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Drilorhinus, a new genus of the family Drilidae Lacordaire, 1857 (Coleoptera: Elateroidea) from Iran

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Abstract

A new genus of the family Drilidae, *Drilorhinus* **gen. nov.** with one new species *D. klimenkoi* **sp. nov.** from the South-West Iran (Lorestan) is described, illustrated and compared with all known genera of this group. The new genus differs from all members of the family in the strong projection of the anterior part of the frons between antennal insertions. Some problems of taxonomic rank and classification of Drilidae are considered.

Key words: Elateroidea, new species, Palaearctic, Middle East

Introduction

The higher classification of the superfamily Elateroidea and the infraorder Elateriformia has been under discussion during decades (Crowson 1972; Lawrence *et al.* 2011; etc.). Additional pressure for a wide revision of these taxa appeared due to the possibility of comparative analysis of DNA sequences in different coleopterous groups. The family Drilidae Lacordaire, 1857 was recently transferred from its traditional placement among "cantharoids", or soft-bodied elateroids, into the elaterid subfamily Agrypninae Candèze, 1857 as a tribe with unclear relationships after analyses of 18S and 28S rDNA, cox1, and rrnl mtDNA (Kundrata & Bocak 2011). The composition of this group was further revised after new studies on the structural features of their adults and larvae (Kazantsev 2007, 2010; Kazantsev & Zaitsev 2017; Kundrata *et al.* 2015b). In the current state the "family" Drilidae or "tribe" Drilini represents a small group of beetles (8 described genera and about 140 species) distributed in the Afrotropical, Palaearctic and Indo-Malayan regions (Trllova & Kundrata 2015; Kundrata & Bocak 2017; etc.) with soft-bodied, fully winged males, and larviform apterous females (Crowson 1972; Bocak *et al.* 2010).

The Palaearctic fauna of this group comprises only three genera: *Drilus* A. Olivier, 1790 (35 species), *Malacogaster* Bassi, 1834 (11 species), and *Selasia* Laporte de Castelnau, 1836 (8 species) (Kundrata *et al.* 2015a; Petrzelkova & Kundrata 2015; Trllova & Kundrata 2015; Kundrata 2017; etc.).

A study on various beetles from Iran provided by A.A. Klimenko reveals a member of a new genus of the group under consideration, described in the present paper.

Material and methods

The holotype of the new species herein described is deposited in the collection of the Zoological Institute of the Russian Academy of Sciences. Study of the specimen was carried out with the stereomicroscopes MBS 1 and Leica MZ 12.0, photographs were taken with a Canon EOS 40D digital camera with a Canon MP-E 65 mm objective and were combined using Zerene Stacker 1.04 software.

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Taxonomy

Order COLEOPTERA

Suborder POLYPHAGA Emery, 1886

Superfamily ELATEROIDEA Leach, 1815

Family DRILIDAE Lacordaire, 1857

Drilorhinus gen. nov.

Type species: *Drilorhinus klimenkoi* **sp. nov.**

Etymology. The name of the new genus is formed from the generic name "*Drilus*" and Greek "ῥίς, ῥινός" (nose, snout). Gender masculine.

Composition. The type species only.

Diagnosis. Head somewhat wider than anterior margin of pronotum. Frons between antennal insertions strongly protruding forward and forming long subtriangular projection, covering mouthparts from above; antennal insertions located at base of sides of this projection. Antennae pectinate. Labrum small and slightly transverse, freely attached and fully exposed. Mandibles comparatively short and stout, moderately curved, with angularly curved outer margin. Pronotum slightly transverse, subtrapezoid, with lateral ridge distinct only in posterior half. Elytra shortened and somewhat divergent, covered with rough rugose-granulate sculpture. Prosternum with prosternal process short and widely rounded at apex. Mesoventrite V-shaped, with anterior margin deeply and widely emarginate.

Comparison. A strong projection of the anterior part of the frons between antennal insertions distinguishes the new genus from all known genera of Drilidae (*Drilus* A. Olivier, 1790; *Flabelloselasia* Kundrata et Bocak, 2017; *Kupeselasia* Kundrata et Bocak, 2017; *Lolosia* Kundrata et Bocak, 2017; *Malacogaster* Bassi, 1834; *Microselasia* Kundrata et Bocak, 2017; *Selasia* Laporte de Castelnau, 1836, and *Wittmerselasia* Kundrata et Bocak, 2017). *Drilorhinus* **gen. nov.** is most similar to *Malacogaster* in sharing the subtrapezoidal pronotum with shortened lateral ridge, shortened elytra (reaching only the base of abdominal segment 6), and V-shaped mesoventrite with deeply emarginate anterior margin, but the latter genus differs from *Drilorhinus* **gen. nov.** in the serrate antennae, very transverse labrum, widely separated falcate mandibles, subparallel-sided pronotum, and shape of the parameres. *Drilus* resembles the new genus in the shape of the mesoventrite, however, in contrast to the new genus, *Drilus* demonstrates the convex lateral pronotal margins with almost complete lateral ridges and not shortened elytra. *Selasia* differs from *Drilorhinus* **gen. nov.** in the concave anterior margin of the mesoventrite, elytra that are not shortened, and flabellate antennae. In addition to the above-mentioned diagnostic characters of *Drilorhinus* **gen. nov.**, the anterior part of the head of the new genus differs from the Afrotropical members of this family (*Flabelloselasia* Kundrata et Bocak, 2017; *Kupeselasia* Kundrata et Bocak, 2017; *Lolosia* Kundrata et Bocak, 2017; *Microselasia* Kundrata et Bocak, 2017 and *Wittmerselasia* Kundrata et Bocak, 2017, known to the authors after Kundrata & Bocak, 2017) in the shortened elytra, and also from *Flabelloselasia, Microselasia* and *Wittmerselasia* in the pectinate antennae (not flabellate), and from *Kupeselasia* and *Lolosia* in the much larger body and pectinate antennae (not serrate).

Description. Head slightly hypognathous, slightly wider than anterior margin of pronotum, dorsally convex, frons between antennal insertions strongly protruding forwards and forming long subtriangular projection, antennal insertions located at base of sides of projection, mouthparts completely concealed observing head from above; upper plane of this projection nearly horizontal and flattened, lateral planes strongly converging toward cariniform emarginate anterior edge, frontal plane strongly inclined ventroposteriorly toward emarginate anterior margin of epicranium (Figs 1, 2, 7). Eyes medium-sized, hemispherically prominent and rather coarsely facetted; frontal distance between eyes 1.85 times as great as eye diameter. Labrum small and slightly transverse, sclerotized, free and completely exposed, with anterior margin slightly concave (Fig. 2). Mandibles moderately separated, comparatively short and robust, moderately curved, with short shining apical region and sharp subapical tooth, apex acute, outer margin angularly curved (Fig. 2). Maxillary palpi short and slender, tetramerous, palpomere 1

short and wide; palpomere 2 about 1.5 times as long as wide; palpomere 3 short, about as long as wide; apical palpomere elongate, about twice as long as palpomere 3, obliquely truncate at apex (Fig. 4). Labium short; labial palpi trimerous, with apical palpomere subacute (Fig. 5). Antennae 11-segmented, pectinate, covered with moderately dense setae (Fig. 3).

Pronotum slightly transverse, subtrapezoidal, widest at base; anterior margin slightly concave medially; sides subrectilinear: slightly diverging posteriorly in anterior half and scarcely convex before posterior angles; posterior margin slightly bisinuate and nearly straight medially. Anterior angles obtuse; posterior angles subacute and narrowly rounded at apex. Lateral carina separating pronotum from prohypomeron distinct in posterior half and obliterated anteriorly (Fig. 7). Prohypomeron carinate sublaterally; prosternal suture short. Prosternum transverse; chin-piece short, with anterior margin widely emarginate; prosternal process very short and widely rounded at apex (Fig. 6).

Scutellum elongate, flattened, subtriangular, with concave sides and blunt apex. Elytra elongate, each gradually narrowing posteriorly, reaching only the base of abdominal segment 6, divergent, adjacent to each other only at its basal third, elytral apices separately rounded; elytral striae indistinct; each elytron somewhat raised along suture, with weakly expressed arcuate costa running from humeri towards apices and short oblique weak keel in scutellar region. Integument uniformly rugose-granulate and dull.

Mesoventrite widely V-shaped, with frontal margin widely and deeply emarginate; mesoventral cavity shallow, with weakly defined walls. Mesocoxal cavity open to both mesepimeron and mesepisternum. Metaventrite large, subtrapezoidal.

Legs slightly narrow and compressed; coxae robust; trochanters slender, elongate, slightly widened apically, obliquely attached to femora. Tarsi moderately long; tarsomeres 1 and 2 subequal in length; tarsomere 3 slightly shorter than preceding ones, about 1.5 times longer than tarsomere 4; tarsomere 4 shortest, extended ventrally; apical tarsomere slender and elongate, about 2.5 times as long as tarsomere 4; claws simple, slender, slightly curved, each with one long seta at base.

Abdomen soft and slender; penultimate ventrite subtruncate at apex. Tergite 9 shallowly concave at apex; tergite 10 subquadrangular and widely rounded at apex. Sternite 9 about 1.8 times as long as wide, slightly notched at base and with widely rounded apical margin, its apex finely punctate and sparsely setose.

Male genitalia trilobate (Figs 9–11); phallobase robust, slightly longer than wide, basally narrowed; penis (median lobe) robust, longer than parameres and slightly longer than phallobase, moderately curved in lateral view, basally with pair of short divergent apophyses, dorsally with long robust subapical hook (Fig. 11); parameres robust, elongate and narrowing apically, about twice as long as wide at base, with rounded and setose apices.
Females and immature stages unknown.

***Drilorhinus klimenkoi* sp. nov.**
Figs 1–11.

Type material. Holotype, ♂ (ZIN), "SW Iran, Lorestan province, 20 km N Pol-e Dokhtar, Baba Zeyd vill., 2.V.2007, A.A. Klimenko leg.".

Etymology. The new species is named after Alexey A. Klimenko (1970–2017), a famous collector of beetles who presented the type material of the new species for this study.

Description. Body length 6.8 mm from anterior margin of frontal projection to elytral apices and 8.4 mm to abdominal apex. Body elongate, with full body length 3.6 times as long as wide at humeri, slightly convex dorsally. Head, mandibles, pro- and mesothorax reddish-yellow, head between eyes, frontal projection of head and mandibles apically somewhat darkened; elytra, metathorax and abdominal ventrites 1–7 brown with lighter metepisterna (metanepisterna) and metepimera as well as penultimate ventrite; antennae brownish-yellow, palpi, legs and pregenital segments yellowish. Head, pro- and mesothorax covered with yellowish pubescence and elytra, metathorax and abdominal ventrites (except for pregenital ones) with brownish pubescence.

Head at eyes 1.1 times as wide as anterior margin of pronotum and about as wide as pronotum, clothed with moderately dense, semierect to erect long setae; integument between eyes shiny, strongly punctate, interspaces between punctures mostly smaller than one puncture diameter; upper surface of frontal projection extremely finely rugose and dull. Antennae reaching one-sixth of elytral length; scape moderately robust, widened apically; pedicel

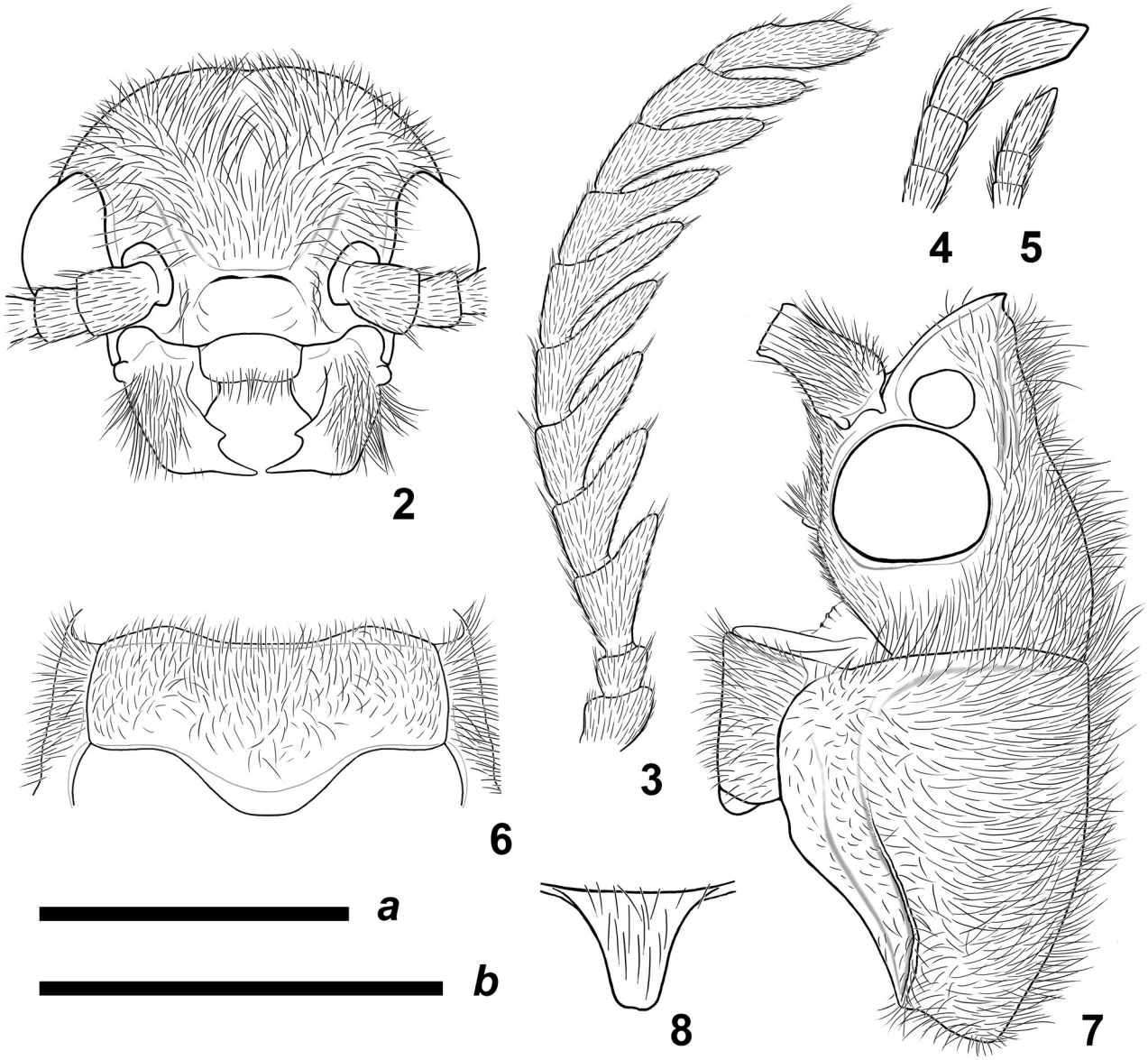
FIGURE 1. Holotype of *Drilorhinus klimenkoi* **gen.** et **sp. nov.** Scale bar = 1 mm.

small, subtrapezoidal, about as long as broad; antennomere 3 subtriangular, about twice as long as pedicel, with ventroapical angle produced into robust lobe; antennomeres 4–10 pectinate and subequal in length, with ventroapical angles produced into flattened lamellae, each lamella about as long as body of corresponding antennomere; apical antennomere longest, about twice as long as body of penultimate antennomere (Fig. 3).

Pronotum about 1.3 times as wide as long at midline, shining, clothed with moderately dense, semierect to erect long setae and covered with sparse shallow punctures on disc, punctures becoming denser and stronger towards the sides and base; sides of prothorax along lateral margins and posterior angles rugose. Prohypomeron and prosternum moderately densely punctate and covered with long semi-erect setae.

Scutellum about 1.4 times as long as wide, sparsely and shallowly punctate, shiny. Elytra 1.9 times as long as wide combined at humeri, dull; integument uniformly rugose-granulate and clothed with dense, semierect, moderately long setae. Meso- and metathorax ventrally sparsely covered with shallow punctures and sparse semierect, moderately long setae. Legs clothed with moderately dense semierect setae. Abdominal ventrites 1–7 with shallow and rather dense punctures, clothed with dense, semierect, moderately long setae.

Aedeagus as in Figs 9–11.



FIGURES 2–8. *Drilorhinus klimenkoi* **gen.** et **sp. nov.**, holotype, details. **2**: head, frontal. **3**: antenna; **4**: maxillary palpus; **5**: labial palpus; **6**: prosternum; **7**: head and prothorax, lateral; **8**: scutellum. Scale bars = 1 mm: a, for Figs. 2, 3, 6–8; b, for Figs. 4, 5.

Discussion and conclusions

The group under consideration is rather isolated from other elateroids by both structures and bionomy and, therefore, it was traditionally interpreted as a separate family (Barker 1969; Crowson 1972; etc.) and many other recent authors prefer to maintain this tradition (Kazantsev 2007; Lawrence & Ślipiński 2013; Lawrence 2016; etc.). Recent intensive molecular comparisons do not agree with the system of the formerly accepted elateroid groups and re-interpret placement of many elateroids, including the drilids, which is treated as a tribe in the elaterid subfamily Agrypninae. The taxonomic rank of tribe for these groups was introduced by Kundrata & Bocak (2011) after a comparison of 18S and 28SrDNA, cox1, and rrnl mtDNA of different groups of Elateroidea. Although these authors summarized "the inferred relationships among major elateroid lineages obtained low bootstrap and posterior probabilities value" (Kundrata & Bocak 2011: 372), they decided that the obtained results could be quite enough to propose a strict phylogenetic hypothesis without any additional comparison of other genes (particularly other nuclear genes which could be more reliable for such purposes). These authors insisted on the close relationship of Elateridae and Drilidae (Kundrata & Bocak 2011: 373 – "A possible affiliation between Drilidae and Elateridae has been proposed only recently (Bocakova *et al.* 2007) and there is no apparent signal from morphology to support it"). It is thought that such a declaration should be accompanied by additional arguments, particularly by support in structural features of adults and larvae. Considering such a close relationship between agrypnines and drilids (according to Kundrata & Bocak 2011), it is impossible to imagine a complete loss of all traces in structures of modern members of these groups. Even when these authors tried to ground the rank of the subfamily Pityobiinae Hyslop, 1917 and a new rank (superfamily) for the family group taxon proposed for *Rhinorhipus* Lawrence, 1988 they mostly applied to statistic methods of comparison of DNA sequences (Kundrata *et al.* 2016; Kusy *et al.* 2018). Such an approach leads to the assumption that other fields of science are useless and unnecessary, especially the study of fossils, which, according to the opinion of these authors, loses informative meaning. The problem is that even the "calibrations" of the proposed dendrograms need some knowledge on the relationship of fossil representatives chosen for this purpose, however the latter contradicts the main principle of the approach of Kundrata & Bocak (2011) ending in irresolvability of relationship in morphological data.

The cladistic analysis published by Lawrence *et al.* (2011) supported the traditional opinion of a close relationship between Drilidae and some other soft-bodied elateroids (Phengodidae LeConte, 1861 Rhagophthalmidae E. Olivier, 1907, Omalisidae Lacordaire, 1857, Telegeusidae Leng, 1920). If any molecular comparison conflicts with comparisons of a great number of structural characters in general, it would be better to suppose that our available data have a serious defect and it is necessary to seek for a way to find it in order to reach a correspondence between comparisons of different aspects of the integrated evolutionary process. Thus, at this moment, phylogeny and systematic position of the group interpreted as family or tribe (Drilidae or Drilini) should be considered as unresolved and in need of further studies. The family Drilidae and most mentioned "cantharoid" families remain unknown in fossils (Kirejtshuk & Ponomarenko 2018), although the family Omalisidae was recorded in the Eocene Baltic amber (Kirejtshuk & Kovalev 2015) and other "cantharoids" appeared in the fossil record no earlier than the Lower Cretaceous (Kirejtshuk & Azar 2013). Thus, it seems necessary to find correspondence between the diversification of structures and changes in molecular sequences to support the recent conclusions of the molecular comparisons of some genes analyzed by Kundrata & Bocak (2011).

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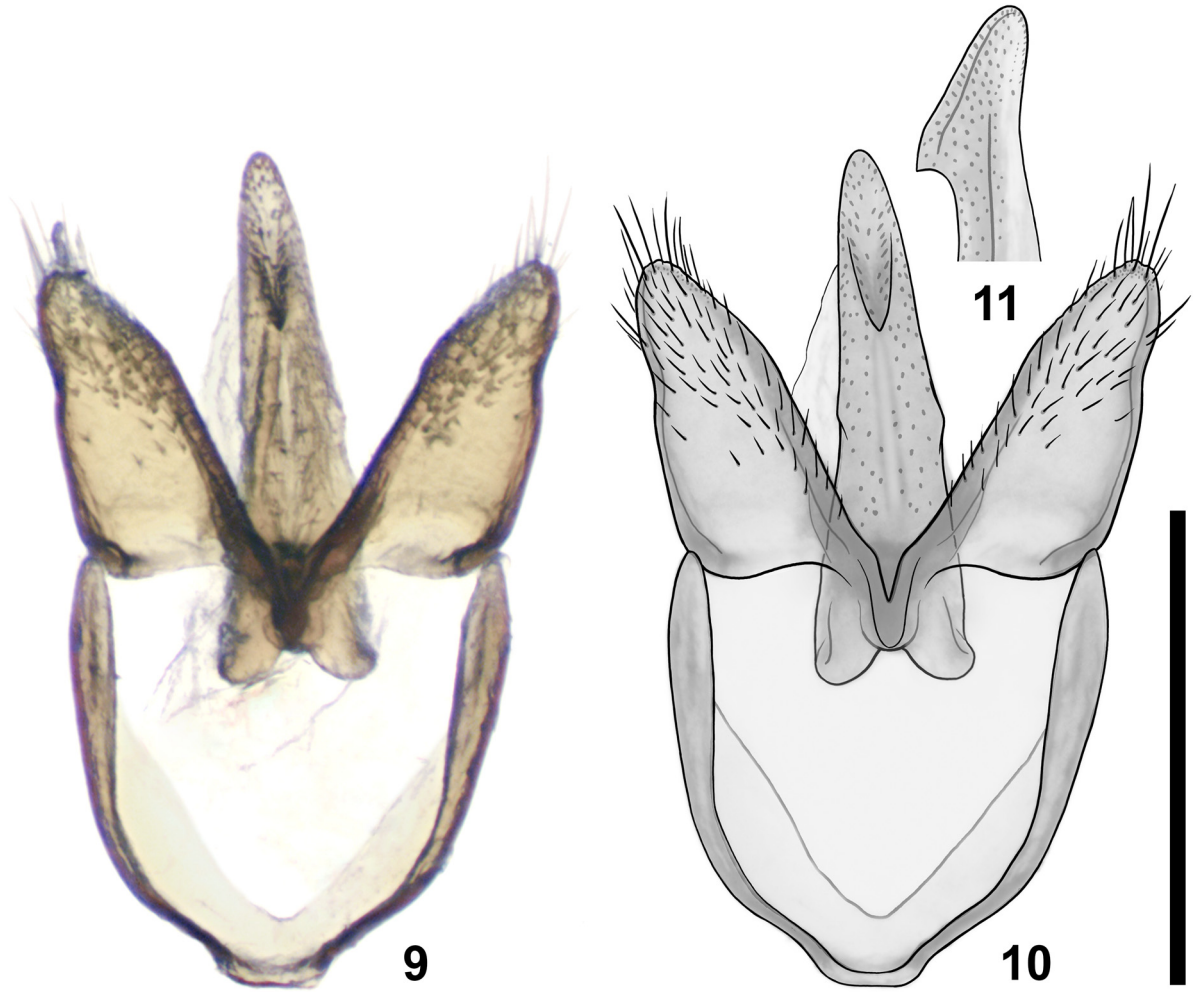

FIGURES 9–11. *Drilorhinus klimenkoi* **gen.** et **sp. nov.**, holotype, details. **9, 10**: aedeagus dorsal; **11**: subapical hook of penis trunk, lateral. Scale bar = 0.5 mm.

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