# New data on *Sphaerites perforatus* and *S. nitidus* (Coleoptera: Sphaeritidae): additional diagnostic characters and records from China

Новые данные о *Sphaerites perforatus* и *S. nitidus* (Coleoptera: Sphaeritidae): дополнительные диагностические признаки и указания из Китая

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The article deals with diagnostic characters, distribution including additional faunal records, and ecology of *Sphaerites perforatus* Gusakov, 2017 and *S. nitidus* Löbl, 1996. A redescription of *S. perforatus* with indication of additional morphological characters is given. Wings venation of *S. perforatus, S. nitidus*, and *S. glabratus* (Fabricius, 1792) is analysed. A key to all species of *Sphaerites* Duftschmid, 1805 is given.

В статье рассмотрены диагностические признаки, распространение, включая дополнительные фаунистические находки, и экология *Sphaerites perforatus* Gusakov, 2017 и *S. nitidus* Löbl, 1996. Приводится переописание *S. perforatus* с указанием дополнительных морфологических признаков. Проанализировано жилкование крыльев *S. perforatus*, *S. nitidus* и *S. glabratus* (Fabricius, 1792). Дана определительная таблица всех видов рода *Sphaerites* Duftschmid, 1805.

Key words: false clown beetles, taxonomy, China, Coleoptera, Sphaeritidae, *Sphaerites*, new records

**Ключевые слова**: жуки-таежники, таксономия, Китай, Coleoptera, Sphaeritidae, *Sphaerites*, новые фаунистические указания

## **INTRODUCTION**

Sphaeritidae, commonly called false clown beetles, include a single genus, *Sphaerites* Duftschmid, 1805, with seven currently known species. The majority (viz. six) of species occur in the Palaearctic Region: *S. dimidiatus* Jureček, 1934, *S. glabratus* (Fabricius, 1792), *S. involatilis* Gusakov, 2004, *S. nitidus* Löbl, 1996, *S. opacus* Löbl et Háva, 2002, and *S. perforatus* Gusakov, 2017. These species are known only from China (Jureček, 1934; Löbl, 1996; Löbl et Háva, 2002; Gusakov, 2004, 2017) except for *S. glabratus* widely distributed over the forest zones. A single species, *S. politus* Mannerheim, 1846, is distributed in the Nearctic Region (Mannerheim, 1846; Kryzhanovskij & Reichardt, 1976). The taxonomic review of the family was published by Gusakov (2004), and more recently the distribution of *Sphaerites* in the Palaearctic Region was considered by Löbl (2015).

The present study is based on the recently collected material of the two rare species, *S. perforatus* and *S. nitidus*, from Yunnan and Sichuan (China). The former species was described recently on the basis of seven specimens from five localities in Yunnan; the latter one was known only by the holotype and paratype collected in one locality in Sichuan. The careful study of the morphology of these species, including the hind wings, made it possible to find some additional diagnostic characters and modify the key to the species of the genus proposed by Gusakov (2004).

## MATERIAL AND METHODS

Examined specimens are deposited in the following collections: CDL, D.S. Lundyshev's private collection, Baranovichi, Belarus; CSR, S.K. Ryndevich's collection, Baranovichi, Belarus; ZIN, the Zoological Institute of the Russian Academy of Sciences, St Petersburg, Russia.

The males of Sphaerites species were dissected; their genitalia were placed in watersoluble glue on plastic plates pinned below the respective specimens. Beetles were examined using a Nikon SMZ-745T and Nikon SMZ-800 stereomicroscopes. Measurements were taken using an ocular micrometer. Total body length is measured between the anterior angles of the pronotum and the apices of the elvtra, width is taken as maximum linear distance between the outer margins of the elytra (Kryzhanovskij & Reichardt, 1976; Lackner, 2016). The following two parameters were also considered: the elytral length (EL) measured along the suture from the basal margin of the elytra to their apices; and the length of the metathoracic wings (WL) measured from the outer (basal) margin of the jugal area to wing apex. Habitus photographs were taken using a Nikon D5100 digital camera with attached Nikon 60 mm 1:2.8G macro lens and Meike Macro Extension Tube Set. and subsequently edited in Adobe Photoshop CS5<sup>®</sup>. Genitalia images were taken with a Nikon Eclipse 50i stereomicroscope with mounted camera from glass slides in glycerol. Figures were prepared using the Photoshop CS5® software. Maps were constructed in Google Maps and subsequently edited in Adobe Photoshop CS5<sup>®</sup>.

Terminology for the metathoracic wing venation largely follows Kukalová-Peck & Lawrence (1993) and Newton (2016).

# TAXONOMY

#### Order COLEOPTERA

## Family SPHAERITIDAE

Genus Sphaerites Duftschmid, 1805

*Sphaerites perforatus* Gusakov, 2017 (Figs 1–4, 7–9, 10, 11, 14–17, 24)

*Material examined.* China, *Yunnan*: Laojunshan Mts., NE Liming, 4.2 km S Muzhengdu,  $27^{\circ}6'34''N / 99^{\circ}45'3''E$ , 03.VI.2016, H = 3695 m, I. Kabak, G. Davidian leg., 1 male (CDL); Laojunshan Mts., 6.26 km SSW Segengsheng,  $27^{\circ}0'20''N / 99^{\circ}28'33''E$ , 06.VI.2016, H = 3575 m, I. Kabak, G. Davidian leg., 1 male (CSR); NNE Wexi City, river tributary of Lapugou Riv., 4.7 km ENE Jizong,  $27^{\circ}27'41''N / 99^{\circ}23'53''E$ , 05.VI.2015, H = 3355 m, I. Belousov, I. Kabak, G. Davidian leg., 3 females (CSR); NW of Jianchuan, 6.2 km SW Baiyan Vill.,  $26^{\circ}38'31''N /$  $99^{\circ}44'36''E$ , 19.V.2016, H = 3615 m, I. Kabak, G. Davidian leg., 1 male, 1 female (ZIN, CDL).

*Redescription*. Shape and colour. Body broadly oval, moderately convex (Fig.1), length 5.1-5.6 mm, width 2.9-3.7 mm. Dorsum black, with lateral margins of pronotum and elytra dark brown. Antennae reddish, except for grevish-brown antennal club and dark brown first or first and second antennomeres. Maxillary palpomeres dark reddish, terminal palpomere dark brown. Submentum reddish-brown. Pronotum and elytra shiny, with or without very weak bronze lustre. Ventral surface largely dark brown; epipleurae reddishbrown, abdomen black, apex of pygidium reddish. Legs dark brown, with tarsi paler (Figs 1, 2). Tuft of setae on pro- and mesotrochanters vellowish.

Head. Dorsal surface covered with dense moderately coarse punctures, without microsculpture. Anterior margin of clypeus narrowly bordered. Eyes small, interocular distance about 9.1–9.3 times as wide as eye width from dorsal view (Fig. 1). Mentum glabrous, with shallow and sparse punctation, about 1.5–1.6 times as wide as long. Submentum semi-circular, about 2.5 times as wide as long; anterior margin strongly arcuate and irregularly elevated. Anten-



Figs 1, 2. Sphaerites perforatus, habitus. Dorsal view (1), ventral view (2). Scale bar: 5 mm.



Figs 3, 4. *Sphaerites perforatus.* 3, lateral margin of elytron with denticles (yellow arrow), ventral view; 4, base of elytron with punctate row 6 (yellow arrow), dorsal view. Scale bar: 1 mm.



**Figs 5–7**. Sphaerites spp., metathoracic wing. **5**, *S. glabratus*; **6**, *S. nitidus*; **7**, *S. perforatus*. *RP*, *RP2*, *RP3+4* – radius posterior veins; *RP2a*, *RP2p* – anterior and posterior branches of radius posterior vein; *MP*, *MP3+4* – media posterior veins; CuA2+3+4 – cubitus anterior vein; AA3+4 – anal anterior vein; *J* – jugal area. Scale bar: 5 mm.

nal club compact. Terminal maxillary palpomere almost symmetrical.

Thorax. Pronotum about 2.2 times as wide as long. Pronotal punctation (compared to that of head) sparse and shallow on disc, becoming coarser and denser laterally. Lateral margins of pronotum narrowly bordered, border not reaching anterior angle; anterior and posterior margins not bordered. Prosternum, mesoventrite and lateral parts of metaventrite with coarse and shallow punctation. Median area of metaventrite with sparse and very shallow punctation. Prosternum with very long and narrow intercoxal process. Plate of mesoventrite trapezoidal, almost hexagonal, about 1.4 times as long as wide, widest in anterior part near apex, very coarsely and densely punctate (Fig. 2).

Elytra asetose, with ten longitudinal rows of punctures; rows 1 to 6 reaching or almost reaching elytral base, 7 to 10 not reaching elytral base; rows 1 to 9 consisting of very large and rather coarse punctures, row 10 consisting of smaller punctures and located almost at lateral edge of elytra. Elytral intervals flat, covered with punctation very similar to that of pronotum (Fig. 1). Humeral and subapical bulges low, but distinct. Elytral epipleuron widest in its anterior part; lateral margin of elytra with very small but distinct teeth in middle and



Figs 8, 9. Sphaerites perforatus, aedeagus. Ventral view (8), lateral view (9). Scale bar: 0.5 mm.

anterior parts, and with indistinct teeth in posterior part (Fig. 3).

Metathoracic wings (Fig. 7) greatly shortened (EL/WL = 1.0-1.03).

Legs. Femora with sparse and shallow punctures, without tibial grooves. Pro- and mesotrochanters with dense subapical tuft of erect setae (Fig. 2). Apex of metatrochanters adjoins to femora (Fig. 24). Tarsi with sparse pale setae ventrally; tarsomere 1 as long as tarsomeres 2 and 3 combined; tarsomere 5 about as long as tarsomeres 2–4 combined.

Abdomen. Ventrite 1 very short, ventrite 2 distinctly longer than the others, about 1.4 times as long as ventrite 3 (Fig. 2). Pygidium with dense and shallow punctation.

Male genitalia (Figs 8, 9). Phallobase asymmetrical. Parameres distinctly longer than phallobase (ratio of their length and phallobase length 2.0–2.2), slightly curved inward subapically, each with membranous apex. Median lobe parallel-sided, slightly narrowed distally, with slightly rounded apex; gonopore situated sub-apically (Fig. 8).

*Variation.* Several specimens have their elytral punctate row 6 not reaching the elytral base and bifurcate near the humeral bulge (Fig. 4). Although all the examined specimens are without metallic shine, the holotype, according to the original description (Gusakov, 2017), is with a very weak bronze lustre on the dorsum.

Comparison. Within the genus, S. perforatus is most similar to its Palaearctic congeners S. nitidus, S. glabratus, S. involatilis as well as the Nearctic S. politus in having the elvtra black or brownish-black, without reddish-vellow or brownish-red colouration in anterior half. Sphaerites perforatus can be easily distinguished from them by the absence of a distinct metallic shine on the dorsum (at most with a very faint bronze lustre) and by having the larger and much coarser punctures in the elvtral rows. Sphaerites dimidiatus and S. opacus differ from all other species, including S. perforatus, by having the anterior half of the elytra reddish-yellow or brownish-red.

The important character for identification of the *Sphaerites* species is the ratio of their elytral length to metathoracic wing length (EL/WL). *Sphaerites nitidus* and *S. glabratus* have well developed wings (Figs 5, 6), their EL/WL = 0.5 and 0.6, respectively. *Sphaerites perforatus* is most similar in this character to *S. involatilis* and has almost the same ratio (1.0–1.03). *Sphaerites involatilis* has greatly shortened metathoracic wings, EL/WL = 1.3 (see Gusakov, 2004, fig. 7).

The wing venations of *Sphaerites* are different among species with well-developed wings and species with shortened wings (Figs 5–7). *Sphaerites glabratus* and *S. nitidus* have the distinct radius posterior veins (*RP2* and *RP3*+4) reaching the edge of the wing. In *S. perforatus*, these veins are markedly shortened due to the reduction

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Figs 10–13. Sphaerites spp., distribution. 10, 11, S. perforatus; 12, 13, S. nitidus.

of the wing area. The radius posterior vein (*RP3*+4) is represented by the short vestige, and the radius posterior vein (RP2) at the edge of the wing forks into two branches, anterior and posterior (RP2a and RP2p), which diverge in almost opposite directions. All the three species have the radius posterior vein (RP), however in S. glabratus and S. nitidus, it is shortened, as about half the length of the media posterior vein and does not reach the base of the wing. Furthermore, in S. perforates, this vein is thinned but reaches the base of the wing. In S. glabratus and S. nitidus, the media posterior vein (MP3+4), cubitus anterior vein (CuA2+3+4) and anal anterior vein (AA3+4) are well pronounced. Two veins,

the media posterior vein (MP3+4) and cubitus anterior vein (CuA2+3+4), reach the edge of the wing; the anal anterior vein (AA3+4) is slightly shortened and does not reach the edge of the wing. Sphaerites nitidus has the media posterior vein (MP3+4) with the distinct branch that extends at an acute angle in the direction of the anterior edge of the wing. In S. perforatus, the cubitus anterior vein (CuA2+3+4) and anal anterior vein (AA3+4) are shortened. The anal anterior vein (AA3+4) slightly does not reach the edge of the wing. The media posterior vein (MP3+4) is very thin and in some areas almost indistinguishable. The anterior part of the cubitus anterior vein (CuA2+3+4) is also very thin, the posterior part is almost



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Figs 14-17. Habitats of Sphaerites perforatus in Yunnan. 14, high mountain forest, 4.7 km ENE of Jizong; 15, high mountain forest, 6.2 km SW of Baiyan Vill.; 16, high mountain forest, 4.2 km S of Muzhengdu; 17, high mountain forest, 6.26 km SSW of Segengsheng.

indistinguishable. The jugal area (*J*) is separated from the rest of the wing by a clear cut in S. glabratus and S. nitidus. Sphaerites *perforatus* has the almost reduced jugal area.

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Sphaerites glabratus, S. nitidus, and S. politus have the elytra with the distinct subapical bulges. In S. perforatus, the subapical bulges are distinct, but lower. Based on this character, S. perforatus can be grouped together with S. involatilis which likewise has greatly shortened wings.

Sphaerites politus differs from S. perforatus in the apex of the metatrochanter which is spike-shaped and does not adjoin the femora (Fig. 24). On the other hand, the former species has the lateral elytral margin with very distinct denticles in the anterior and middle parts similar to those of S. perforatus (Fig. 3). In other species, the denticles either are absent on the elytra or they are located in different positions.

Distribution. Hengduan Mountains (Xue Shan, Dao Chun Shan, Laogu Shan, Yun Ling Shan, and Qingshuila Shan), northern Yunnan, China (Figs 10, 11). Type locality: 4.1 km WNW Yanguangcan (27°15′32′′N / 99°24′28′′E, 3595 m), NE Weixi City, Yun Ling Shan.

Ecology. A terrestrial species inhabiting high-mountain forests at an altitude of 3355-4035 m (Figs 14-17). Beetles were collected on fallen tree trunks at night.

Sphaerites nitidus Löbl, 1996 (Figs 12, 13, 18, 19, 20, 21, 23)

Material examined. China, Sichuan: WSW Lixian, 5.9 km SW of Shangzhai, 31°20′54′′N /



Figs 18, 19. Sphaerites nitidus, habitus, dorsal view. Scale bar: 5 mm.

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Figs 20, 21. Habitats of *Sphaerites nitidus* in Sichuan. 20, high mountain forest, 5.9 km SW of Shangzhai; 20, high mountain forest, 13.4 km SW of Shangzhai.

102°50′26′′E, 15.VI.2016, H = 3025 m, I. Kabak, G. Davidian leg., 2 specimens (ZIN, CSR); WSW Lixian, 13.4 km SW of Shangzhai, 31°17′45′′N / 102°47′18′′E, 17.VI.2016, H = 3595 m, I. Kabak, G. Davidian leg., 1 specimen (CDL).

*Diagnosis*. Body broadly oval, moderately convex (Figs 18, 19). Length 5.5–5.7 mm, width 3.7–4.0 mm. Black; pronotum and elytra with blue-green, violet-green or greenish metallic shine. Dorsal surface without microsculpture. Elytra with nine longitudinal rows of punctures: rows 1 to 3 shortened anteriorly, 4 and 5 originating near basal edge, 6 to 9 originating behind humeral bulges; an additional, very short



Figs 22-24. Sphaerites spp., metatrochanter and base of metafemur. 22, S. politus; 23, S. nitidus; 24, S. perforatus. Scale bar: 0.4 mm.

row of punctures lying laterad of humeral bulges. Punctures in rows small and shallow, in rows 1–9 becoming indistinct near elytral apex. Elytral intervals flat, with extremely fine punctation. Humeral and subapical bulges low, but distinct. Apex of metatrochanter adjoining to femur (Fig. 23). Metathoracic wings long (EL/WL = 0.5).

Remark. Löbl (1996) provided a very detailed description of the species and illustrated it with photographs of high quality but without the habitus photograph. Thus, the reader is referred to Löbl's publication (1996) for the details.

Distribution. Described from the Gongga Mountain, Daxue Shan, Sichuan. According to the examined material, the species occurs in the Hengduan Mountains (Mazhi Shan and Daxue Shan), central Sichuan, China (Figs 12, 13).

Ecology. A terrestrial species inhabiting high mountain forests at an altitude of 2800-3600 m (Figs 20, 21). Beetles were collected on fallen tree trunks at night (the similar collecting circumstances were observed for *S. perforatus*).

#### Key to the species of Sphaerites

- 1. Elvtra black, their anterior half reddish-vellow or brownish-red ......2
- 2. Elytra without distinct microsculpture, their anterior part from base to middle reddishvellow; border between light and dark parts
- Elytra with distinct microsculpture, their anterior part (about one-seventh of elytron length) brownish-red; border between light and dark parts indistinct, blurred .....

......S. opacus

- 4. Apex of metatrochanter adjoining to femora, not spike-shaped (Figs 23, 24) ......5
- Apex of metatrochanter spike-shaped, not adjoining to femora (Fig. 22).....S. politus

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