

# To Possible Assignment of a New Genus of Lamellicorn Beetles from the Lower Cretaceous of Mongolia to the Subfamily Pleocominae (Coleoptera, Scarabaeidae)

G. V. Nikolajev

*Al-Farabi State University of Kazakhstan, ul. Vinogradova 95, Almaty, 480012 Kazakhstan*

Received March 31, 2000

**Abstract**—A new genus, *Crecotoma* gen. nov., representing a separate tribe in the subfamily Pleocominae, is described from the Lower Cretaceous of Mongolia. The systematic position of this subfamily and phylogenetic links with other taxa of Scarabaeidae are discussed.

## INTRODUCTION

The venation of the costal area of the wing is clearly traced in a fairly complete fossil beetle from the Lower Cretaceous of Mongolia, which is kept in the collection of the Paleontological Institute, Russian Academy of Sciences (PIN) (Figs. 1a, 1b). Distinctive features of the venation allow easy identification of this beetle it easily as a species of the superfamily of the lamellicorn beetles. The compression represents a female, since the traces of the external female genitalia; namely, the coxites with well-preserved and fairly large styles are clearly visible. Six visible sternites are developed in the abdomen of the beetle. The fore tibia has three outer teeth, and the middle and hind tibiae bear one transverse ridge each. The reduction of the vein R3 in the apical part of the wing occurs among the Recent lamellicorn beetles only in the monotypic subfamily Pleocominae, a small relict group, which is now endemic to North America. Species of this genus have this vein in a form of a stripe, which is sclerotized somewhat stronger than the rest of the wing (Fig. 1d).

However, the structure of the external female genitalia with coxites bearing large styles is not characteristic of Recent Pleocominal species (Zunino, 1984, text-fig. 4). This important feature makes us consider this new beetle to be a representative of a separate taxon of a suprageneric rank. The habitus resembling that of phytophagous lamellicorns from the Pleurosticti species group and the presence of some apomorphies common to the Pleocominae and the species under study (the absence of a leathery bordering at the apex of the pronotum, one transverse ridge on the middle and hind tibiae, and adjoining spurs on the same tibiae) allow us to treat them as synapomorphies and to rank this taxon as a tribe in the subfamily Pleocominae.

The Recent genera *Pleocomina* LeConte, 1856, *Acoma* Casey, 1881, and *Benedictia* Sanderson, 1939 were included in the subfamily Pleocominae (Arnett, 1963). However, the investigation of characters of the

genera *Acoma* and *Benedictia* showed that they should be removed from the Pleocominae (Ritcher, 1969; Hardy, 1978); thus, this subfamily is monotypic in the modern fauna.

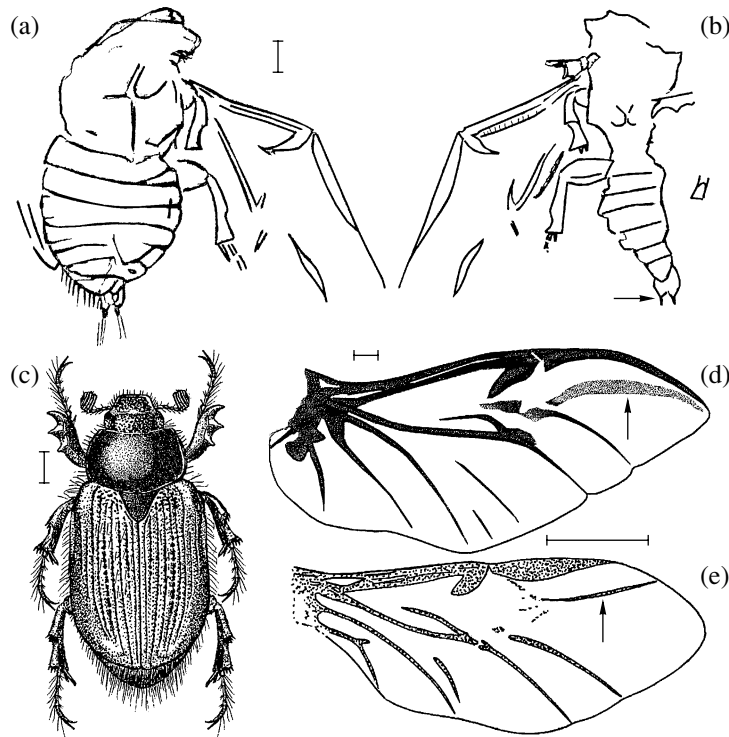
In the entire superfamily of the lamellicorn beetles, the structure of the fore coxal pits, which are unclosed, is unique to the genus *Pleocomina*. In my opinion, the taxonomical rank of the group and its place in the system of the superfamily should be based on this feature.

If the structure of the fore coxal pits of *Pleocomina* is a plesiotypic feature, this taxon should be considered to be a sister group with respect to all other suprageneric taxa of the superfamily taken together. This conclusion inevitably comes from the analysis of other morphological peculiarities of the imago. This genus retains only a few plesiomorphies (mainly in the structure of the antennae), but acquires a number of apomorphies (see below). These apomorphies are to be treated as autapomorphies, and the rank of the taxon will be in no case less than familial.

By assuming that the open fore coxal pits of *Pleocomina* is an apotypic feature, one may try to find out which of the generic apomorphies may represent synapomorphies with other taxa of the superfamily, since the majority of other characters of these beetles are not uncommon among other suprageneric taxa of lamellicorns. In this case, the set of features characteristic of this genus will only suffice to consider it to be a sister-group of one or several taxa rather than of all lamellicorn beetles together; the suprageneric rank of the taxon should be at least one level lower than the rank adopted for all lamellicorn beetles. This is either a tribe (subfamily) within the family or a family within the superfamily.

The genus *Pleocomina* is characterized by the following features (the plesiomorphic state is designated by *p*, the apomorphic state, by *a*).

The antennae are 11-segmented (*p*) with a multisegmented club (*p*); the mouthparts (labrum and mandi-



**Fig. 1.** Fossil and Recent Scarabaeidae: (a)–(c) *Cretocoma tologoica* sp. nov.: (a) and (b) holotype PIN, no. 4271/217: (a) top view, (b) bottom view, (c) reconstruction; (d) and (e) wing venation in Recent species: (d) *Pleocoma australis* Fall., (e) *Oncerus* sp. The arrows indicate (b) the remains of the external female genitalia and (d) and (e) the position of the veins R3. Scale bar 1 mm.

bles) are hidden under the clypeus (a); the leathery bordering along the anterior margin of the pronotum is absent (a); the wings are developed only in males (a); the vein R3 is reduced (a); two free veins are present between the cubital vein and the first anal vein connected with the wing base (p); the abdomen has six visible sternites (p); abdominal spiracles are situated on the intersegmental membrane between the tergites and sternites (p); the fore tibia has more than three teeth on its outer margin (p); the middle coxae are not widely separated (p); the middle and hind tibiae have one transverse ridge on their outer face (a) and contiguous apical spurs (a); and the coxites of the external female genitalia bear very small styles (a).

A number of the above apotypic features of *Pleocoma*, i.e., the labrum and mandibles hidden under the clypeus and the middle and hind tibiae having one transverse ridge on their outer side, are characteristic of the oligotypic subfamily Oncerinae Saylor, 1938 and monotypic subfamily Pachypodinae Erichson, 1840 [authors of the taxa and years of publication are given after Ritcher (1969) and Laurence and Newton (1995)]. Currently, I see no insurmountable obstacles to consider these taxa to be members of one phyletic line. However, a combination of plesiotypic and apotypic characters in each of these taxa (Pachypodinae, Pleocominae, and Oncerinae) is such that each subfamily may be a sister-group of any member of this phyletic line.

To illustrate this, it is suffice to consider the structure of antennae and wing venation. Retaining the vein R3 (Fig. 1e) in the apical portion of the wing (plesiomorphy), the subfamilies Pachypodinae and Oncerinae possess antennae with a smaller number of segments than those belonging to the Pleocominae (apomorphy). A multisegmented antennal club of the Pachypodinae, which in turn is a plesiomorphy against a three-segmented club of the Oncerinae, goes with a smaller number of antennomeres (autapomorphy) compared with the ten-segmented antennae of the Oncerinae.

At present, I do not think it sensible to consider this phyletic line to be a single taxon, i.e., a subfamily within the family Scarabaeidae or a family within the superfamily Scarabaeoidea, and, thus, to lower the rank of each group constituting the cladon; it should be noted that the name Pachypodinae Erichson, 1840 has a priority.

A founder species of this line must have the whole set of characters of the genus *Pleocoma* except for the open anterior coxal pits, contiguous spurs on the hind tibiae, wing venation in the apical portion with the vein R3 that must be developed, small styles on the coxites of the external female genitalia, and, most probably, wing reduction in female. Wing reduction only in the female may be caused by unfavorable conditions of the life of larvae that lead to high mortality rates during this stage (long larval periods or developing in arid and

semiarid conditions, Nikolajev, 1984). Such a reduction is called ootrophic and most probably developed quite recently in two of the three above-mentioned groups, i.e., subfamilies Pachypodinae and Pleocominae; unfortunately, I do not know whether the ootrophic reduction of wings is developed in Oncerinae females.

Possible relations of Pleocominae with species of the families Diphyllostomatidae, Lucanidae, and Passalidae are thoroughly studied in (Nikolajev, 2000).

Possible assignment of the fossil genus *Proteroscarabaeus* Grabau, 1923 from the Mesozoic of China to the subfamily Pleocominae has also been hypothesized (Nikolajev, 1996). A multisegmented antennal club and fore tibiae with a large number of teeth along the outer margin make it possible to bring this genus together with the type genus of the subfamily. Regrettably, the description of the genus is vague and the condition of many taxonomically important characters are not mentioned in the original description; without further examination of the type species, it is impossible neither to check this hypothesis nor to elucidate closer links of this genus with any other taxa of the lamellicorn beetles including the genus *Cretocoma* gen. nov. However, identification of these two taxa, which are being brought together with the subfamily Pleocominae, allows one to surmise with a high probability that the origin of this subfamily occurred not later than at the beginning of the Cretaceous, where representatives of several Recent lamellicorn subfamilies are already known from (Nikolajev, 1993, 1995, 1996, 1998, 1999). It is necessary to note that the rank of majority of these groups is raised to familial by the Old World authors.

## SYSTEMATIC PALEONTOLOGY

### Family Scarabaeidae Laicharting, 1781

#### Subfamily Pleocominae LeConte, 1861

#### Tribe Cretocomini Nikolajev, trib. nov.

Type genus. *Cretocoma* gen. nov.

**Diagnosis.** Pronotum without leathery bordering along fore margin; vein R3 not developed in apical part of wing; midcoxae contiguous or much closed; coxites of external genital apparatus of female with large styles; abdomen with six visible sternites.

**Composition.** Type genus.

**Remarks.** As it has been already said above, the wing venation is only suffice to bring together the tribe in question with the species of the Recent subfamily Pleocominae. The absence of the vein R3 in the apical portion of the wing, the presence of six visible sternites, one transverse ridge on the middle and hind tibiae, and the general appearance allow comparison of this monotypic tribe exclusively with representatives of the subfamily Pleocominae. The only species of this new tribe differs from the Recent North American genus *Pleocoma* with a similar wing venation in having a smaller number of teeth on the lateral side of the anterior tibiae (apomorphy), highly closed or contiguous anterior coxae

(also apomorphy), the presence of well developed wings in female (plesiomorphy), and in the presence of well developed large styles of the gonocoxites of female genitalia (plesiomorphy). Regrettably, some details, such as the position of the labrum and the mandibles against the clypeus (usually, this feature is well preserved in fossils) and whether or not the anterior coxal pits are closed (this feature is hardly visible in lamellicorn beetle fossils), cannot be observed. This taxon may be a sister group of the Pleocomini sensu stricto despite the state of these characters in representatives of the Cretocomini.

#### Genus *Cretocoma* Nikolajev, gen. nov.

**Etymology.** Latin *creta* (chalk) and the genus *Pleocoma*.

**Type species.** *C. tologoica* sp. nov.

**Diagnosis.** Moderate-sized beetle. Elytra not cover pygidium completely; sculpture of elytra simple; wings developed in both sexes; fore tibiae with three teeth along outer margin; middle and hind tibiae with one transverse ridge; hind tibiae narrow.

**Specific composition.** Type species.

**Remarks.** The new genus distinctly differs from all genera of Mesozoic Scarabaeoidea. From genera, the wing venation of which is at least partially known, i.e., *Holcorobeus* Nikritin, *Lithoscarabaeus* Nikolajev, *Cretogeotrupes* Nikolajev, *Cretochodaesus* Nikolajev, *Cretobolbus* Nikolajev, *Cretaegialia* Nikolajev, *Cretoscarabaeus* Nikolajev, *Cretomelolontha* Nikolajev, *Cretohybosorus* Nikolajev, it differs in the vein R3 being absent in the apical part of the wing. Additionally, it differs from the genera *Holcorobeus*, *Lithoscarabaeus*, *Cretogeotrupes*, *Cretobolbus*, *Cretaegialia*, *Cretoscarabaeus*, and *Avitortor* Ponomarenko in having an abdomen not completely hidden under the elytra. This new genus differs from genera with noncontiguous middle coxae, i.e., *Prototrox* Nikolajev and *Cretaesalus* Nikolajev, in the presence of six visible abdominal sternites. From *Holcorobeus*, *Lithoscarabaeus*, *Cretorabaeus* Nikolajev, *Lithanomala* Nikolajev, *Cretogeotrupes*, and *Prototrox*, it differs in the presence of only one ridge on the outer face of the middle and hind tibiae; from the genus *Proteroscarabaeus* Grabau, it differs in the presence of only three teeth on the outer face of the fore tibiae; from the genus *Cretoserica* Nikolajev, it differs in the hind tibiae being narrow; and from the genus *Cretanaides* Nikolajev, it differs in the simple sculpture of the elytra.

#### *Cretocoma tologoica* Nikolajev, sp. nov.

**Etymology.** From the locality of Shar-Tolgoi.

**Holotype.** PIN, no. 4271/217, part and counterpart of beetle with strongly deformed head and pronotum and expanded right wing; apex of left fore tibia poorly preserved and right middle and hind tibiae clearly distinct; middle tarsus and several hind tarsomeres preserved as well; traces of external female genital

apparatus present; Mongolia, Bayan-Hongor Aymag, southeast slope of Ih-Bogd Mountain 53 km north of Bayan-Leg somon (district), southwestward of Tsaagan-Ovo, locality of Shar-Tolgoy; Lower Cretaceous, Shar-Tolgoy Sequence.

**Description** (Figs. 1a–1c). The beetle is not large, convex, with well developed wings in both sexes, the elytra bear shallow furrows, the midcoxae are large and hind coxae are narrower and contiguous. The hind femora are rather broad with a furrow, which is closer to the hind margin. A short stout spur is developed at the apex of the tibia; it is situated in an excavation between the middle and apical teeth but a little closer to the apical one. The middle and hind tibiae with one transverse row of setae, which is situated at the midlength of the middle tibia and closer to the apical portion of the hind tibia, and the middle and possibly hind tibial spurs are contiguous. The middle and hind tarsi are somewhat longer than the tibiae. The apices of one to five sternites have narrow leathery bordering. The whole surface of sternites is densely covered with tubercles, which might bear a bristle. The apex of the pygidium bears long bristles. The coxites of the external genital apparatus of female have large elongate styles bearing apical fascicle of long bristles.

**Measurements**, mm: length of impression from tip of head to apices of genital styles, 10; width of impression, 4.5; length of elytra from shoulder to apex, 6.5; wing length from base to bent, 5; distance between apical teeth of fore tibia, 0.45; length of its apical spur, 0.3; length of metathorax at mid-line, 1.6; width of middle coxa, 0.4; length of middle tibia, 1.5; its apical width, 0.45; length of its apical spur, 0.3; length of middle tarsus, 1.8; length of its tarsomeres, 0.5 : 0.25 : 0.2 : 0.25 : 0.6 (with claw); width of hind coxa, 0.5; length of hind femur, 1.85; its width, 1; length of hind tibia, 1.75; its apical width, 0.45; length of its apical spur, 0.5; length of abdominal sternites at midline, starting with the first, 0.5 : 0.5 : 0.4 : 0.4 : 0.6 : 0.35; width of lateral margin of 1–5 sternites, 0.65; that of 6 sternite, 0.5; length of stylus of external genital apparatus, 0.4; and its width, 0.1.

**Material.** Holotype.

#### ACKNOWLEDGMENTS

I express my cordial thanks to A.G. Ponomarenko and V.V. Zherikhin (both from the Paleontological Institute, Russian Academy of Sciences) for providing material that served as a cornerstone for this paper.

#### REFERENCES

- Arnett, R. H., Jr., *The Beetles of the United States (A Manual for Identification)*, Washington: The Catholic Univ. of America Press, 1963.
- Hardy, A.R., Placement of the Genus *Benedictia* Sanderson (Coleoptera: Scarabaeidae), *Coleopterists' Bull.*, 1978, vol. 32, no. 1, pp. 67–70.
- Laurence, I.F. and Newton, A.F., Jr., Families and Subfamilies of Coleoptera (with Selected Genera, Notes, References, and Data on Family-Group Names), *Biology, Phylogeny, and Classification of Coleoptera (Papers Celebrating the 80th Birthday of Roy A. Crowson)*, Pakaluk, J. and Slipinski, S. Eds., Warsaw, 1995, pp. 779–1006.
- Nikolajev, G.V., Possible Reasons of Wing Reduction in the Lamellicorn Beetles (Coleoptera, Scarabaeidae), in *Tr. Inst. Zool. Akad. Nauk KazSSR (Alma-Ata)*, 1984, vol. 41, pp. 44–49.
- Nikolajev, G.V., The Taxonomic Placement in the Subfamily Aphodiinae (Coleoptera, Scarabaeidae) of the New Genus of Lower Cretaceous Scarab Beetles from Transbaikalia, *Paleontol. J.*, 1993, vol. 27, suppl. no. 1A, pp. 1–8.
- Nikolajev, G.V., Materials to the Taxonomy of the Family Ochodaeinae (Coleoptera, Scarabaeidae), *Zool. Zh.*, 1995, vol. 74, issue 8, pp. 72–82.
- Nikolajev, G.V., Lamellicorn Beetles (Coleoptera, Scarabaeidae) with a Large Number of Striae on the Elytra from the Lower Cretaceous Baissa Locality in Transbaikalia, *Paleontol. Zh.*, 1996, no. 2, pp. 91–99.
- Nikolajev, G.V., Pleurostict Lamellicorn Beetles (Coleoptera, Scarabaeidae) from the Lower Cretaceous of Transbaikalia, *Paleontol. Zh.*, 1998, no. 5, pp. 513–520.
- Nikolajev, G.V., Materials to the Taxonomy of the Lamellicorn Beetles of the Subfamily Hybosorinae (Coleoptera, Scarabaeidae), with the Erection of a New Tribe for Four Monobasic Genera from South America and Description of New Taxa from the Lower Cretaceous of Transbaikalia, *Tethys Entomol. Res.*, 1999, no. 1, pp. 173–182.
- Nikolajev, G.V., New Subfamily of Stag Beetles (Coleoptera, Lucanidae) from the Mesozoic of Mongolia, and Its Place in the System of the Superfamily, *Paleontol. J.*, 2000, vol. 34, suppl. no. 3, pp. 327–330.
- Ritcher, P.O., Spiracles of Adult Scarabaeoidea (Coleoptera) and Their Phylogenetic Significance. 1. The Abdominal Spiracles, *Ann. Entomol. Soc. Amer.*, 1969, vol. 62, no. 4, pp. 869–880.
- Zunino, M., Analisi sistematica e zoogeografica della sottofamiglia Taurocerastinae Germain (Coleoptera, Scarabaeoidea: Geotrupidae), *Bull. Mus. Reg. Sci. Nat. Torino*, 1984, vol. 2, no. 2, pp. 445–464.