Ajmeraphodius clypeosetosus, a new genus and new species of Aphodiini from India (Coleoptera: Scarabaeidae: Aphodiinae)

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Abstract. *Ajmeraphodius clypeosetosus*, a new genus and new species of the tribe Aphodiini from India (Rajasthan), is described and illustrated. Differences between the genera *Ajmeraphodius* gen. nov. and *Pharaphodius* Reitter, 1892 are discussed (two genera exerting most elytral intervals running free posteriorly, i.e. not fused before elytral apex). The new genus is particularly characterized by its clypeus without distinct anteromedian emargination, genae not exceeding eyes, macrosetaceous clypeus margin, flat epistome, elytral intervals only moderately convex apically, only moderately sclerotised parameres, and arrangement of setae on epipharynx.

INTRODUCTION

The authors of the present work received 11 specimens considered here from collections of Institut royal des Sciences naturelles de Belgique, Brussels, Belgium (curator Alain Drumont) for the study and identification. They came from India (Rajasthan) and were found to belong to a new species and new genus of the tribe Aphodiini, similar to the genus *Pharaphodius* Reitter, 1892 in certain respects, but considerably different from its type species *Pharaphodius marginellus* (Fabricius, 1781) in certain important characters.

A new monotypical genus, *Ajmeraphodius* gen. nov., is thus proposed below for the type species *Ajmeraphodius clypeosetosus* 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. Lines within each label are separated by a slash "/". Information in quotation marks indicates the original spelling. Our remarks and additional comments are placed in brackets. For morphological terms used in the description of epipharyngeal structures we follow Dellacasa et al. (2010).

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

IRSN Institut royal des Sciences naturelles de Belgique, Brussels, Belgium (Alain Drumont);
LMCT Ladislav Mencl private collection, Týnec nad Labem, Czech Republic;
MRCD Miloslav Rakovič private collection, Dobřichovice, Czech Republic;
NMPC National Museum, Praha, Czech Republic (Jiří Hájek).

TAXONOMY

Ajmeraphodius gen. nov.

Type species. *Ajmeraphodius clypeosetosus* sp. nov.; by original designation.

Genus diagnosis. Small (body length under 5 mm), moderately convex, glabrous except for presence of macrosetae on clypeus margin, fairly shining; brown to dark brown.

Head relatively only slightly convex, clypeus margins with macrosetae outgrowing from head underside. Epistome not elevated above surrounding area. Frontoclypeal suture in form of darkened line, without tubercles. Clypeus truncate anteriorly. Head surface sparsely punctate.

Anterior margin of epipharynx weakly tetralobed; sides of epitorma subparallel, widened anteriad; corypha with six stout, relatively short spinules only slightly differing in length, and with a considerably long spinule between them; acanthopariae densely macrosetaceous (Fig. 24).

Pronotum moderately convex, transversal, anterior as well as posterior angles rounded, anterior margin not bordered, lateral and basal margins finely furrowed. Pronotum surface sparsely punctate.

Scutellum triangular, only moderately longer than wide at base, with only moderately arcuate sides; apex not rounded.

Elytra elongate, widest at about midlength, moderately wider than pronotum, with sides considerably arcuate; moderately convex, glabrous, without humeral denticles, with ten striae and ten intervals. Elytral intervals convex, intervals 1-6 running free backward (without any fusion before reaching apical margin).

Protibia with three large outer teeth in apical half and three rather obsolete denticles in basal half; inner edge mostly straight, smooth; both outer and inner edges with individual setae; apical spur stout, longer than basal protarsomere. Meso- and metatibiae slim, only moderately widened apically, with two well developed oblique ridges; their apices with two slim and acute spurs, fringed with short inequal spinules; superior apical spur of each mesotibia and metatibia shorter than corresponding basal meso- and metatarsomere, inferior apical spur shorter than corresponding superior spur.

Ventrum shining. Femora sparsely finely punctate. Mesometaventrum sparsely finely punctate, mesometaventral plate considerably concave, with narrow, almost complete median longitudinal furrow (in form of distinctly impressed longitudinal line without any dilation). Abdominal ventrites with distinct setigerous punctures bearing long, acute macrosetae.

Pygidium shape with setigerous punctures bearing short macrosetae.

Aedeagus with slim, moderately sclerotised parameres (Figs. 22-23).

Remark. The present genus diagnosis comprises those characters, which are of importance for the genus definition. Based on our experience with genera and species of Aphodiini, some further species of the genus can be discovered and thus, a future refinement of the diagnosis can be expected.

Distribution. India (Rajasthan).

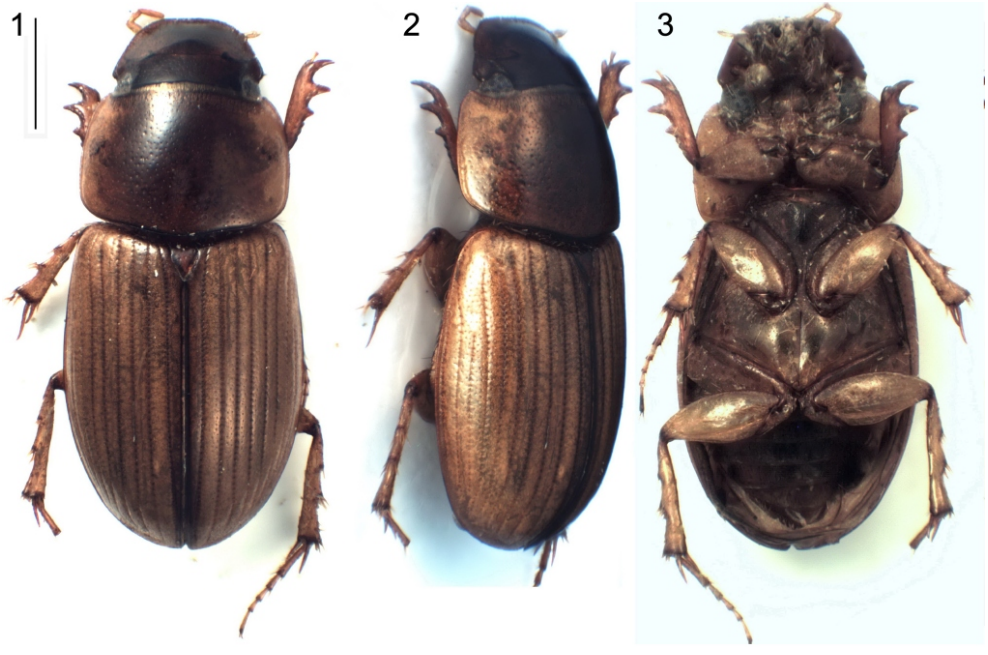
Name derivation. A combination of the location name "*Ajmer*" and generic name "*Aphodius*"). The gender is masculine.

Ajmeraphodius clypeosetosus sp. nov.

(Figs. 1-29)

Type locality. N. W. India, Rajasthan, Ajmer.

Type material. Holotype (♂), deposited in IRSN, equipped with the following printed labels. Yellow label: "*coll.R.I.Sc.N.B* / N. W. India: Ajmer / Rajasthan / coll J. Muller"; Pale green label: "2786 [number related to a photo-documentation system by the second author (LM)] / Dok.L.Mencl,2021"; Red label: "HOLOTYPUS (♂) / *Ajmeraphodius / clypeosetosus* gen. nov., sp. nov. / David Král, Ladislav Mencl & / Miloslav Rakovič det. 2021". Allotype (♀), IRSN, with yellow label same as in holotype; pale green labels same as in holotype, but with number 2789 instead of 2786; red label same as in holotype, but with word ALLOTYPE instead of HOLOTYPE. Paratypes (3x IRSN, 2x LMCT, 2x MRCD, 2x NMPC with yellow label same as in holotype; pale green labels absent or same as in holotype, but with numbers 2786, 2788, 2790-2792 instead of 2787; red labels same as in holotype, but with word PARATYPE instead of HOLOTYPE.
See also Figs. 27-29 for photographs of labels pinned under type specimens.



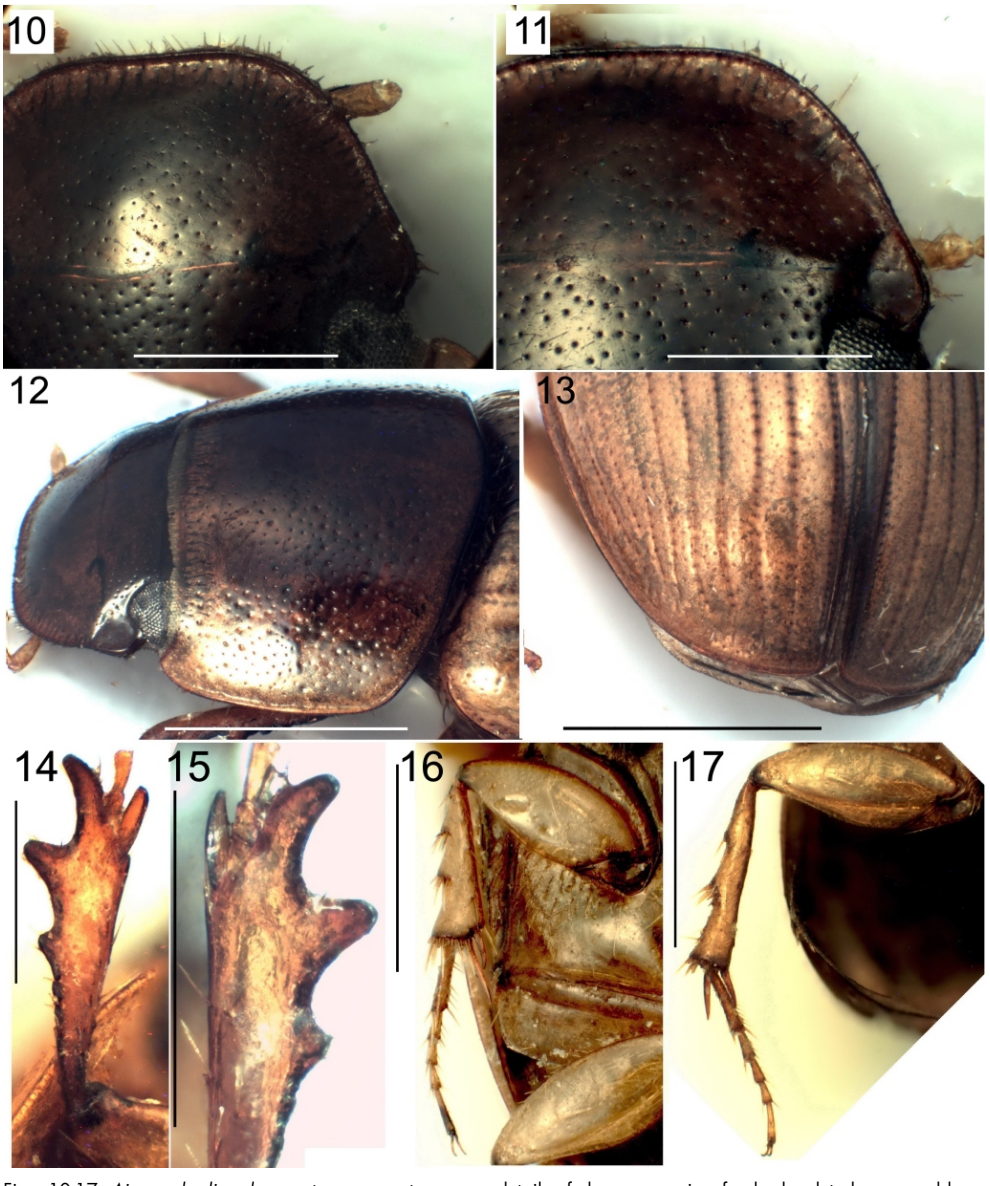
Figs. 1-3. *Ajmeraphodius clypeosetosus* gen. et sp. nov., holotype, ♂, habitus: 1- dorsal view; 2- dorsolateral view; 3- ventral view; Scale line 1 mm. Photographs by L. Mencl.

Description of holotype. Dorsum (Figs. 1-2). Total body length 4.6 mm, maximum width 2.2 mm), moderately convex, glabrous except for presence of macrosetae on clypeus margin, fairly shining; brown to dark brown (head, major area of pronotum, elytral sutural interval, and apical edges of meso- and metatibiae darker than lateral areas of pronotum, elytra, antennae, palpi and legs).

Head (Figs. 4, 10, 12) relatively only slightly convex, shining, dark brown, glabrous except for presence of macrosetae on clypeus margin, epistome not higher than surrounding area, frontoclypeal suture in form of darkened line; clypeus truncate anteriorly, rounded on each side anterolaterally, and then its lateral margins essentially straight up to genae; clypeus margins turned upward (particularly anteriorly), clypeus margins equipped with macrosetae outgrowing from head underside, clypeus lateral margin moderately differentiated from genae (the differentiation more distinct in lateral or dorsolateral view compared to dorsal view; genae obtusely angulate, not very large, but exceeding eyes, with few short setae. Head surface covered with sparse fine and shallow punctures, rather shallow and non-uniform in size.

Figs. 4-9. *Ajmeraphodius clypeosetosus* gen. et sp. nov., details of head, pronotum and mesometaventrum: 4- head, dorsal view (holotype, ♂); 5- head, dorsal view (paratype, ♀); 6- pronotum, dorsal view (holotype, ♂); 7- pronotum, dorsal view (paratype, ♀); 8- mesometaventrum, ventral view (holotype, ♂); 9- mesometaventrum, ventral view (allotype, ♀). Scale lines 1.0 mm. Photographs by L. Mencl.

Epipharynx (Fig. 24). Anterior margin weakly tetralobed, regularly broadly rounded anterolaterally; epitorma narrowly conical, regularly widened anteriad; apotormae and dexiotorma well sclerotized, relatively long; ipophobae weakly sclerotized; corypha not reaching anterior margin, with six stout, relatively short spinules slightly different in length, and with a considerably long spinula between them; acropariae with dense, long macrosetation,

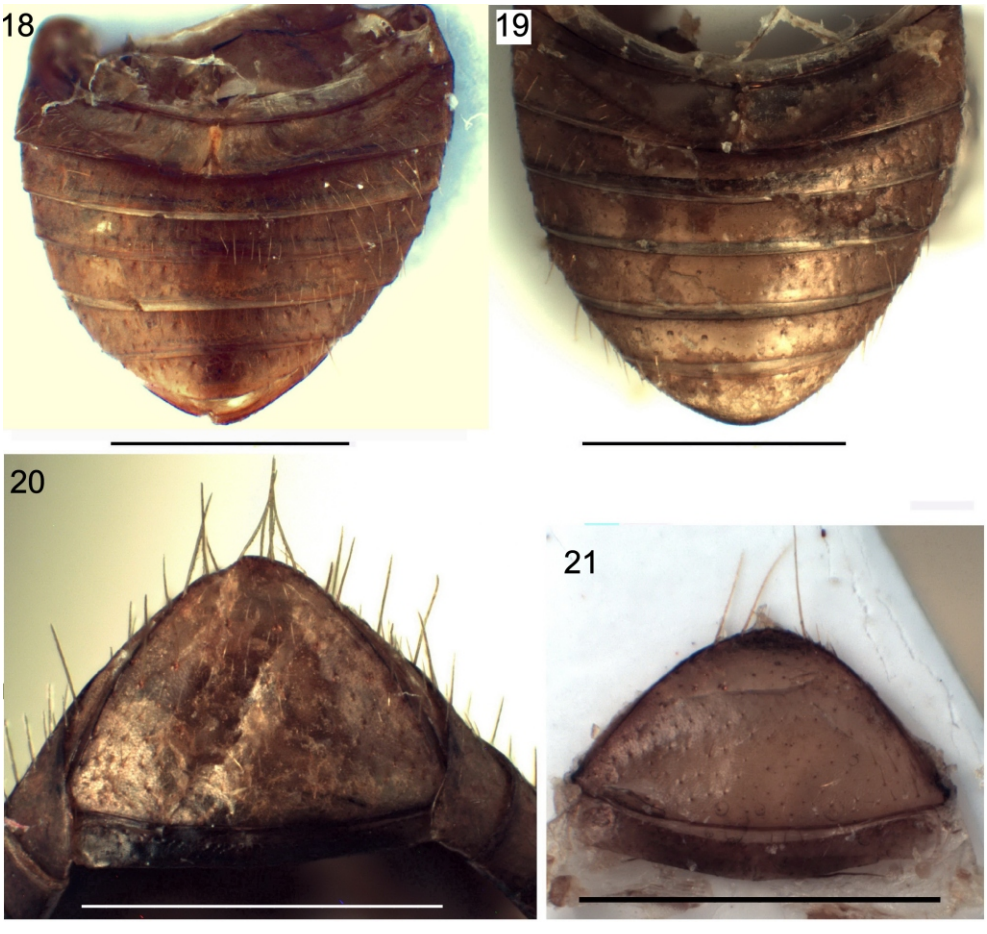


Figs. 10-17. *Ajmeraphodius clypeosetosus* gen. et sp. nov., details of clypeus margins, forebody, elytral apex and legs: 10- clypeus margins, dorsal view (holotype, ♂); 11- clypeus margins, dorsal view (paratype, ♀); 12- head and pronotum, lateral view (holotype, ♂); 13- elytral apex, dorsocaudal view (holotype, ♂); 14- right anterior leg, ventral view (holotype, ♂); 15- left anterior leg, ventral view (allotype, ♀); 16- right intermediate leg, ventral view (holotype, ♂); 17- right posterior leg, ventral view (holotype, ♂). Scale lines 0.5 mm for Figs. 10-11, 1 mm for Figs. 12-17. Photographs by L. Mencl.

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 double row of coarse

macrosensilla; epitorma with numerous irregularly spaced macrosensilla.

Pronotum (Figs. 6, 12, 26) moderately convex, transversal (length-to-width ratio 0.73), in anterior half considerably narrower than in posterior half, anterior as well as posterior angles rounded, anterior margin with longitudinal wrinkles (Fig. 6) not bordered, lateral and basal margins finely furrowed. Pronotum surface punctate similarly as head surface, punctures on pronotum disc more distinct compared to those on lateral areas.

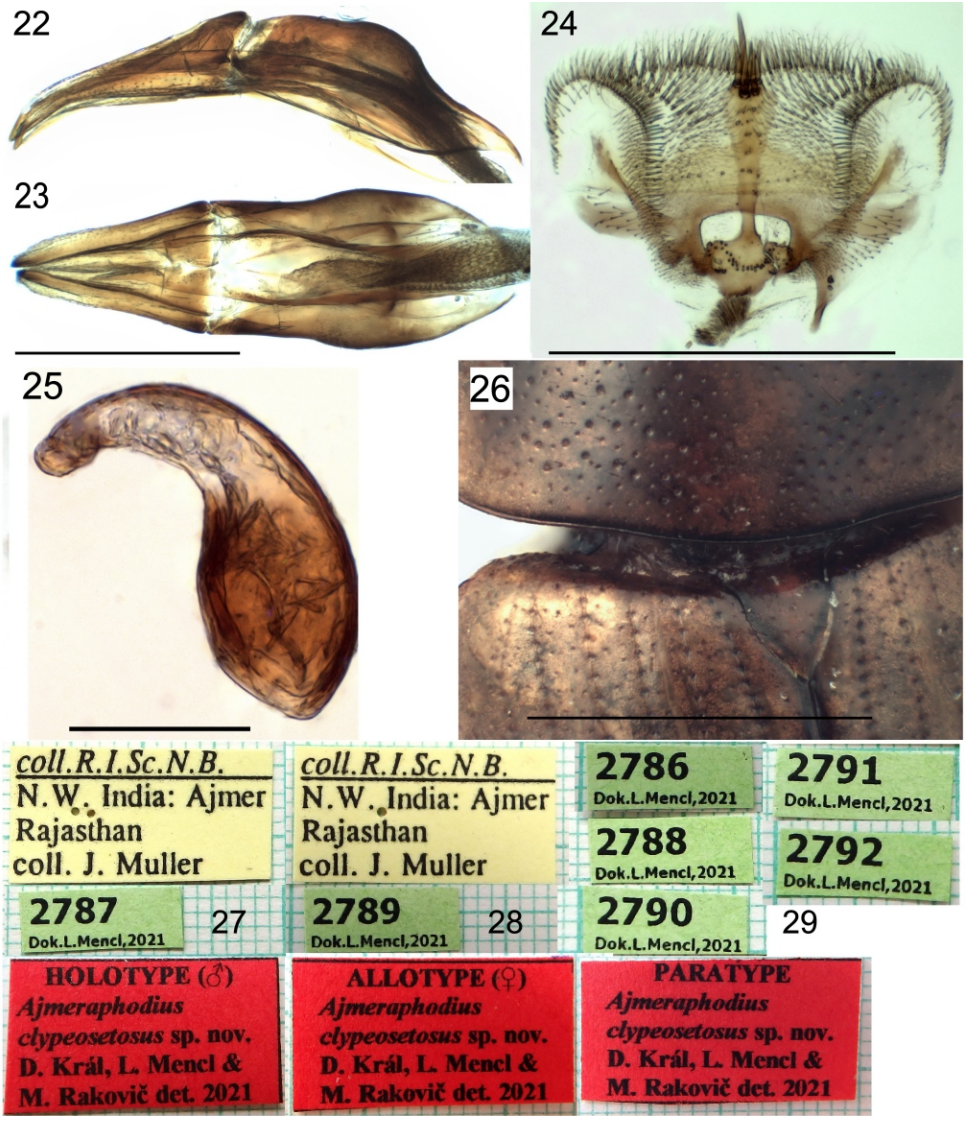


Figs. 18-21. *Ajmeraphodius clypeosetosus* gen. et sp. nov., details of abdomen and pygidium: 18- abdomen, ventral view (paratype, ♂); 19- abdomen, ventral view (allotype, ♀); 20- pygidium, caudal view (paratype, ♂); 21- pygidium, caudal view (allotype, ♀). Scale lines 1 mm. Photographs by L. Mencl.

Scutellum (Fig. 1) triangular, only moderately longer than wide at base, with only moderately arcuate sides; apex not rounded, lateral areas moderately darkened, surface with few quite obsolete punctures.

Elytra (Figs. 1, 2, 13) elongate (length-to-width ratio 1.40, widest at about midlength), 1.13 times wider than pronotum, with sides considerably arcuate; moderately convex, glabrous, shining, brown with darkened elytral interval, without humeral denticles, with ten striae and ten

intervals. Elytral striae with medium-sized, rather round than elongate, punctures moderately crenating intervals; stria 7 considerably shortened anteriorly (Fig. 2). Elytral intervals convex, with fine punctures not regularly arranged in longitudinal rows (some punctures situated closer to either inner or outer interval side and some others exert similar distances from both interval sides). Intervals 1-6 running free backward (without any fusion before reaching apical margin).



Figs. 22-29. *Ajmeraphodius clypeosetosus* gen. et sp. nov., details of aedeagus, epipharynx, spermatheca, pronotum basal margin, and etiquettes: 22- aedeagus, lateral view (holotype, ♂); 23- aedeagus, ventral view (holotype, ♂); 24- epipharynx (holotype, ♂); 25- spermatheca (allotype, ♀); 26- pronotum base (paratype, ♂); 27- etiquettes (holotype); 28- etiquettes (allotype); 29- etiquettes (paratypes). Scale lines 0.5 mm for Figs. 22-24, 0.1 mm for Fig. 25. 1 mm for Fig. 26. Photographs by L. Mencl.

Protibia with three large outer teeth in apical half and three rather obsolete denticles in basal half; inner edge mostly straight, smooth; both outer and inner edges with individual setae; apical spine stout, longer than basal protarsomere. Meso- and metatibiae slim, only moderately widened apically, with two well developed oblique ridges; their apices with two slim and acute spurs, fringed with short inequal spinules; superior apical spur of each meso- and metatibia shorter than corresponding basal meso- and metatarsomere, inferior apical spur shorter than corresponding superior spur. Basal protarsomere about as long as metatarsomeres 2-4 combined.

Ventrum shining (Figs. 3, 8, 18) brown, legs yellowish brown, with darkened knees in all three pairs of legs and apical edges of meso- and metatibiae. Femora sparsely finely punctate. Mesometaventrum sparsely finely punctate, mesometaventral plate considerably concave, with narrow, almost complete median longitudinal furrow (in form of distinctly impressed longitudinal line without any dilation). Abdominal ventrites with distinct setigerous punctures bearing long, acute macrosetae. Ventral surfaces of legs as in Figs. 14, 16-18.

Pygidium with setigerous punctures bearing short macrosetae, its shape as in Fig. 20.

Aedeagus as in Figs. 22-23.

Sexual dimorphism. Head and pronotum punctation finer in males (Figs. 4 and 6), rather coarser in females (Figs. 5 and 7). Clypeus margins setaceous in both males and females; possible differences (Figs. 10-11) can be rather attributed to individual variability. Mesometaventral plate distinctly concave in males (Fig. 8), rather flat in females (Fig. 9). Male pygidium longer (Fig. 20) compared to female pygidium (Fig. 21). For slight differences between shapes of male and female terminal spur of anterior tibia see Figs. 14 and 15, respectively. No differences were found between male and female abdominal sternites (Figs. 18-19). Male aedeagus as in Figs. 22-23; female spermatheca as in Fig. 25.

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 slighty larger and deeper in some specimens compared to other specimens of same sex). The body length ranges from 3.9 to 4.6 mm.

Differential diagnosis. Only the new species described here is currently known in *Ajmeraphodius* gen. nov. Differences from members of the genus *Pharaphodius* based particularly on characters of the type species *Pharaphodius marginellus*, are mentioned in the genus description and in the part Discussion.

Collecting circumstances. Unknown.

Distribution. India (Rajasthan).

Name derivation. The specific name refers to the presence of setae on the clypeus margin.

DISCUSSION

Table 1. Differences between characters of the monotypical new genus *Ajmeraphodius* gen. nov. described here and type species of the genus *Pharaphodius* Reitter, 1892

character	*Ajmeraphodius* gen. nov.	*Pharaphodius* Reitter, 1892
head	slightly convex, nearly flat	moderately convex
epistome	flat	gibbous
clypeus	truncate anteriorly, without distinct anteromedian emargination	rounded anteriorly, with moderate but distinct anteromedian emargination
clypeus margins	distinctly macrosetaceous (the macrosetae outgrow from the head underside)	entirely glabrous
elytron intervals	less convex, and thus, apical arrangement of striae and intervals less distinct under low magnification	considerably convex, arrangement of striae and intervals at elytron apex being thus very distinct
aedeagus	parameres moderately sclerotized throughout, smooth (Figs. 22-23)	parameres with considerably sclerotized structure (see figs. 777-778 by Dellacasa et al. (2001))
epipharynx	anterior margin of epipharynx weakly tetralobed; sides of epitorma subparallel, widened anteriad; corypha with six stout, relatively short spinules only slightly differing in length, and with a considerably long spinule between them; acanthopariae densely macrosetaceous (Fig. 24)	anterior margin of epipharynx weakly, broadly crenulate; sides of epitorma nearly parallel, widened posteriad; corypha with eight relatively long spinules distinctly differing in length; acanthopariae sparsely macrosetaceous (see fig. 776 by Dellacasa et al. (2001))

The species described here, *Ajmeraphodius clypeosetosus* sp. nov., reminds of the taxon *Pharaphodius* due to the fact that the type specimens have elytral intervals (at least intervals 1-6) running free backward (without any fusion before reaching the apical margin). *Pharaphodius* was formerly mostly considered as a subgenus (or genus group) of the big genus *Aphodius* Hellwig, 1798 - see for example monographs by Schmidt (1922), Balthasar (1964), and Endrödi (1964) or a catalogue by Dellacasa (1988). In the principal work by Dellacasa et al. (2001) dealing with genus group taxa in Aphodiinae, *Pharaphodius* is considered as a genus, but the authors emphasize its heterogeneous nature, which should result in a reclassification of numerous species, proposal of new genera, etc. These contemporary or future actions are beyond the scope of the present work. On the other hand, the species studied here is definitely new and thus, it was necessary to consider its generic status.

For practical reasons (in spite of the above mentioned heterogeneity of *Pharaphodius*), it was necessary to compare the new species with the type species of the genus *Pharaphodius* - *Pharaphodius marginellus* due to the arrangement of elytral intervals on the elytral apex. The results of the comparison are summarised above in Table 1. They were based on rich materials in our collection, but particularly on the work by Dellacasa (1996) which offers important data on external characters, aedeagi, and epipharyngi of the type species and of three similar species ("sibling species"), *Pharaphodius attritus* (Balthasar, 1933), *P. diadema* (Wiedemann, 1823) and *P. priscus* (Motschulsky, 1858) - all of them from Asia. We strongly believe that this group is considerably homogeneous. Almost all characters correspond to those quoted in Table 1 under

P. marginellus; only in *P. attritus*, the clypeus is rather rounded than emarginate anteriorly, but definitely not truncate like with *Ajmeraphodius* gen. nov. We believe that in the future, after any actions concerning genera of species commonly considered within the framework of *Pharaphodius*, the four Asian species (including the type species of *Pharaphodius*) studied by Dellacasa (1996) will be furthermore kept in *Pharaphodius*.

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REFERENCES

BALTHASAR V. 1964: *Monographie der Scarabaeidae der palaearktischen und orientalischen Region. Bd. 3.* Prag: Verl. Tschechoslowak. Akad. Wiss., 652 pp.

DELLACASA M. 1988: Contribution to a world-wide catalogue of Aegialiidae, Aphodiidae, Aulonocnemidae, Termitotrogidae (Coleoptera: Scarabaeoidea). *Memorie della Società Entomologica Italiana* 66(1987): 1-455.

DELLACASA G. 1996: *Aphodius marginellus* (Fabricius, 1781) and its sibling species in the subgenus *Pharaphodius* Reitter, 1892 (Coleoptera: Aphodiidae). *Elytron* 10: 139-145.

DELLACASA G., BORDAT P. & DELLACASA M. 2001: A revisional essay of world genus-group taxa of Aphodiinae (Coleoptera Aphodiidae). *Memorie della Società Entomologica Italiana* 79(2000): 1-482.

DELLACASA G., DELLACASA M., & MANN D. J. 2010: The morphology of the labrum (epipharynx, ikrioma and aboral surface) of adult Aphodiini (Coleoptera: Scarabaeidae: Aphodiinae), and its implications for systematics. *Insecta Mundi* 132: 1-21.

ENDRŐDI S. 1964: Die Aphodiinae des Congo-Gebietes in Rahmen der Fauna von zentral-Afrika (Coleoptera: Scarabaeidae). *Annales du Musée Royal de l'Afrique Centrale, Tervuren* 123: 1-415.

SCHMIDT A. 1922: *Coleoptera Aphodiinae. Das Tierreich. Vol. 45*. Berlin & Leipzig: W. de Gruyter and Co., 614 pp.

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