

Two new species of Aphodiini from China (Coleoptera: Scarabaeidae: Aphodiinae)

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Taxonomy, new species, new combination, distribution, Coleoptera, Scarabaeoidea, Aphodiinae, Aphodiini, Gilletianus, Trichonotulus, China, Palaearctic Region

Abstract. Two new species of the tribe Aphodiini from China are described and illustrated: *Gilletianus yunnanensis* sp. nov. from the Yunnan Province and *Trichonotulus amdoensis* sp. nov. from the Qinghai Province. Two new combinations are proposed: *Trichonotulus dzamosanicus* (Stebnicka, 1973) and *Trichonotulus vultuosus* (Balthasar, 1971), both from *Aphodius* (Hellwig, 1798). The species *T. vultuosus* is reported from India (Jammu and Kashmir) for the first time based on one specimen and also illustrated for the first time in the present study.

INTRODUCTION

The work presented here continues a series of studies by the first author focused on Chinese species of genera, formerly considered to be subgenera of the genus *Aphodius* Hellwig, 1798 (cf. e.g., Schmidt 1922, Balthasar 1964) and relatively recently (Dellacasa et al. 2001) elevated to the genus rank: Král (1995, 1997a,b,c, 2000, 2002, 2011, 2013). The following genus group taxa were dealt with in these studies: *Agrilinus* Mulsant & Rey, 1870 (Král 2013), *Aphodius* Hellwig, 1798 (Král 1997c), *Brachiaphodius* W. Koshantschikov, 1913 (Král 2000), *Neagolius* W. Koshantschikov, 1912 [as *Agolius* Mulsant & Rey, 1870] (Král 1995, 1997a), *Phaeaphodius* Reitter, 1892 (Král 2002), *Pseudacrossus* Reitter, 1892 (Král 1997b, 2011) and *Qingaphodius* (Král, 1997).

The present work offers a contribution to knowledge of the genera *Gilletianus* Balthasar, 1933 and *Trichonotulus* Bedel, 1911. The newest list of Asian species of the genus *Gilletianus* (Král et al. 2014) comprises 25 species from Asia including five species from China. The new species described here is thus a sixth Chinese species of the genus. According to the Catalogue of Palearctic Coleoptera (Dellacasa & Dellacasa 2006), six species of the genus *Trichonotulus* are considered to occur in Asia, most of them from the Eastern Palearctic. A seventh species of the genus known from Asia is described below.

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. The morphological terminology concerning the epipharyngeal structures was adopted from Dellacasa et al. (2001).

The following acronyms identify the collections housing the material examined:

DKCP David Král collection (deposited in NMPC);

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

MRC D Miloslav Rakovič private collection, Dobřichovice, Czech Republic;

NMPC National Museum, Praha, Czech Republic (Jiří Hájek).

The type material is specified in the part taxonomy together with descriptions of the two new species.

Specimens of the newly described species are provided with printed red labels: “name of the taxon sp. nov., HOLOTYPUS ♂ [or] ALLOTYPUS ♀ [or] PARATYPUS, ♂ [or] ♀, David Král, Miloslav Rakovič & Ladislav Mencl det. 2015” and with pale green labels specifying numbers related to a photo-documentation system by the third author (L. M.). Exact label data are cited for the type material examined. Individual lines within each label are separated by slashes “/”, separate labels are indicated by double slashes “//”. Information in quotation marks indicates the original spelling. Our remarks and additional comments are found in brackets.

TAXONOMY

Gilletianus yunnanensis sp. nov.

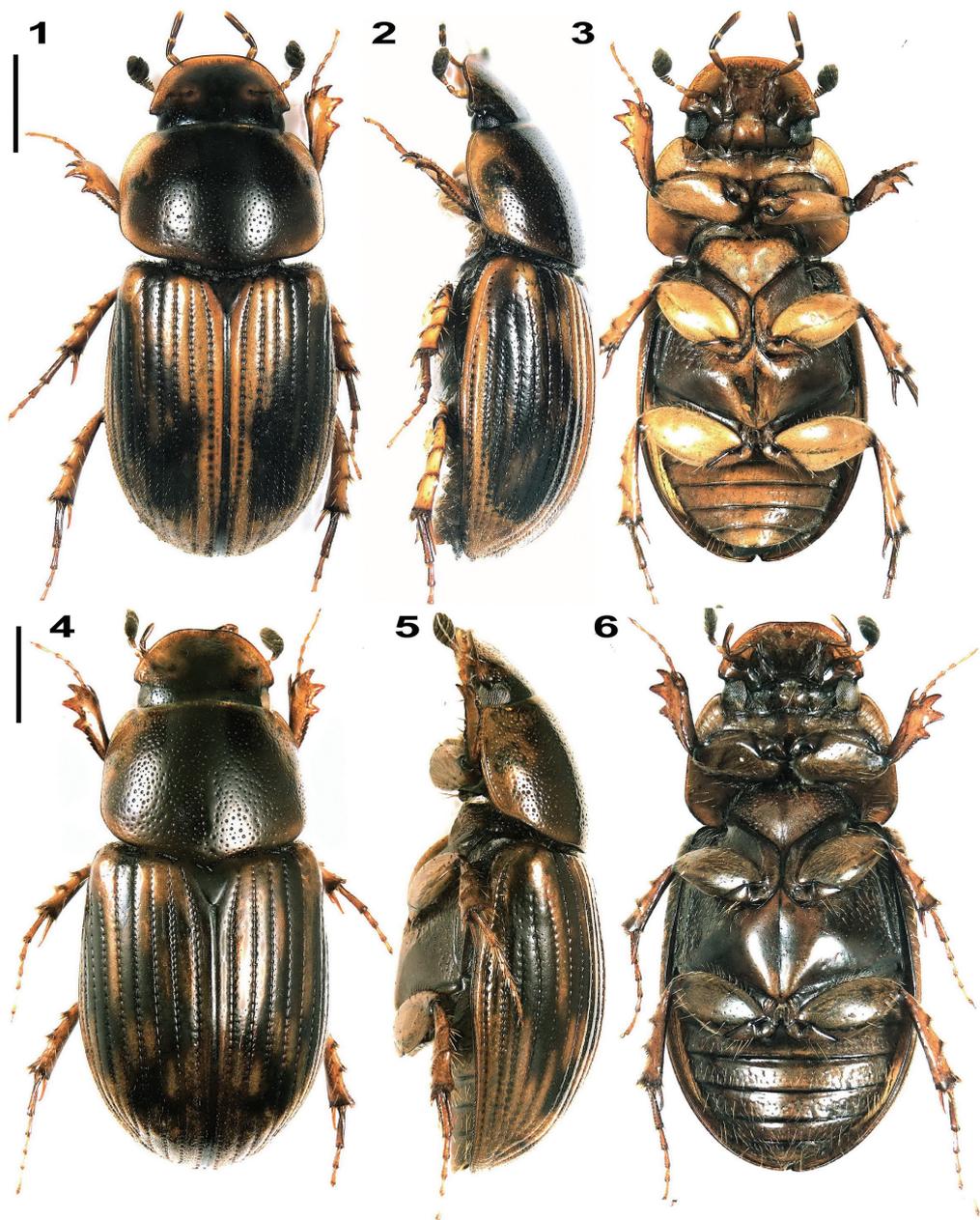
(Figs. 1-15)

Type locality. China, S Yunnan, Mts. NE of Tengchong, 25°01'54"N 98°38'47"E, 1700 m.

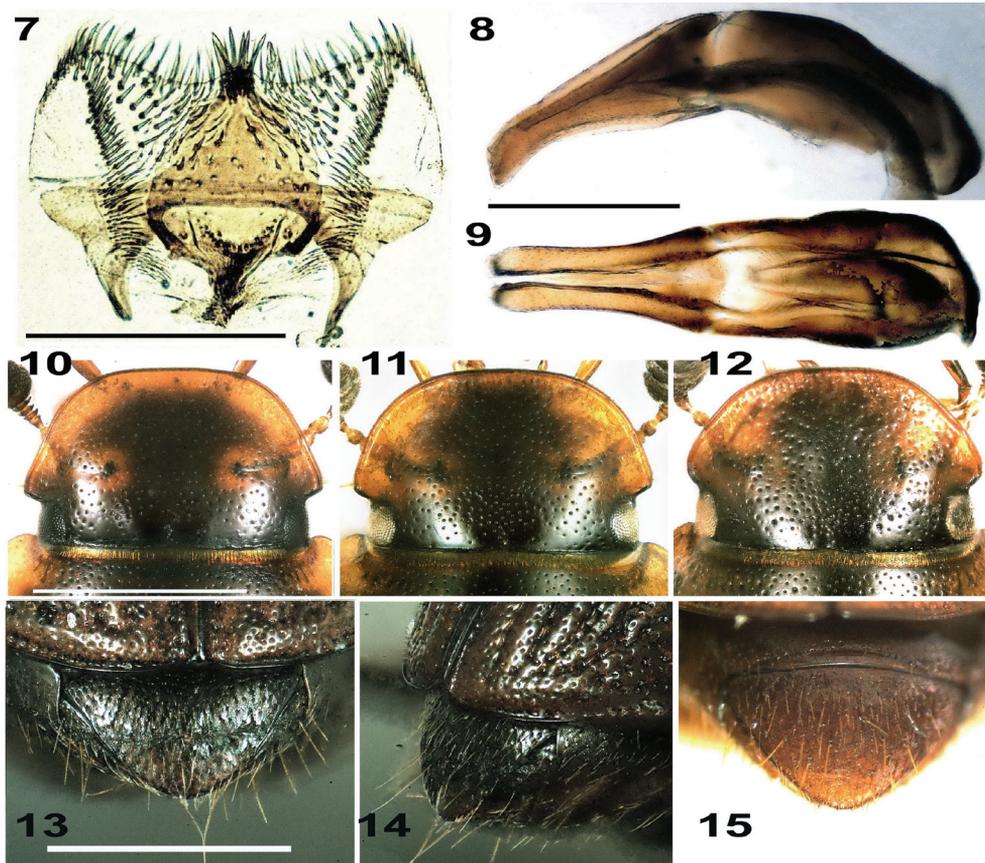
Type material. China: Yunnan: Holotype, ♂ (DKCP), “China, S Yunnan, 1.vii.2010 / Mts. NE of TENGCHONG / 25°01'54"N 98°38'47"E / 1700m, David Král lgt. [printed]” [No.: 1989]. Paratypes: allotype, ♀ [No.: 1990] and 1 ♂ (DKCP), 1 ♂ (LMCT) and 1 ♂ (MRC D), “CHINA, Yunnan prov. / 10 km NE TENGCHONG / ZingHai lake env. / J. Štátný 27.10.1999 [printed]”; 1 ♂ (DKCP), 1 ♂ (LMCT) and 1 ♂ (MRC D), “CH, SW. Yunnan, 4.vii.2010 / E of TENGCHONG, 1750 m / 25°01'54"N 98°38'47"E / David Král lgt. [printed]”.

Description of holotype. Dorsum (Figs. 1-2). Small, body length of 5.1 mm, width of 2.2 mm, oblong oval, convex, shining, head and pronotum glabrous, elytra macrosetaceous; brown, clypeus margins, genae, pronotum basal and lateral margins, spots on elytral disc, lateral margins of elytra, elytral apex, and legs paler, yellowish.

Head (Fig. 10) relatively large, nearly flat, glabrous. Frontoclypeal suture absent medially, slightly indicated as darkened line segments laterally. Clypeus semicircular (neither truncate nor emarginate anteriorly), with narrow, upward lifted anterior margin. Genae large, protruding much more strongly than fairly large eyes, their anterior margins being aligned with clypeus lateral margins; lateral margin of gena forming nearly right angle with its posterior margin; few rather long, fine, pale macrosetae present on gena margin in front of this angle. Clypeus (Fig. 10) only very slightly punctate anteriorly, punctures being difficult to observe even under highest magnification, area between eyes sparsely microscopically punctate, punctures on occiput also sparse and fine but slightly more distinct. Head mostly



Figs. 1-6. *Gilletianus yunnanensis* sp. nov., habitus: 1-3- ♂ holotype; 4-6- ♀ allotype. 1, 4- dorsal view; 2, 5- left lateral view; 3, 6- ventral view. Scale line: 1.0 mm for all figures.



Figs 7-15. *Gilletianus yunnanensis* sp. nov.: 7- epipharynx; 8, 9- aedeagus; 10, 11- ♂ head; 12- ♀ head; 13-15- pygidium. 7-10- ♂ holotype; 11, 15- ♂ paratype; 12-14- ♀ allotype. 7- ventral view; 8, 10-15 dorsal view; 9- lateral view. Scale lines: 0.3 mm for Figs. 7-9, 1.0 mm for Figs. 10-15.

brown, clypeus anterior and lateral areas and genae yellow and rather translucent, without sharp limits between darker and lighter areas.

Epipharynx (Fig. 7). Anterior margin shallowly sinuate medially, regularly rounded anterolaterally; epitorma broadly triangular, regularly widened posteriorly; corypha not reaching anterior margin, with two long, stout spinules; acropariae with dense, long macrosetation, prophobae considerably densely macrosetaceous; chaetoparia slender, densely macrosetaceous; tormae short.

Pronotum (Figs. 1-2) convex, transversal, widest at about midlength, lateral margins considerably arcuate anteriorly, moderately arcuate posteriorly, anterior as well as posterior angles rounded, lateral margins moderately bordered, base not bordered, slightly sinuate on each side (against elytral intervals 3-4). Pronotum surface finely punctate, punctures moderately variable in their size and separation, but mostly separated by more than puncture

diameter. Pronotum disc brown, areas along base and lateral margins lighter, yellowish and translucent.

Scutellum equilateral triangular, its surface nearly glossy (very fine shagreened - visible under high magnification only), with few very finely punctures, brown with slightly darkened sides.

Elytra (Figs. 1-2) convex, with ten striae and ten intervals, without humeral denticles, only very finely microscopically shagreened and thus still fairly shining, macrosetaceous, yellowish brown, with small dark brown spot in interval 5 reaching elytron base and large dark brown discal spot on each elytron (Fig. 1); small yellowish brown spots (arranged in oblique pattern) present inside of the large discal spot in intervals 3, 4, 5 and 6. Striae very distinct, dark, with very distinct punctures moderately crenating intervals; punctures on disc nearly round, neighbouring punctures separated by less than puncture diameter. Intervals convex, very sparsely, minutely punctate and very finely, microscopically shagreened, but still fairly shining. Inner elytral intervals glabrous within triangular area around scutellum (extending from elytral base to about 2/3 interval length for interval 1, to about 1/2 for intervals 2-3, and to less than 1/2 for intervals 4-5); remaining parts of elytral surface with fine setigerous punctures bearing short, fine semierect macrosetae arranged in two rows in each interval, with presence of further additional macrosetae between these two rows on elytral apex making apex more macrosetaceous. Epipleurae with about ten long, acuminate, hairlike, moderately arcuately curved and backward directed macrosetae distributed about along 2/3 their length.

Legs yellowish brown. Protibiae with three large outer teeth in apical half and five small denticles in basal half; a short macroseta present in each indentation between two neighbouring small denticles; dorsal face glossy, impunctate, except for row of punctures extending along outer edge from base to posterior large tooth and continuing along intervals between posterior and middle teeth and then between middle and anterior teeth; terminal spur flat, spatulate (not pointed), relatively short (only about twice as long as wide), slightly longer than basal protarsomere. Meso- and metatibiae with pairs of distinct oblique ridges; inferior terminal spur of mesotibia blunt and short (not reaching 1/2 superior spur length); metatibia apex fringed with irregularly unequal spinules, its inferior apical spur moderately shorter than superior one, the latter moderately shorter than basal metatarsomere; basal metatarsomere longer than metatarsomeres 2 and 3 combined but shorter than metatarsomeres 2-4 combined.

Pygidium punctate, with long macrosetae throughout.

Ventrum (Fig. 3). Femora with few setigerous punctures. Metaventral plate (Fig. 3) sparsely, finely punctate, with a complete longitudinal furrow. Abdominal ventrites with rows of medium-sized punctures along their anterior and posterior margins.

Aedeagus (Figs. 8-9). Slender; parameres shorter than phallobasis, weakly regularly arcuate apicad; apices rounded in dorsal aspect, acute ventrally in lateral aspect.

Sexual dimorphism. The clypeus is semicircular (sometimes slightly truncate but never emarginate anteriorly) in males; it has a moderate, but still distinct anteromedian emargination in females (Figs. 4, 12). The pronotum surface is finely punctate, the punctures are relatively finer, sparser and moderately variable in their size in males; it exerts a more distinct and

denser double punctation (medium-sized punctures intermixed with fine ones) in females (Figs. 4-5). In males, there are semierect setae in lateral intervals and in posterior 1/3 to 1/2 area of inner intervals; elytra of females are almost glabrous (with only very short macrosetae in posterior 1/4) (Figs. 4-5). The apical spur of protibia is flat, spatulate in males; it is continuously narrowed from its base toward a blunt apex in females. The inferior terminal spur of mesotibia is blunt and very short (not reaching 1/2 superior spur length) in males; it is pointed, and longer (exceeding 1/2 superior spur length) in females.

Variability. Within the type series, the specimens vary in length from 4.6 mm to 5.5 mm. Seven males and only one female are available. The variability can be thus discussed just for male individuals. The clypeus shape varies from semicircular to slightly truncate anteriorly (cf. Figs. 10 and 11). The sparse punctures on the disc surface can be more or less distinct. Some of small light spots inside of the large dark discal spot on each elytron are sometimes less distinct or missing.

Differential diagnosis. The new species described here differs from other species of the genus by the following combination of characters: semicircular shape of the clypeus in males and distinctly emarginate clypeus in females; distinct and rather deep punctures in elytral striae; semierect setae on elytral intervals in males (present laterally and in posterior 1/3 to 1/2), and nearly glabrous elytra in females (with only very short macrosetae in posterior 1/4); spatulate apical spur of the male protibia and very short, blunt inferior apical spur of the male mesotibia.

Collection circumstances. Specimens collected by David Král were taken from cow dung on a shady pathway in secondary shrubs.

Distribution. China, south-western part of the Yunnan Province.

Name derivation. Toponymic; an adjective derived from the name of the Chinese Province of Yunnan where the new species was collected.

***Trichonotulus amdoensis* sp. nov.**

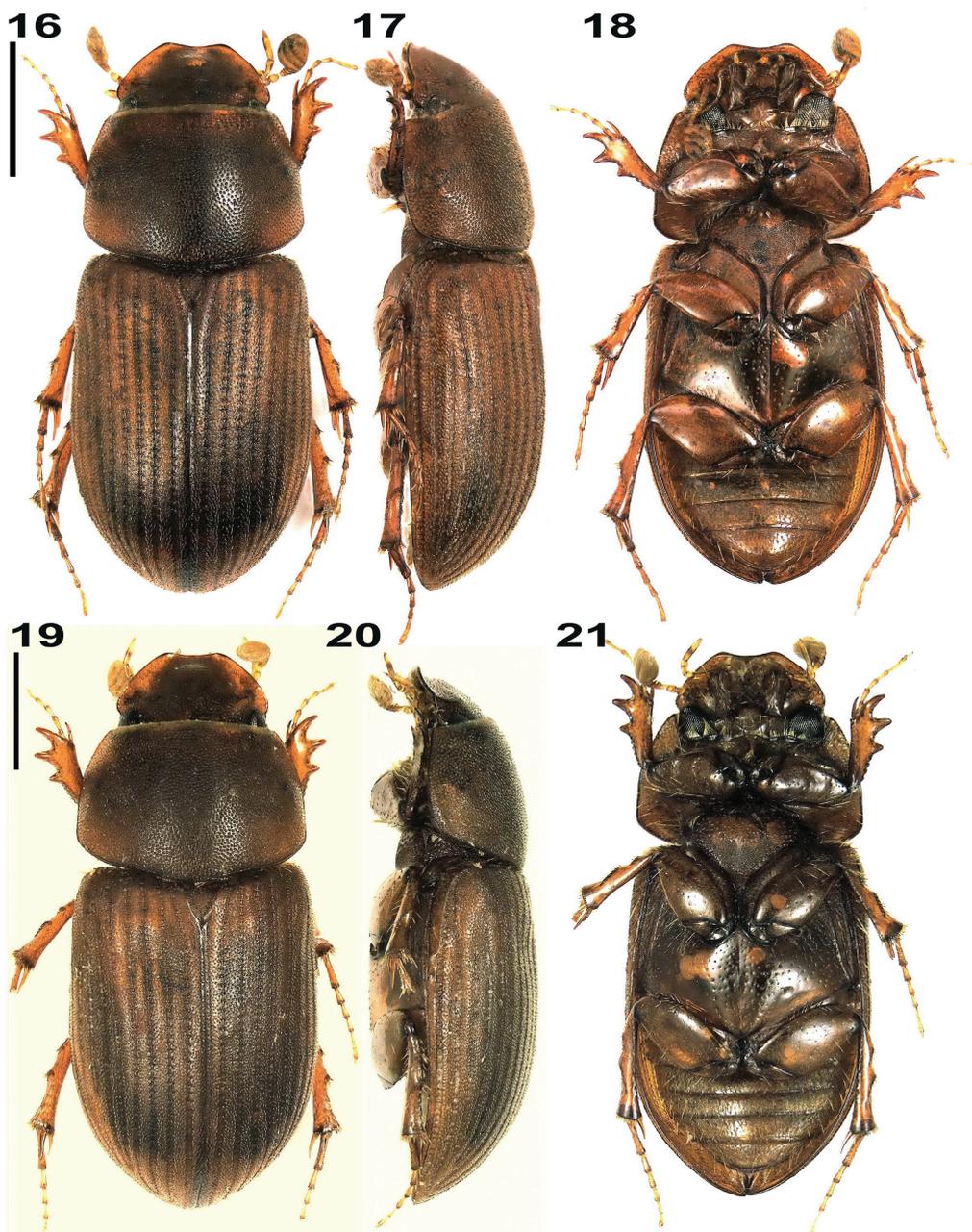
(Figs. 16-31)

Type locality. China, E Qinghai Prov., 30 km N of Ertala [about 36°00'N 100°12'E], 3000 m.

Type material. China, Qinghai: Holotype, ♂ (DKCP), "China, E. Qinghai Prov. / desert 30 km N. of Ertala 23.-24. vii.1992, 3000 m / J. Kaláb leg. [printed] [No.: 1986]". Paratypes: allotype, ♀ [No.: 1987] (DKCP), 2 spec. (LMCP) and 2 spec. (MRCD), same data as holotype.

Description of holotype. Dorsum (Figs. 16-17). Small, body length of 4.3 mm, width of 1.8 mm, oblong oval, moderately convex, head glabrous and shining, pronotum and elytra pubescent and opaque; reddish brown.

Head (Fig. 22) moderately convex, punctate, glabrous, with moderately convex epistomal gibbosity. Frontoclypeal suture very fine, thin, only slightly elevated and thus rather indistinct laterally, finely, but more distinctly elevated at middle. Clypeus (Fig. 22) obtusely angulate each side of distinct round anteromedian emargination; clypeus anterior angles and lateral margins lifted upward; lateral margins essentially aligned with anterior margins of genae; genae rounded, protruding about as much as eyes; eyes large, well visible from above; margin



Figs. 16-21. *Trichonotulus amdoensis* sp. nov., habitus: 16-18- ♂, holotype; 19-21- ♀, allotype. 16, 19- dorsal view; 17, 20- left lateral view; 18, 21- ventral view. Scale line: 1.0 mm for all figures.



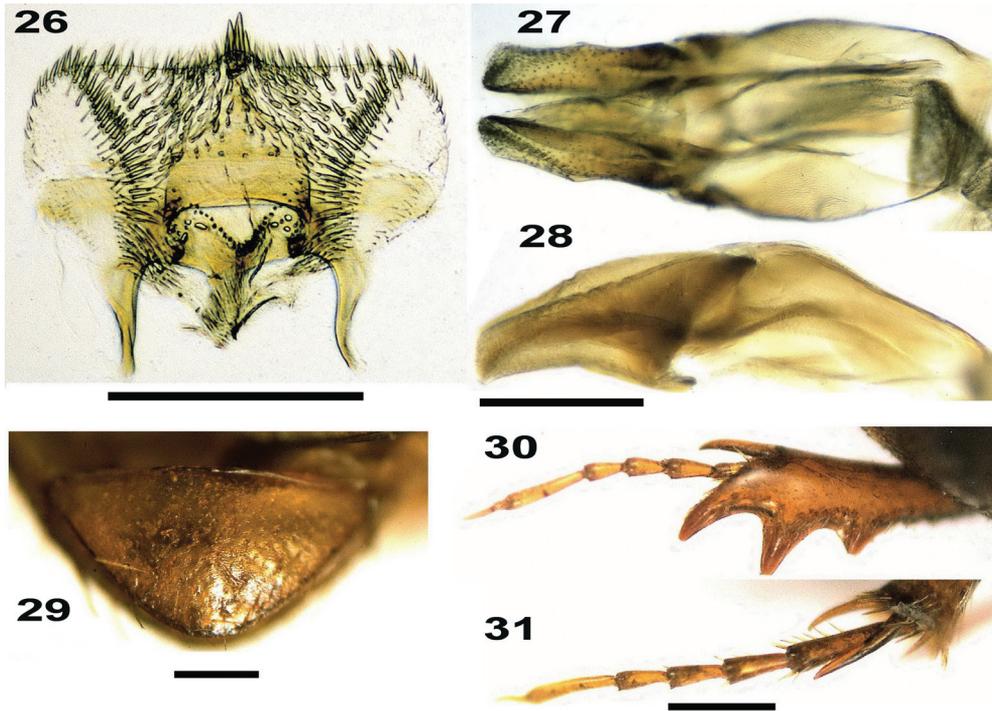
Figs. 22-25. *Trichonotulus amdoensis* sp. nov.: 22- ♂ head, 23- ♀ head; 24- ♂ metaventral plate; 25- ♀ metaventral plate. 22, 24- holotype; 23, 25- allotype. 23-24- dorsal view, 24-25- ventral view. Scale line: 1.0 mm for all figures.

of each gena with few (about 5-7) fine, acuminate, irregularly unequal macrosetae. Head surface finely densely punctate in front of as well as behind clypeofrontal suture (punctures visible under high magnification only); punctate surface followed by glossy impunctate zone posteriorly; occiput with sparsely distributed, moderately larger and rather transverse punctures. Head colour reddish brown, lateral areas of clypeus lighter than remaining head surface.

Epipharynx (Fig. 26). Anterior margin shallowly sinuate medially, obtuse anterolaterally; epitorma narrowly conical, regularly widened posteriad; corypha not reaching anterior margin, with two long, stout spinules; acropariae with dense, long macrosetation, prophobae densely macrosetaceous with several stouter antero-lateral spinules; chaetoparia slender, densely macrosetaceous; tormae short.

Pronotum (Figs. 16-17) moderately convex, transversal, widest at base; anterior as well as posterior corners rounded, base finely bordered, slightly sinuate on each side (against elytral intervals 3-5). Pronotum surface densely punctate; punctures medium-sized, rugose, setigerous (macrosetae short, fine, pale, decumbent, directed backward); interspaces between punctures shagreened, opaque, narrower than puncture diameter. Pronotum colour reddish brown, darker on disc compared to surrounding areas.

Scutellar plate isosceles triangular with moderately arcuate sides, its surface uneven, considerably shagreened, reddish brown, sides dark brown, nearly black.



Figs. 26-31. *Trichonotulus amdoensis* sp. nov., ♂, holotype: 26- epipharynx; 27-28- aedeagus; 29- pygidium; 30- left protibia; 31- right metatibia. 26- ventral view; 27, 29- dorsal view; 28- left lateral view. Scale line: 0.25 mm for all figures.

Elytra (Figs. 16-17) moderately convex, considerably shagreened and macrosetaceous, reddish brown, with slightly or moderately darker suture; with ten striae and ten intervals, without humeral denticles. Striae groove-shaped (narrow, but distinctly delimited on both sides, not quite shallow); punctures in striae moderately (narrowly) crenating intervals (medially as well as laterally) - they would be otherwise poorly distinct; striae 1-5 reaching elytron base, striae 6-7 reaching humeral callus, striae 8-10 more shortened anteriorly. Intervals much wider than striae, flat, considerably shagreened, with setigerous punctures (punctures rugose but much smaller than those on pronotum, macrosetae very short, pale, much shorter than those on pronotum; about four setigerous punctures present per interval width, punctures not arranged in longitudinal rows.

Legs reddish brown, but glossy and lighter than body dorsal surfaces. Protibia (Fig. 30) with three large outer teeth in apical half and six small denticles in basal half; its dorsal face impunctate; terminal spur continuously narrowed from base to apex, moderately arcuately bent outward. Meso- and metatibiae with pairs of distinct oblique ridges; metatibia apex (Fig. 31) fringed with irregularly unequal spinules, its inferior apical spur moderately shorter than superior one, the latter moderately shorter than basal metatarsomere; basal metatarsomere about as long as metatarsomeres 2 and 3 combined.

Pygidium (Fig. 29) scabrously punctate, with two long pygidial macrosetae outgrowing from very coarse punctures.

Ventrum (Fig. 18). Femora with few setigerous punctures. Metaventral plate (Fig. 24) sparsely, coarsely, somewhat irregularly punctate, with complete longitudinal furrow. Abdominal ventrites (Fig. 18) finely scabrous, densely macrosetaceous.

Aedeagus (Figs. 27-28). Short; parameres remarkably shorter than phallobasis, almost straight with apices obliquely cut off.

Sexual dimorphism. The frontoclypeal suture is more elevated at middle in males compared to females (Fig. 23).

Variability. Within the type series (holotype, allotype and four paratypes), the specimens vary in length from 4.3 mm to 5.2 mm.

Differential diagnosis. *Trichonotulus amdoensis* sp. nov. differs from any other European or Asian species of the genus by having glabrous, shining head and obtusely angulate (not rounded) clypeus both sides of the distinct anteromedian emargination, with upward lifted margins. Its body size comparable with the species *Trichonotulus vultuosus* (Balthasar, 1971), comb. nov. and relatively close geographic occurrence suggest that a comparison of the two species is desirable. The latter species (for habitus see Figs. 32-34) is distinctively different in the following features: its anterior clypeus margins are rounded, anterior and lateral edges of the clypeus are considerably bristled, the frontoclypeal suture is fine, but distinct throughout, margins of genae are not aligned with lateral margins of the clypeus (Fig. 35), and the elytral intervals are fairly convex and their macrosetae are longer and arranged in rows (biseriate) (Figs. 32-33); in the species *T. amdoensis* sp. nov. the anterior angles of the clypeus are obtusely angulate, edges of the clypeus are glabrous, the frontoclypeal suture is only partially indicated, margins of genae are aligned with clypeus lateral margins (Figs. 22-23), and the elytral intervals are flat and their macrosetae are very short and not arranged in rows (four macrosetae are present per the elytral interval width) (Figs. 16-17, 19-20).

Distribution. China, eastern part of the Qinghai Province.

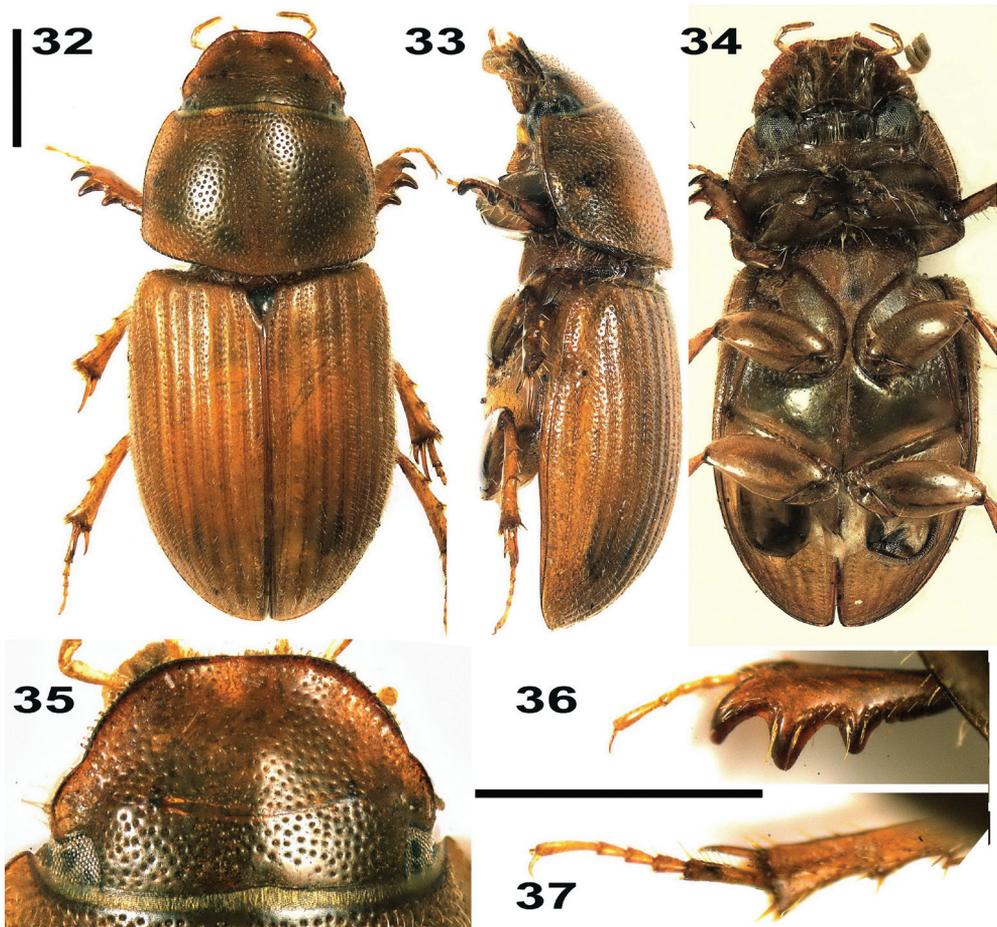
Name derivation. Toponymic; an adjective derived from Amdo, the name of one of three traditional regions of Tibet (nowadays approximately comprised in the Qinghai Province of China) where the new species was collected.

***Trichonotulus vultuosus* Balthasar, 1971 comb. nov.**

(Figs. 32-37)

Material studied. A specimen (DKCP) labelled as follows: "INDIA, Jammu u. Kashmir / Jammu, District Kishtwar / Jourdu, 2100 - 2400 m / leg. C. Holzschuh, 16. 7. 1980 [printed] // Aphodius / (Trichonotulus / vultuosus Balth. / David Král det. / compared with HT / in NMPC (♂)" [handwritten]"// [No.: 1988].

Note. The species was studied for reasons mentioned above in association with the differential diagnosis of *Trichonotulus amdoensis* sp. nov. The species has not yet been sufficiently illustrated and thus, relevant photographs are presented here.



Figs. 32-37. *Trichonotulus vultuosus* (Balthasar, 1971), ♂ (India, Jammu and Kashmir, Jourdu): 32-34- habitus, 35- head, 36- left protibia, 37- right metatibia; 32, 35-36- dorsal view; 33- left lateral view; 34- ventral view. Scale line: 1.0 mm for all figures.

DISCUSSION

In addition to descriptions of two new Chinese species of Aphodiini, *Gilletianus yunnanensis* sp. nov. and *Trichonotulus amdoensis* sp. nov. with giving differential diagnoses and providing relevant illustrations we felt that it is useful to compare the new species of the genus *Trichonotulus* with the species *T. vultuosus* and to provide its illustrations, which have not yet been available in the literature. The reasons for doing so was the comparable body size and not very distant areas of the occurrence of the two species: it was described from Nepal (Rapti-Tal [= Rapti River valley]) (Balthasar 1971) and is reported from Nepal and Pakistan in the Catalogue of Palearctic Coleoptera (Dellacasa & Dellacasa 2006); the specimen examined and illustrated here comes from India (Jammu and Kashmir) - the first record from India. In our consideration, we respected the

classification of the species in accordance with the Catalogue of Palearctic Coleoptera (Dellacasa & Dellacasa 2006), but it is to note that its position is rather outstanding within the framework of the genus, particularly due to the considerably bristled anterior and lateral edges of the clypeus.

It is of interest to note that the new species described here has its arrangement of short macrosetae in elytral intervals similar to that in a quite allopatric (described from North Korea) species *Trichonotulus dzamosanicus* (Stebnicka, 1973) comb. nov.: macrosetae not arranged in rows, outgrowing from fine setigerous punctures (four macrosetae per elytral interval width); the latter is, however, distinctively different in a number of other features, as for example the presence of deep punctures in elytral striae (Stebnicka 1973).

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