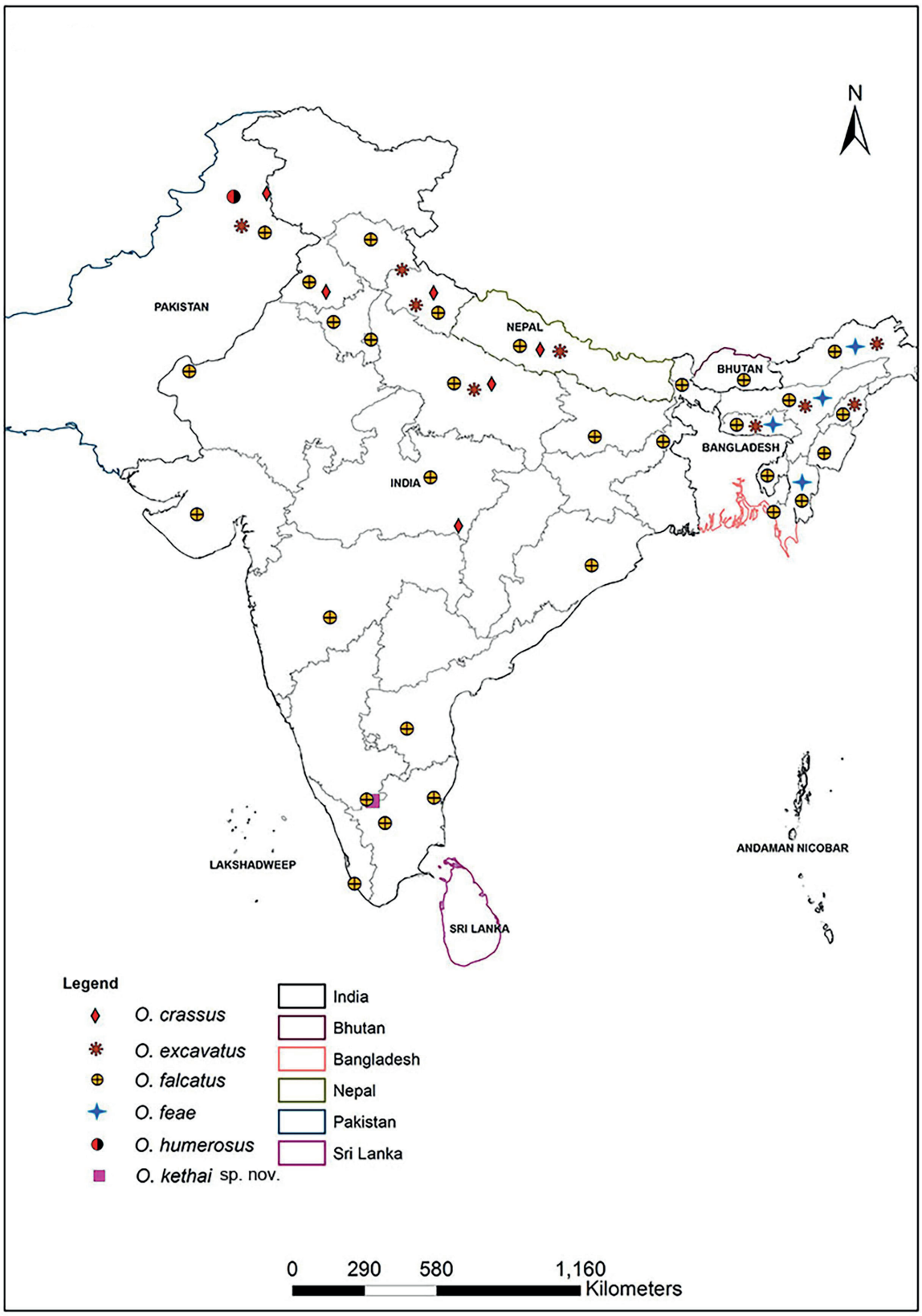

Fig. 18. Map showing the distribution of *Onitis crassus* Sharp, 1875; O. *excavatus* Arrow, 1931; *O. falcatus* (Wulfen, 1789); *O. feae* Felsche, 1907; *O. humerosus* (Pallas, 1771) and *O. kethai* sp. nov. in the Indian Subcontinent.

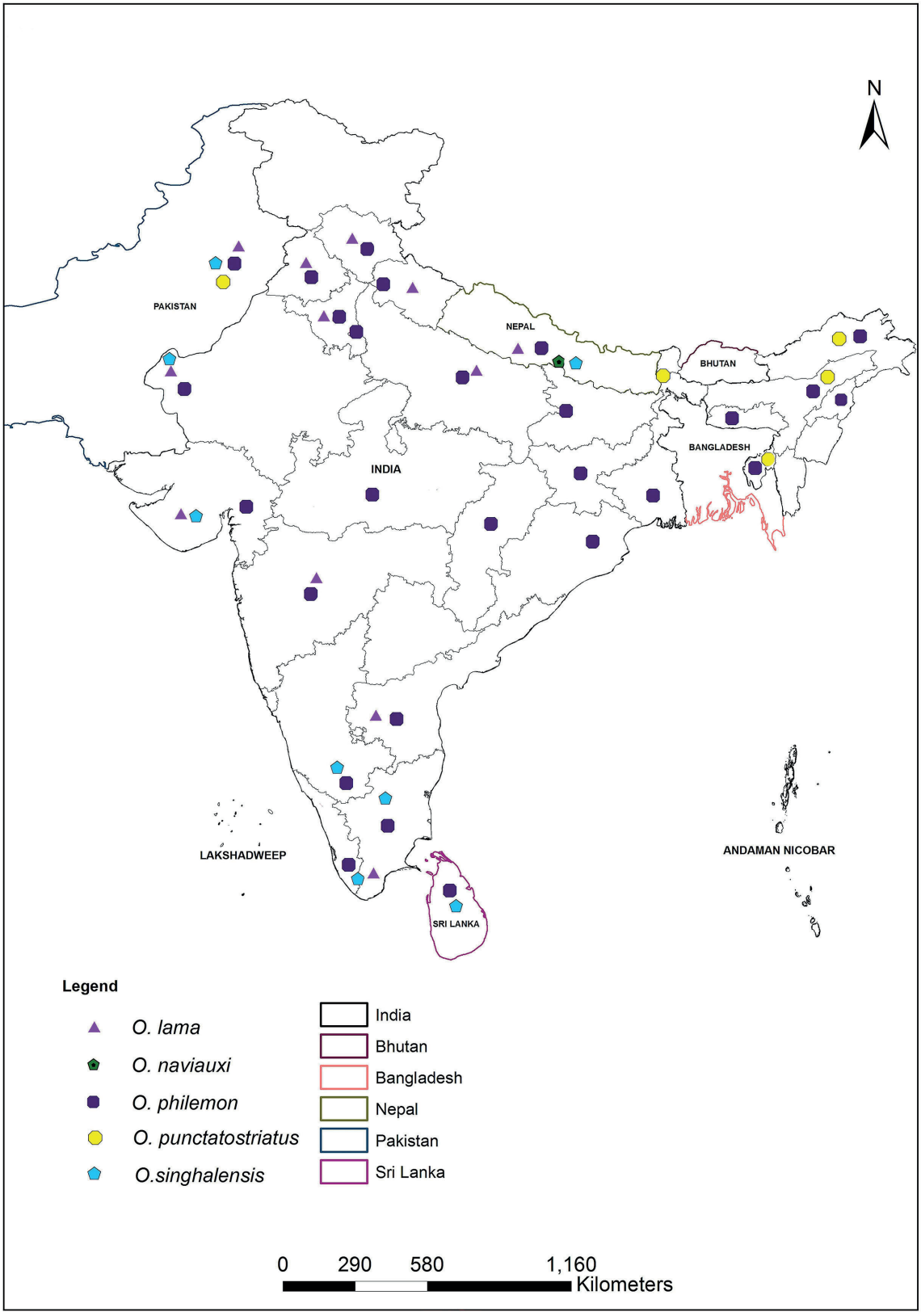

Fig. 19. Map showing the distribution of *Onitis lama* Lansberge, 1875; *O. naviauxi Cambefort*, 1988; *O. philemon* Fabricius, 1801; *O. punctatostriatus* Janssens, 1937 and *O. singhalensis* Lansberge, 1875 in the Indian Subcontinent.

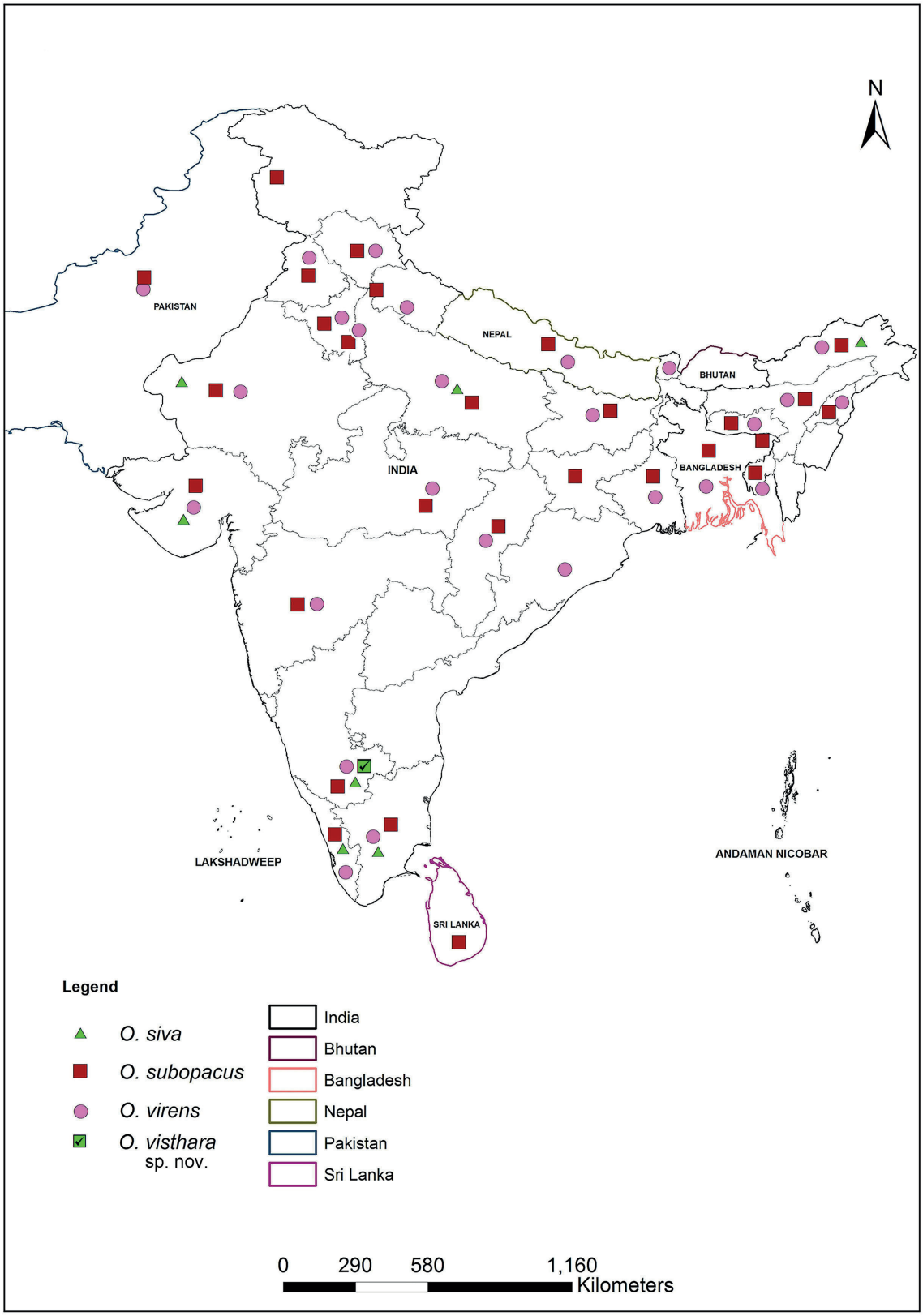

Fig. 20. Map showing the distribution of *Onitis siva* Gillet, 1911; *O. subopacus* Arrow, 1931; *O. virens* Lansberge, 1875 and *O. visthara* sp. nov. in the Indian Subcontinent.

Aedeagus (in mm) (Fig. 13E– H). LP = 3.5, Lp = 3; BP = 1.6, BpB = 0.7, BpT = 0.5. Phallobase slightly longer than the paramere, both straight below and sharp at the tip.

Female

Protibia short, broad with four stout teeth, the mid and hind femur without teeth.

Distribution

India: Arunachal Pradesh, Assam, Bihar, Chattisgarh, Gujarat, Haryana, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Nagaland, New Delhi, Odisha, Punjab, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh, West Bengal. Other countries: China, Bangladesh, Laos, Myanmar, Nepal, Pakistan, Thailand, Vietnam (Chandra 2000; Chandra & Ahirwar 2005, 2007; Bezděk & Krell 2006; Sewak 2009a, 2009b; Sabu *et al.* 2011; Chandra *et al.* 2012a; Karimbumkara & Rajan 2013; Gupta *et al.* 2015; Siddiqui *et al.* 2014; Bezděk 2016; Ghosh *et al.* 2020; Schoolmeesters 2022).

Onitis visthara sp. nov.
urn:lsid:zoobank.org:act:0E89DF71-6A9D-4E88-8C49-84281CC84C2A
Figs 8M–P, 9E, 12E–F, 14E, 15E, 16E, 20

Differential diagnosis

Onitis visthara sp. nov. belongs to Group II; it shows affinity to *Onitis philemon*, *O. kethai* sp. nov and *O. singhalensis* as the metasternum is longitudinally grooved anteriorly and the clypeal margin feebly emarginate. The pronotum of *Onitis visthara* is more convex and wider and has a smooth median line similar to that in *O. singhalensis* but absent in *O. philemon* and *O. kethai*. *Onitis visthara* can be differentiated from *O. singhalensis* by the pronotal front angle which is sharp in the former while blunt or rather rounded in the latter (compare Fig. 9E–F). The clypeus and vertex in *O. visthara* are rugose while they are closely granular in *O. singhalensis*. The genae of the former is gently rounded while that of the latter is sharply rounded. Profemur in the male of *O. visthara* is without tooth while there is a strong tooth towards the end of its anterior edge in the male of *O. singhalensis*. The mid femur in the male of *O. visthara* is without a tooth near the middle of its posterior edge, but with two teeth at the extremity, a sharp one on the lower edge and a blunt one above; while in the male of *O. singhalensis*, the middle femur has a strong tooth near the middle of its posterior edge and another tooth at the extremity. The middle tibia in male *O. visthara* is slender at the base and they curve and angularly dilate before the middle; in *O. singhalensis*, the middle tibia is slender at the base, less curved, abruptly, angularly dilated before the middle (compare 16E–F).

Type material

Holotype

INDIA • ♂; Karnataka, Hesaraghatta, Bangalore, hand-picked from cattle dung; 4 Jan. 2015, Mohammed Ashraf K. leg.; specimen deposited at NBAIR, NIM/NBAIR/COL/ONIT/H-271023C.

Paratype

COUNTRY • ♂; same collection details as holotype; AIMB/Co/Sc1000789.

Etymology

The pronotal and elytral measurements of this species are almost the same, giving it a broader rectangular appearance while comparing with other species, thus the name *visthara* which means ‘expanse’ in Sanskrit.

Description

Measurements (in mm). TL = 17–18; BW = 9–10; PL = 8–9; PW = 9.5–10.5; EL = 8–9.5; HL = 4–4.5; HW = 5–5.5.

Male (Holotype)

Brownish black, not shining, pronotum bronzy black, elytra bronzy red, ventral side blackish-red; antennae and mouth reddish; oval, not very convex. Clypeus (Fig. 14E) rugulose, anterior margin parabolic, slightly straight in the middle; clypeal carina not much elevated, bears a few punctures; clypeo-frontal carina not widely interrupted, the tubercle behind blunt, rounded and closer to carina, bears a few punctures; vertex rugulose in the middle and sides more or less smooth with a few scattered granules; genae broad and smooth, slightly reflexed anteriorly with a few scattered punctures. Pronotum strongly and fairly closely punctured, scattered in the middle, more strongly and closely pitted anteriorly, lightly and closely at the base, with a slight median groove starting above the basal foveae and extending to anterior margin as a thin smooth line; front angles moderately sharp, almost right angled, hind angle obsolete, lateral margin straight anteriorly, strongly curved or rounded in the middle and bisinuate behind; base of pronotum bluntly angulate; basal foveae rounded and concave. Elytra moderately shining, lightly and broadly striate, striae smooth, intervals almost flat, strongly and closely punctured; sutural interval convex and slightly elevated than the rest, finely and deeply punctured. Pygidium not shining, lightly and uniformly punctured. Metasternum with deep broad longitudinal groove; metasternal shield smooth in the middle with fine scattered punctures and with strong close aciculate punctures anterio-laterally; sides of metasternum with setigerous granules. Femora smooth with some punctures and hairs on anterior part near the tibial joint. Protibia with four teeth, with the tip extended to a curved process; teeth very short, blunt, the terminal tooth trapezoid. Profemur without teeth. Mid femur has a pair of sharp teeth near the end of the lower edge, and a blunt curved process towards the middle; hind trochanter with a small blunt tooth.

Aedeagus (in mm) (Fig. 8M–P). LP = 3, Lp = 2.5; BP = 0.75, BpB = 0.5, BpT = 0.25. Phallobase slightly curved, longer than parameres, the latter curved at the tip, with an opening on the ventral side at the point of articulation with the phallobase. The base of the opening is with a cup-shaped extension which is curved inwards.

Female

Unknown.

Habitat

The specimens were collected from cattle dung in open grassland near Hesaraghatta lake, the vegetation of which is undergoing rapid changes due to human activities and ecological succession.

Discussion

While discussing the increase in the number of African *Onitis* described before 50 years, Cambefort (1988) indicated that the chances of finding more species of dung beetles in Asia are high. Since the publication of Balthasar (1963), only two species, viz. *Onitis assamensis* Biswas 1980 and *O. naviauxi* Cambefort, 1988, have been described from the Indian subcontinent. Apart from these, the other reports of *Onitis* for this region are from faunal surveys of different states of India (Ghosh *et al.* 2020; Gupta *et al.* 2014, 2015; Chandra & Gupta 2012a, 2012b, 2013a, 2013b; Karimbumkara & Priyadarsanan 2013; Chandra *et al.* 2012a, 2012b; Thakare *et al.* 2012; Jain & Mittal 2012; Sabu *et al.* 2011; Sewak 2009a, 2009b; Rajan 2006; Chandra 2000a, 2000b, 2008, 2009; Chandra & Ahirwar 2005; Mittal 2005; Biswas & Ghosh 2000; Chatterjee & Biswas 2000; Biswas & Chatterjee 1985, 1986; Biswas 1980) and from other countries

which are part of the Indian subcontinent – Bhutan, Bangladesh, Nepal, Pakistan and Sri Lanka (Hashmi & Tashfeen 1992; Shrestha *et al.* 2005; Mahto 2010; Siddiqui *et al.* 2014; Abbas 2015; Ali *et al.* 2015; Noureen *et al.* 2015; Hussain *et al.* 2020). They were also reported from the neighbouring countries of Afghanistan, Burma and China (Bai *et al.* 2006). Haridas *et al.* (2022) contend that a void exists in the systematic studies of dung beetles in Northeast India, as the discoveries were made only around cities which were accessible through roads. There are many unexplored areas where systematic monitoring and inventory can lead to the discovery of many new species.

In this study, we have described three new species of *Onitis*, viz. *O. bhomorensis* sp. nov., *O. kethai* sp. nov. and *O. visthara* sp. nov., and also reported *O. bordati* Cambefort from Meghalaya, which is a new distribution record for the Indian subcontinent. With the addition of three new species and one new distribution record from India, the number of *Onitis* species from the Indian Subcontinent has been raised from 16 to 20. The aedeagus of 17 species of *Onitis* has been studied and described. We have comprehensively reviewed the *Onitis* of the Indian subcontinent based on our own collections at the ATREE insect museum, as well as collections including the holotypes maintained at several museums and repositories. The lectotype and two paralectotypes have been designated for *Onitis philemon* which has been deposited at ZMUK.

We have reported species of dung beetles from resources other than mammalian excrement (Karimbumkara & Rajan 2016), but *Onitis* species were collected mainly from mammalian ungulate dung. While many of the species of *Onitis* were collected from open cow dung baits, *O. assamensis* was collected from rhinoceros dung (Biswas 1980) and *O. bordati* from wild elephant dung (Cambefort 1988). Like many African species, they may be specialised on the dung of large non-ruminant mammals. Comprehensive, multi-seasonal collection of dung beetles with various baited and non-baited methods based on different dung types should be carried out in the future to understand their distribution, and also the resource and habitat requirements of the species.

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References

Ali S.M.S., Naeem M., Baig F., Shazad A. & Zia A. 2015. New records, distributional notes and species diversity of dung beetles (Coleoptera: Scarabaeidae: Scarabaeinae) from Pothohar Plateau of Punjab. *Pakistan. Journal of Entomology and Zoology Studies* 3 (3):1–6. Available from: https://www.entomoljournal.com/archives/2015/vol3issue3/PartA/3-3-23.pdf [accessed 27 Nov. 2019]

Arrow G.J. 1931. The fauna of British India including Ceylon and Burma, Coleoptera Lamellicornia Part III, (Coprinae). Taylor & Francis, London.

Awal M.M. 2006. Preliminary studies on Scarabaeoidea (Coleoptera) fauna of Razavi Khorasan province of Iran. *Turkiye Entomoloji Dergisi* 30 (3): 163–172. Available from: https://dergipark.org.tr/tr/download/article-file/64989 [accessed 27 Nov. 2019]

Bai M., Yang X. & Youwei Z. 2006. A key to species of the genus *Onitis* Fabricius (Coleoptera: Scarabaeidae: Scarabaeinae) from China, with the description of a new species and a new record for China. *Proceedings of the Entomological Society of Washington* 108: 389–395. Available from: https://www.biodiversitylibrary.org/part/69133 [accessed 27 nov. 2019]

Balthasar V. 1935. Scarabaeidae des paläarktischen Faunengebietes. Monographische Bestimmungstabelle. I. Coprinae I. Teil. Scarabaeini, Sisyphini, Panelini, Coprini, Onitini, Oniticellini. Edm. Reitter's Nachf. Emmerich Reitter, Troppau.

Balthasar V. 1963. Monographie der Scarabaeidae und Aphodiidae der palaeoarktischen und orientalischen Region (Coleoptera: Lamellicornia). Band 2: Coprinae (Onitini, Oniticellini, Onthophagini). Verlag der Tschechoslowakischen Akademie der Wissenschaften, Prague.

Bates H.W. 1891. Coleoptera from Kulu in NW India. *The Entomologist's Supplement* 24: 7–23.

Bedel L. 1892. Revision des Scarabaeus paléarctiques. L'Abeille, *Journal d'Entomologie* 27: 282–288.

Bezděk A. 2016. Scarabaeidae, subfamily Scarabaeinae, tribe Onitini. *In*: Löbl I. & Löbl D. (eds) *Catalogue of Palaearctic Coleoptera. Volume 3. Scarabaeoidea – Scirtoidea – Dascilloidea – Buprestoidea – Byrrhoidea*. Revised and updated edition: 177–180. Brill, Leiden, Boston.

Bezděk A. & Krell F.-T. 2006. Tribe Onitini. *In*: Löbl I. & Smetana A. (eds) *Catalogue of Palaearctic Coleoptera. Volume 3. Scarabaeoidea – Scirtoidea – Dascilloidea – Buprestoidea – Byrrhoidea*. 158–159. Apollo Books, Stenstrup.

Binaghi G., Dellacasa G. & Poggi R. 1969. Nuovi caratteri diagnostici per la determinazione degli *Onthophagus* del gruppo ovatus (L.) e geonemia controllata delle specie Italiane del gruppo. *Memorie della Societá Entomologica Italiana*, *Genoa* 48: 29–46.

Biswas S. 1980. Studies on the scarab beetles (Coleoptera: Scarabaeidae) of North India Part II. Three new species and two new records from India. *Journal of Bombay Natural History Society* 76: 338–342. Available from: https://www.biodiversitylibrary.org/part/151549 [accessed 15 Oct. 2018]

Biswas S. & Chatterjee S.K. 1985. Insecta: Coleoptera: Scarabaeidae: Coprinae. *Records of the Zoological Survey of India, Fauna of Namdapha, Arunachal Pradesh (Special Issue)*, 82 (1–4): 147–177. https://doi.org/10.26515/rzsi/v82/i1-4/1984/161291

Biswas S. & Chatterjee S.K. 1986a. Dung beetle fauna (Coleoptera: Scarabaeidae: Scarabaeinae) of Palamou Tiger Reserve, Bihar, with description of a new species. *Records of the Zoological Survey of India* 83 (3–4): 57–67. https://doi.org/10.26515/rzsi/v83/i3-4/1986/161311

Biswas S. & Chatterjee S.K. 1986b. Scarabaeidae (India Coleoptera) of Silent Valley, Kerala, India with descriptions of three new species. *Records of the Zoological Survey of India* 84 (1–4): 79–96.
Available from: https://faunaofindia.nic.in/PDFVolumes/records/084/01-04/0079-0096.pdf [accessed 15 Oct. 2018]

Biswas S. & Chatterjee S.K. 1991. Insecta: Coleoptera: Scarabaeidae. *Zoological Survey of India, State Fauna Series* 1: *Fauna of Orissa* (Part 3): 243–262.
Available from: https://shorturl.at/rZQQv [accessed 15 Oct. 2018]

Biswas S. & Ghosh A.K. 2000. Coleoptera: Scarabaeidae: Scarabaeinae. *Zoological Survey of India, State Fauna Series*, 4: *Fauna of Meghalaya*, Part 5: 513–623.

Bornemissza G.F. 1960. Could dung eating insects improve our pastures? *Journal of the Australian Institute of Agricultural Science* 26: 54–56.

Bornemissza G.F. 1976. The Australian dung beetle project 1965–1975. *Australian Meat Research Committee Review* 30: 1–30.

Boucomont A. 1914. Les Coprophages de I'Archipel Malais. *Annales de la Société entomologique de France.* LXXXIII: 238–350.

Boucomont A. & Gillet J. 1921. Faune entomologique de l'Indochine française. Famille Scarabaeidae Laparosticti (Coleoptères). *Portail. Saigon* 4: 1–76.

Branco T. 2007. Scarabaeoidea (Coleoptera) of Portugal: genus-group names and their type species. *Zootaxa* 1453: 1–31. https://doi.org/10.11646/zootaxa.1453.1.1

Brewster C. & Mayrhofer W. 2012. Handbook of Research on Comparative Human Resource Management: 576. Edward Elgar Publishing, Camberley, Massachusetts.

Bunalski M., Samin N., Ghahari H. & Hawkeswood T. J. 2014. Contributions to the knowledge the scarab beetles of Golestan province, Northern Iran with checklist of Iranian Scarabaeoidea (Coleoptera). *Polish Journal of Entomology* 83: 141–170. https://doi.org/10.2478/pjen-2014-0011

Bunalski M., Samin N. & Ghahari H. 2016. A contribution to the faunistic study of Scarabaeoidea (Coleoptera) from Mazandaran Province, northern Iran. *Wiadomości Entomologiczne* 35 (1): 31–40.
Available from: https://sparrow.up.poznan.pl/pte/we/2016/35_3_Bunalski_i_in.pdf [Accessed 15 Nov. 2018]

Cambefort Y. 1988. Deux nouveaux *Onitis* d'Asie tropicale. *Bulletin de la Société entomologique de France*, Paris 92 (5–6): 189–192.
Available from: https://www.persee.fr/doc/bsef_0037-928x_1987_num_92_5_17495 [accessed 10 May 2017]

Chandra K. 2000. Inventory of scarabaeid beetles (Coleoptera) from Madhya Pradesh India. *Zoos' Print Journal* 15 (11): 359–362. https://doi.org/10.11609/JoTT.ZPJ.15.11.359-62

Chandra K. 2005. Insecta: Coleoptera: Scarabaeidae. *Zoological Survey of India, Fauna of Western Himalaya* (Part 2): 141–155.
Available from: https://faunaofindia.nic.in/PDFVolumes/ess/021/index.pdf [accessed 15 Oct. 2018]

Chandra K. 2008. Insecta: Coleoptera. *Zoological Survey of India, Faunal Diversity of Jabalpur District, Madhya Pradesh*: 159–186.

Chandra K. 2009a. Insecta: Coleoptera: Scarabaeidae. *Zoological Survey of India, Fauna of Tamil Nadu, State Fauna Series* 1: 79–89.

Chandra K. 2009b. Insecta: Coleoptera: Scarabaeidae. *Zoological Survey of India, Fauna of Bandhavgarh Tiger Reserve, Conservation Area Series* 40: 81–88.

Chandra K. & Ahirwar S.C. 2005. Scarabaeid Beetles (Coleoptera) of Kanha Tiger Reserve, Madhya Pradesh. *Records Zoological Survey of India* 105 (1–2): 147–155.

Chandra K. & Ahirwar S.C. 2007. Insecta: Coleoptera: Scarabaeidae. *Zoological Survey of India, Fauna of Madhya Pradesh (Including Chhattisgarh), State Fauna Series* 15 (Part 1): 273–300.

Chandra K. & Gupta D. 2011. Study of scarabaeid beetles (Coleoptera) of Veerangana Durgavati Wildlife Sanctuary, Damoh, Madhya Pradesh, India. *Deccan Current Science* 5: 272–278.

Chandra K. & Gupta D. 2012a. An inventory of scarab beetles (Coleoptera: Scarabaeidaae) of Achanakmar-Amarkantak Biosphere Reserve, Chhattisgarh, India. *Indian Journal of Science and Nature* 3 (4): 886–891.

Chandra K. & Gupta D. 2012b. Diversity and composition of dung beetles (Scarabaeidae: Scarabaeinae and Aphodiinae) assemblages in Singhori Wildlife Sanctuary, Raisen, Madhya Pradesh (India). *Munis Entomology and Zoology* 7 (2): 812–826.

Chandra K. & Gupta D. 2013a. Taxonomic studies on dung beetles (Coleoptera: Scarabaeidae, Geotrupidae, Hybosoridae) of Chhattisgarh, India. *Munis Entomology and Zoology* 8 (1): 331–360.

Chandra K. & Gupta D. 2013b. Scarab beetles (Coleoptera: Scarabaeoidea) of Barnawapara Wildlife Sanctuary, Chhattisgarh, India. *Journal of Threatened Taxa* 5 (12): 4660–4671.

Chandra K., Khan S., Gupta D. & Singh S.P. 2011. Additional Records of Scarab Fauna (Coleoptera: Scarabaeidae) of Pachmarhi Biosphere Reserve, Madhya Pradesh, India. *National Journal of Life Sciences* 8 (1): 65–68.

Chandra K., Gupta D., Uniyal V.P., Bharadwaj M. & Sanyal A.K. 2012a. Studies on Scarabaeid beetles (Coleoptera) of Govind Wildlife Sanctuary, Garhwal, Uttarakhand, India. *Biology Forum* 4 (1): 49–55.

Chandra K., Khan S. & Gupta D. 2012b. New records to the species diversity of family Scarabaeidae and Hybosoridae (Coleoptera: Scarabaeoidea) of Jabalpur, Madhya Pradesh (India). *Academic Journal of Entomology* 5 (1): 28–36.

Chatterjee S.K. & Biswas S. 2000. Insecta: Coleoptera: Scarabaeidae. In Zoological Survey of India. *State Fauna Series 7: Fauna of Tripura*, Part 3: 87–98.

Davis A.L.V., Frolov A.V. & Scholtz C.H. 2008. *The African Dung Beetle Genera*. Protea Book House, Pretoria.

Davis A.L.V., Scholtz C.H. & Philips T.K. 2002. Historical biogeography of scarabaeine dung beetles. *Journal of Biogeography* 29: 1217–1256.

Fabricius J. C. 1781. *Species insectorum exhibentes eorum differentias specificas, synonyma auctorum, loca natalia, metamorphosin adiectis observationibus, descriptionibus*. 1: 1–552. Hamburgi, Kilonii. (Bohn).

Fabricius J.C. 1798. *Supplementum Entomologiae Systematicae*. Proft et Storch, Copenhagen [Hafniae]. https://doi.org/10.5962/bhl.title.122153

Fabricius J.C. 1801. *Systema Eleutheratorum secundum ordines, genera, species adjectis synonymis, locis, observationibus, descriptionibus*. Volume 2. Impensis Bibliopolii novi academici, Kiel.

Felsche C. 1907. Coprophage Scarabaeiden. *Deutsche Entomologische Zeitschrift*: 273–296.

Gillet J. J. E. 1911. Coprides nouveaux de la region orientale (etc.). *Annales de la Société entomologique de Belgique* LV: 313–314.

Ghosh J., Das, P., Ghosh S.K., Bhunia D., Kushwaha R.K., Gupta D., & Chandra K. 2020. Insecta: Coleoptera. *Zoological Survey of India, Fauna of Haryana, State Fauna Series* 24: 221–275.

Gupta D., Chandra K. & Khan S. 2014. An updated checklist of Scarabaeoid beetles (Coleoptera: Scarabaeoidea) of Pench Tiger Reserve, Madhya Pradesh, India. *Journal of Entomology and Zoology Studies* 2 (5): 225–240.
Available from https://www.entomoljournal.com/vol2Issue5/57.1.html [accessed 12 Jun. 2024]

Gupta D., Chandra K. & Khan S. 2015. Studies on Tribe Onitini (Scarabaeinae: Scarabaeidae: Coleoptera) from Madhya Pradesh with a Checklist from India. *Proceedings of the National Academy of Sciences, India Section B: Biological Sciences* volume 87: 1025–1039.
https://doi.org/10.1007/s40011-015-0676-9

Hanski I. & Cambefort Y. (eds). 1991. *Dung Beetle Ecology*. Princeton University Press, NJ, USA.

Hanboonsong Y. & Masumoto K. 2000. Dung beetles (Coleoptera, Scarabaeidae) of Thailand, Part 2, Genus *Onitis*. *Elytra, Tokyo* 28 (1): 101–114.

Hanboonsong Y., Chunram S., Pimpasalee S., Emberso R.W. & Masumoto K. 1999. The dung beetle fauna (Coleoptera: Scarabaeidae) of Northeast Thailand. *Elytra, Tokyo* 27 (2): 463–469.

Haridas S., Malhotra H., Karimbumkara, S.N. & Priyadarsanan D.R. 2022. Dung beetles (Coleoptera: Scarabaeidae: Scarabaeinae) of Northeast India – Patterns and gaps in discovery. *Journal of Insect Biodiversity* 032 (1): 026–036.

Hashmi A. & Tashfeen A. 1992. Coleoptera of Pakistan. *Proceedings of Pakistan Congress of Zoology* 12: 133–170.

Hussain M., Younas M., Malik M.F., Umar M., Kanwal M. & Batool M. 2020. Spatio-temporal Diversity of Dung Beetles in Selected Locales of Sialkot, Punjab, Pakistan. *Punjab University Journal of Zoology* 35 (1): 35–42.

Jain R. & Mittal I.C. 2012. Diversity, faunal composition and conservation assessment of dung beetles (Coleoptera: Scarabaeidae) in two reserve forests of Haryana (India). *Entomologie faunistique* 65: 69–79.

Janssens A. 1937. *Révision des Onitides*. Deuxième série, fascicule 11. Mémoires du Musée royal d'Histoire naturelle de Belgique, Brussels 11 (2).

Janssens A. 1938. Notes sur les Onitides. Quatrième note. *Bulletin du Musée royal d'Histoire naturelle de Belgique* XIV, N° 45: 1–8.

Jones R.W. 2011. *Applications of Palaeontology: Techniques and Case Studies*: 267–271. Cambridge University Press, Cambridge. https://doi.org/10.1017/CBO9780511793752

Kabakov O.N. & Napolov A. 1999. Fauna and ecology of Lamellicornia of subfamily Scarabaeinae (Scarabaeidae, Coleoptera) of Vietnam and some parts of adjacent countries: South China, Laos and Thailand. *Latvijas Entomologs* 37: 58–96.

Kollar V. & Redtenbacher L. 1844. Aufzählung und Beschreibung der von Freiherrn Carl v. Hügel auf seiner Reise durch Kaschmir und das Himaleyagebirge gesammelten Insecten. Mit 28 Steindruck-Tafeln. *In* Hügel C.A.A. von (ed.), *Kaschmir und das Reich der Siek*: 395–564. Hallberger, Stuttgart.

Karimbumkara S.N. & Rajan P.D. 2013. Insecta: Coleoptera: Scarabaeidae: Scarabaeinae, Dung Beetles. *Zoological Survey of India, Fauna of Karnataka, State Fauna Series* 21: 173–178.

Lansberge G. 1875. Monographie des Onitides. *Annales de la Société entomologique de Belgique* 11 (2): 1–200.

Latreille P.A. 1810. Considérations générales sur l'ordre naturel des animaux composant les classes des crustacés, des arachnides, et des insectes; avec un tableau méthodique de leurs genres, disposés en familles. F. Schoell, Paris.

Lucas P.H. 1849. *Exploration Scientifique de l'Algerie pendant les années 1840, 1841, 1842. Histoire naturelle des Animaux articulés (3). Insects*: 248–299. Imprimerie royal, Paris.

Mahto S.P. 2010. *Taxonomic Studies on Dung Beetles (Coleoptera: Scarabaeidae: Coprinae) of Dhanusha District, Nepal.* Phd Thesis, Central Department of Zoology, Institute of Science and Technology, Tribhuvan University, Kathmandu, Nepal.

Martín-Piera F. 1987. Revision of the genus Chironitis Lansberge 1875. *Entomologische Arbeiten aus dem Museum G. Frey Tutzing bei München* 35/36: 203–245.

Masumoto, K. 1995. Coprophagid-beetles from Northwest Thailand (X) (Coleoptera, Scarabaeidae). *The Entomological Review of Japan* 50 (2): 87–94.
https://archive.org/details/entomologicalreviewofjapan19960050002/page/n16

Medina C.A., Molano F. & Scholtz C.H. 2013. Morphology and terminology of dung beetles (Coleoptera: Scarabaeidae: Scarabaeinae) male genitalia. *Zootaxa* 3626 (4): 455–476.
https://doi.org/10.11646/zootaxa.3626.4.3

Mikšić, R. (1950). Biljeske o Scarabaeidama palearkticke faune. *Glasnik Bioloski Sekcije Hrvatkog Privredno Drustvo Zagreb* (2-B) 2–3:165–167.

Mittal I.C. 2005. Diversity and conservation status of dung beetles (Laparosticti: Scarabaeidae: Coleoptera) in North India. *Bulletin of National Institute of Ecology* 15: 43–51.

Monaghan M.T., Inward D.J.G., Hunt T. & Vogler A.P. 2007. A molecular phylogenetic analysis of the Scarabaeinae (dung beetles). *Molecular Phylogenetics and Evolution* 45: 674–692.
https://doi.org/10.1016/j.ympev.2007.06.009

Montreuil O. 2017. New records of Geotrupidae and Scarabeidae dung beetles (Insecta, Coleoptera) from Iran. *Journal of Entomological Society of Iran* 36 (4): 259–277.

Noureen N., Hussain M. & Malik M.F. 2015. Taxonomic account of dung beetles from Gujrat, Punjab (Pakistan). *Journal of Biodiversity and Environmental Sciences 7* (3): 20–26.

Ocampo F.C. & Hawks D.C. 2006. Molecular phylogenetics and evolution of the food relocation behavior of the dung beetle tribe Eucraniini (Coleoptera, Scarabaeidae, Scarabaeinae). *Invertebrate Systematics* 20: 557–570.

Ochi T. & Kon M. 1996. Studies on the coprophagous scarab beetles from East Asia: IV. (Coleoptera, Scarabaeidae). *Giornale Italiano di Entomologia* 8: 17–28.

Pallas P.S. 1771. *Reise durch verschiedene Provinzen des Russischen Reiches in den Jahren 1768–1774* I: 1–504 (453–504). Petersburg Akademische Buchhandlung, St Petersburg.

Pallas P.S. 1781. *Icones Insectorum praesertim Rossiae Siberiaeque pecularium quae collegit et Descriptionibus illustravit*: 1–96. Sumptu Wolfgangi Waltheri, Erlangen.

Paulian R. 1945. *Faune de l'empire français: Coléoptères Scarabéides de l'Indochine, Vol.* III: 1–227. Librairie Larose, Paris.

Péringuey, L. 1901. Descriptive catalogue of the Coleoptera of South Africa (Lucanidae and Scarabaeidae). *Transactions of the South African Philosophical Society* 12: 1–920.
https://doi.org/10.1080/21560382.1901.9525977

Philips K., Pretorius E. & Scholtz H.C. 2004. A phylogenetic analysis of dung beetles (Scarabaeinae: Scarabaeidae): unrolling an evolutionary history. *Invertebrate Systematics* 18: 53–88.
https://doi.org/10.1071/IS03030

Porta A. 1932. *Fauna Coleopterorum Italica, Vol. II: Scarabaeidae*: 373–454. Stabilimento Tipografico piancentino, Piacenza.

Price D.L. 2005. Descriptions of the male and female genitalia of *Phanaeus* (MacLeay) (Scarabaeidae: Scarabaeinae): The *Vindex* species group. *The Coleopterists Bulletin* 59: 197–203. https://doi.org/10.1649/743

Preudhomme de Borre C.F.P.A. 1881. *Bulletin ou Comptes-Rendus des Séances de la Société entomologique de Belgique* XXXIX.

Rajan P.D. 2006. Insecta: Coleoptera: Scarabaeoidea: Scarabaeidae (dung beetles). *Zoological Survey of India. Fauna of Bilgiri Rangaswamy Tiger Wildlife Sanctuary, Conservation Area Series* 27: 91–135.

Reitter E. 1892. Bestimmungs-Tabelle der Lucaniden und coprophagen Lamellicornen des palaearctischen Faunengebietes. *Verhandlungen des Naturforschenden Vereines in Brünn*. https://www.zobodat.at/pdf/Verh-naturf-Ver-Bruenn_31_0003-0109.pdf

Sabu T.K., Vinod K.V. & Vineesh P.J. 2006. Guild structure, diversity and succession of dung beetles associated with Indian elephant dung in South Western Ghats forests. *Journal of Insect Science* 6 (1): 1–17. https://doi.org/10.1673/2006_06_17.1

Sabu T.K., Nithya S. & Vinod K.V. 2011. Faunal survey, endemism and possible species loss of Scarabaeinae (Coleoptera: Scarabaeidae) in the western slopes of the moist South Western Ghats, South India. *Zootaxa* 2830: 29–38. https://doi.org/10.11646/ZOOTAXA.2830.1.3

Sahlberg J. 1913. Coleoptera mediterranea orientalia, quae Aegypto, Palaestina, Syria, Caramania atque in Anatolia occidentali anno 1904 (Scarabaeidae). *Ofversight af Finska Vetenkaps-Societatens Forhandlingar. Helsingfors* 55 (19): 113–128. https://www.archive.org/stream/fversigtaffins552suom#page/113/mode/1up

Schoolmeesters P. 2022. Scarabs: World Scarabaeidae Database. *In*: Bánki O., Roskov Y., Döring M., Ower G., Hernández Robles D.R., Plata Corredor C. A., Stjernegaard Jeppesen T., Örn A., Vandepitte L., Hobern D., Schalk P., DeWalt R.E., Ma K., Miller J., Orrell T., Aalbu R., Abbott J., Adlard R., C. Aedo C. *et al.* (Version 2024-03-05). https://doi.org/10.48580/dfz6w-38g

Scholtz C.H., Davis A.L.V. & Kryger U. 2009. *Evolutionary Biology and Conservation of Dung Beetles*. Pensoft Publications, Sofia-Moscow.

Sewak R. 2009a. Dung beetles (Coleoptera: Scarabaeidae: Coprinae) of Thar desert of Gujarat. *Records of the Zoological Survey of India, Occassional Paper* N° 295: 1–48.

Sewak R. 2009b. Dung beetles (Coleoptera: Scarabaeidae: Coprinae) of Rajasthan. *Records of the Zoological Survey of India*, *Occassional Paper* N° 296: 1–106.

Siddiqui H., Ahmed Z. & Khatri I. 2014. Distributional notes and new records for the dung beetles (Coleoptera: Scarabaeidae: Scarabaeinae) of Pakistan. *Pakistan Journal of Zoology* 46 (2): 295–307.

Tarasov S. & Dimitrov D. 2016. Multigene phylogenetic analysis redefines dung beetles relationships and classification (Coleoptera: Scarabaeidae: Scarabaeinae), *Evolutionary Biology* 16: 257. https://pubmed.ncbi.nlm.nih.gov/27899070/

Thakare V., Zade V., Chandra K. & Gupta D. 2012. Scarab beetles (Coleoptera: Scarabaeoidea) of Melghat Tiger Reserve, Central India. *Academic Journal of Entomology* 5 (2): 73–80.

Wulfen X. 1786. *Descriptiones quorumdam Capensium insectorum*. Sumptu Wolfgangi Waltheri, Erlangen.

Ziani S. & Gudenzi I. 2001. A survey of the *Onthophagus* (s.l.) species occurring in Syria (Coleoptera Scarabaeidae Scarabaeinae). *Memorie della Societa Entomologica Italiana* 80: 87–105.

Zunino M. 1978. La posizione sistematica del "*Caccobius* (*Caccophilus*) *anomalus*" (Coleoptera, Scarabaeoidea). *Bollettino del Museo di Zoologia dell*'*Università di Torino* 3: 9–14.

Zunino M. 1979. Gruppi artificiali e gruppi naturali negli *Onthophagus* (Coleoptera Scarabaeoidea. *Bollettino del Museo di Zoologia dell*'*Università di Torino* 1: 1–18.

Zunino M. 1985. Las relaciones taxonómicas de los Phanaeina (Coleoptera, Scarabaeinae) y sus implicaciones biogeográficas. *Folia Entomologica Mexicana* 64: 101–115.

Zunino M. & Halffter G. 1987. Sobre *Onthophagus* Latreille, 1802 americanos (Coleoptera: Scarabaeidae: Scarabaeinae). *Elytron* 11: 157–178.

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