

## A Review of Bolboceratidae (Coleoptera, Scarabaeoidea) Species from the Russian Far East

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**Abstract**—A review of Bolboceratidae species from the Russian Far East is given. The distribution of the species is considered. Maps of their ranges in the territory of Russia are compiled. *Bolbotrypes davidis* (Fairmaire, 1891) was found in the Jewish Autonomous Area for the first time. Micetophagy of *Bolbocerodema zonatum* Nikolajev, 1973 and coprophagy of *Bolbotrypes davidis* are confirmed. The phenology of their adults and topical preferences are considered. The whole available information on the little-known *Bolbelasmus orientalis* Petrovitz, 1968 (holotype, the type locality, citing) is provided.

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The representatives of the family Bolboceratidae Mulsant, 1842 are medium-sized or rather large Palaearctic beetles varying in length from 7 to 23 mm. The adults are characterized by an 11-segmented antenna with a 3-segmented club. One of their main differences from the adults of Geotrupidae is the absence of a distinct hairy spot on the fore femur. The body is oval, convex dorsally. The head is large, with the mandibles frequently well visible from under the labrum. The wings are always developed. Part of the species are mycetophagous, feeding on the fungus mycelium, and some may be aphagous (Nikolajev, 1987). The adult beetles dig vertical holes and reserve the soil humus for larval feeding (Howden, 1982). Bolboceratidae is a worldwide distributed family with the highest taxonomic diversity in the southern hemisphere; it comprises over 500 recent species of 40 genera (Nikolajev and Puntsagdulam, 1984). In the Palaearctic Region, the family Bolboceratidae is represented by 13 genera comprising 53 species (Nikolajev, 2003; Kral et al., 2006). In Russia, 5 species of 4 genera were recorded (Kral et al., 2006). Earlier, this group was considered a supertribe (Nikolajev, 1970), and later, a subfamily within Geotrupidae Latreille, 1802 (Nikolajev and Puntsagdulam, 1984). Rather recently, Bolboceratinae was raised to the family Bolboceratidae (Scholtz and Browne, 1996). Some authors still consider this beetle group in the rank of a subfamily (Nikolajev, 2003; Verdu et al., 2004).

The representatives of the family Bolboceratidae are among the least studied lamellicorn beetles (Scarabaeoidea) in the Russian Far East. No accurate data on the distribution of these species in the Russian part of their ranges have been published. The biology and ecology (phenology, topical preferences, and trophic associations) remain unstudied. The larvae have not been described.

In this connection, a review of the Far Eastern representatives of the family Bolboceratidae is given here, and new data on the distribution and ecology of these species in the Russian sector of their ranges are considered.

The names of the scientific centers and the surnames and names of the persons whose material was used in the study are abbreviated as follows: AB BGI, the Amur Branch of the Botanical Garden-Institute, the Far Eastern Branch of the Russian Academy of Sciences, Blagoveshchensk; BO, Berlov Oleg Eduardovich, Irkutsk; BE, Berlov Eduard Yakovlevich, Irkutsk; IBSS, Institute of Biology and Soil Sciences, the Far Eastern Branch of the Russian Academy of Sciences, Vladivostok; ZIN, the Zoological Institute, Russian Academy of Sciences, St. Petersburg; IS, Ivanov Sergei Nikolaevich, Vladivostok; ISEA, Institute of Systematics and Ecology of Animals, the Siberian Branch of the Russian Academy of Sciences, Novosibirsk; KE, Koshkin Evgenii Sergeevich, Kha-



Fig. 1. *Bolbocerodema zonatum* Nikolajev, 1973.

barovsk; NG, Nikolajev Georgii Vladimirovich, Almaty, Kazakhstan.

In the Asian part of Russia, Bolboceratidae is distributed only in the south of the Far East, being represented there by 3 species belonging to 3 genera of 2 tribes of 1 subfamily.

Family BOLBOCERATIDAE Mulsant, 1842

Subfamily **Bolboceratinae** Mulsant, 1842

Tribe Bolbochromini Nikolajev, 1970

Genus ***Bolbocerodema*** Nikolajev, 1973

Type species *Bolboceras nigroplagiatum* C.O. Waterhouse, 1875.

***Bolbocerodema zonatum*** Nikolajev, 1973 : 859  
(Fig. 1)

The holotype is in ZIN (St. Petersburg, Russia). The type locality is the “Kedrovaya Pad” Nature Reserve, Primorskii Territory, Russia.

*Bolbocerodema zonatum*: Nikolajev, 1973 : 856–859; 1979 : 99; 1989 : 383; 2003 : 200; Kral et al., 2006 : 83; Bezborodov, 2009 : 17; 2013 : 81, 86; Shabalina, 2011 : 66.

*Bolbocerosoma zonatum*: Krikken, 1979 : 41–43, 47; *Check List* ..., 1994 : 146.

*Bolbocerosoma nigroplagiatum*: Hua, 2002 : 160.

**Material.** Primorskii Territory: 1 ♀, Vladivostok, 03.VIII.1903, Gavronskii (ZIN); 1 ♀, Primorskaya Province, B. Tulamu, Slavyanskii Gulf, 20.VII.1911 (ZIN); 3 ♀, Khasanskii District, “Kedrovaya Pad” Nature Reserve, 14.VIII–06.IX.1963, L. Zimin, O. Velishchev (paratypes, ZIN); 2 ♀, same locality, 31.VIII–01.IX.1976, G.V. Nikolajev (ZIN); 4 ♀, Narva River, 26–31.VIII.1976, G.V. Nikolajev; 1 ♂, same locality, 01.IX.1976, G.V. Nikolajev (IBSS); 1 ♂ and 1 ♀, Golubinyi Utes, 06–08.VIII.1970, A. Egorov (IBSS); 1 ♂, Ryazanovka Vill., at light, 27.VII.1985, G.Sh. Lafer (IBSS); 1 ♀, “Nerpich’ya” Bay (Far Eastern Marine Preserve, 5 m from the coastline) in dried up horse dung on mold, 23.VIII.2006, S.N. Ivanov (IS); 1 ♀, “Vityaz” Bay, 02.VIII.1979, V.V. Dubatolov (ISEA); 1 ♀, same locality, at light, 23.VIII.2006, V.G. Bezborodov (AB BGI); 1 ♂, Gamov Peninsula, Andreevka Vill., by side of earth-road, 21.VII.2007, V.G. Bezborodov (AB BGI); 1 ♀, same locality, 18–23.VIII.2007, E.S. Koshkin (KE); 1 ♀, Krabbe Peninsula, 10.VII.2012, O. Losev (AB BGI); 1 ♂, Beregovoe Vill., 08.VIII.2008, N.N. Voronin (AB BGI); 1 ♀, Andreevka Vill., 25.VII.1967, G.Sh. Lafer (BE); 1 ♀, “Kedrovaya Pad” Nature Reserve, 22–27.VIII.1985, O. Berlov (BO).

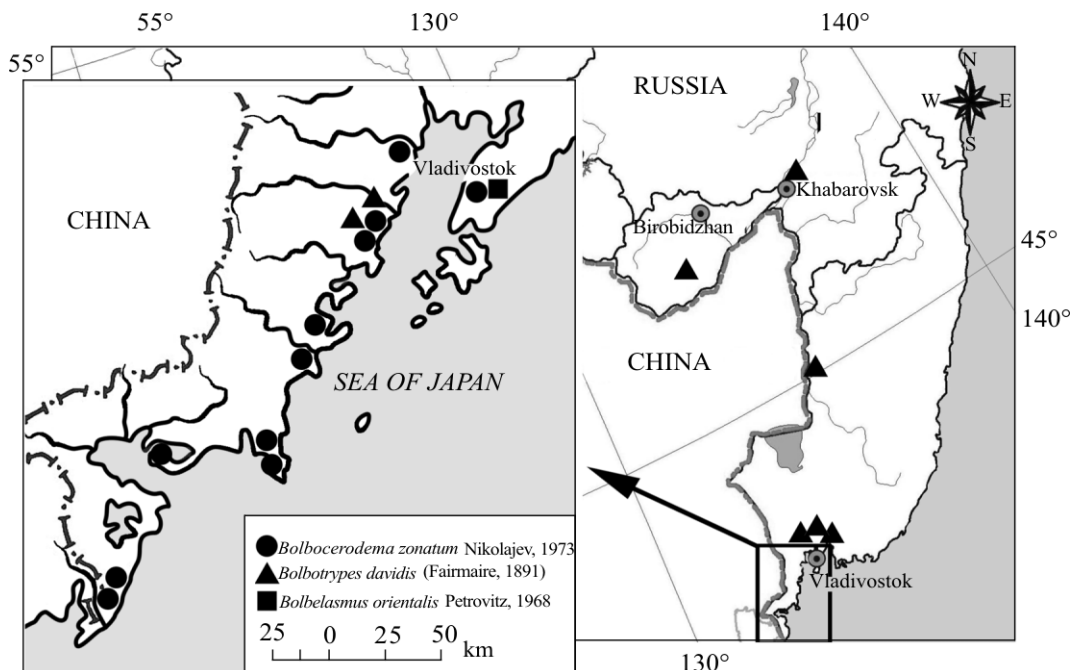


Fig. 2. Distribution of the species of Bolboceratidae in the Russian Far East.

**Distribution.** Russia: Primorskiy Territory (Khasanskiy District and the Murav'ev-Amurskiy Peninsula), the Korean Peninsula, Northeastern China (Liaoning).

The new genus *Bolbocerodema* and the new species *Bolbocerodema zonatum*, the subfamily Geotrupinae Latreille, 1802, the family Scarabaeidae Latreille, 1802, were described by G.V. Nikolajev in 1973 from the 13 specimens collected in Khasanskiy District of Primorskiy Territory of the USSR (Russia) (Nikolajev, 1973). The new genus was differentiated from the American-Asian genus *Bolbocerosoma* Schaeffer, 1906 and comprised all the Asian species. Later, Krikken (1979) published his fundamental revision of the genus *Bolbocerosoma*, in which he considered the taxon *Bolbocerodema* as a subgenus of the genus *Bolbocerosoma*. This viewpoint is frequently shared by Japanese, Chinese, and Korean authors (Ueno et al., 1989; *Check List ...*, 1994; Li et al., 2008). It is noteworthy that the distinctions between the American taxon *Bolbocerosoma* and the Asian *Bolbocerodema* are seen from a number of the constant morphological characters confirming the generic status of the taxa (Nikolajev, 1973). In particular, in the male of *Bolbocerosoma*, the horn on the frons does not fuse with the tubercle on the clypeus, and the base of the pronotum is entirely marginate. In *Bolbocerodema*, by contrast, the horn fuses with the tubercle of the clypeus, and the base of the pronotum is not entirely marginate. In the

American species, the middle coxae are more widely spaced than those in the Asian species.

The material from the southern part of Primorskiy Territory of Russia, from the Korean Peninsula, and from Northeastern China can be reliably identified using Nikolajev's keys (1973, 1989) as *Bolbocerodema zonatum* and exhibits essential specific differences from *B. nigroplagiatum* (an endemic to the Japanese Archipelago). In particular, in *Bolbocerodema zonatum*, the base and the apex of the rufous pronotum are black at the center, and the black spots at the center of the elytra are rounded. In *Bolbocerodema nigroplagiatum*, in contrast, the rufous pronotum has no black spots, and the black spots on the elytra occupy the apical 2/3 and form at the border with the rufous area an even line running diagonally from the outer margin of the elytra to the inner suture. In the Chinese literature, *B. nigroplagiatum* is mentioned as a Chinese-Korean-Japanese species; several species from Eastern Asia hide under this name (Hua, 2002). In the Catalogue of the Coleoptera of the Palearctic Region (Kral et al., 2006), the taxon *Bolbocerodema* is considered in the rank of a genus and comprises 7 species. Most of these species are distributed within Eastern China, Japan, India, and Nepal, and only *B. zonatum* penetrates northwards as far as the extreme southeast of Russia. According to Krikken (1979), *B. zonatum* is distributed within the bounds of the



Fig. 3. *Bolbotrypes davidis* (Fairmaire, 1891).

entire south and the center of Primorskii Territory of Russia, which is erroneous. The southern border of the distribution range of the species must have run in Liaoning Province of China (Bezborodov, 2009).

Most part of the material of *B. zonatum*, including the holotype, was collected in Russia from the “Kedrovaya Pad” Nature Reserve. The species was found throughout the entire eastern maritime area of Khasanskii District of Primorskii Territory (Bezborodov, 2009). Yan-chi-khe (at present, Tsukanovo Vill.) at the border with Korea (Nikolajev, 1973) and the Golubinyi Cliff are the southernmost, and Beregovoe Village is the northernmost record of the species. There are no data on records of *B. zonatum* in Russia beyond Khasanskii Distr., but the ZIN collection includes 1 specimen collected in 1903 in Vladivostok. The map of the Russian sector of the species range is shown in Fig. 2.

According to Nikolajev (1979), holes of the beetles on wet meadows were easily seen due to soil excavations. The 20 cm deep holes contained no food reserve, but a male and a female occasionally occurred there. Most beetles were found 5 km away from the sea. The species is common in broadleaf forests and open woods and also in local meadow communities. The beetles frequently occur in the nearshore zone. The same peculiarities of the distribution are observed on the Korean Peninsula and in Northeastern China, which points to hygrophily of the species (Bezboro-

dov, 2009). In dried up horse and cow dung, the adult beetles were found within cavities covered with white mold, which confirms the assumption about mycetophagy of the adults. No holes were found under the dung. The beetles are active by day (on the soil surface and in dung) and night (readily fly at light). Day and evening (before sunset, especially in cloudy weather) flights are occasionally observed. A mass flight was recorded (Nikolajev, 1979), but it was not observed later. As all the known specimens were collected from the second ten-day period of July to the first ten days of September, the species can be attributed to a late-autumn group, with respect to the phenology of the activity of adults.

Tribe Bolbelasmini Nikolajev, 1996

Genus *Bolbotrypes* Olsoufieff, 1907 [monotypical]

*Bolbotrypes davidis* (Fairmaire, 1891) (Fig. 3)

*Bolboceras davidis* Fairmaire, 1891 : 6, the type species of the genus. The holotype is in the National Museum of Natural History in Paris, France (MNHN). The type locality is Beijing, China.

= *Bolboceras chaoyanum* Nijjima et Kinoshita, 1937 : 4.

*Bolbotrypes davidis*: Olsoufieff, 1907 : 21; Boucomont, 1910 : 334; Kozlov, 1923 : 177; Miwa, 1930 : 164; 1931 : 276; Masumoto, 1976 : 2; Nikolajev and Puntsagdulam, 1984 : 103; Nikolajev, 1989 : 384;



Fig. 4. *Bolbelasmus orientalis* Petrovitz, 1968 (after: Krikken, 1977).

2003 : 203, 204; Hua, 2002 : 160; Chun-Lin Li et al., 2008 : 477–479.

*Bolbotrypes davidis*: Kral et al., 2006 : 83; Shabalin, 2011 : 66; Bezborodov, 2013 : 81, 86.

**Material.** Primorskii Territory: 1 ♂, Khasanskii Distr., Barabash Vill., 19.VIII.1987, N.A. Zalimskaya (AB BGI); 1 ♀, “Kedrovaya Pad” Nature Reserve, near central office (at light), 03.IX.1990, V.R. Saveljev (AB BGI); 1 ♀, Suputinskii Nature Reserve, 05–15.VIII.1972, V.G. Shilenkov (NG); 2 ♂, 25 km E of Ussuriisk, 21–24.VII.1974, B. Verzhutsky (BE); 1 ♀, same locality, 09.VII.1974, B. Verzhutsky (NG); 1 ♀, Nadezhdinskii Distr., Terekhovka Vill., 09.IX.1982, V. Mutin (IBSS); 1 ♀, Dalnerechenskii Distr., Dalnerechensk, 21.VII.1997, S.V. Il'yashchenko (AB BGI); Khabarovsk Terr.: 1 ♀, Khabarovskii Distr., Knyaze-Volkonskoe Vill., 02–08.VII.2000, V.S. Grinbaum (AB BGI); Jewish Autonomous Area: 1 ♂, Leningradskii Distr., “Churki” Nature Reserve, 7 km SE of Babstovo Vill., foothills of Bolshie Churki Mt. Range, oak open wood, 08.VII.2013, E.S. Koshkin (AB BGI).

**Distribution.** Russia: Primorskii Terr., the south of Khabarovsk Terr. (the habitation has been confirmed), the Jewish Autonomous Area (indicated for the first time); the Korean Peninsula, Northeastern, Eastern, and Southern China, Taiwan, Vietnam, Laos, and Cambodia.

For the territory of Russia, *B. davidis* is an exceptionally rare taxon with the northeastern boundary of the distribution situated in Eastern Asia (in the pessimism zone). Most part of the known material from the Russian part of its range is considered in the present paper. In contrast to *Bolbocerodema zonatum*, *B. davidis* extends much farther northward, as far as the Middle Amur Area, being recorded there only for the regions bordering with China, along the Amur River. In Primorskii Territory, the species was found in the Ussuri River valley, on the southwestern spurs of the Sikhote-Alin Mts., in the eastern part of the Borisovskoe Plateau, and on the eastern spurs of the Eastern Manchurian Mts. (the Chernye Mountains). In most cases, the beetles were found in open meadow communities and in light forests, less frequently, in forests. This may be indicative of the steppe origin of the species, as in Northeastern China, this species is distributed throughout the whole arid zone of Manchuria, including the deserted Alashan District of Inner Mongolia and in Gansu Province (Kozlov, 1923; Nikolajev and Puntsagdulam, 1984), being rather common there. In humid areas, *B. davidis* is distributed in eastern Manchuria, penetrates to the north of the Korean Peninsula, and then reaches the Hebei Province of China in the south (Kral et al., 2006). The data on its distribution in Eastern Asia southward of Beijing are discrepant. In Chinese publications, the species is in-

licated for the whole of Northeastern and Eastern China, from Manchuria to Jiangxi and Taiwan and then to the south through the entire Indochina to Cambodia (Hua, 2002). In later publications, the taxon is indicated for Mongolia, Eastern China, Taiwan, and Northern Vietnam (Li et al., 2008). Within the territory of Russia, the taxon was first recorded by us from the Jewish Autonomous Area. Earlier, for Khabarovsk Territory, *Bolbotrypes davidis* was indicated without listing the material (Nikolajev and Puntsagdulam, 1984; Nikolajev, 1989). Having examined the known collections, we did not find localities indicated for *B. davidis* from Khabarovsk Territory. In the present communication, we list the original material from Khabarovsk Territory. The map of the Russian sector of the species range is shown in Fig. 2. With respect to the phenology of the activity of adults, the species belongs to a late-autumn group. The specimens examined were collected from the first ten-day period of July to the first ten days of September. Most part of the beetles were caught at light. It is of interest that one male was found in fresh horse dung containing no mold but coprophagous lamellicorn beetles of the genera *Aphodius* Illiger, 1798 and *Onthophagus* Latreille, 1802; this fact may point to coprophagy of *B. davidis*.

Genus *Bolbelasmus* Boucomont, 1911

*Bolbelasmus orientalis* Petrovitz, 1968 : 185 (Fig. 4)

The holotype is deposited in R. Petrovitz's collection in Geneva (Switzerland). The type locality is "Wladiwostock."

*Bolbelasmus orientalis*: Petrovitz, 1968 : 185; Krikken, 1977 : 281; Nikolajev, 1989 : 383; 2003 : 203; Kral et al., 2006 : 82; Shabalin, 2011 : 66.

**Material.** 2 ♂, holotype and paratype from Vladivostok (Krikken, 1977).

**Distribution.** Russia: Primorskii Territory, Vladivostok (Fig. 2).

*Bolbelasmus* Boucomont, 1911 is a genus widely distributed in the Old and New World and comprising 17 species (Nikolajev, 2003). The only species recorded for the fauna of the Russian Far East is known from two specimens collected in the environs of Vladivostok. The taxon is rarely mentioned in the literature. Since the time of the description, record of the species has been confirmed neither in Russia nor in adjacent territories; thus, this may be an error of geo-

graphical labeling. The figure of the species is based on Krikken's (1977) paper.

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