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The *Hercostomus exarticulatus* species group in the Palaearctic Region (Diptera: Dolichopodidae)

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Abstract. The *Hercostomus exarticulatus* species group in the Palaearctic Region is defined and reviewed. It comprises 4 species belonging to the nominotypical *Hercostomus longiventris* lineage. The species group is differentiated from other *Hercostomus* by the male mid femur bearing ventral tubercle at base, one subtriangular and one semirounded projections at middle of narrow cercus directed ventrally, peculiar hitching lock between hind tibia and basitarsus. Syntypes of *H. exarticulatoides* Stackelberg, 1949 are studied. Lectotype is designated for the latter species. *Hercostomus tanjusilus* Negrobov et Tsurikov, 1988, **syn. n.** is proposed as a junior synonym of *H. exarticulatus* (Loew, 1857). Photographs of *H. exarticulatoides*, *H. exarticulatus* and *H. canariensis* Santos Abreu, 1929 are published for the first time. A key for the species group is provided. The known distribution of *H. exarticulatus* group is briefly discussed.

Key words: *Hercostomus*, species group, distribution, lectotype, synonym.

Палеарктические виды группы *Hercostomus exarticulatus* (Diptera: Dolichopodidae)

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Резюме. Дан обзор палеарктических видов группы *Hercostomus exarticulatus*, которая содержит 4 вида, выделенных из номинотипической группы видов *Hercostomus longiventris*. Группа отличается от других видов рода строением среднего бедра самцов, которое несет вентральный бугорок в основании; одной треугольной и одной полукруглой лопастью в середине узкой церки, которая загнута к вентральной стороне эпандрия; своеобразным сцеплением задней голени и лапки. Изучены синтипы *H. exarticulatoides* Stackelberg, 1949, для которого обозначен лектотип. *Hercostomus tanjusilus* Negrobov et Tsurikov, 1988, **syn. n.** помещен в младшие синонимы к *H. exarticulatus* (Loew, 1857). Впервые публикуются фотографии *H. exarticulatoides*, *H. exarticulatus* и *H. canariensis* Santos Abreu, 1929. Приведен определитель известных видов группы.

Ключевые слова: *Hercostomus*, группа видов, ареал, лектотип, синоним.

The *Hercostomus* Loew, 1857 is mainly Holarctic and Oriental genus with nearly 500 species worldwide [Grichanov, 2017]. The Palaearctic fauna comprises nearly 150 species. Keys to species of traditional Palaearctic groups of *Hercostomus* were composed by Negrobov et al. [2008, 2012], Negrobov, Nechay [2009a, b] and Naglis, Negrobov [2017]. Later nine species of the genus were described from western part of the Palaearctic Region (see [Grichanov, Freidberg, 2018], and references cited therein).

A peculiar species of the genus collected recently from Morocco has attracted our attention to a poorly known group of Palaearctic species. The Moroccan fauna is largely undercollected, with eight previously known *Hercostomus* species [Kettani, Negrobov, 2016; Nourti et al., 2019; Ebejer et al., 2019]. Here we record *H. canariensis* Santos Abreu, 1929 from Morocco for the first time and define the limits of the *H. exarticulatus* species group, which comprises four species. Lectotype is designated for *H. exarticulatoides* Stackelberg, 1949. *Hercostomus tanjusilus* Negrobov et Tsurikov, 1988 is placed in synonymy to *H. exarticulatus* (Loew, 1857). Photographs of *H. canariensis*, *H. exarticulatoides* and *H. exarticulatus* are published for the first time. A key of the species group is provided.

Material and methods

The specimens have been studied and photographed with a ZEISS Discovery V-12 stereo microscope and an AxioCam MRc5 camera. Genitalia preparations have been photographed with a ZEISS Axiostar stereo microscope and an AxioCam ICc3 camera. Morphological terminology and abbreviations follow Cumming and Wood [2017] and Grichanov and Brooks [2017]. Material cited in this work is housed at the Zoological Institute of the Russian Academy of Sciences (ZIN, St Petersburg, Russia).

Genus *Hercostomus* Loew, 1857
Hercostomus exarticulatus species group

Diagnosis. Body size 2–3 mm.

Male. Head about as wide as high; antenna black; postpedicel rounded-ovate, with distinct apex, about as long as high, with short hairs; arista-like stylus mid-dorsal, about 2 times longer than antennomeres combined; distal segment of arista with short hairs; frons grey pollinose, nearly parallel-sided, wider than high; eyes finely haired; face densely white pollinose, narrow; clypeus small, slightly bulging; palpus small, with few hairs and 1 seta; proboscis

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short, with hairs; upper postocular setae black, lower postoculars yellow.

Thorax with all setae black; pronotum pubescent, with black hairs; proepisternum with 1 long black bristle above fore coxa; mesonotum dark with metallic reflection, weakly grey pollinose; 6 dorsocentral setae, 8–10 well developed acrostichals, biserial, almost reaching 5th pair of dorsocentrals; pleura dark, with whitish grey pruinosity, in front of posterior spiracle bare; metapleuron bare; scutellum black with bluish reflection, with 2 strong medial setae and 2 short lateral setae or hairs.

Legs mostly yellow, hairs and setae black; fore coxa yellow or blackish (*exarticulatus*); mid and hind coxae dark with yellow apex, tarsi simple except hind basitarsus; fore leg with coxa bearing black hairs anteriorly and 3 black setae apically, fore femur with preapical posterior seta, fore tibia with few short anterodorsal and posterodorsal setae, 2–3 short apicals, with anterodorsal comb-like row of setae distally, no long apicoventral seta; midleg with coxa bearing some black hairs and setae laterally and apically, mid femur with 1 strong anterior preapical seta and 1 posteroventral preapical seta, with more or less distinct glabrous ventral tubercle at base; mid tibia usually with 3 anterodorsal, 2 posterodorsal and 5 apical bristles; hind leg with coxa bearing 1 strong seta at middle and 1 fine seta at apex, hind femur with row of dorsal setae on basal half, 1 anterior preapical bristle at apical quarter, hind tibia with some strong anterodorsal, posterodorsal, 3 apical bristles, row of 3–5 short ventral setae, densely covered with elongate setulae posteroventrally on distal half, with apical posteroventral comb of about 10 setulae and rounded or triangular or ovate dorsolateral apical projection covering distal excavation; hind basitarsus distinctly shorter than next tarsomere, with 3–4 short ventral setae, usually slightly curved at base, slightly swollen and flattened and/or excavated at extreme base, bearing ventrolateral thick seta or spine basally; apical projection of hind tibia and basal spine of hind basitarsus forming peculiar hitching lock between tibia and basitarsus.

Wing about 3 times longer than wide; membrane almost hyaline or greyish; costa simple, with short black setae dorsally; R_1 and R_{2+3} almost straight; R_{4+5} slightly convex anteriorly; M_1 with week curvation towards R_{4+5} in middle of distal half, almost straight in distal section; R_{4+5} and M subparallel at apex of wing; M_1 joining costa at wing apex; distal part of M_4 about 2 times longer than dm-m; anal vein distinct; anal angle obtuse; lower calypter yellow with black cilia; halter yellow.

Abdomen entirely dark and shiny dorsally, whitish grey pollinose laterally, with black hairs and long marginal setae; 6th and 7th segments bare, 7th segment with well developed tergum and sternum; 8th segment pear-like, with black cilia dorsally. Epandrium slightly longer than high, ovate or cuboidal, flattened basally; hypandrium mostly free, forming 2 pairs of symmetrical lobes reaching apex of small distoventral epandrial lobe; phallus long, thin; anteroventral part of postgonite not developed; posterodorsal portion strongly developed, long, horn-like, curved ventrally; surstylus bilobed, with dorsal lobe larger and broader than ventral lobe; cercus brown (*exarticulatus*) or yellow, dark at apex, band-like, strongly curved and directed ventrally; one subtriangular and one semirounded projections at middle of cercus.

Female similar to male except lacking male secondary sexual characters. Face wider than that in male.

Included species. *Hercostomus exarticulatus* (Loew, 1857); *Hercostomus exarticulatoides* Stackelberg, 1949; *Hercostomus canariensis* Santos Abreu, 1929; *Hercostomus vodjanovi* Negrobov, Maslova et Selivanova, 2016.

Notes. According to Brooks [2005], species of the *exarticulatus* group key to the *Hercostomus longiventris* lineage. According to the old keys to the Palaearctic *Hercostomus* species, the *exarticulatus* group belongs to the traditional 2nd group of species [Negrobov et al., 2012], although *H. exarticulatus* itself with partly dark femora has been usually included in the 4th group as well [Negrobov, Nechay, 2009b]. According to Yang et al. [2011], species of the *exarticulatus* group come to *H. curvus* group differing from the former in wholly black postocular setae and hypopygium morphology. The two species of the *curvus* group are known only from Oriental China.

Key to the Palaearctic species of *Hercostomus exarticulatus* group (males)

1. Fore and/or hind femora partly dark; hind tibia with weakly sclerotized triangular dorsolateral apical projection bearing minute spike; outer hypandrial arm with thick L-shaped curvation projecting ventrally; 2.5–3 mm ..... *H. exarticulatus*
– Femora entirely light yellow; hind tibia with strongly sclerotized triangular or ovate dorsolateral apical projection; outer hypandrial arm hidden, more or less straight, weakly curved at apex 2
2. Hypandrium with 2 pairs of arms almost concealed, thin at apex; 1.8–2.2 mm .... *H. exarticulatoides* and *H. vodjanovi*
– Hypandrium with outer arm concealed and inner arm trapezoid, strongly projected distoventrally; 2.5 mm .... *H. canariensis*

Hercostomus exarticulatus (Loew, 1857) (Figs 1–8)

Gymnopternus exarticulatus Loew, 1857: 18.

Hercostomus exarticulatus (Loew, 1857): Mik, 1880: 357. Becker, 1917: 215; Stackelberg, 1934: 142, figs 87–88; Parent, 1938: 165, figs 213–217; Negrobov, 1991: 85.

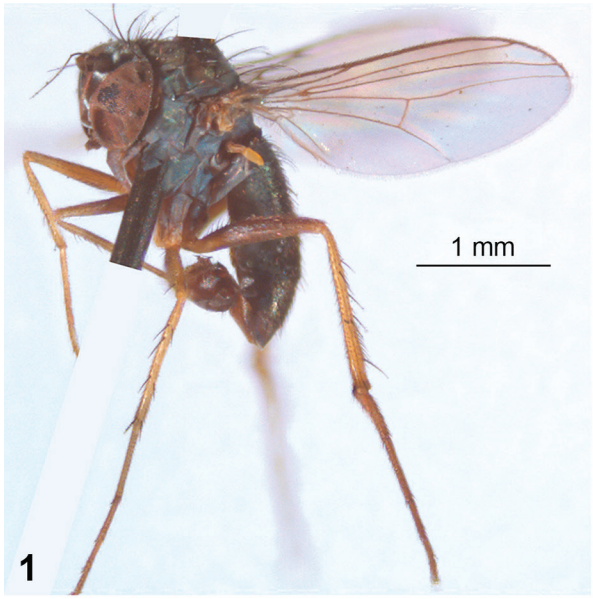
Hercostomus (*Gymnopternus*) *exarticulatus* (Loew, 1857): Mik, 1884: 181.

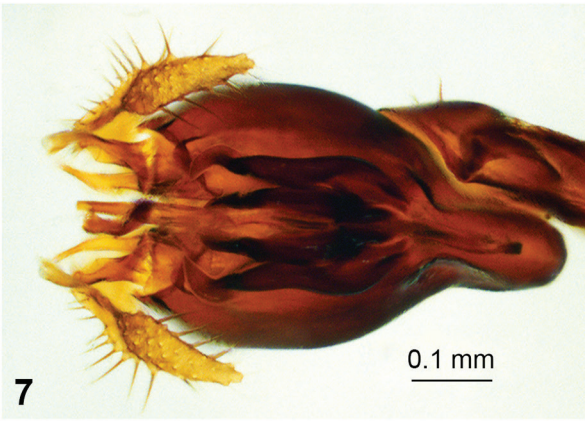
Hercostomus papillifer Mik, 1880: 353, figs 1–5 (synonymized by Mik, 1884: 181) (type locality: Austria, "bei Hütteldorf nächst Wien").

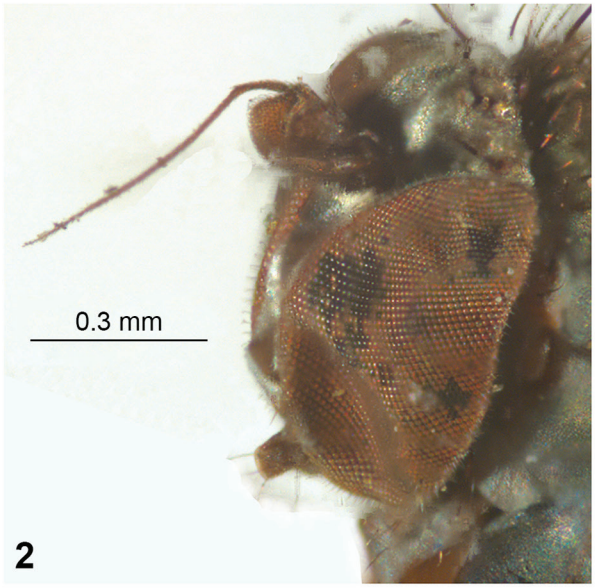
Hercostomus tanjusilus Negrobov et Zurikov in Negrobov et al., 1988: 219, **syn. n.** (type locality: Georgia, Lagodekhi Reserve, 2000 m).

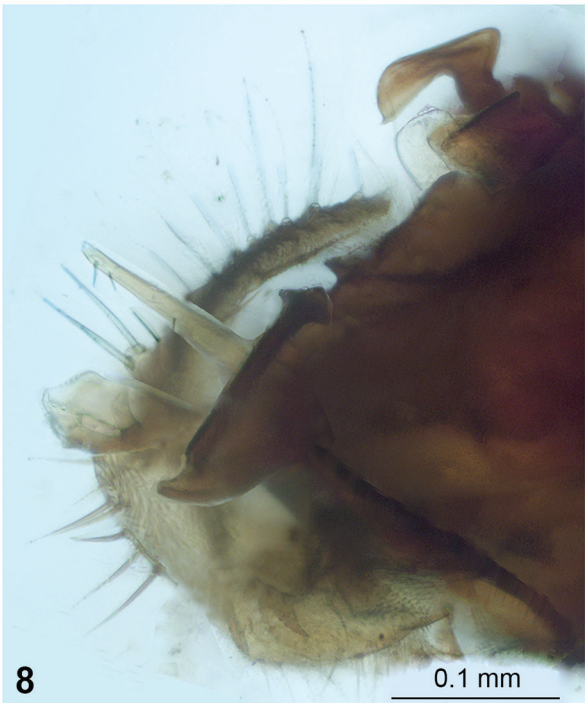
Material. 1♂ (ZIN), Romania, "Herculesbad, 19.06.1871", "716", "*Hercostomus exarticulatus* Lw., Kowarz det."; 1♀ (ZIN), Italy, "Varena, 1876", "718", "*Hercostomus papillifer* Mik, Kowarz det.", "*Hercostomus exarticulatus* Lw., det. Grichanov"; 4♀ (ZIN), Abkhazia, "Gagra, 9.09.1937 (Filipiev)", "*Hercostomus exarticulatus* Lw., det. Stackelberg".

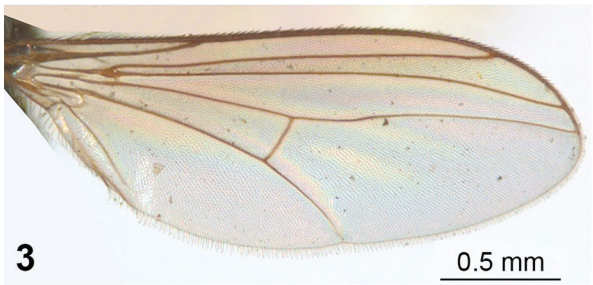
Diagnosis. Fore coxa mainly blackish or brown; fore and/or hind femora largely blackish or brown, or only hind femur with brown strip along anterior side; hind tibia

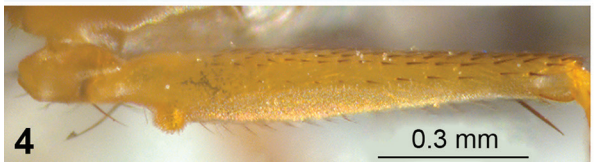










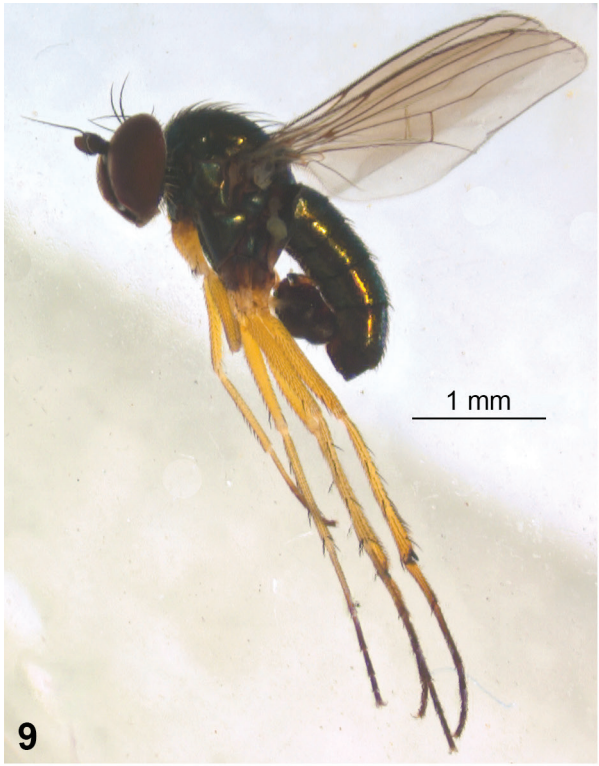


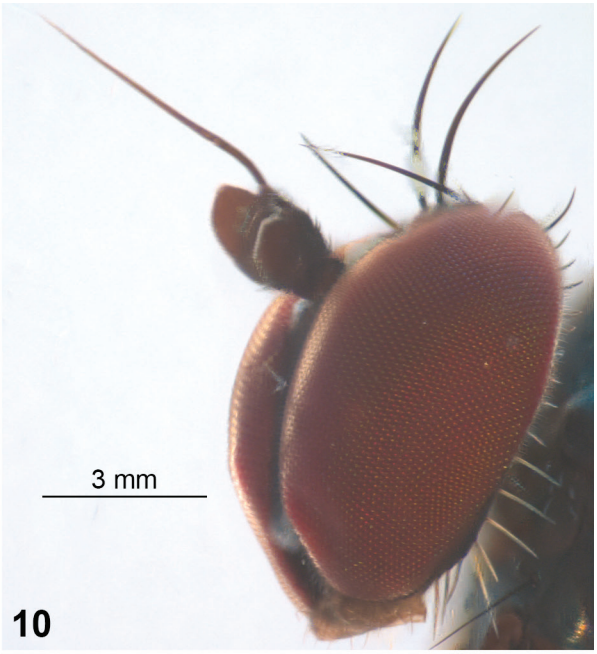
Figs 1–8. *Hercostomus exarticulatus* (Loew, 1857).

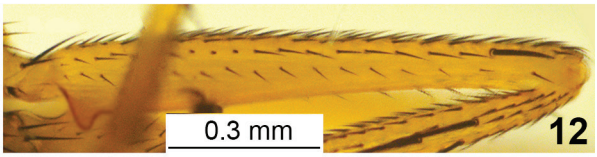
1 – habitus; 2 – head; 3 – wing; 4 – mid femur; 5 – hitching lock between hind tibia and basitarsus, ventrolateral aspect; 6 – hitching lock between hind tibia and basitarsus, dorsolateral aspect; 7 – hypopygium, ventral view; 8 – apex of hypopygium, lateral view.

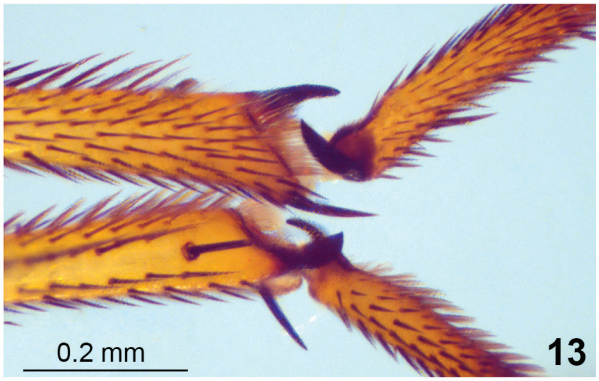
Рис. 1–8. *Hercostomus exarticulatus* (Loew, 1857).

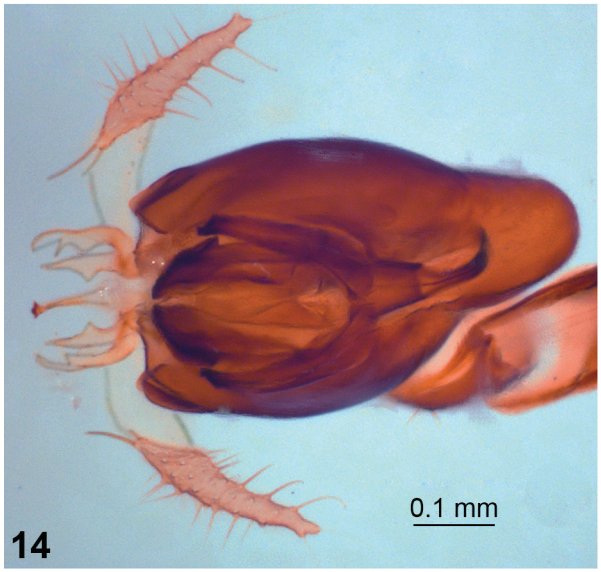
1 – общий вид; 2 – голова; 3 – крыло; 4 – среднее бедро; 5 – сцепление задней голени и лапки, вид снизу сбоку, 6 – сцепление задней голени и лапки, вид сверху сбоку, 7 – гипопигий, вид снизу, 8 – вершина гипопигия, вид сбоку.

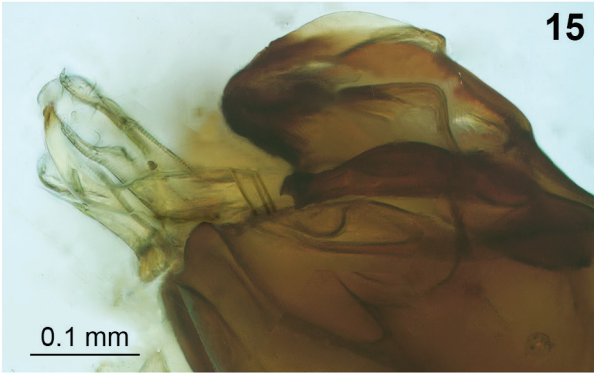












Figs 9–15. *Hercostomus canariensis* Santos Abreu, 1929.

9 – habitus; 10 – head; 11 – wing; 12 – mid femur; 13 – hitching lock between hind tibia and basitarsus; 14 – hypopygium, ventral view; 15 – apex of hypopygium, lateral view.

Рис. 9–15. *Hercostomus canariensis* Santos Abreu, 1929.

9 – общий вид; 10 – голова; 11 – крыло; 12 – среднее бедро; 13 – сцепление задней голени и лапки; 14 – гипопигий; вид снизу; 15 – вершина гипопигия, вид сбоку.

dark at apex; hind tibia with weakly sclerotized rounded dorsolateral apical projection bearing minute spike; outer hypandrial arm with thick L-shaped curvation projecting ventrally; inner hypandrial arm straight, with subapical dorsal tooth; cercus wholly brown.

Notes. Loew [1857] did not mention ventral tubercle at base of mid femur in his description of *Gymnopternus exarticulatus*. Mik [1880] distinguished his *Hercostomus papillifer* from other then known species by that character in addition to the others. He mentioned also *H. exarticulatus*, but noted that the latter had much darker femora. Mik [1884] considered the two species as varieties of *H. exarticulatus*; one with darker legs known from the type locality (Triest) and Romania (Iron Gates near Herculesbad (= Băile Herculane) and another variety with lighter legs known at that time from Austria and Northern Italy. Later the species was reported from many countries, from the Canary Islands and Morocco in the West to Tajikistan and Kyrgyzstan in the East [Grichanov, 2017]. However, careful examination of the material published by Negrobov and Rodionova [2004] has revealed that females from Kyrgyzstan and Tajikistan must be associated with *H. exarticulatoides*, including one female topotype. Females mentioned by the same authors from the Caucasus and Voronezh Region of Russia belong most probably to the true *H. exarticulatus*. This species was collected on the Canary Islands and redescribed by Santos Abreu [1929]. It was collected and mentioned there again by Frey [1936], who considered the Canarian species *H. canariensis* as a colour variety of *H. exarticulatus*. However, Santos Abreu clearly stated that his species has broad shining black tooth between male tibia and tarsus in contrast to small spine at the same place in *H. exarticulatus*. The latter species was insufficiently described and illustrated [Loew, 1857; Mik, 1880; Santos Abreu, 1929; Stackelberg, 1934; Parent, 1938]. Moreover, Mik [1884], Becker [1917], Stackelberg [1934] and Parent [1938] noted dark-legged and light-legged varieties. Therefore, we provide here photos of colour characters of a specimen from Romania (mentioned by Mik [1884]), suggesting that the old records from Morocco, Spain and France (e.g. [Vaillant, 1956]) can belong to either *H. exarticulatus* or *H. canariensis*.

Hercostomus tanjusilus was described by single holotype collected from the southern slopes of the Greater Caucasus mountain range, which has historically been considered a natural barrier between Eastern Europe and Western Asia. *Hercostomus tanjusilus* description and schematic drawings of hypopygium correspond to the morphology of *H. exarticulatus* male collected from Romania. The only difference is the colour of coxae. They were described [Negrobov et al., 1988] as metallic green in *H. tanjusilus* (including fore coxa), but being blackish or black in *H. exarticulatus*. We consider this character as a colour variation and place the former name in synonymy to the latter name.

Distribution. Type locality: Italy, Triest. Palaearctic: Morocco, Algeria, Spain (incl. Canary Isl.), France, Netherlands, Belgium, Germany, Austria, Italy, Hungary, Romania, Russia (Voronezh), Abkhazia, Georgia, Armenia. The species occurs also in the Republic of Adygea (Russia) (O.P. Negrobov, personal communication, 2019).

Hercostomus canariensis Santos Abreu, 1929
(Figs 9–15)

Hercostomus canariensis Santos Abreu, 1929: 386; Frey, 1936: 70 (as ? var. of *Hercostomus exarticulatus*).

Hercostomus canariensis var. *femoratus* Santos Abreu, 1929: 389 (type locality: Spain, Canary Is., La Palma).

Hercostomus canariensis femoratus Santos Abreu, 1929: 389; Negrobov, 1991: 83 (unavailable name according to the International Code of Zoological Nomenclature [1999], article 45.6.4.1, as published after 1980).

Hercostomus aff. *exarticulatoides*: Nourti et al., 2019: 123 (misidentification).

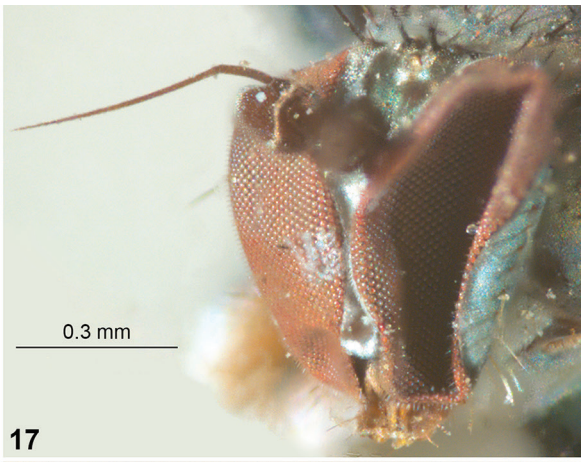
Material. 2♂, 1♀ (ZIN), Morocco, Rif, Akchour env., Pont de Dieu (river), 35°13′42″N / 5°10′31″W, 536 m, 1.07.2019 (M. Nourti, I. Grichanov).

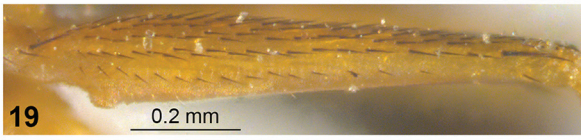
Diagnosis. Fore coxa and femora light yellow; hind tibia entirely yellow; hind tibia with strongly sclerotized ovate dorsolateral apical projection; hypandrium with outer arm concealed, more or less straight, weakly curved at apex, and with inner arm trapezoid, strongly projected distoventrally; cercus yellow, dark at apex.

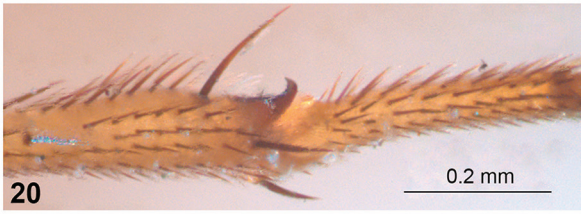
Notes. The wordy description of *H. canariensis* by Santos Abreu [1929] contains mainly qualitative features being common for all species of the *exarticulatus* group. A broad shining black tooth between male tibia and tarsus is the most striking key character provided by Santos Abreu [1929: 384] to distinguish his species from *H. exarticulatus*. This character allows us associating our Moroccan material with *H. canariensis*. In fact, males of the latter species possess apical projection of hind tibia and basal spine of hind basitarsus, both strongly scletotized and relatively broad, shining black, forming peculiar hitching lock between tibia and basitarsus. *Hercostomus exarticulatus* and *H. exarticulatoides* males have the same hitching lock, but with differently shaped and coloured teeth or spines being also weaker sclerotized. Santos Abreu [1929] noted a variety of his new species with partly black fore and hind femora (*femoratus*). Specimens of this variety belong highly likely to *H. exarticulatus*.

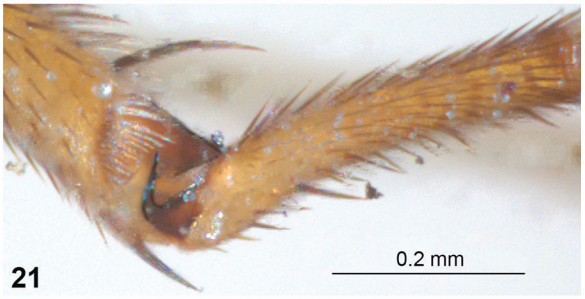
Ecological notes. The Moroccan material has been collected during joint field trips of all authors of this paper in July 2019 to the Rif Mountains. The God's Bridge (or Pont de Dieu in French) is an impressive rock arch, located in the north of Morocco, in the heart of Talassemtane National Park; it has a height of 25 m above the river, Oued Farda, which eroded the rock until to form this natural work of art. This station is characterized by clear, fresh and fast-flowing water. The substrate is formed essentially of coarse formations such as gravel and blocks. Adults of *H. canariensis* have been found resting on large wet stones within stream and grasped from their surfaces by use of plastic pots. This site is part of the subhumid bioclimatic thermomediterranean zone, where vegetation is mainly organised by Quercus rotundifolia, Tetraclinis articulata and Pinus halepensis. The riparian vegetation is very dense, represented essentially by Nerium oleander and Pistacia lentiscus. The vegetal cover of the area and its richness in aquatic resources have established a significant bryological diversity that grows on the rocks.

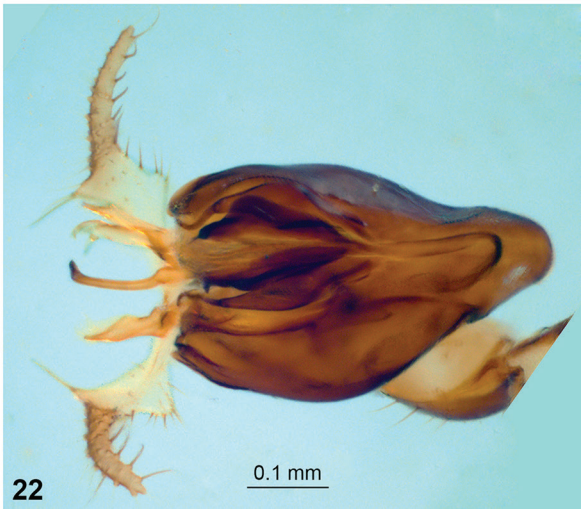
Distribution. Type locality: Spain, Canary Is., La Palma. Palaearctic: Spain (Canary Is.). First record from Morocco.

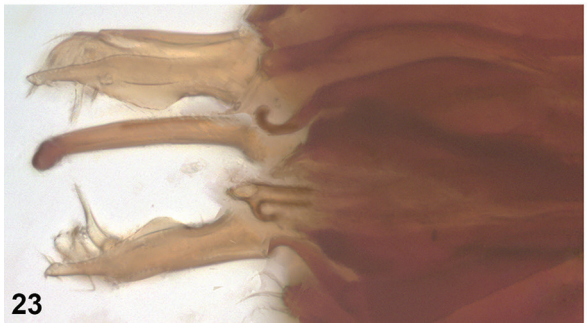












Figs 16–23. *Hercostomus exarticulatoides* Stackelberg, 1949.

16 – habitus, with inset showing labels under the fly; 17 – head; 18 – wing; 19 – mid femur; 20 – hitching lock between hind tibia and basitarsus, dorsolateral aspect; 21 – hitching lock between hind tibia and basitarsus, ventrolateral aspect; 22 – hypopygium, ventral view; 23 – apex of hypopygium, ventrolateral view.

Рис. 9–15. *Hercostomus exarticulatoides* Stackelberg, 1949.

16 – общий вид и этикетки; 17 – голова; 18 – крыло; 19 – среднее бедро; 20 – сцепление задней голени и лапки, вид сверху сбоку; 21 – сцепление задней голени и лапки, вид снизу сбоку; 22 – гипопигий, вид снизу; 23 – вершина гипопигия, вид снизу сбоку.

Hercostomus exarticulatoides Stackelberg, 1949
(Figs 16–23)

Hercostomus exarticulatoides Stackelberg, 1949: 680.

Hercostomus exarticulatus: Negrobov, Rodionova, 2004: 202 (misidentification).

Material. Lecotype, ♂ (ZIN), labeled: Rakhaty, Gissar Valley, Tajikistan, 6.08.1943, Stackelberg (in Russian), "Syntypus *Hercostomus exarticulatoides* Stackelberg, 1949", "Lecotype *Hercostomus exarticulatoides* Stack., des. Grichanov, 2019". Paralectotypes: 1♂, 1♀ (ZIN), same 1st and 3rd labels with collecting dates 6.08 (♂) and 5.08.1949. Lecotype is designated here according to the articles 61.1 and 74.7.3 of the International Code of Zoological Nomenclature [1999] to fix the current taxonomic concept and ensure consistent future interpretation.

Diagnosis. Fore coxa and femora light yellow; hind tibia entirely yellow; hind tibia with sclerotized triangular dorsolateral apical projection; hypandrium with 2 pairs of arms concealed, more or less straight, thin and curved at apex; outer hypandrial arm worm-like at apex; cercus yellow, dark at apex.

Notes. Stackelberg [1949] provided two pictures (figs 11 and 15) for this species with different shape of male cercus. His picture (fig. 36) and description of hind leg is correct from lateral aspect, but being incorrect, if looking from other aspects. The black and thick transverse spine at base of hind tarsus is visible from only ventrolateral aspect. In fact, the sclerotized dorsolateral apical projection on the hind tibia looks like a regular triangle from lateral aspect, but resembling strongly curved spine from dorsolateral aspect. *Hercostomus exarticulatoides* was never recorded again after its description. However, Negrobov and Rodionova [2004] mentioned *H. exarticulatus* females (including one *H. exarticulatoides* topotype) from Tajikistan (Gissar Range) and Kyrgyzstan (Chatkal Range) that must be associated with *H. exarticulatoides*. The exact type locality of the species is unknown for us; we were not able to trace the geographical name "Rakhaty" within the borders of Tajikistan. Anyway, *H. exarticulatoides* types were certainly collected in one of gorges on southern slope of the Gissar Range between Tajik-Uzbek border and Kofarnihon River head (the distance is about 100 km), i.e., in the same area of the country where several other species were described by Stackelberg.

Distribution. Type locality: Tajikistan, "Rakhaty, Gissar Valley" (originally published as "Rakhaty, Gissar Range, 1000–1200 m"). Palaearctic: Kyrgyzstan, Tajikistan.

Hercostomus vodjanovi
Negrobov, Maslova et Selivanova, 2016

Hercostomus vodjanovi Negrobov, Maslova, Selivanova, 2016: 175.

Notes. The species has been recently described by single holotype collected from the southern slope of Gissar Range at about 20 km from the country capital Dushanbe. *Hercostomus vodjanovi* description and illustrations correspond to the morphology of *H. exarticulatoides* types examined. However, a small ventral tubercle at base of male mid femur was not found by authors [Negrobov et al., 2016], (O.P. Negrobov, personal communication, 2019). We think that this character has been overlooked, and the species is a possible synonym to *H. exarticulatoides.*

Distribution. Type locality: Tajikistan, Gissar Range, historical nature park Shirkent. Palaearctic: Tajikistan.

Discussion

The *Hercostomus exarticulatus* species group includes three recognisable and one doubtful species. They were reported from the Canary Islands and Morocco in the West across the western Palaearctic to Tajikistan and Kyrgyzstan in the East, in countries with usually mild climate. *Hercostomus exarticulatus* has the largest area, being known from West and South Europe, southern part of Central Europe, North Africa including Canary Islands, and the Caucasus. *Hercostomus canariensis* is found in Morocco for the first time; nevertheless, some old records from Morocco, Spain and France can belong to *H. canariensis*, because two varieties of *H. exarticulatus* were recognised by some European authors (see above). The other two species are known from mountainous localities in Middle Asia.

All species of the *exarticulatus* group have rather similar habitus, slightly differing in colour characters. There are microscopic differences in shape of basoventral tubercle on mid femur and shape of hitching lock between hind tibia and basitarsus (both are male secondary sexual characters that were often overlooked by researchers). It is remarkable that the hypopygial cerci, surstyli and postgonite are almost identical in males of species examined; but the hypandrial arms are species specific. Females of *H. exarticulatus* have somewhat lighter legs than males, but somewhat darker legs than females of other species; the latter difference can be useful for distinguishing close species in some localities.

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