

***Gaindaphodius gainda*, a new genus and new species of Aphodiini from Nepal (Coleoptera: Scarabaeidae: Aphodiinae)**

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Taxonomy, new genus, new species, Coleoptera, Scarabaeoidea, Aphodiinae, Aphodiini, Terai, Oriental Region

Abstract. *Gaindaphodius gainda*, a new genus and new species of the tribe Aphodiini from the Terai of Nepal, is described and illustrated. This new genus is compared with the most morphologically similar genera *Aphodius* Hellwig, 1798 and *Rhodaphodius* Ádám, 1994. The characteristic apomorphy of the new genus seems to be the presence of a brush of fine, short setae bearing a fine yellowish waxy coating of unclear function on the abdominal ventrite 2 in females.

INTRODUCTION

The tribe Aphodiini is among the most numerous groups of the superfamily Scarabaeoidea with more than 2300 described taxa at the species level (Schoolmeesters 2023). In 2001 Dellacasa et al. distinguish a total of 181 genera in their world monograph of this group. In 2023, we already know 261 formally described genera (Kakizoe et al. 2021, Schoolmeesters 2023). However, not all of these genera have been newly described, some have only recently been restored from synonymy with others. This trend is likely to continue for some time. The diversity of some areas is still very little explored. For the Aphodiini tribus, this applies especially to the transitional zoogeographical zone between the Palaearctic and the Oriental region and also to some areas of the Afrotropical region (cf. e.g. Schoolmeesters 2023). So for example, the most recently described genera *Ajmeraphodius* Král, Mencl & Rakovič, 2021 (Král et al. 2021) and *Sphaeraphodius* Kakizoe, Jiang & Wang, 2021 (Kakizoe et al. 2021) come from the first-named area.

During the continuous study of Aphodiini material, the authors discovered a short series of unknown species of this tribe with a very unusual apomorphy. The females possesses a brush of fine, short setae covered with a fine yellowish waxy coating on the abdomen. The function of such a structure is unclear to the authors.

A new monotypical genus, *Gaindaphodius* gen. nov., is thus proposed below for the type species *Gaindahodius gainda* sp. nov. described here.

MATERIAL AND METHODS

Specimens were examined with Olympus SZ61, MBS-10 and SZP 1120-T stereomicroscopes. Measurements were taken with an ocular grid. The photographs published here were taken by using a Meopta laboratory microscope and CMOS 5 digital camera with the Helicon Focus 3.20.2 Pro software. Exact label data are cited for the material examined.

Specimens of the newly described species are provided with one red printed label ALLOTYPUS or PARATYPUS | *Gaindahodius gainda* gen. nov., sp. nov. | D. Král & L. Mencl det. 2023". Verbatim label data are cited for the type material, individual lines of every label are separated by a vertical bar ("|"), individual labels by a double vertical bar ("||"). Information in quotation marks (" ") indicates the original spelling. Our remarks and additional comments are found in brackets ("[]").

For morphological terms used in the description we follow Král (1997) and Dellacasa et al. (2010).

The following acronyms are used for collections housing particular type specimens.

LMCT Ladislav Mencl collection, Týnec nad Labem, Czech Republic;

NMPC National Museum, Praha, Czech Republic;

VTCZ Václav Týr collection, Žihle, Czech Republic.

TAXONOMY

Aphodiini Leach, 1815

Type genus. *Aphodius* Hellwig, 1798.

See Dellacasa et al. (2001), Gordon & Skelley (2007) and Smith & Skelley (2007) for synonymies and detailed description.

The new genus shares the following synapomorphies with the Aphodiini representatives: head without any longitudinal groove or costa; labrum and mandibles invisible in anterodorsal view; pronotum without any longitudinal groove; scutellum well visible in dorsal view; protibia not perpendicularly truncate apically; external transversal carinae on meso- and metatibiae distinct; metatibial spurs separated by basal tarsomere; abdominal ventrites not fused, moveable.

Gaindaphodius gen. nov.

Type species. *Gaindaphodius gainda* sp. nov., by present designation.

Diagnosis. Head with frontal suture trituberculate; epistome not granulate, not setaceous; clypeus not denticulate, not bristled; genae not auriculate. Epipharynx with anterior margin almost straight, with distinct serrate denticles bearing tufts of coarse and dense setae. Pronotum with anterior margin not bordered; basal margin bordered; posterior angles visible in dorsal view, obliquely truncate. Scutellum small, approximately as long as 0.7 of sutural margin of elytra; in shape of isosceles triangle. Elytra with ten striae and ten intervals, glabrous. Elytral striae distinct, joined praeapically. Elytral intervals simple, not with secondary interstices; not carinate; intervals 7-9 not raised into oblique, prominent

fold. Posterior margin of metafemora simple; protibiae with three external teeth; metatibiae fimbriate with short and equal apical spinule; metatarsal claws corneous, strongly curved. Abdominal ventrite 2 with brush of fine, short setae and with a fine yellowish waxy coating in females.

Description. Large sized; oblong, strongly convex, dorsal surface entirely bare, shining. Colour black, dorsal surface reddish, with blackish, rounded spot on head centrally; clypeal margin, frontoclypeal tubercles and approximately triangular spot on pronotum and elytral suture; scutellum black. Head trapezoidal, only slightly convex, trituberculate. Genae regularly rounded, distinctly exceeding eyes, Clypeal surface covered with fine and simple, almost regular punctation. Epipharynx with anterior margin almost straight, with distinct serrate denticles; corypha not reaching anterior margin, with four stout, relatively short spinules, slightly different in length; denticles of acropariae bearing tufts of coarse and dense setae. Pronotum with anterior angle rounded, only slightly projecting anteriorly, sides regularly arcuate, not inwardly sinuate before posterior angles in dorsal view; lateral and posterior margin remarkably bordered. Scutellum in shape of isosceles triangle, surface with several fine punctures. Elytra with humerus not denticulate; striae distinctly impressed, small punctures moderately deeply impressed, regularly spaced, separated by approximately their diameters, distinctly crenating margins of intervals; intervals almost flat, impunctate, sutural interval strongly angustate apically. Mesometaventral plate very weakly concave, impunctate, with complete longitudinal line. Apical margin and two well developed transversal carina of meso- and metatibia fimbriate densely with setae of equal length. Abdominal ventrite 2 with brush of fine, short setae and with fine yellowish waxy coating in female

Differential diagnosis. In the key to genera of Aphodiini by Dellacasa et al. (2001), the new genus will key to the couplet with the genus *Aphodius* [and *Rhodaphodius* Ádám, 1994 (then still a synonym of the genus *Aphodius*, see Dellacasa & Dellacasa (2005: 67), for details]. To differentiate these three genera from each other, see the key below:

- a (b, c) Pronotum with anterior angles rounded, sides regularly arcuate, not inwardly sinuate before posterior angles in dorsal view; scutellum in shape of equilateral triangle; elytra regularly convex on disc; female abdomen without brush of setae and yellowish waxy coating; epipharynx with anterior margin almost straight, simple or wavy, with weak setae. Blackish species, elytra reddish or yellowish, often with pattern of blackish spots, rarely entirely blackish, abdomen nearly always black. Palearctic and Oriental genus, introduced to America and Australia.....*Aphodius*
- b (a, c) Pronotum with anterior angles distinct, sides inwardly sinuate before posterior angles in dorsal view; scutellum in shape of isosceles triangle; elytra somewhat flattened on disc; female abdomen without brush of setae and yellowish waxy coating; epipharynx with anterior margin almost straight, wavy, with weak setae. Blackish species, elytra reddish or yellowish, sometimes with more or less widened blackish spots, rarely entirely blackish, abdomen pale reddish. Western Palearctic genus. *Rhodaphodius*
- c (a, b) Pronotum with anterior angles rounded, sides regularly arcuate, simply sinuate before posterior angles in dorsal view; scutellum in shape of isosceles triangle; elytra regularly convex on disc; abdominal ventrite 2 with brush of fine, short setae and with fine yellowish waxy coating in females; epipharynx with anterior margin almost straight, with distinct serrate denticles bearing tufts of coarse and dense setae. Blackish species, elytra reddish, abdomen pale reddish. Oriental genus (Nepal). *Gaindaphodius* **gen. nov.**

Distribution. Bagmati province, Nepal.

Name derivation. A combination of the Nepali name for the rhino “*gainda*” and the generic name “*Aphodius*”; gender masculine.

***Gaindaphodius gainda* sp. nov.**

(Figs. 1-24)

Type locality. Nepal, National park Chitwan environment, bank of the river Dungere, 27°34'08"N, 84°29'45"E, 150 m a. s. l.

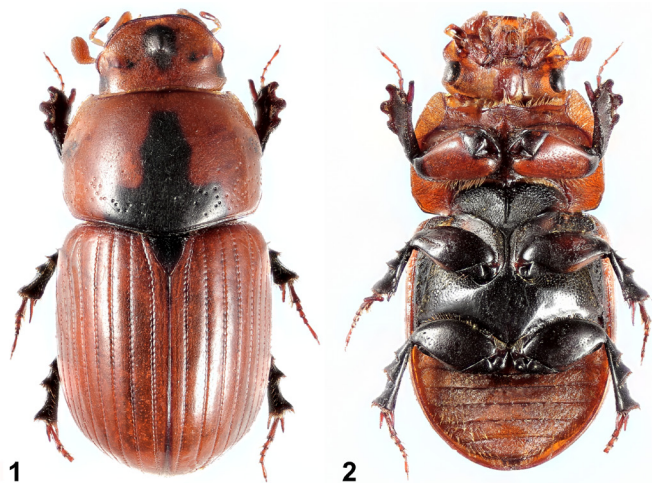
Type material. Nepal, Bagmati province: Holotype (♂) (NMPC): “NEPAL, 25. xi. 2022 | NP [National park] Chitawan [= Chitwan] env[ironment]., alt[ititude] 150m | bank of the river Dungere | excrement Rhinoceros and Elephas | 27°34'08"N, 84°29'45"E | lgt. MUDr Marcel Hájek || 3051 | Dok.L.Mencl,2023 [pale green label, number related to a photo-documentation system by LM] [printed]”. Paratypes, allotype, (♀), No. 3049. (NMPC) and (1 ♂), No 3052, (LMCT) and (2 ♀♀), Nos 3050, 3053, (VTCZ), same data as holotype, but different numbers on pale green labels related to a photo-documentation system by LM. See also Fig. 28 for photographs of labels pinned under type specimens.

Description of holotype (♂). (Figs. 1-2). Oblong, strongly convex, dorsal surface entirely bare, shining. Colour black, dorsal surface reddish, with blackish, rounded spot on head centrally; clypeal margin, frontoclypeal tubercles and approximately triangular spot on pronotum and elytral suture; scutellum black. Ventral surface (Fig. 2) blackish, excepting reddish head, prothorax, abdominal ventrites, profemora and tarses. Setation pale.

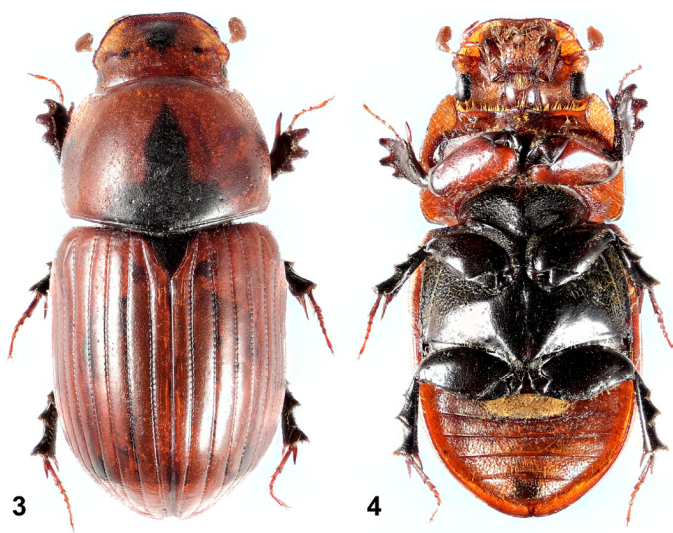
Head (Figs. 6, 10) trapezoidal, only slightly convex. Clypeal margin distinctly upturned, anteriorly broadly emarginate, anterior angle rounded, sides almost straight towards genae. Genae regularly rounded, distinctly exceeding eyes, separated from clypeal side by weak sinuation. Medial frontal tubercle remarkably developed, with almost sharp apex, lateral tubercles less prominent. Clypeal surface covered with fine and simple, almost regular punctation, punctures separated by approximately 1-2 their diameters, posteriorly of frontal tubercles becoming sparser.

Epipharynx (Fig. 22). Anterior margin almost straight, with distinct serrate denticles; regularly, broadly rounded anterolaterally; epitorma approximately pentagonal, regularly narrowed anteriorly; apotormae, laeotorma and dexiotorma well sclerotized, relatively long; ipophobae weakly sclerotized; corypha not reaching anterior margin, with four stout, relatively short spinules, slightly different in length; denticles of acropariae bearing tufts of coarse and dense setae, prophobae densely macrosetaceous with several stouter spinules anterolaterally; chaetopariae arcuate, slender, with row of numerous (more than 40) dense macrosetae; acanthopariae densely macrosetaceous; ipophobae sparsely macrosetaceous; nesium with irregular double row of coarse macrosensilla; epitorma with numerous irregularly spaced macrosensilla anteriorly.

Pronotum (Figs. 7-9) strongly convex, broadest just before middle of pronotal length, distinctly narrowed anteriorly. Anterior fovea almost missing (Fig. 9). Anterior angle rounded, only slightly projecting anteriorly, sides regularly arcuate, not inwardly sinuate before posterior angles in dorsal view (Fig. 8). Lateral and posterior margin remarkably bordered. Punctation of dorsal surface limited to basal and lateral parts, consisting of coarse, very irregularly and sparsely spaced punctures, mixed with fine punctures separated approximately by 2-3 their diameters (Figs. 1, 8).



Figs. 1-2. *Gaindaphodius gainda* gen. nov., sp. nov.; holotype, ♂, habitus. 1- dorsal view; 2- ventral view; Not to scale. Photographs by D. Král.

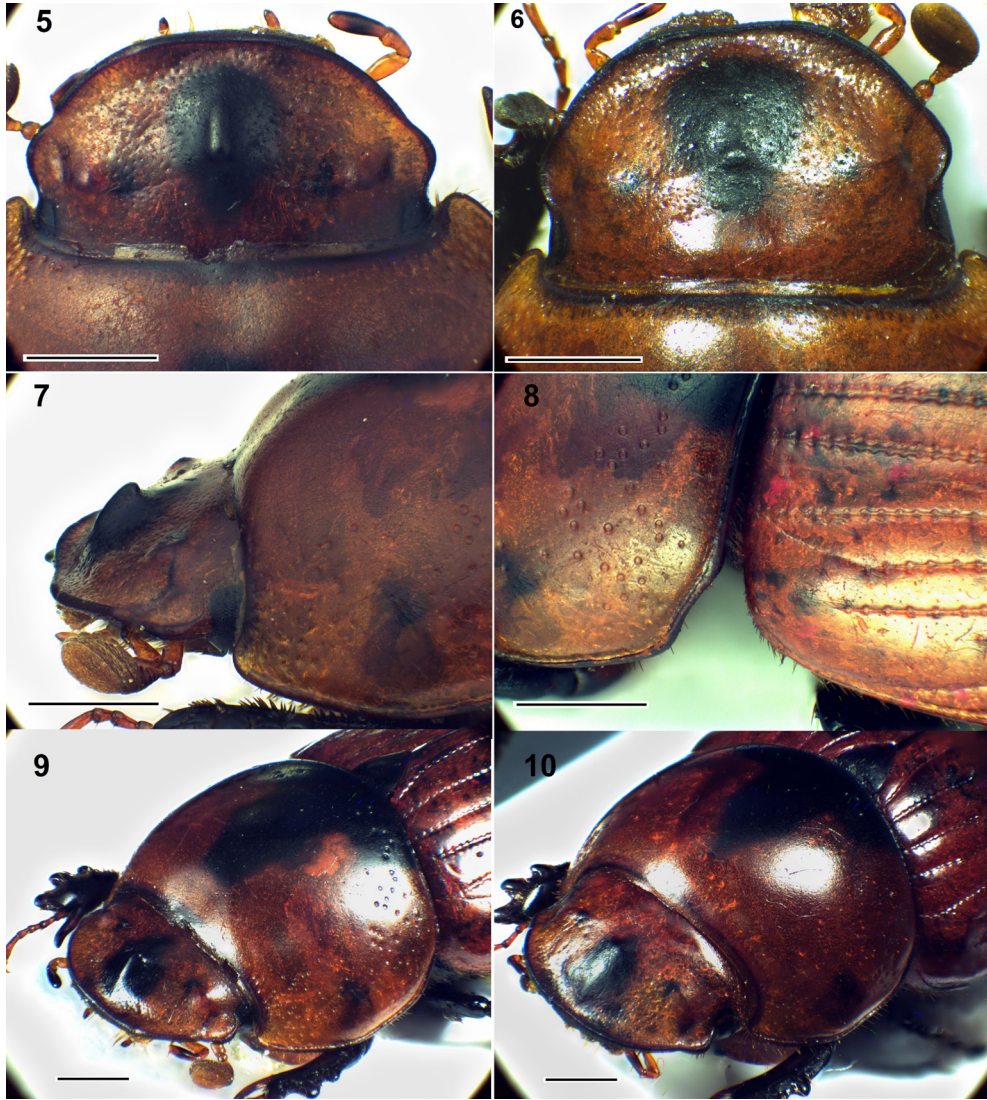


Figs. 3-4. *Gaindaphodius gainda* gen. nov., sp. nov.; paratype (allotype), ♀, habitus. 3- dorsal view; 4- ventral view; Not to scale. Photographs by D. Král.

Scutellum (Figs. 1, 17) in shape of isosceles triangle, surface with several fine punctures.

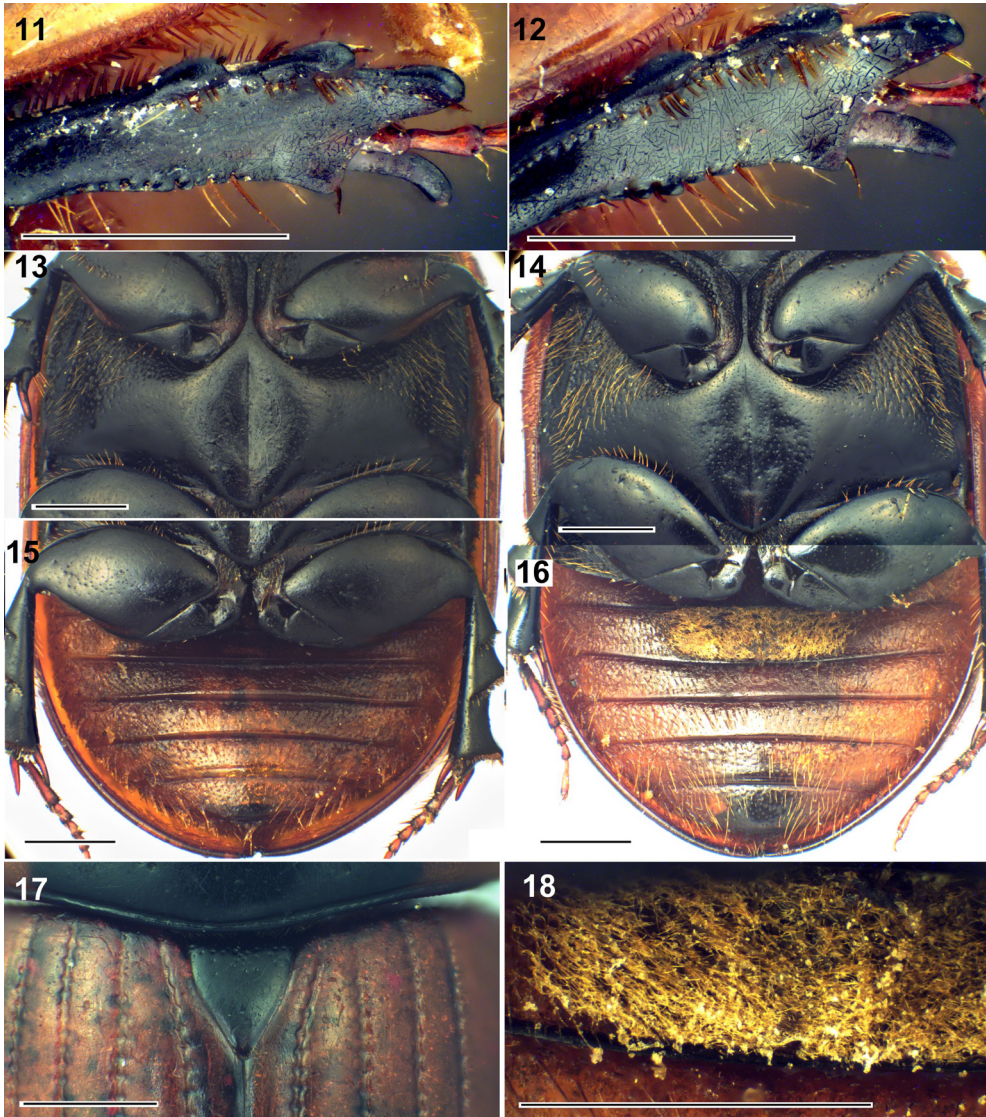
Elytra (Figs 1, 8) strongly convex, nearly parallel, humerus not denticulate (Fig. 8). Striae distinctly impressed, small punctures moderately deeply impressed, regularly spaced, separated by approximately their diameters, distinctly crenating margins of intervals (Fig. 8). Striae 1 and 10 completely developed, reaching nearly apex of elytron, stria 2 joining 3 and 9 just before apex, striae 4-6 shortened and confluent subapically, striae 7 and 8 distinctly shortened and confluent approximately in apical 1/6 of elytron length. Stria 8 distinctly shortened before humerus. Intervals almost flat, impunctate, sutural interval strongly angustate apically.

Macropterous.

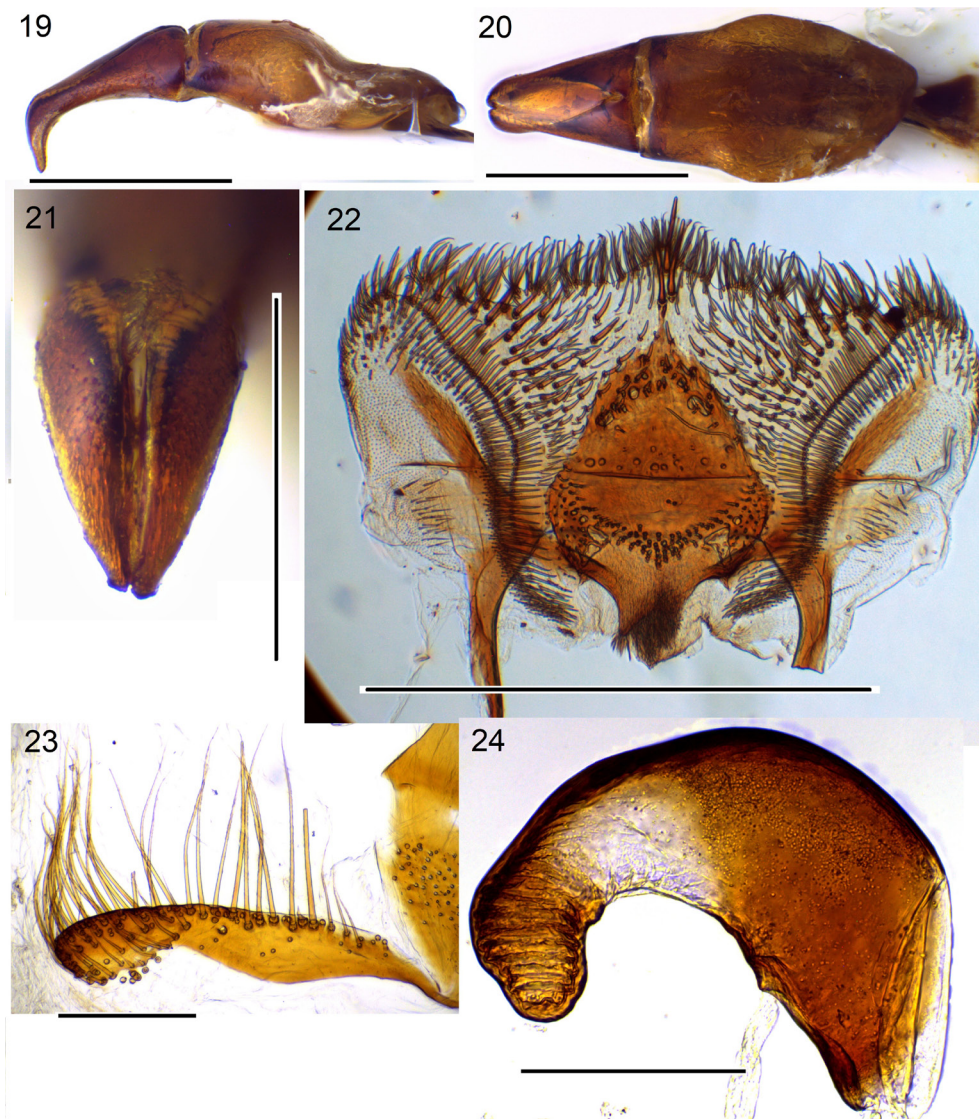


Figs. 5-10. *Gaindaphodius gainda* gen. nov., sp. nov. 5- head, ♂, dorsal view; 6- head, ♀, dorsal view; 7- head, ♂, left lateral view; 8- posterior pronotal angle, ♂, left lateral view; 9- head and pronotum, ♂, oblique frontal view; 10- head and pronotum, ♀, oblique frontal view. Scale line - 1.0 mm. Photographs by L. Mencl.

Mesometaventral plate very weakly concave, impunctate, with complete longitudinal line (Fig. 13). Femora (Figs. 13, 15) with double, irregularly distributed, sparse punctation. Protibia with three sharp external teeth, ventromedial edge with several, remarkably irregularly spaced denticles, 1-2 of them at middle more developed (Fig. 11), terminal spur inserting against emargination between medial and apical external teeth, stout and long, reaching approximately



Figs. 11-18. . *Gaidaphodius gainda* gen. nov., sp. nov. 11- protibia, ♂, ventral view; 12- protibia, ♀, ventral view; 13- mesometaventrum, ♂; 14- mesometaventrum, ♀; 15- abdomen, ♂; 16- abdomen, ♀; 17- scutellum and pronotum basis, ♂; 18- abdominal brush, ♀. Scale line - 1.0 mm. Photographs by L. Mencl.



Figs. 19-24. *Gaidaphodius gainda* gen. nov., sp. nov. 19- aedeagus, lateral view; 20- aedeagus, dorsal view; 21- aedeagus, frontal view; 22- epipharynx; 23- female stylus, 24- spermatheca. Scale lines: 1.0 mm - Fig. 19, 20, 22; 0.5 mm - Fig. 21; 0.2 mm - Fig. 23, 24. Photographs by L. Mencl.

to apical third of protarsomere 2, obtusely angulate apically (Fig. 1). Apical margin and two well developed transversal carina of meso- and metatibia fimbriate densely with setae of equal length. Basimesotarsomere long approximately as superior terminal spur of mesotibia, inferior terminal spur simply pointed. Basimetatarsomere distinctly longer than superior terminal spur of metatibia and equal approximately to next three tarsomeres combined (Fig. 15). Abdominal



Figs. 25-28. *Gaidaphodius gaida* gen. nov., sp. nov. 25-27- type locality (Chitwan National Park vicinity, Nepal, November 25, 2022), with Indian rhino (*Rhinoceros unicornis*) (26); 28- labels of type specimens. Photographs by Sylva Hájková.

ventrites with short recumbent setae (Fig. 15).

Aedeagus as in Figs. 19-21.

Sexual dimorphism. Female (Figs. 3-4) differs from male as follows: frontoclypeal tubercles only very slightly developed (Fig. 6), pronotum without anterior fovea (Fig. 10), coarse punctures more dense, terminal spur of protibia slender, apically pointed. Mesometaventral plate almost flat (Fig. 14). Abdominal ventrite 2 with brush of fine, short setae and with fine yellowish waxy coating. Stylus and spermatheca as in Figs. 23 and 24.

Measurements. Total body length: 11.2-11.9 mm (holotype - 11.2 mm; allotype - 11.8 mm).

Variability. No considerable variability was found as to the shape, sculpture and colour of type specimens (only punctures on the head and pronotum can be slightly larger and deeper in some specimens compared to other specimens of same sex).

Remarks. Only the new species described here is currently known in *Gaindaphodius* gen. nov. Differences from members of the morphologically most similar genera *Aphodius* and *Rhodaphodius* are described in the genus description and in the part Differential diagnosis.

Collecting circumstances. Collected from dung of Indian rhino (*Rhinoceros unicornis*) and Asian elephant (*Elephas maximus*) in shaded places on the bank of the Dungere River near the confluence with the East Rapti River (see Figs. 25-27).

Distribution. So far known only from the type locality, vicinity of the Chitwan National Park in Bagmati province, Nepal.

Name derivation. The word “*gaimda*” means rhinoceros in Nepali language; noun in apposition.

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