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## THE GENUS *BOLBOCEROSOMA* SCHAEFFER IN ASIA (COLEOPTERA: GEOTRUPIDAE)

by

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With 14 text-figures and two plates

### ABSTRACT

The genus *Bolbocerosoma* Schaeffer is diagnosed and discussed. The Oriental and Palaearctic species are keyed and illustrated. A checklist of species and subspecies is given. Three new species are described: *Bolbocerosoma dierli* (Nepal), *garritor* (China), *sikkimensis* (North India). The other Asian species are discussed and their distribution is recorded. *Bolbocerodema* Nikolajev is here considered a subgenus within *Bolbocerosoma*.

The scope of this paper on *Bolbocerosoma* Schaeffer is similar to the one on *Bolbelasmus* Boucomont recently published (Krikken, 1977), and the introduction would run exactly parallel. The Nearctic species were revised by Howden (1955). Compared to *Bolbelasmus*, the taxonomic characters of Asian *Bolbocerosoma* can be analysed more thoroughly because the species are more diverse. Consequently I have been able to add a rather detailed synoptic table of characters.

Nikolajev (1973) proposed *Bolbocerodema* as a new genus for the Asian species; this group is here reduced to subgeneric rank, primarily in order to prevent the obliteration of the close affinity between the Nearctic and Asian species. The group *Bolbocerosoma* & *Bolbocerodema* is undoubtedly monophyletic. It seems impossible, however, to attribute a phylogenetic qualification (autapomorphic, plesiomorphic, parallelism) to the character states separating *Bolbocerodema* from Nearctic *Bolbocerosoma* (key couplet 1, below), and, as the Asian species are much more diversified than their Nearctic relatives, my hypothesis is that the latter constitute an offshoot from some Asian ancestor. *Bolbocerodema* would then be a paraphyletic taxon.

**Bolbocerosoma** Schaeffer

*Bolbocerosoma* Schaeffer, 1906: 254 (diagnosis, type-sp. *Scarabaeus farctus* F.).

*Bolbocerosoma* Nikolajev, 1973: 856 (diagnosis, type-sp. *Bolboceras nigroplagiatum* Waterhouse). Subgenus: stat. nov.

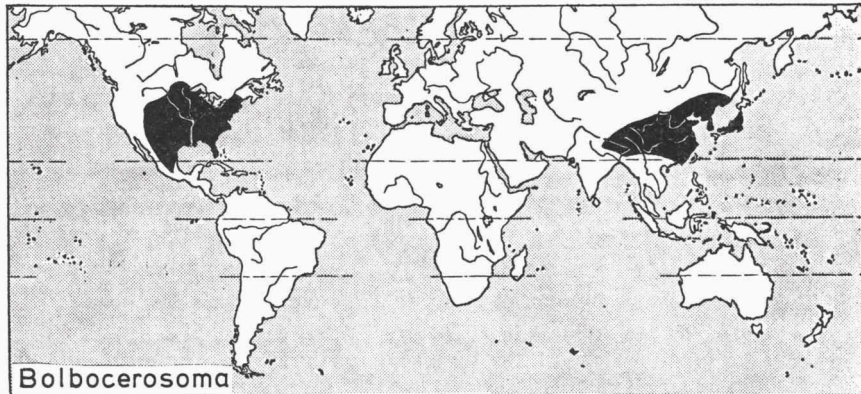


Fig. 1. Approximate known range of *Bolbocerosoma*.

Generic diagnosis. — Seven striae between elytral suture and humeral umbone, but striae 2 and 5 more or less effaced; stria 1 terminating at side of scutellum, 5 (as far as distinct) not reaching elytral base. Head with single projection (♂) or with transverse frontal ridge (♀); in one case male with additional paraocular tubercles; male with the projection on the cephalic midline, somewhere between clypeal apex and interocular area; clypeus may bear discal callosity. Pronotal base marginate, at least medially. Concavity in front of middle coxae with set of three spines (Asian species only).

Dorsal outline of mandibles, apart from usual lobes, symmetrically arcuate. Transverse ridge of labrum absent. Clypeal border (apart from median protrusion in some species) in dorsal view arcuate (semicircular-elliptic), perimarginal ridge usually distinct. Sides of frontovertex may be deeply concave, sharply separated from tempora. Margin of eye-canthus angulate anterolaterally; canthus and temporal lobe contiguous, dividing eye in two parts; dorsally visible area of eye smaller than that of eye-canthus. Pronotum with various, usually well-pronounced protrusions and cavities (males), or with simple transverse ridge (females). Scutellum deltoid, wide (length/width ratio ca. 1), with simply arcuate sides. Elytral base immarginate. Elytral epipleura reaching apicosutural angle. Elytral striae more or less sulcate, intervals distinctly convex. Humeral angle of elytra unmodified. Antennal club slightly thickened, outline (full-face) elliptic-circular; proximal side of

club segment I with glabrous polished area well separated from surrounding pubescent surface; club otherwise unmodified. Anterior part of prosternum protuberant medially (more or less convex in cross-section). Middle coxae subcontiguous. Metasternal disc rhomboid in outline, midline suture distinct. Fossorial elevations on middle and hind tibiae with bilobate crest. Fore tibia normally dilated, with 7-10 external denticles (proximal serration included); fore tibial spur elongate-tapering. Tarsi unmodified, except for occasional "inflation" of terminal segments of middle and hind legs. Aedeagus comprising two distinct parameres, which are usually poorly sclerotized and without notable accessory elements. Head usually black, pronotum and elytra usually with pattern of black and reddish or orange. Pronotum and elytra may be finely setose. Medium-sized (length usually 8-16 mm).

Type-species. — Of *Bolbocerosoma*: *farctum* (F.); of *Bolbocerodema*: *nigroplagiatum* (Waterhouse). See generic heading.

Affinities. — *Bolbocerosoma* belongs in the group of Bolboceratini with (sub)contiguous middle coxae, and it shares the completely divided eyes with two other genera, *Bolbochromus* Boucomont and *Odonteus* Samouelle (= *Bolboceras* Kirby, *Odontaeus* auctorum). *Odonteus* differs in many characters (e.g. in the structure of the antennal club and the intercoxal process of the metasternum); *Bolbochromus* seems to be the closest relative of *Bolbocerosoma*, the major differences being found in the shape of the antennal club, in the elytral striation, in the general pattern of the cephalic and pronotal protrusions, in the shape of the eye-canthi. *Bolbocerosoma* is restricted to temperate regions, while *Bolbochromus* developed throughout the Asian tropics between India and Celebes.

Distribution and composition. — 19 species known from eastern Asia and North America (fig. 1). See checklist.

Bionomics. — The Nearctic species live in sandy areas, where they make burrows to nearly 50 cm deep. The terminal brood chamber, packed with humus, contains a single egg, larva, pupa, or young adult (see Howden, 1955: pl. 10 fig. 3). Larvae were described by Ritcher (i.a. 1966) and Howden (1955: pl. 13 gives habitus picture). The many collections made with the aid of light suggest nocturnal or crepuscular above-surface activity. To my knowledge nothing has been published about the habits of the Asian species.

Infrageneric dissimilarities. — Nikolajev (l.c.) transferred the Asian species he knew to a separate group, a matter already discussed in the second paragraph of the introduction. The differences between the Asian and Nearctic groups, here regarded as subgenera, are summarized in the first couplet of the analytical key given below.

Contrary to the Nearctic forms, the Asian *Bolbocerosoma* are very diverse,

and can easily be divided into three groups: (1) two species with "inflated" terminal segments of the middle and hind tarsi, and strongly concave sides of the frontovertex; (2) one species in which the males have a very unusual cephalic and pronotal armature; (3) four species with normally claviform terminal tarsal segments, and with at most very feebly concave sides of the frontovertex. There are more characters, as explained by means of the synoptic table given hereafter; in that table the primary characters just mentioned are marked with an asterisk. There are differences in the shape of the phallus (figs. 5, 6), but the paucity of the material does not yet permit firm conclusions with regard to species identification. The identification of females has to remain rather circumstantial.

Apart from what has been discussed in the introduction, little or nothing can be said about the phylogeny of *Bolbocerosoma*.

SYNOPTIC TABLE OF ASIAN *BOLBOCEROSOMA* SPECIES

	Characters																
	*1	2	3	4	*5	6	7	8	9	10	11	12	13	*14	15	16	17
<i>Bolbocerosoma</i>	states																
<i>nigroplagiatum</i>	b	b	b	a	b	a	b	a	a	a	a	b	a	a	a	a	(a)-b
<i>garritor</i>	b	a	a	b	a	a	a	b	a	b	a	b	a	a	b	a/b	a
<i>kiyoyamai</i>	a-b	a	a	a	a	a	a	a	a	a	a	b	a	a	b	c	b
<i>zonatum</i>	a	c	b	b	a	a	b	a	a	a	b	b	a	a	b	a	a
<i>dierli</i>	a	b	b	a	c	a	a	a	b	a	a	b	a	b	b	a	a
<i>sikkimensis</i>	a	a	a	a	c	a	a	a	b	a	b	a	b	b	b	b	a
<i>apicatum</i>	c	a	a	a	a	b	o	o	a	b	a	b	a	a	a	a	b

Explanation of characters and character states (see figures):

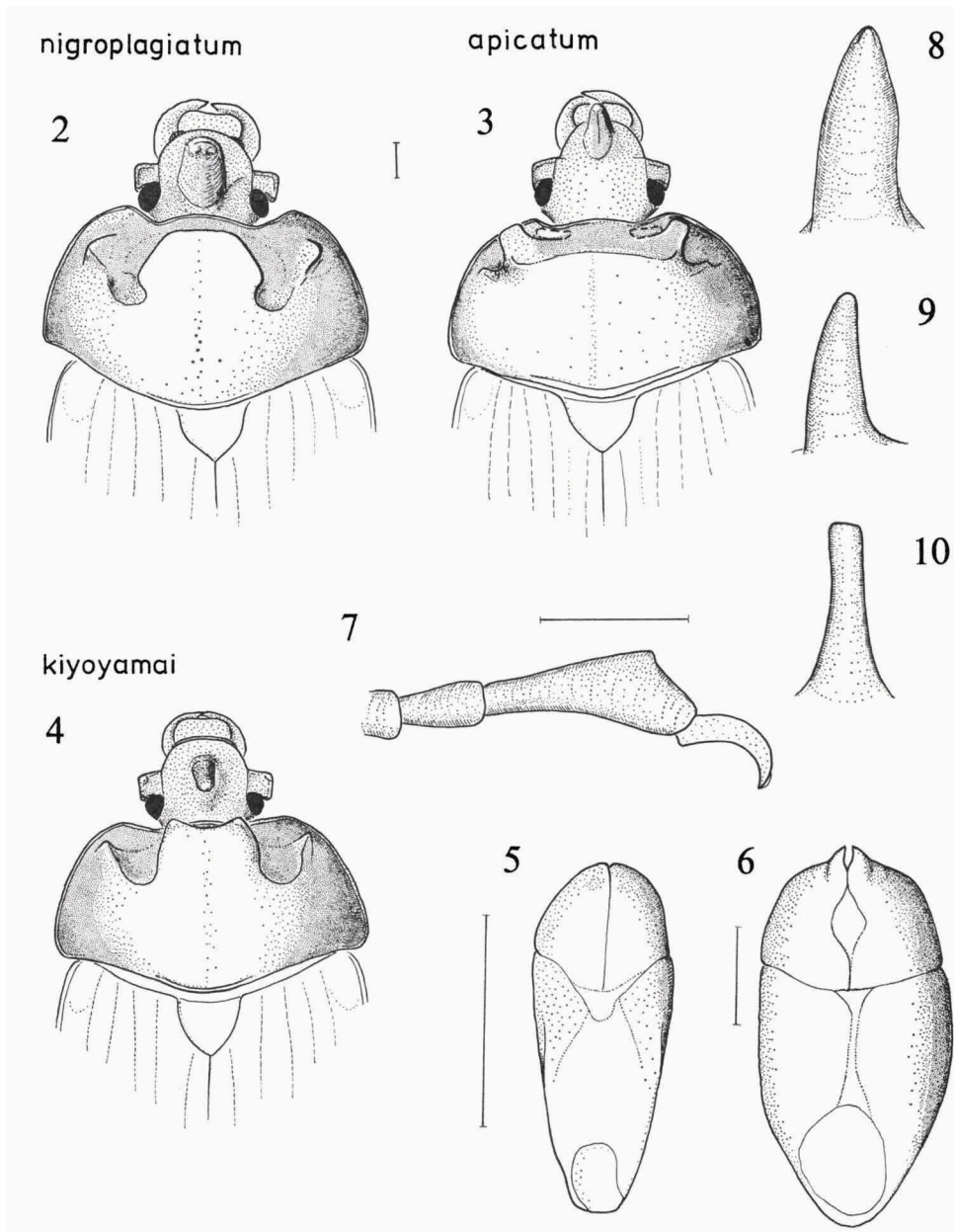
- \*1, cephalic horn or tubercle ( $\delta$ ) largely between/behind eye-canths (a); largely in front of eye-canths (b); at anterior border of clypeus (c).
- 2, basal width or cephalic horn ( $\delta$ ) less than one-fourth of interocular distance (a); over or equal to one-fourth of interocular distance (b); base modified, with paraocular protrusions (c).
- 3, tip of cephalic horn (large males) simple (a); bifid (b).
- 4, sides of eye-canths (sub)parallel (a); converging caudad (b).
- \*5, lateral cavities of vertex ( $\delta$ ) absent or shallow (a); moderate (b); very deep (c).
- 6, pronotal armature ( $\delta$ ) quadrituberculate (a); bilobate (alate) (b).
- 7, conditional on 6a: paramedian tubercles well pronounced (a); ill pronounced (b).
- 8, conditional on 6a: lateral cavities of pronotum with "overflow" between paramedian and lateral tubercles (a); lateral cavities isolated from anterior declivity (b).

- 9, sides of pronotal outline continuously rounded (a); sides abruptly curved inward anteriorly (b).
- 10, anterior declivity of pronotum glabrous (a); setose laterally (b).
- 11, paramedian surface of pronotal disc feebly punctate (a); strongly punctate (b).
- 12, elytral striae 2, 5 distinct (a); more or less effaced (b).
- 13, punctures in elytral striae scarcely crenulating interstriae (a); strongly crenulating interstriae (b).
- \*14, tarsal segments 5 of middle and hind tarsi simply claviform (a); "inflated", and angulate superiorly (b).
- 15, legs orange-brown (a); blackish (b).
- 16, pronotum largely orange-brown (a); largely blackish (b); entirely black (c).
- 17, small species, length usually less than 13 mm (a); large species, length usually over 13 mm (b).

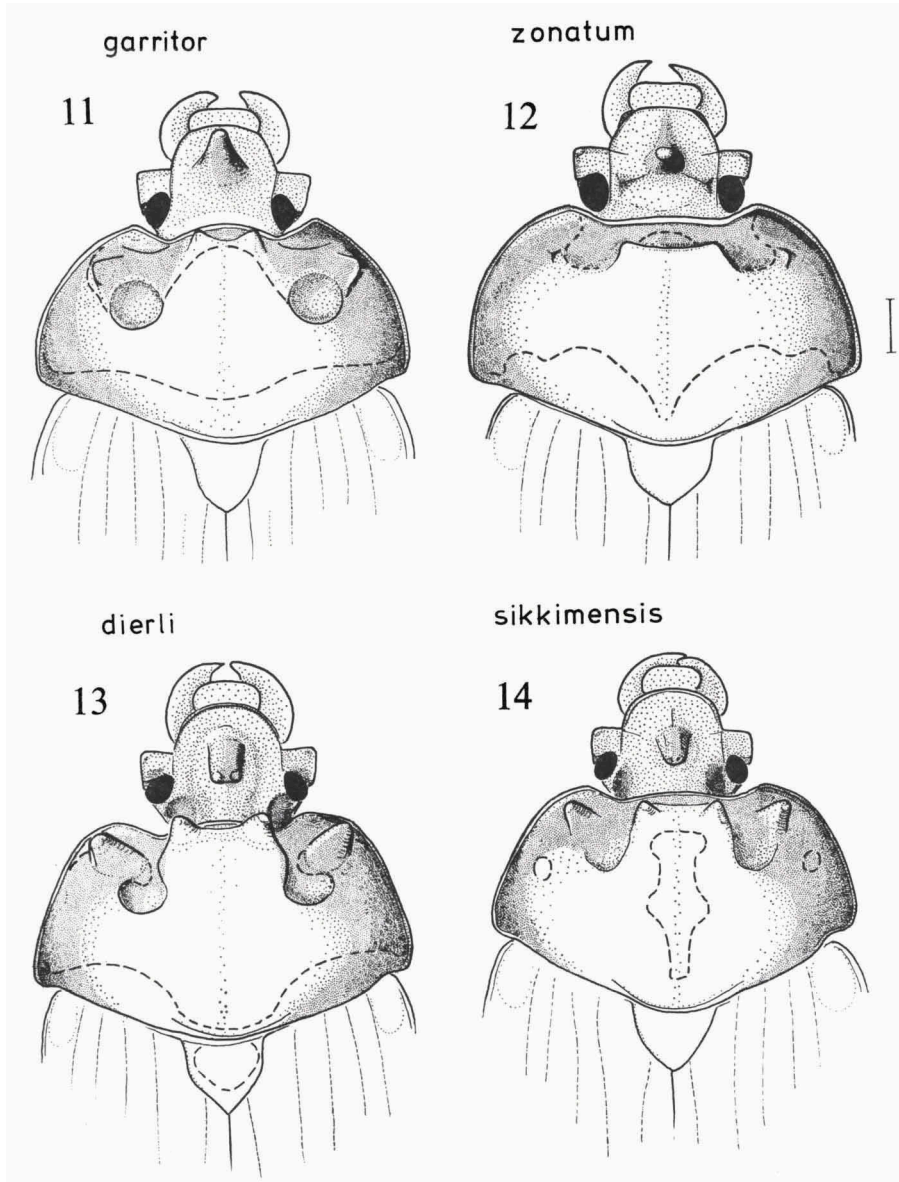
Between parentheses: character state poorly pronounced; oblique dash: both states occur; hyphen: transitional state occurs; zero: not applicable; asterisk: characters of primary diagnostic importance.

KEY TO *BOLBOCEROSOMA* SPECIES

- 1. Metasternal process between middle coxae with three spines in front. Basal ridge of pronotum interrupted laterally. (Subgenus *Bolbocerosoma*) . . . . . 2
- Metasternal process between middle coxae simple. Basal ridge of pronotum complete. Clypeal apex more or less protuberant. (Subgenus *Bolbocerosoma*, Nearctic species) . . . . . cf. Howden, 1955: 164
- 2. Males, with cylindrical or tapering horn on clypeus or frons . . . . . 3
- Females, with transverse, medially dentate frontal ridge; pronotal prominence a simple transverse ridge. Tentative key (females of two species unknown; names between square brackets: characters by inference) . . . . . 9
- 3. Cephalic apex with slender horn (fig. 3). Anterior declivity of pronotum alate (fig. 3). Pronotum predominantly reddish, scutellum black; legs reddish. Anterior declivity of pronotum laterally setose. Habitus elongate . . . . . *apicatum*
- Cephalic tubercle/horn well behind apex. Pronotal protrusions different . . . . . 4
- 4. Tarsal segments 5 of middle and hind legs angulate superiorly (fig. 7), more or less "inflated". Posterolateral area of dorsal side of head deeply concave (figs. 13, 14). Cephalic horn largely between and behind eye-canths. Pronotum quadrituberculate, lateral tubercles well developed;



Figs. 2-10. *Bolbocerosoma* species. Contours of: 2, *B. nigroplagiatum*, Inokashira; 3, 6, *apicatum*, Mou-Pin; 4, *kiyoyamai*, Fenchihu; 5, 7, 8, *dierli*, holotype; 9, 10, *sikkimensis*, holotype. — 2, 3, 4, male forebody, dorsal view; 5, 6, phallus, dorsal; 7, distal segments of hind tarsus, lateral; 8-10, clypeofrontal horn of male, laevolateral (8, 9), frontal view (10). — Scale lines = 1 mm, except with fig. 6 = 0.5 mm; 5, 8-10, same scale; forebody contours, same scale.



Figs. 11-14. *Bolbocerosoma* species. Contours of male forebody of: 11, *B. garritor*, holotype; 12, *zonatum*, paratype; 13, *dierli*, holotype; 14, *sikkimensis*, holotype. — Dashes = limits in black/orange colour patterns, see text. Scale line = 1 mm, all same scale.

- lateral cavities plus "overflow" areas distinct (figs. 13, 14). Smaller species (length usually less than 13 mm) from the Indian and Nepalese Himalayas . . . . . 5
- Tarsal segments 5 unmodified. Posterolateral area of head surface at most moderately concave. China, Korea, USSR, Japan . . . . . 6
5. Frontal horn of large male a robust erect pole with a bifid tip (figs. 8, 13). Contours of pronotum, figs. 13. Anterior declivity of pronotum abundantly punctate, not rugulate. Strial punctures more superficial, slightly crenulating interstriae . . . . . *dierli*
- Frontal horn slender, its tip rounded off or truncate (figs. 9, 10, 14). Contours of pronotum, fig. 14. Anterior declivity of pronotum rugulate-punctate. Strial punctures strongly crenulating interstriae *sikkimensis*
6. Frons with paracocular tubercles, connected with the larger median tubercle by feeble ridge (fig. 12). Pronotum lacking more or less isolated lateral cavities, with shallow postocular impressions. Red lateral zone of elytra extending to near apicosutural angle. Legs black . . . *zonatum*
- Frons with variably shaped clypeofrontal horn only. Pronotum with distinct lateral cavities . . . . . 7
7. Entirely black. Lateral cavities of pronotal disc with "overflow" area between lateral and median protrusions (fig. 4). Clypeofrontal horn reclined backward, strongly tapering; paramedian tubercles well pronounced (fig. 4) . . . . . *kiyoyamai*
- Pronotum and elytra partly reddish-orange, or otherwise different 8
8. Smaller species (length 13.5 mm or less) with slender clypeofrontal horn, its width one-fifth or less of intergenal distance (fig. 11). Paracocular surface of frons unmodified. Pronotum (fig. 11) with protuberant paramedian cones; lateral cavities of disc fully isolated; postocular impressions setose. Legs black . . . . . *garritor*
- Large species (length up to 15.6 mm) with robust clypeofrontal horn, its width approximately one-third of intergenal distance (fig. 2). Paracocular surface of frons distinctly concave. Pronotum (fig. 2) with median protrusion lacking cones; lateral cavities of disc with distinct "overflow" area between lateral and median protrusions; postocular impressions glabrous. Legs reddish . . . . . *nigroplagiatum*
9. Tarsal segments 5 of middle and hind legs angulate superiorly (fig. 7), more or less "inflated". Indian and Nepalese Himalayas . . . . .  
. . . . . *sikkimensis*, [*dierli*]
- Tarsal segments 5 simply claviform. China, Korea, USSR, Japan . . . . . 10
10. Legs reddish . . . . . 11
- Legs blackish . . . . . 12



11. Lateral reddish-orange zone of elytra reaching apex . . . *apicatum*  
 — Lateral reddish-orange zone of elytra not reaching apex, or absent . . .  
 . . . . . *nigroplagiatum*  
 12. Entirely black. Taiwan . . . . . *kiyoyamai*  
 — Pronotum and elytra partly reddish-orange . . . . . 13  
 13. Northeast Asia. Elytral apex without microsetae . . . . . *zonatum*  
 — Southern China. Elytral apex with microsetae . . . . . [*garritor*]

CHECKLIST OF *BOLBOCEROSOMA* SPECIES

## Asian

*apicatum* (Fairmaire, 1891: VI, *Bolboceras*), lectotype in Paris<sup>1</sup>). ♂♀. — China (type-loc. Chang-Yang).

*dierli* Krikken, present paper, holotype in Munich. ♂. — Nepal (type-loc. Junbesi).

*garritor* Krikken, present paper, holotype in London. ♂, ♀. — China (type-loc. Chung-king).

*kiyoyamai* Nomura, 1973: 38, ♀ holotype in coll. T. Shibata. ♂ described herein. — Taiwan (type-loc. Funchiifo).

*nigroplagiatum* (C. O. Waterhouse, 1875: 96, *Bolboceras*), lectotype in London. Lewis, 1895: 385. ♂♀. — Japan (type-loc. Nagasaki), Corea?

*sikkimensis* Krikken, present paper, holotype in London. ♂♀. — N. India (type-loc. Darjeeling).

*zonatum* (Nikolajev, 1973: 859, *Bolbocerodema*), holotype in Leningrad. ♂♀. — Pacific USSR (type-loc. Kedrovaya Pad).

## American

*biplagiatum* Dawson & McColloch, 1924: 12, holotype in Univ. of Nebraska. ♂♀. — U.S.A. (type-loc. Oxford, Nebraska).

*bruneri* Dawson & McColloch, 1924: 14, holotype in Univ. of Nebraska. ♂♀. — U.S.A. (type-loc. Fairmont, Nebraska).

*cartwrighti* Howden, 1955: 188, holotype in Washington D.C. ♂♀. — U.S.A.: Texas (type-loc. El Paso).

*confusum* Brown, 1928: 194, holotype in Ottawa. ♂♀. — U.S.A. (type-loc. Payne Co., Oklahoma).

*elongatum* Howden, 1955: 189, holotype in San Francisco. ♂. — U.S.A.: Texas (type-loc. Big Bend).

*farctum* (Fabricius, 1775: 14, *Scarabaeus*), type in London. ♂♀. (Syn. *Scarabaeus Cephus* F.). — U.S.A. (type-loc. Pennsylvania).

<sup>1</sup>) For larger museums only locality name is given.

*hamatum* Brown, 1929: 213, holotype in Cornell Univ. ♂♀. — SE U.S.A. (type-loc. Okefenoke Swamp, Georgia).

*lepidissimum* Brown, 1928: 193, holotype in Ottawa. ♂♀. — U.S.A. (type-loc. Payne Co., Oklahoma).

*pusillum pusillum* Dawson & McColloch, 1924: 11, holotype in Kansas State Univ. ♂♀. — U.S.A. (type-loc. Riley Co., Kansas).

*pusillum townesi* Howden, 1955: 183, holotype in Washington D.C. ♂♀. — S U.S.A. (type-loc. St. Johns, Arizona), Mexico.

*quadricornum* Robinson, 1941: 132, holotype in Robinson coll. ♂. — U.S.A.: Texas (type-loc. New Braunfels).

*ritchieri* Howden, 1955: 186, holotype in Washington D.C. ♂♀. — U.S.A.: Texas (type-loc. Brownsville); Mexico.

*tumefactum* Palisot de Beauvois, 1809: 91, location of type unknown. ♂♀. — U.S.A. (type-loc. Pennsylvania).

#### DESCRIPTIONS, RECORDS, OTHER NOTES

##### ***Bolbocerosoma nigroplagiatum*** (Waterhouse) (fig. 2, pl. 1 figs. 1, 2)

Identification. — This is the only species of *Bolbocerosoma*, presumably the only bolboceratine scarab, occurring in Japan. Within its group *B. nigroplagiatum* males are distinguished by the shape of the cephalic horn and by the disposition of the pronotal protrusions. Contrary to the other members in the group, the legs of *nigroplagiatum* are reddish, only very rarely somewhat infuscated. Nakane (1952: 22) has named one variety, forma *nijimai*.

Although the pronotum is usually almost entirely orange, there may be more or less extensive black markings, medially and/or laterally on the base; the elytral margin may be black or orange posteriorly; the distal black of the elytra is variably extended to their base.

Length ♂ 12-15.5, ♀ 11-15 mm.

Distribution. — *Bolbocerosoma nigroplagiatum* seems restricted to Japan; I have no confirmed recent continental records. I strongly mistrust the records given by Miwa (1931: 276); they could pertain to other species (*garritor?*).

Material examined. — 26 males, 35 females, from the following localities, months, collections:

Japan: Celibo; Hiogo; Iha[?]; Inokashira; Irumagawa; Kasumigaseki; Kyoto; Komaba; Meguro Dentô; Mizuho; Mukoda; Nagasaki; Nakano; Noziri; Tokyo; Watari-cho; Yokohama. — Coreia. — India: Khasi Hills [mislabelled].

Months iv (1 specimen), vii (5), viii (1), ix (2), x (2), xi (2).

Collections London, Berlin, Paris, Dresden, Eberswalde, Chicago, Tokyo (NIAS), Leiden, Oxford; also private collection P. J. Kuijten (Leiden).

The female lectotype (pl. 1 fig. 2), here designated, is from "S./Japan" (British Museum, London). The female paralectotype from "Corea" differs by the more extended black colour on the pronotal base, by the extension of the marginal orange-red of the elytra to their apex, and by the blackish legs; it may well belong to a different species.

***Bolbocerosoma garritor*** sp. nov. (fig. 11, pl. 1 fig. 3)

Holotype (male). — Approximate length 12, width 7.5, height 5.5 mm. Bright orange-brown, black, patterned, shiny; head dorsally entirely black, legs and venter brown-black; pilosity brownish. Habitus like paratype, fig. 3 (plate 1).

Labrum straight in front, sides rounded, surface rugulate-punctate; black. Cephalic contours, fig. 11. Clypeal border semicircular-trapeziform, margin ridged; surface rugulate-punctate. Clypeofrontal suture vague; horn situated just in front of eye-canthi; horn slightly inclined forward, very slightly tapering, with subtruncate tip, base contiguous with clypeal callosity; basal portion of horn, like most of head surface, with crowded, subrugulate double punctation ( $\times 15$ ); paraocular surface abundantly finely punctate; vertex densely punctate. Eye-canthi rectangular, surface irregularly, abundantly punctate, separated from frons by feeble ridge extending to internal border of eye.

Pronotal contours and colours, fig. 11. Pronotum quadrituberculate; disc laterally limited by distinct setose cavity; this cavity well defined, not "overflowing" to anterior declivity between paramedian and lateral protrusions; postocular impression of pronotum densely setose; anterolateral angle of pronotum rounded off; borders of pronotum ridged, except in front of elytral interstriae 3-5 and humeral umbone. Pronotal punctation triple; primary punctation abundant, punctures very well defined, restricted to disc and lateral declivities, slightly concentrated on midline depression and lateral depression; black anterior surface of pronotum with dense secondary punctation; tertiary punctation ( $\times 25$ ) abundant. Scutellum (fig. 11) black, with irregular, sparse double punctation comparable to primary and tertiary punctation of pronotum.

General surface of elytra strongly convex; 5 striae between suture and humeral umbone, 2 further longitudinal rows of vague punctures on interstriae 2 and 4. Striae distinctly impressed, distinctly punctate; punctures well defined, distinctly affecting the feebly convex interstriae. Interstitial derm with sparse, minute punctation; elytral apex finely, sparsely setose.

Fore tibia with 2 + 5 external denticles; terminal spur scarcely tapering, tip rounded, reaching apex of tarsal segment 3. Middle and hind tibiae with one spiniferous, complete antepical fossorial elevation, a pair of opposite protrusions, and some more or less opposite minor protrusions more proximally; antepical elevations with bilobate crest, superiorly with ca. 7, inferiorly with ca. 7 spines. Terminal spurs and tarsi of middle and hind legs unmodified.

Phallus unmodified.

Some measurements in mm. Width base of clypeofrontal horn 0.4; interocular distance 2.05; maximum length of head (exclusive of labrum and mandibles) 2.15, maximum width 3.3. Distance anterolateral angles of pronotum 3.4; distance tips of paramedian protrusions 1.0, ditto lateral protrusions 4.9; median length of pronotum 4.0, maximum width 7.0. Maximum scutellar length 1.35, maximum width 1.5. Maximum width of elytra combined 7.3. Densities of primary punctures behind lateral cavities of pronotum 15-20/sq. mm, their diameters ca. 0.06 mm.

Variation. — A male from Taiwan in the Paris museum has the same length as the holotype; the pronotum is different by being predominantly black: only a vague spot on the midline and a lateral area are orange; the black colour of the elytra is more extended to the base.

The pronotal disc of the female tentatively assigned to *garritor* is black; the marginal red on the elytra reaches the apex; its length is ca. 13.5 mm.

Identification. — *Bolbocerosoma garritor* is a rather small species in the *nigroplagiatum* group, with fully isolated lateral pronotal cavities in the male sex; the postocular cavities of the pronotum are setose, the elytral apex is microsetose ( $\times 50$ ). Contrary to *nigroplagiatum* the legs are blackish.

Material examined. — 2 males, 1 female.

Holotype from West China: Sze-chuen Prov.: Chung-king, leg. W. A. Maw, BM accession 1912-11 (London). A paratype, male, from "Formosa" in Paris ex H. W. Bates 1892. A female (excluded from type-series) from Chang . . . (illegible) in the Kiangsu Prov. (Berlin museum) is tentatively assigned to this species.

#### ***Bolbocerosoma kiyoyamai* Nomura (fig. 4, pl. 2 fig. 6)**

Identification. — The pronotum and the elytra of this species are, contrary to all the other species, entirely black. The general appearance reminds one strongly of the two black *Bolbelasmus* species occurring in South Europe and North Africa. The clypeofrontal horn has a wide base and a reclining, simply acuminate apex.

Length of the male on which these notes are based ca. 15 mm.

Note. — Despite the fact that the original description of *B. kiyoyamai*, being based on one female, contains little of diagnostic value, I believe on the strength of the entirely black colour and the same geographical origin, that the male diagnosed in this paper belongs to the same species.

Material examined. — A male from the Geneva museum, collected on Taiwan: Fenchihu, iv-v.1977, J. & S. Klapperich.

***Bolbocerosoma zonatum*** (Nikolajev) comb. nov. (fig. 12, pl. 1 fig. 4)

Identification. — *Bolbocerosoma zonatum* males are easily distinguished by the presence of well-developed paraocular protrusions. The reddish-orange lateral margin of the elytra extends far to the elytral apex, which is without microsetae. Like in *B. garritor* the legs of *zonatum* are blackish.

Material examined. — 2 males, 2 females.

All from USSR: Kedrovaya Pad, including one male paratype (Leningrad; Nikolajev collection).

***Bolbocerosoma dierli*** sp. nov. (figs. 5, 7, 8, 13, pl. 2 fig. 5)

Holotype (male). — Approximate length 12, width 7, height 5 mm. Bright orange-brown, black, patterned, shiny; head dorsally entirely black, legs and venter brown-black; pilosity brownish. Habitus, fig. 5 (plate 2).

Labrum straight in front, sides rounded, surface rugulate-punctate; black. Cephalic contours, fig. 13. Clypeal border arcuately rounded, ridged; surface rugulate-punctate. Clypeofrontal suture indistinct; between eye-canthi a most robust, erect, transversely somewhat compressed horn (fig. 8) with feebly bifid tip; derm of horn with crowded, coarse, rather superficial punctation basally, toward apex passing into dense, fine punctation; vertex and sides of frons sparsely punctate; sides of frontovertex remarkably concave. Eye-canthi rectangular, surface irregularly punctate, separated from frons by feeble ridge extending to anterolateral corner of eye.

Pronotal contours and colours, fig. 13. Pronotum with anteromedian protrusion laterally conically produced; separated from lateral teeth by deep roundish cavity, "overflowing" to a postocular impression; anterolateral angle of pronotum rounded off; borders of pronotum ridged, except in front of elytral interstriae 3-6. Pronotal punctation double; primary punctation coarse, dense, locally contiguous, fine on anteromedian declivity; absent on concave surfaces; secondary punctation ( $\times 25$ ) abundant. Scutellum, fig. 13; derm with irregular sparse double punctation.

General surface of elytra strongly convex; 7 striae between suture and humeral umbone, but striae 2 and 5 obsolescent, scarcely impressed, punctures

distinct. Other discal striae distinctly impressed, distinctly punctate, punctures not notably affecting the moderately convex interstriae. Interstitial derm with sparse, minute punctation.

Fore tibia with 2 + 5 external denticles; terminal spur slightly tapering, tip rounded, reaching fore tarsal segment 3. Middle and hind tibiae with one spiniferous complete antepical fossorial elevation, a pair of opposite protrusions, and some ill-pronounced protrusions more proximally; antepical elevations with bilobate crest, superiorly with ca. 5, inferiorly with ca. 7 spines. Terminal spurs of middle and hind tibiae unmodified. Segments 5 of middle and hind tarsi peculiarly "inflated" (fig. 7).

Phallus unmodified, fig. 5.

Some measurements in mm. Width base of frontal horn 0.6; interocular distance 2.1; maximum length of head (exclusive of labrum and mandibles) 2.15, maximum width 3.35. Distance anterolateral angles of pronotum 3.4; distance tips of paramedian protrusions 1.7; ditto lateral protrusions 4.8; median length of pronotum 4.3, maximum width 7.0. Maximum scutellar length 1.35, maximum width 1.5. Maximum width of elytra combined 7.0. Densities of primary punctures behind lateral cavities of pronotum ca. 14/sq. mm, their diameters 0.10-0.15 mm.

Identification. — The male of *Bolbocerosoma dierli* has a robust, erect pole on its head, which, at least in well-developed males, should immediately distinguish the species from *sikkimensis* (see figs. 8-10). The pronotal punctation is abundant, but nowhere becomes rugulate, as in *sikkimensis*. Both species share the remarkable shape of the fifth segment of the middle and hind tarsi, and therefore must be very closely allied inter se.

Material examined. — Holotype from Nepal: Prov. Nr. 3 East: Junbesi, 2750 m, 25-31.vii.1964, W. Dierl. The collector is lepidopterist with the Zoologische Staatssammlung, Munich, where the type is kept.

***Bolbocerosoma sikkimensis* sp. nov.** (figs. 9, 10, 14, pl. 2 fig. 7)

Holotype (male). — Approximate length 12, height 5, width 6 mm. Orange-brown, black, patterned; head dorsally entirely black, legs and venter brown-black; pilosity brownish. Habitus, fig. 7 (plate 2).

Labrum straight in front, sides rounded, surface rugulate-punctate; black. Cephalic contours, fig. 14. Clypeal border arcuately rounded, ridged; surface rugulate-punctate, with median callosity. Clypeofrontal suture indistinct; between eye-canths a robust, erect, transversely somewhat compressed, slightly tapering horn with rounded tip; derm of horn densely, finely punctate, basally punctate-rugulate, surface around base ditto; sides of frontovortex concave, sparsely punctate. Eye-canths rectangular, surface irregularly punc-

tate, separated from frons by feeble ridge extending to anterolateral corner of eye.

Pronotal contours and colours, fig. 14. Pronotum with anteromedian protrusion laterally conically produced; separated from lateral teeth by roundish cavity, "overflowing" to a postocular impression; anterolateral angle of pronotum rounded off; borders of pronotum ridged, except in front of elytral interstriae 3-6. Pronotal punctation double; primary punctation dense, well defined on disc, laterally crowded; anteromedian declivity densely, minutely punctate, concave surfaces more sparsely punctate; secondary punctation ( $\times 25$ ) abundant. Scutellum (fig. 14) entirely black, irregularly punctate, lateral margin slightly thickened.

General surface of elytra strongly convex; 7 striae between suture and humeral umbone, but striae 2 and 5 obsolescent, hardly impressed, their punctation ill defined. Other discal striae distinctly impressed, with densely arranged distinct punctures which strongly crenulate the convex interstriae. Interstitial derm with sparse, minute punctation.

Fore tibia with 2 + 5 or 6 external denticles; terminal spur slightly tapering, tip rounded, reaching fore tarsal segment 3. Middle and hind tibiae with one spiniferous complete antepical fossorial elevation, a pair of opposite protrusions, and some ill-pronounced protrusions more proximally; antepical elevations with bilobate crest, superiorly with ca. 6, inferiorly with ca. 8 spines. Terminal spurs of middle and hind tibiae unmodified. Segments 5 of middle and hind tarsi "inflated" as in *dierli* (fig. 7).

Phallus unmodified.

Some measurements in mm. Width base of frontal horn 0.7; interocular distance 2.1; maximum length of head (exclusive of labrum and mandible) 1.8, maximum width 3.05. Distance anterolateral angles of pronotum 3.3, distance tips of paramedian protrusion 1.4, ditto lateral protrusions 4.1; median length of pronotum 4.0, maximum width 6.9. Maximum scutellar length 1.25, maximum width 1.6. Maximum width of elytra combined 7.0. Densities of primary punctures behind lateral cavities of pronotum ca. 14/sq. mm, their diameters 0.15-0.20 mm.

Sexual dimorphism. — The females are smaller (ca. 8 and 10 mm) and have a black pronotum with a somewhat cross-like orange-red discal marking.

Identification. — *Bolbocerosoma sikkimensis* has a very strongly punctate (or even punctate-rugulate) pronotum. The clypeofrontal horn of the male is slender, more tapering, in which it is also distinct from its nearest known relative, *dierli* (see figs. 8-10). Both species share the inflated-angulate terminal segment of the middle and hind tarsi.

Material examined. — 1 male, 2 females.

Holotype from India: Sikkim: Darjeeling, from the Nevinson collection, BM accession 1918-14 (London). Two female paratypes, one from Kurseong, vi, no further details (also in London), one from Pedong, 1931, no further details (Paris).

***Bolbocerosoma apicatum*** (Fairmaire) (figs. 3, 6, pl. 2 fig. 8)

Identification. — The elongate habitus of this species is in the male sex accented by the long horn on the clypeal apex. The male pronotum is peculiarly winged, a nearly unique feature in the Geotrupidae (I have seen an undescribed South African bolboceratine with such wings, clearly a parallelism). The legs of *B. apicatum* are reddish, and the reddish margin of the elytra reaches the apicosutural angle. The characters of the female sex (key couplet 9 & c.) are very tentative considering the few *Bolbocerosoma* known from China: there may be many more species in that vast, poorly explored country.

Length ♂ 11.5-15 + (horn) 1 mm, ♀ 11.5-15 mm.

Material examined. — 17 males, 14 females, from the following localities and collections:

China (Thibet included): Ch-Yang; Chang-Yang nr Ichang; Mò-Sy-Mien; Mou-Pin; Siào-Lou; Ta-t sien-Loû; Toi Hang Jang. Yunnan.

Collections London, Berlin, Paris, Dresden, Leiden.

A male from "Ch-Yang" in the Paris museum, bearing my number 6911-8, is here designated lectotype.

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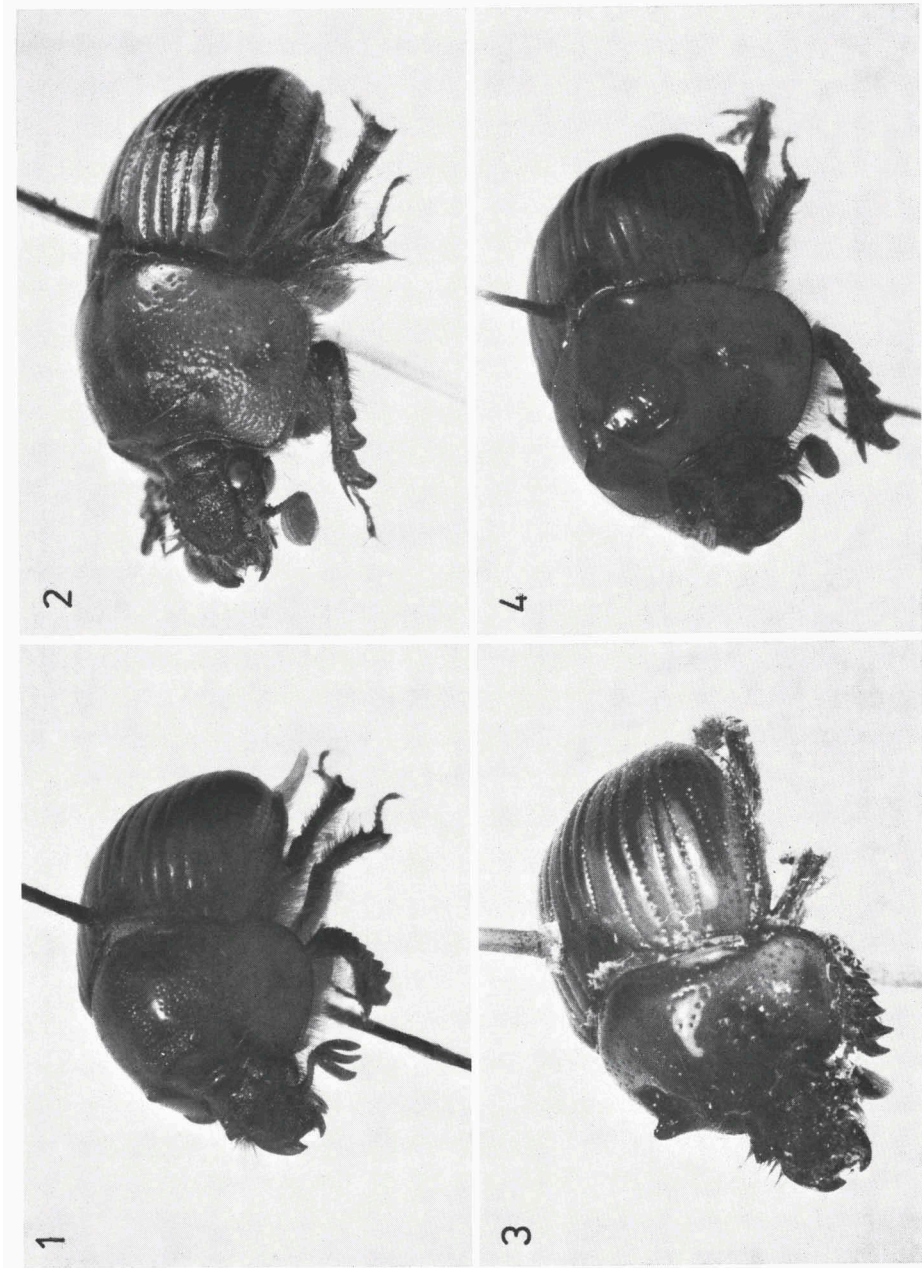
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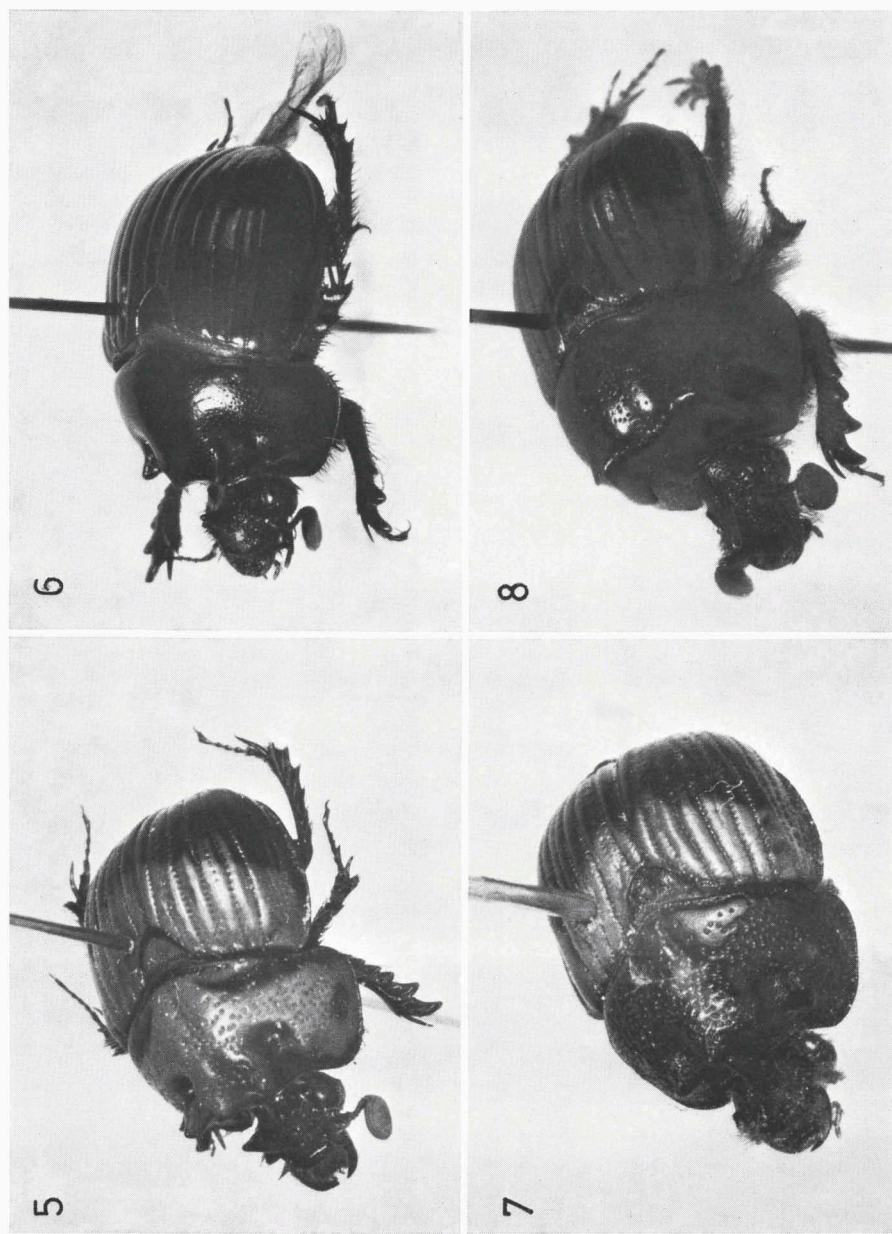


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Figs. 1-4. *Bolbocerosoma* species, males, female. 1, *B. nigroplagiatum*, Inokashira, length ca. 14.5 mm; 2, do., ♀ lectotype, 14.5 mm; 3, *garritor*, paratype, 12 mm; 4, *zonatum*, paratype, 12 mm.



Figs. 5-8. *Bolbocerosoma* species, males. 5, *B. dierli*, holotype, 12 mm; 6, *kijoyamai*, Fenchihu, 15 mm; 7, *sikkimensis*, holotype, 12 mm; 8, *apicatum*, Mou-Pin, 16 mm.