

# ZOOLOGISCHE MEDEDELINGEN

UITGEGEVEN DOOR HET

RIJKSMUSEUM VAN NATUURLIJKE HISTORIE TE LEIDEN  
(MINISTERIE VAN WELZIJN, VOLKSGEZONDHEID EN CULTUUR)

Deel 58 no. 3

13 juni 1984

ISSN 0024-0672

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## A GENERIC RECLASSIFICATION OF THE AFROTROPICAL BOLBOCERATINI (COLEOPTERA: GEOTRUPIDAE)

by

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Krikken, J.: A generic reclassification of the Afrotropical Bolboceratini (Coleoptera: Geotrupidae).

Zool. Med. Leiden 58(3), 13-vi-1984: 23-45, figs. 1-27. — ISSN 0024-0672.

Key words: Coleoptera; Geotrupidae; Bolboceratini; key, genera; Afrotropical; checklists, species.

The generic classification of the Afrotropical Bolboceratini is discussed. Fourteen genera are recognized, five of them new: *Bolboceratellus*, *Bolbodius*, *Bolboceratex*, *Namibiobolbus* and *Meridiobolbus*. *Microbolbus* Vulcano et al. is synonymized with *Mimobolbus* Vulcano et al. *Bolbaffroides* and *Bolboceratops* are raised to generic rank. The genera are keyed, diagnosed, and their species are listed. Many new combinations are proposed, mainly for species hitherto combined with *Bolboceras* Kirby.

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## INTRODUCTION

In this paper the classification of the Afrotropical Bolboceratini (= Bolbocerini) is reviewed and suggestions for further improvements are made. Till about 15 years ago the Afrotropical Bolboceratini were placed in a single "cosmopolitan" genus, *Bolboceras* auctorum, the last synoptic work placing them all in *Bolboceras* being the revision by Paulian (1941). This generic name *Bolboceras*, however, is in no way applicable to any of the Afrotropical Bolboceratini, (1) because *Bolboceras* Kirby (July 1819) is a junior synonym of *Odonteus* Samouelle (June 1819) (date from Sherborn, 1922; cf. also Krikken 1978b), and (2) because *Odonteus* is a genus of Europe and North America, not directly related to any of the Afrotropical groups. From 1969 on a total of ten new genus-group taxa were proposed to partly rectify this taxonomical and nomenclaturally unacceptable situation (Vulcano et al., 1969; Krikken, 1977a, 1978a; Nikolajev, 1979). Most of the species, however, formally remain-

ned combined with *Bolboceras* and therefore a further break-down of this "genus" appears inevitable. In view of the scanty material as yet available for study, I have been rather reluctant to add more genera to those proposed in the aforesaid papers (cf. also Krikken, 1977c, 1978b). Meanwhile, however, my continued reconnaissance of the Afrotropical and other bolboceratine faunas has yielded enough information to enable the proposal of a tentative, expanded generic reclassification.

In this paper the Afrotropical genera are keyed and concisely diagnosed, whereas the known species are re-arranged as far as possible. Several new species are known to me, which may be described later. Several types should be re-examined, but at the moment I have no plans to conduct a full-scale species-level investigation. The diagnoses of the new genera given here largely follow my earlier survey of supraspecifically important characters (Krikken, 1977d; the importance of some characters was at the time underestimated, e.g. the detailed shape of the eye-canthus). The diagnoses of the other genera contain the primary features only, in their approximate order of importance. After each of the generic accounts the names of the included species are listed. The papers in which species are described that were not included in Paulian (1941) are mentioned in full in the references. The new generic combinations are indicated as such (comb. nov.; omitted for new genera). I have refrained from giving any distributional information for the species, because several of the literature records are based on misidentifications. The synonymies of species-group names proposed by Paulian (1941) are only tentatively accepted here; some have already been rectified and further revision is needed. Doubtful generic positions are marked with an asterisk.

I have qualified this reclassification as tentative, and consequently any suggestions for further improvements from other workers are welcome, especially those based on new characters.

#### AFROTROPICAL BOLBOCERATINI

As a group the Afrotropical Bolboceratini are easily recognizable (cf. fig. 27, *Bolbocaffer*). Their general shape is always more or less semiglobular; their colour is yellow to brown, occasionally black, and nearly always uniform; their total length ranges from a few mm to about 3 cm. The mandibles and the labrum project strongly in front of a usually more or less trapeziform clypeus. The eye-canthi are very distinct. The antennae have 11 segments, including an extremely well developed oval or disc-shaped 3-lamellate club. The fore tibiae are strongly serrate-dentate (at least 5 external denticles pre-

sent); the middle and hind tibiae have fossorial elevations and spines on their outer surface. On the head surface there is nearly always some ornamentation consisting of tubercles and/or ridges. The scutellum is always very distinct. The Afrotropical Bolboceratini have on their elytra 7 punctate striae between the suture and the humeral umbone; there is no umbone on the posterior elytral declivity; the elytral disc is never setose. In the two last-mentioned features the Bolboceratini differ from the closely related Athyreini (there are more differences; cf. also Howden & Martinez, 1963). The abdomen of the Bolboceratini is moderately sclerotized and usually entirely retracted under the globose elytra (in *Bolbaffer* males the abdominal sternites may be extremely modified).

The recognition of the respective genera is far from easy. With some experience, however, the characters employed in the key and the diagnoses will be appreciated. The characters of primary importance in the present classification are: (1) the detailed disposition of the cephalic protrusions; (2) the shape of the eye-canthus; (3) the disposition of any pronotal protrusions and impressions; (4) any modifications of the pronotal margins; (5) the shape of the scutellum; (6) the width of the elytral epipleuron; (7) the shape of the elytral basal margin; (8) the shape of the antennal lamellae; (9) the shape of the metasternal disc; (10) the dentation and general shape of the fore tibia; (11) the length proportions of fore tarsal segments 1 to segments 2–5; (12) the structure of the male genitalia. The species characters usually concern details in the shape of the various elements mentioned, especially of the male genitalia and the forebody; microsculptural features are also very important. In groups where no post-1941 synopsis is available it is virtually impossible to achieve a reliable species identification without the study of type-material.

Bolboceratini are (in Africa) usually active during the night; they have burrowing habits, possibly feeding and/or breeding on hypogean fungi, like their relatives on other continents; certain North American Bolboceratini provision their burrows with humus (cf. Howden, 1955). Nothing substantial is known of the habits of the Afrotropical forms treated here. Virtually all the museum specimens seem to have been collected at light; my own experience (in East Africa) is indeed that they frequently come to light, but rarely in numbers (more than five specimens per hour is exceptional). The repeated suggestion that Bolboceratini have coprophagous habits seems unfounded.

Very little can be said about the biogeographical status of the Afrotropical fauna (cf. enumeration below). Some genera (*Bolbaffroides*, *Indobolbus*, *Bolboceratops*) extend their range into India, in Africa having most of their species in the northeastern corner of the continent; *Indobolbus* has most of its species in India (several of them undescribed). The remaining genera are en-

demic, eight being confined to southern Africa. Actually only *Bolbaffer*, *Bolbocaffer* and *Mimobolbus* are widespread in the Afrotropical region. Northern Africa has only representatives of the genus *Bolbelasmus* Boucomont, an old Laurasian element, and of the poorly known genus *Eubolbitus* Reitter. All the Afrotropical forms belong to an apparently Gondwanan section of the Bolboceratini, characterized by distinctly separated middle coxae. Apart from the above-mentioned extensions into the Oriental region (and the intervening Palearctic), the affinities of these Afrotropical Bolboceratini are with the South American and Australian faunas. They are undoubtedly ancient inhabitants of parts of the African continent, their origin possibly dating back as far as the Cretaceous. Bolboceratini seem to be absent from Madagascar.

The Afrotropical Bolboceratini certainly do not constitute a monophyletic group, but more than this general negative statement can scarcely be given. Some genera seem to be more closely interrelated than others, although distinct suprageneric synapomorphies are rarely obvious (see also comments at the end of some of the generic accounts), and much of the overall similarity may be due to plesiomorphous features.

#### Enumeration of Afrotropical genera and species

number of spp.

	Afrotropical	Arabia-Lebanon	India
<i>Prototrupes</i>	2 S	—	—
<i>Namibiotrupes</i>	1 S	—	—
<i>Bolboceratellus</i>	> 1 S	—	—
<i>Bolboceratex</i>	4 S	—	—
<i>Indobolbus</i>	3 N	>7 (+ 1)	1
<i>Bolbaffroides</i>	2 N	1	2
<i>Bolbodius</i>	1 S	—	—
<i>Bolbocerooides</i>	1 S	—	—
<i>Namibiobolbus</i>	2 S	—	—
<i>Meridiobolbus</i>	> 3 S	—	—
<i>Bolbaffer</i>	> 10	—	—
<i>Bolboceratops</i>	> 4 N	1 (+ 1)	—
<i>Bolbocaffer</i>	> 23	—	—
<i>Mimobolbus</i>	> 24	—	—
total described	81		

N northern (Sudan – Sahel) section only

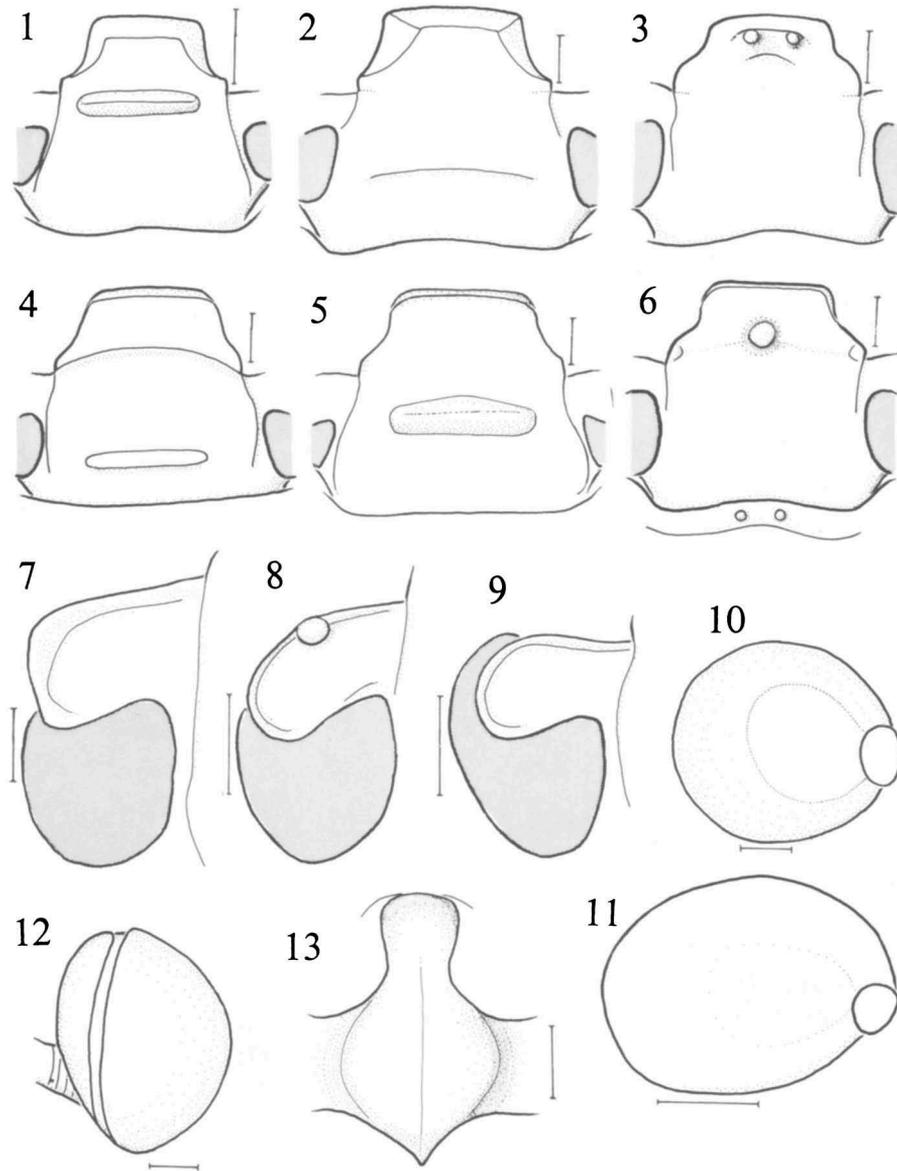
S southern (Angola – Natal and south) section only

> undescribed spp. seen (not included in number given here)

(+ 1) one species also in Afrotropics

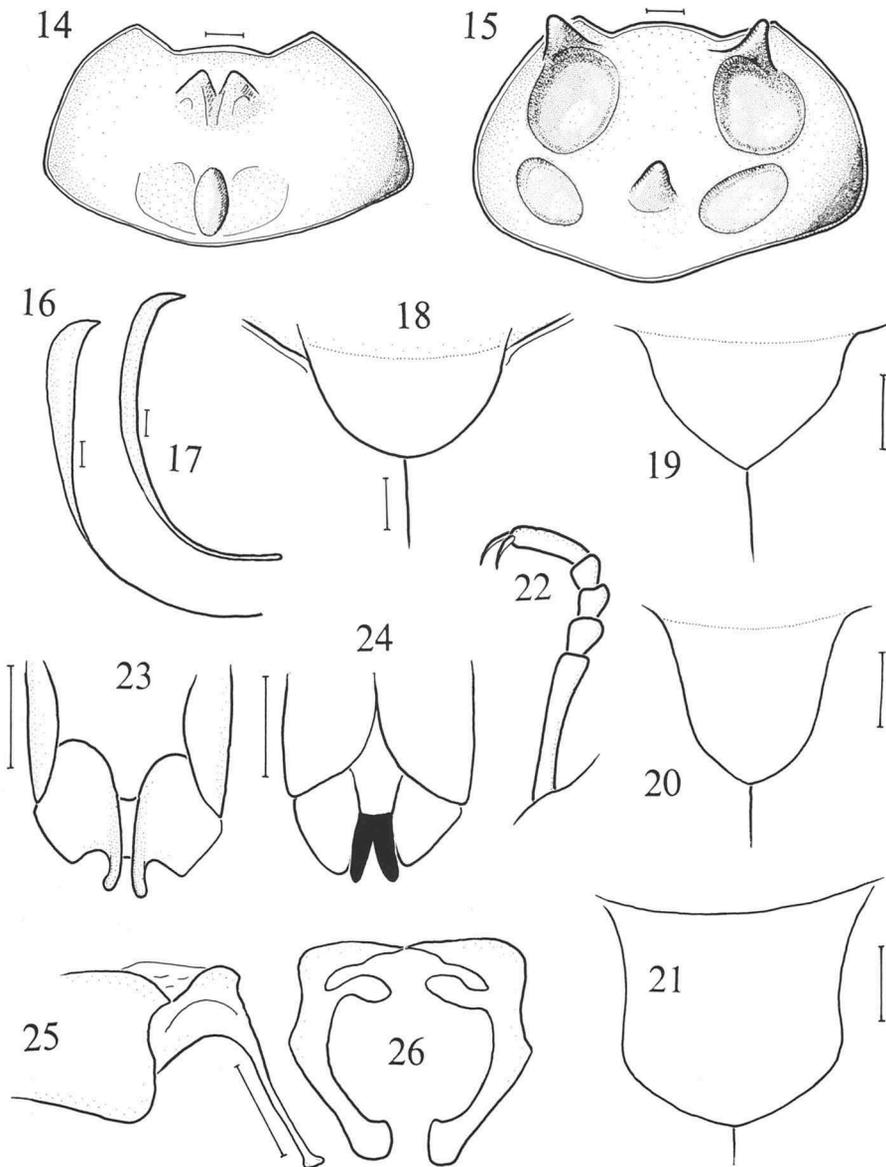
## KEY TO THE AFROTROPICAL GENERA

1. Outer segment of antennal club strongly “inflated” (fig. 12) ..... 2
- Outer segment of antennal club at most with slightly convex distal side, club as a whole may be large ..... 3
2. Elytral base marginate (fig. 18, adjacent to scutellum). Tarsal segment 1 longer than 2–5 combined (fig. 22). Scutellum semicircular (fig. 18) ..... *Prototrupes*
- Elytral base immarginate. Tarsal segment 1 much shorter. Scutellum elongate semielliptic-deltoid ..... *Namibiotrupes*
3. Metasternal disc pyriform (fig. 13), anterior lobe bulbous, widely separating middle coxae. Pronotum with steep, abrupt anteromedian declivity, limited by concavity on either side ..... *Bolboceratellus*
- Anterior lobe of metasternum not bulbous, meso-metasternal transition always more or less abrupt. Pronotum not thus modified (if modified at all) ..... 4
4. Pronotum (fig. 14) with 2 paramedian tubercles topping anterior declivity; one median boss on pronotal base. Anterolateral angles of clypeus each with upright tubercle ..... *Bolbodius*
- Pronotum as well as head with different ornamentation ..... 5
5. Antennal club of the “*Indobolbus* type”: lammellae massive, usually circular in outline, proximal side of lamella 1 usually with larger, well-defined smooth glabrous area (fig. 10). Eye-canthus usually with more or less distinct (occasionally tuberculate) anterolateral angle (figs. 7, 8). Fore tibia with 5 or 6 external denticles. Pronotal base marginate ..... 6
- Antennal club of the “*Mimobolbus* type”: lamellae flexible, usually elliptic in outline, proximal side of lamella 1 at most with smaller, ill-defined, smooth glabrous area (fig. 11). Eye-canthus usually evenly, widely arcuate in front (fig. 9). Pronotal disc never deplanate to apex ..... 12
6. Phallus with „median apparatus”: a pair of movable sclerotized projections attached to the tip of the median lobe (cf. fig. 24). Cephalic and pronotal ornamentation more or less similar in both sexes ..... 7
- Phallus without “median apparatus” ..... 8
7. A transverse ridge situated between eyes (fig. 2). Scutellum elongate, semielliptic to deltoid (cf. fig. 20). Anterior declivity of pronotum usually with 3 impressions separating 4 variably pronounced protrusions ..... *Indobolbus*
- A median (usually bituberculate) protrusion situated on clypeus (cf. fig. 3). Scutellum distinctly transverse, more or less triangular (fig. 20): Pronotum impressed or more deeply sulcate anteromedially ..... *Bolboceratex*



Figs 1–13. Afrotropical Bolboceratini. — Contours of: 1–6, Clypeofrontal ornamentation; 1, *Bolbaffroides* (♂); 2, *Indobolbus*; 3, *Bolboceratops*; 4–5, *Mimobolbus* (5, unusual type, *M. peringueyi*); 6, *Bolbocaffer*; 7–9, left eye-canthus, plus eye; 7, *Bolbaffer*; 8, *Indobolbus*; 9, *Mimobolbus*; 10–11, antennal club; 10, *Bolbocaffer*, proximal side of lamella 1; 11, *Mimobolbus*, ditto; 12, *Prototrupes*, superior side; 13, *Bolboceratellus*, metasternal disc (anterior intercoxal lobe on top). — Scale lines are 0.5 mm.

8. Elytral epipleuron very wide in front, strongly diminished in width on posterior curve (fig. 16). Males with flattened pronotal disc between swollen (frequently tuberculate) base and (frequently protuberant, in one case horned) apex. Length over 1.5 cm. .... *Bolbaffer*
- Elytral epipleuron very gradually narrowing from humerus to apicosutural angle (fig. 17). Pronotal shape different (if flattened, shape more or less as in fig. 15) ..... 9
9. Parameres very strongly modified (figs. 25, 26), with long, slender distal section. Pronotal ornamentation similar in both sexes, anterior declivity with 3 impressions separating 4 slight protrusions. Head with (para)median protrusion(s) in front of eyes, different according to sex ..... *Bolboceroides*
- Parameres not thus modified. .... 10
10. Head on clypeus or clypeofrontal transition with long transverse ridge, not reaching clypeal sides (fig. 1). Pronotum of males with transversely symmetrical ornamentation of (0, 2 or 4) protrusions and associated impressions, topping anterior declivity ..... *Bolbaffroides*
- Frons with short transverse ridge or median tubercle. Pronotal ornamentation of males different ..... 11
11. Pronotum of males with 3 conical or spiniform protrusions (fig. 15). Strong sexual dimorphism in pronotal ornamentations, females with short transverse protrusion on convex disc. Parameres simple ..... *Namibiobolbus*
- Pronotum of males and females with broadly concave anterior declivity, with or without tubercles (0, 2 or 4). Parameres with blunt internal stylus (fig. 23) ..... *Meridiobolbus*
12. Head, on clypeus or between eye-canths, always with a medially placed pair of approximated small tubercles (fig. 3), frontovertex lacking well-defined protrusions ..... *Bolboceratops*
- Head never with such an ornamentation (any median tubercle, on clypeus or between eye-canths, with single tip, cf. *Bolbocaffer*) ..... 13
13. Head, on clypeus or between eye-canths, with (medially frequently tuberculate) ridge, or with single tubercle (fig. 6); genal corners frequently elevated (more or less dentate). Pronotal apex usually bituberculate or bicallose (fig. 6). Fore tibia usually with 5 or 6 external denticles .... *Bolbocaffer*
- Head (figs. 4, 5) with transverse elevation on frontovertex, which frequently consists of a pair of approximated small tubercles; clypeofrontal transition frequently with transverse ridge reaching genal angles (fig. 4). Pronotal apex simply marginate. Fore tibia usually with more than 6 external denticles ..... *Mimobolbus*



Figs. 14–26. Afrotropical Bolboceratini. — Contours of: 14–15, pronotum; 14, *Bolbodius* (♂); 15, *Namibiobolbus* (♂); 16–17, epipleural width (from humerus to apex); 16, *Bolbaffer*; 17, *Bolbaffroides*; 18–21, scutellum; 18, *Prototrupes*; 19, *Bolboceratex*; 20, *Bolboceratops*; 21, *Mimobolbus* (extra broad, *M. sedhiounense*); 22, *Prototrupes*, fore tarsus; 23–26, parameres and “median apparatus” (24); 23, *Meridiobolbus*; 24, *Indobolbus* (movable projections black); 25–26, *Bolboceroides* (25, lateral, 26, full-face). — Scale lines with 14–17 are 1 mm, others 0.5 mm.

## GENERIC ACCOUNTS

**Prototrupes** Krikken, 1977

Generic diagnosis (primary features only). — Elytral base marginate (fig. 18). Tarsal segments 1 longer than 2–5 combined (fig. 22). Scutellum semicircular (fig. 18). Distal side of antennal lamella 3 strongly “inflated” (fig. 12). Fore tibia strongly dilated, with 5 or 6 external denticles, terminal spur broad. Head strongly setose, pronotal apex with fringe of serrated setae. Labral surface flat. Metasternal disc more or less pyriform. Eye-canthus with distinct anterolateral angle. Clypeal apex with 3 or 4 tubercles (which may be shifted caudad in minor specimens). Anteapical fossorial elevation on middle and hind tibiae enlarged, with arcuate crest. Large, total body length ca. 1.5 cm or more.

Type-species. — *Bolboceas copridoides* Kolbe (original designation).

Distribution. — Southwestern Africa (two species known).

Reference. — Krikken, 1977a (synopsis).

Comment. — The affinities of this genus are most problematic; it certainly stands isolated in the Afrotropical context. The marginate elytral base is also a characteristic feature of certain Australian and Nearctic Bolboceerati, and may be a synapomorphy that would join them (with *Prototrupes*) in a phylogenetic tree. The strong development of the antennal club, also occurring in the Australians and in *Namibiotrupes*, is undoubtedly a parallelism.

Described species:

*P. copridoides* (Kolbe, 1907)

*P. kochi* (Paulian, 1952)

**Namibiotrupes** Krikken, 1977

Generic diagnosis (primary features only). — Distal side of antennal lamella 3 strongly “inflated”, “inflated” surface a-centrally convex. Pronotum anteromedially with abrupt, steep declivity, which is laterally more or less rectangular, limited by cavities. Elytral base immarginate. Eye-canthus straight in front, with distinct anterolateral angle. Fore tibia with 5 or 6 external denticles. Anteapical fossorial elevation on middle and hind tibiae arcuate. Clypeus with strong protrusion(s), frontovertex unmodified. — Female sex unknown.

Type-species. — *N. penrithae* Krikken (original designation).

Distribution. — Namibia (one species known).

Comment. — The affinities of this monotypic desert genus are problematic. The only possible relative might be *Bolboceratellus* (q.v.), which somewhat agrees in the shape of the pronotum and certain other details. The “inflation” of the outer antennal lamella in *Namibiotrupes*, *Prototrupes* (q.v.) and certain Australian Bolboceratini is undoubtedly due to parallel evolution.

Described species:

*Namibiotrupes penrithae* Krikken, 1977

***Bolboceratellus* gen. nov.**

Generic diagnosis. — Metasternal disc (fig. 13) pyriform, anterior lobe simply bulbous, widely separating the middle coxae. Anterior declivity of pronotum steep, topped by transverse, laterally more or less rectangular ridge.

Left mandible with evenly arcuate outer border. Clypeal outline more or less trapeziform. Eye-canthus straight in front, rounded laterally, separated from temporal lobe. Perimarginal ridge of clypeus distinct (may be modified). Frontolateral ridge distinct. Entire pronotal margin with continuous, unmodified ridge. Scutellum elongate semielliptic to deltoid. Elytral base immarginate. Elytral epipleuron broad, distinctly reaching apicosutural angle. Elytra with 7 striae between suture and humeral umbone, stria 1 terminating at side of scutellum; striae 2–7 reaching base, stria 2 more or less effaced in front, all striae superficially impressed; elytral intervals not or very slightly convex. Antennal club massive, subcircular in outline, outer lamella with moderately convex distal side; proximal surface of club segment 1 almost entirely finely punctate-pubescent. Preprosternum with fine paramedian ridges, intervening surface convex. Fore tibia multidentate-serrate (more than 6 external denticles); terminal spur flat, elongate-acuminate. Middle and hind tibiae with distinctly arcuate anteapical fossorial crest; proximal elevations poorly, variably pronounced. Colour uniform brown or yellow. Habitus approximately semiglobular. Total length 0.5–1.5 cm.

Type-species. — *Bolboceras auspicatum* Péringuey.

Distribution. — Southern Africa (one species described, a second one known to me).

Comment. — This genus is not directly related to any of the other bolboceratine genera. There is some similarity with *Namibiotrupes* (q.v.), but this may be due to parallelism and plesiomorphism.

Note. — *Bolboceratellus* is to be treated as a masculine noun.

Described species:

*B. auspicatus* (Péringuey, 1901) (= *Bolboceras zumpti* Frey, 1955, syn. nov.)

**Bolboceratex** gen. nov.

Generic diagnosis. — Median lobe of phallus with pair of movable, strongly sclerotized projections (“median apparatus”). Clypeus with median protrusion, which usually is bituberculate (fig. 3). Scutellum transversely subtriangular (fig. 19).

Clypeal outline trapeziform. Eye-canthus subrectangular, separated from temporal lobe. Perimarginal ridge of clypeus subdistinct. Frontolateral ridge distinct, extending to vertex. Pronotum with anteromedian depression, adjacent declivity with midline impression. Entire pronotal margin with continuous, unmodified ridge. Elytral base immarginate. Elytral epipleuron broad, rapidly narrowing on reaching distal curve. Elytra with 7 striae between suture and humeral umbone, striae 1 terminating at side of scutellum, near apex; striae 2–7 reaching base, all striae superficially impressed; elytral intervals not or very slightly convex. Antennal club massive, subcircular in outline, distal side of outer lamella moderately convex; proximal surface of club segment 1 with large glabrous, polished area, distinctly separated from pubescent peripheral parts. Preprosternum with paramedian costae. Middle coxae distinctly separated by metasternal lobe, which is not particularly modified and passes abruptly to mesosternal declivity. Metasternal disc rhomboid in outline. Fore tibia usually with 6 external denticles; terminal spur flat, elongate-acuminate. Middle and hind tibiae with arcuate, or feebly bilobate, anteapical fossorial crest; proximal elevations poorly, variably pronounced. Colour uniform brown or yellow. Habitus approximately semiglobular. Total length 1–1.5 cm.

Type-species. — *Bolboceras posticatum* Boheman.

Distribution. — Southern Africa (four species known).

Comment. — *Bolboceratops* (q.v.) is superficially similar, but has a different scutellum and very different male genitalia. The presence of a “median apparatus” in the male genitalia of both *Bolboceratex* and *Indobolbus* (q.v.) may be indicative of a genuinely close relationship. Some specific names (cf. also synonyms in Paulian, 1941) refer to females, or to males which have their genitalia missing (fresh material needed!).

Note. — *Bolboceratex* is to be treated as a masculine noun.

## Described species:

- |   |                                      |
|---|--------------------------------------|
| * <i>B. indubius</i> (Péringuey, 1901)  | <i>B. posticatus</i> (Boheman, 1860) |
| <i>B. rhodesianus</i> (Petrovitz, 1973) | <i>B. spurius</i> (Péringuey, 1901)  |

**Indobolbus** Nikolajev, 1979

Generic diagnosis (primary features only). — Median lobe of phallus with pair of movable, strongly sclerotized projections (“median apparatus”) (fig. 24). Pronotum similar in both sexes, anterior declivity with 3 (sometimes confluent) impressions separating 4 variably pronounced protrusions. Frons between eyes with transverse elevation (fig. 2). Eye-canthus (fig. 8) straight in front, arcuate laterally, both sections separated by (anterolateral) tubercle. Antennal club disc-shaped, more or less circular in outline, massive, proximal side of lamella 1 usually with large, well-defined, smooth glabrous area. Fore tibia with 5 or 6 external denticles. Antepical fossorial elevation on middle and hind tibiae arcuate to feebly bilobate. Scutellum elongate semielliptic to deltoid. Pronotal base distinctly marginate.

Type-species. — *Scarabaeus quadridens* Fabricius (original designation).

Distribution. — India (many species, most of them undescribed) to Africa (three species known) and Near East (one species known).

Comment. — Nikolajev’s diagnosis (1979) did not mention the peculiar structure of the phallus and other characters of primary importance. Apart from the type-species many other Indian species are referable to *Indobolbus* (list given below is provisional, revision by Krikken, in prep.), as well as some Africans and one from the Lebanon.

## Described Afrotropical species:

- |   |   |
|---|---|
| <i>I. inaequalis</i> (Westwood, 1848) comb.<br>nov. | <i>I. gaujani</i> (Fairmaire, 1892) comb.<br>nov. |
| <i>I. niloticus</i> (Boucomont, 1928) comb.<br>nov. |   |

## Remaining species (Asia):

- |  |  |
|--|--|
| <i>I. berytensis</i> (Petrovitz, 1963) comb.<br>nov.   | <i>I. nigricans</i> (Westwood, 1848)<br>comb. nov.     |
| <i>I. birmanicus</i> (Lansberge, 1885) comb.<br>nov.   | <i>I. quadridens</i> (Fabricius, 1781)                 |
| <i>I. consanguineus</i> (Lansberg, 1885)<br>comb. nov. | <i>I. transversalis</i> (Westwood, 1848)<br>comb. nov. |
| <i>I. dorsalis</i> (Westwood, 1848) comb.<br>nov.      | <i>I. trisulcatus</i> (Klug, 1843) comb.<br>nov.       |

**Bolbaffroides** Nikolajev, 1979 (stat. nov.)

Generic diagnosis (primary features only). — Strong sexual dimorphism: males with 2 or 4 protrusions topping anterior pronotal declivity; females with simple transverse ridge on convex pronotal disc; males with transverse ridge on clypeus or clypeofrontal transition, females with transverse ridge on frons, never reaching clypeolateral or frontolateral ridge (fig. 1). Parameres with internal lobe and/or stylus, without “median apparatus” (cf. *Indobolbus*). Large, total body length ca 1.5 cm or more. Eye-canthus with distinct (non-tuberculate) anterolateral angle. Antennal club disc-shaped, more or less circular in outline, massive, proximal side of lamella 1 usually with large, well-defined, smooth glabrous area. Fore tibia with 6 or 7 external denticles. Anteapical fossorial elevation on middle and hind tibiae bilobate(-bidentate). Scutellum elongate semielliptic to deltoid. Pronotal base distinctly marginate.

Type-species. — *Bolboceras validus* Klug (original designation).

Distribution. — Northern parts of tropical Africa (two species known), Arabia (two species known) to northeastern India (one species known).

Reference. — Krikken, 1978b (synopsis).

Comment. — The genus was proposed by Nikolajev (1979) as a subgenus of *Bolbaffer*, but this status does not appear from his 1982 review of *Bolbaffer*. I stick to my original opinion that the group around *validus* (Klug) stands close to *Bolbohamatum* Krikken, 1980, and I here attribute *Bolbaffroides* generic rank, thus formally removing it from *Bolbaffer*.

Described Afrotropical species:

*B. serripes* (Fairmaire, 1882) comb. nov.      *B. validus* (Klug, 1843) comb. nov.

Remaining species (Asia):

*B. carinicornis* (Castelnau, 1840) comb. nov.      *B. scotti* (Paulian, 1948) comb. nov.

*B. kubaricus* (Krikken, 1978) comb. nov.

**Bolbodius** gen. nov.

Generic diagnosis. — Clypeus with tubercle on both anterolateral corners. Pronotum (fig. 14) with anterior declivity topped by paramedian projections; base with large boss. Parameres without notable accessory elements, strongly sclerotized, snout-shaped in lateral view.

Outline of mandibles symmetrical, apart from usual incision of right mandible. Clypeal outline more or less squarish. Eye-canthus rectangular, separa-

ted from temporal lobe. Entire pronotal margin with continuous, unmodified ridge. Scutellum broadly deltoid, short. Elytral base immarginate. Elytral epipleuron broad, rapidly narrowing on reaching distal curve. Elytra with 7 striae between suture and humeral umbone, stria 1 terminating at side of scutellum, 2–7 reaching base, all striae scarcely impressed; elytral intervals not or very slightly convex. Antennal club massive, subcircular in outline, distal side of outer lamella moderately convex; proximal surface of club segment 1 with large glabrous, polished area, gradually passing to pubescent parts. Preprosternum with paramedian costae. Postprosternum with slight median ridge. Middle coxae distinctly separated by metasternal lobe, which is scarcely modified, abruptly passing to mesosternal declivity. Metasternal disc rhomboid in outline. Fore tibia with 5 external denticles; terminal spur large, tapering. Middle and hind tibiae with bidentate or bilobate anteapical fossorial crest; proximal elevations dentiform, 3–5 on each of the two external longitudinal ridges. Colour uniform brown or yellow. Habitus approximately semiglobular. Total length 1.5–2 cm. — Female sex unknown to me.

Type-species. — *Scarabaeus coryphaeus* Fabricius.

Distribution. — Southern Africa (one species known).

Comment. — The single included species is a very peculiar, little-known species, which may be confined to the Cape region. I cannot find any synapomorphy clarifying its position in relation to the other genera.

Note. — *Bolbodus* is to be treated as a masculine noun.

Described species:

*Bolbodus coryphaeus* (Fabricius, 1775)

#### **Bolboceroides** Vulcano et al., 1969

Generic diagnosis (primary features only). — Parameres (figs. 25, 26) with remarkably slender distal section. Cephalic protrusions situated in front of eyes, different according to sex. Anteapical fossorial elevation on middle and hind tibiae distinctly bilobate or bidentate. Pronotal surface generally convex, 3 shallow impressions on anterior declivity separating 4 slight protrusions. Eye-canthus subangulate laterally. Antennal club disc-shaped, more or less circular in outline, massive, proximal side of lamella 1 usually with large, well-defined, smooth glabrous area. Fore tibia with 5 or 6 external denticles. Scutellum deltoid. Pronotal base distinctly marginate.

Type-species. — *Bolboceras capense* Klug (original designation).

Distribution. — Southern Africa (one species known).

Comment. — Previously I included in *Bolboceroides* two groups (*iphicles*

and *validus* groups) for which the proposal of separate genera seemed undesirable (Krikken, 1977c, 1978b). Meanwhile Nikolajev (1979) moved one of the groups to *Bolbaffer*, by placing one species in a separate subgenus, which I here attribute generic rank (cf. *Bolbaffroides*). For the second group I here propose a new genus (cf. *Namibiobolbus*).

Described species:

*Bolboceroides capense* (Klug, 1843)

***Namibiobolbus* gen. nov.**

Generic diagnosis. — Pronotum of males (fig. 15) with three conical or spiniform projections, separated by deep impressions. Females with short transverse protrusion on anterior side of pronotal disc.

Left mandible with rounded or feebly sinuate outer border. Clypeal outline more or less trapeziform. Frons with short transverse protrusion. Eye-canthus straight in front, subangulate anterolaterally, separated from temporal lobe. Perimarginal ridge of clypeus distinct. Frontolateral ridge distinct, extending to vertex. Entire pronotal margin with continuous, unmodified ridge. Scutellum broadly deltoid. Elytral base immarginate. Elytral epipleuron wide in front, strongly but gradually narrowing to apicosutural angle. Elytra with 7 striae between suture and humeral umbone, stria 1 terminating at side of scutellum; striae 2–7 reaching base, stria 2 more or less effaced in front, all striae superficially impressed; elytral intervals not or very slightly convex. Antennal club massive, subcircular in outline, distal side of outer lamella moderately convex, proximal surface of lamella 1 with large glabrous, polished area, distinctly separated from pubescent peripheral parts. Preprosternum with paramedian costae. Postprosternum dentate. Terminal spur of fore tibia flat, elongate-acuminate. Fore tibia with 5 external denticles. Middle and hind tibiae with more or less bilobate anteapical fossorial crest. Parameres without distinct accessory elements; “median apparatus” absent. Colour uniform brown or yellow. Habitus approximately semiglobular. Total length 1.5–2.5 cm.

Type species. — *Bolboceras iphicles* Kolbe.

Distribution. — Southwestern Africa (two species known).

Reference. — Krikken, 1977c (synopsis).

Comment. — Previously (l.c.) I placed the two species in *Bolboceroides*, considering their group characters of minor importance. Now that I have a better view of the overall situation, a separate generic position seems warranted: *Bolboceroides capense* (Klug) has very different genitalia, and on the other hand, the complex pronotal ornamentation of the males of *Namibiobol-*

*bus* is unique among Bolboceratini.

Note. — *Namibiobolbus* is to be treated as a masculine noun.

Described species:

*N. heracles* (Krikken, 1977) comb. nov.    *N. iphicles* (Kolbe, 1907) comb.nov.

#### **Meridiobolbus** gen. nov.

Generic diagnosis. — Parameres (fig. 23) internally with blunt stylus. Pronotum of both sexes with broadly concave anterior declivity, with or without tubercles (two or four). Fore tibia with 5 external denticles.

Left mandible with rounded or feebly sinuate outer border. Clypeal outline more or less trapeziform. Eye-canthus more or less curved in front, subangulate laterally, separated from temporal lobe. Perimarginal ridge of clypeus distinct. Frontolateral ridge distinct, extending to vertex. Entire pronotal margin with continuous, unmodified ridge. Scutellum elongate semielliptic to deltoid. Elytral base immarginate. Elytral epipleuron broad in front, strongly diminished in width on posterior curve. Elytra with 7 striae between suture and humeral umbone, stria 1 terminating at side of scutellum; striae 2–7 reaching base, stria 2 more or less effaced in front, all striae superficially impressed; elytral intervals not or very slightly convex. Antennal club massive, subcircular in outline, distal side of outer lamella 1 with large glabrous, polished area, distinctly separated from pubescent peripheral parts. Preprosternum with paramedian costae. Postprosternum dentate (all species?). Terminal spur of fore tibia flat, elongate-acuminate. Middle and hind tibiae with distinctly arcuate anteapical fossorial crest; proximal elevations poorly, variably pronounced. Colour uniform brown or yellow. Habitus approximately semiglobular. Total length 1–1.5 cm.

Type-species. — *Bolboceras hebes* Péringuey.

Distribution.— Southern Africa (three species described, one more known to me).

Comment. — *Meridiobolbus* is rather similar to *Bolboceroidea*, but differs strongly in the shape of the parameres. *Bolboceratex* and *Indobolbus* differ from both by having a peculiar “median apparatus” between their parameres.

Note. — *Meridiobolbus* is to be treated as a masculine noun.

Described species:

*M. faustus* (Péringuey, 1908)

*M. quinquedens* (Kolbe, 1894)

*M. hebes* (Péringuey, 1908)

**Bolbaffer** Vulcano et al., 1969

Generic diagnosis (primary features only). — Pronotal base more or less swollen in front of marginal ridge, especially in males; pronotal disc of males flattened, base variably dentate or tuberculate (except in one species); females with transverse ridge on convex pronotal disc. Elytral epipleuron (fig. 16) very wide in front, width rapidly diminishing caudad, leaving abdomen exposed. Anteapical fossorial elevations on middle and hind tibiae bilobate or bidentate. Fore tibia with 5 or 6 external denticles and strongly developed terminal spur. Eye-canthus (fig. 7) subrectangular, anterolateral angle very distinct. Head with single median (usually transverse) elevation, either on clypeus (males) or on frons (females). Abdomen of males frequently enormously modified (venter strongly protuberant). Scutellum semicircular to deltoid. Antennal club disc-shaped, with more or less circular outline, massive. Large, total length usually ca 1.5 cm or more.

Type-species. — *Bolboceras princeps* Kolbe (original designation).

Distribution. — Widespread in tropical Africa (twelve species known to me).

Reference. — Nikolajev, 1982 (synopsis).

Comment. — Nikolajev (1979) also included *Bolbaffroides* (q.v.) as a subgenus of *Bolbaffer*, a treatment that does not appear from his 1982 review of *Bolbaffer*. In my view Müller's two species (vide infra) should be re-examined; certainly there are more species than suggested by Nikolajev (l.c.) and other workers (Paulian, 1942, Petrovitz, 1969).

## Described species:

<i>B. abditum</i> (Petrovitz, 1969)	<i>B. gigas</i> (Kolbe, 1894)
<i>B. abyssinicum</i> (Müller, 1941) comb. nov.	<i>B. petrovitzi</i> Nikolajev, 1982
<i>B. bicorne</i> (Müller, 1944) comb. nov.	<i>B. princeps</i> (Kolbe, 1894)
<i>B. bremeri</i> Nikolajev, 1982	<i>B. splendidum</i> (Petrovitz, 1969)
<i>B. coriaceum</i> (Petrovitz, 1969)	<i>B. tenuelimbatum</i> (Quedenfeldt, 1884)

**Bolboceratops** Krikken, 1978 (stat. nov.)

Generic diagnosis (primary features only). — Head anteriorly, at some distance from clypeal apex, with paramedian tubercles (fig. 3); no further well-defined protrusions. Fore tibia with more than 6 external denticles. Middle and hind tibiae with arcuate or feebly bilobate anteapical fossorial elevation.

Scutellum elongate semielliptic to deltoid (fig. 20). Eye-canthus arcuate in front, not tuberculate. Antennal lamellae more or less elliptic in outline, flexible, proximal side of lamella I usually pubescent throughout. Pronotal base immarginate.

Type-species. — *Bolboceras indicus* Westwood (original designation).

Distribution. — Northern parts of tropical Africa (four species described, more known to me), and India (two species known).

Reference. — Krikken, 1978a (diagnosis and list of spp.)

Comment. — This genus was erected as a subgenus of *Mimobolbus*, but stands closer to *Bolbocaffer* (as defined here). A detailed study of their interrelations is necessary, and for the time being I treat *Bolboceratops* as equivalent to *Bolbocaffer* and *Mimobolbus*, attributing it generic rank. *Bolboceratex* (q.v.) is superficially similar, but has a different scutellum and very different male genitalia.

Described Afrotropical species:

<i>B. buxtoni</i> (Paulian, 1941) comb. nov.	<i>B. suahelus</i> (Kolbe, 1894) comb. nov.
<i>B. indicus</i> (Westwood, 1848) comb. nov.	<i>B. tenuistriatus</i> (Müller, 1941) comb. nov.

Remaining species (India):

*B. imitator* (Krikken, 1978) comb. nov.

#### **Bolbocaffer** Vulcano et al., 1969

Generic diagnosis (primary features only). — Posterior part of head without distinct elevation; clypeofrontal transition with transverse ridge extending between and reaching genal angles, or else at least with median protrusion (fig. 6), which is never bifid. Anterior margin of pronotum usually bituberculate or bicallose (fig. 6). Fore tibia usually with 5 or 6 external denticles. Antennal lamellae more or less elliptic in outline, flexible, proximal side of lamella I usually pubescent throughout. Anteapical fossorial elevation on middle and hind tibiae arcuate to feebly bilobate. Scutellum elongate semielliptic to deltoid. Colour uniform brown or yellow. See also fig. 27.

Type-species. — *Bolboceras sansibaricum* Kolbe (original designation).

Distribution. — Widespread in tropical Africa (23 species described, more known to me).

Reference. — No modern synopsis; most of the species are included in Paulian (1941).

Comment. — I have seen several definitely undescribed relatives of *B. senegalense*, some quite peculiar, others deceptively similar, and consequently much further work is needed. *Bolbocaffer* is closely related to *Bolboceratops* (q.v.).

Described species:

- |  |   |
|--|---|
| <i>B. caffrum</i> (Boheman, 1857) comb.<br>nov.      | <i>B. matabele</i> (Péringuey, 1908)<br>comb. nov.    |
| * <i>B. consocium</i> (Boheman, 1857)<br>comb. nov.  | <i>B. pallens</i> (Klug, 1835) comb. nov.             |
| <i>B. cycloidum</i> (Fairmaire, 1891) comb.<br>nov.  | * <i>B. pannosum</i> (Péringuey, 1901)<br>comb. nov.  |
| <i>B. disparile</i> (Péringuey, 1908) comb.<br>nov.  | <i>B. plausibile</i> (Péringuey, 1901)<br>comb. nov.  |
| <i>B. exasperans</i> (Péringuey, 1908) comb.<br>nov. | <i>B. politum</i> (Westwood, 1848) comb.<br>nov.      |
| <i>B. gautieri</i> (Boucomont, 1911)                 | <i>B. rugiferum</i> (Kolbe, 1883)                     |
| <i>B. indigum</i> (Péringuey, 1908) comb.<br>nov.    | <i>B. sansibaricum</i> (Kolbe, 1894)                  |
| <i>B. innotandum</i> (Péringuey, 1969)<br>comb. nov. | <i>B. schimperi</i> (Paulian, 1941) comb.<br>nov.     |
| <i>B. interruptum</i> (Kolbe, 1894) comb.<br>nov.    | <i>B. senegalense</i> (Castelnau, 1840)               |
| <i>B. kraatzi</i> (Paulian, 1941) comb. nov.         | <i>B. stercorosum</i> (Péringuey, 1901)<br>comb. nov. |
| * <i>B. littorale</i> (Kolbe, 1894) comb. nov.       | <i>B. vacivum</i> (Péringuey, 1901) comb.<br>nov.     |
| <i>B. luniferum</i> (Petrovitz, 1975) comb.<br>nov.  |   |

**Mimobolbus** Vulcano et al., 1969

Generic diagnosis (primary features only). — Area between eyes (figs. 4, 5), or further behind, with transverse elevation (frequently consisting of a pair of slight tubercles); clypeofrontal transition frequently with transverse (more or less modified) ridge extending between and reaching genal angles (fig. 4). Fore tibia with more than 6 external denticles. Pronotal apex simply marginate (not bituberculate, not bicallose, not strongly carinate). Scutellum deltoid, occasionally very broad (fig. 21), sides sinuate. Anterior declivity of pronotum at most slightly modified (never deeply impressed or with strong protuberan-

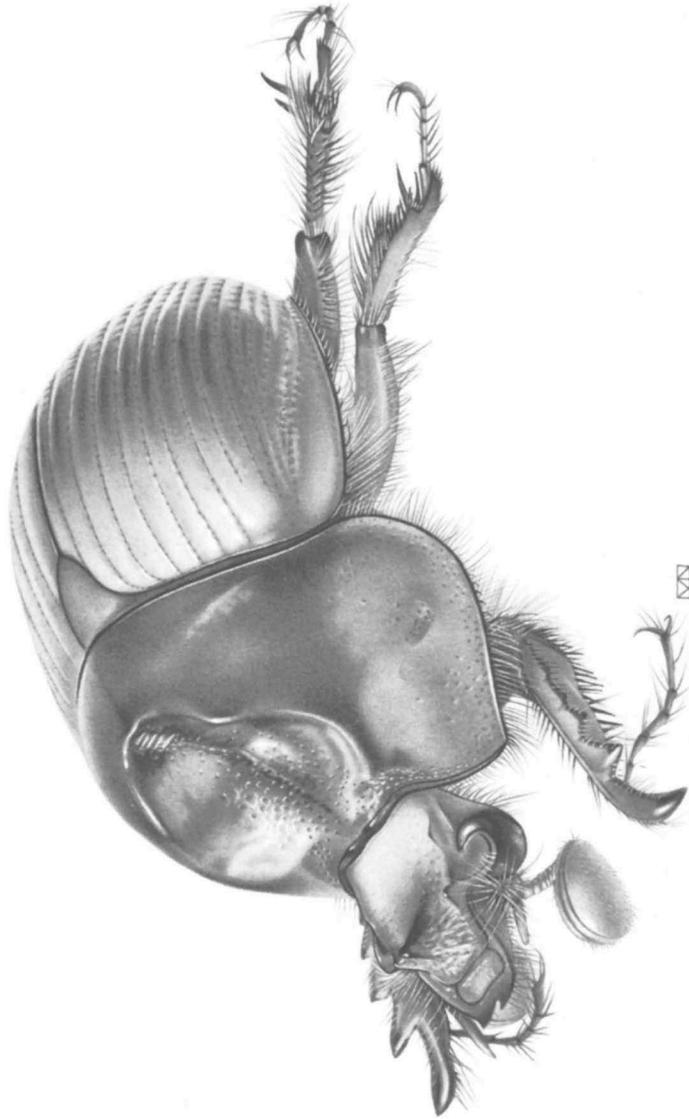


Fig. 27. A characteristic representative of the Afrotropical Bolboceratini, *Bolbocaffer politum* (Westwood), from Nigeria; length ca 11.5 mm.

ces). Anterior border of eye-canthus simply arcuate. Antennal lamellae more or less elliptic in outline, flexible, proximal side of lamella 1 usually pubescent throughout. Anteapical fossorial elevation on middle and hind tibiae arcuate to feebly bilobate.

Type-species. — *Bolboceras ornatellum* Péringuey (original designation).

Distribution. — Widespread in tropical Africa (24 species described, more known to me).

Reference. — No modern synopsis; most of the species are included in Paulian (1941).

Comment. — *Microbolbus* Vulcano et al., 1969 (type-sp. *M. decoratus* Vulcano et al.) is here treated as a synonym of *Mimobolbus*, being a close relative of the *Mimobolbus* type-species and other small species (especially those lacking the clypeofrontal elevation). Further detailed study of the numerous included species is certainly needed, especially in view of the diversity in the cephalic ornamentation (compare figs. 4 and 5) and the shape of the scutellum (usually as in fig. 20, certain species as in fig. 21). It seems premature to propose a further subdivision of *Mimobolbus* without studying genitalia and other potentially useful features.

Described species:

* <i>M. ambiguus</i> (Péringuey, 1908) comb. nov.	* <i>M. nigropiceus</i> (Felsche, 1910) comb nov.
<i>M. angolensis</i> Krikken, 1977	<i>M. nigrum</i> (Péringuey, 1908) comb. nov.
<i>M. congolensis</i> (Paulian, 1941)	<i>M. ornatellum</i> (Péringuey, 1901)
<i>M. decoratus</i> (Vulcano et al., 1969) comb. nov.	<i>M. peringueyi</i> (Paulian, 1941) comb. nov.
* <i>M. decorsei</i> (Paulian, 1941) comb. nov.	<i>M. pilulus</i> (Gestro, 1895) comb. nov.
<i>M. endroedyyoungai</i> (Petrovitz, 1973) comb. nov.	<i>M. pygmaeus</i> (Frey, 1967) comb. nov.
<i>M. fulvus</i> (Gory, 1842) comb. nov.	<i>M. remedellii</i> (Müller, 1941) comb. nov.
<i>M. globularis</i> (Kolbe, 1894) comb. nov.	<i>M. rufotestaceus</i> (Boheman, 1857) comb. nov.
* <i>M. maculicollis</i> (Boheman, 1857) comb. nov.	<i>M. sebakuensis</i> (Péringuey, 1908) comb. nov.
<i>M. monticola</i> (Kolbe, 1894) comb. nov.	* <i>M. sedhiounensis</i> (Paulian, 1941) comb. nov.

<i>M. subcariniceps</i> (Müller, 1941) comb. nov.	<i>M. viviana</i> (Paulian, 1941) comb. nov.
<i>M. togonicus</i> (Kolbe, 1894) comb. nov.	<i>M. zavattarii</i> (Müller, 1941) comb. nov.

### ACKNOWLEDGEMENTS

Many institutions and individuals have in various ways contributed to this paper. Afrotropical specimens were studied in, or sent by: Muséum National d'Histoire Naturelle, Paris (A. Descarpentries, Y. Cambefort); Musée Royal de l'Afrique Centrale (P. Basilewsky, J. Decelle); Zoologisches Museum, Humboldt-Universität, Berlin (F. Hieke, J. Schulze); British Museum (Natural History), London (R. D. Pope, M. E. Bacchus); South African Museum, Cape Town (V. Whitehead); State Museum, Windhoek (M.-L. Penrith); National Museum, Bulawayo (F. de Moor); Transvaal Museum, Pretoria (S. Endroedy-Younga); University of Pretoria, Dept. of Entomology (E. Holm); Museo Civico di Storia Naturale "Giacomo Doria", Genoa (R. Poggi); Museo Civico di Storia Naturale, Trieste (R. Mezzena); Museum G. Frey, Tutzing (the Frey family, R. Kadlec); P. Kuijten, Leiden; Ph. Walter, Libreville. Other institutions and individuals also have increased my knowledge of extra-Afrotropical Bolboceratini; these are appropriately acknowledged elsewhere.

The habitus drawing was produced by our staff artist Mrs Inge den Boer-van Noortwijk.

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**ERRATUM**

The headings of the enumeration on page 26 were misplaced:  
India should head the middle of the three columns giving the species numbers, Arabia – Lebanon should head the right hand column.