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Ked *Lipoptena arianae* Maa, 1969 (Diptera: Hippoboscidae) and wild *Ovis* Linnaeus, 1758 (Mammalia: Bovidae)

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Abstract. One of the specialized groups of ectoparasites of mammals from the family Hippoboscidae Samouelle, 1819 is the genus *Lipoptena* Nitzsch, 1818. *Lipoptena arianae* Maa, 1969 is one of the widespread species in Asia. This species was recorded from different species of *Ovis* Linnaeus, 1758 in Iran, Kazakhstan and Uzbekistan. In the studies of various authors there are noticeable discrepancies and contradictions in the drawings and in the morphological data. In this article, a new material on morphology, distribution and hosts of *L. arianae* is presented. The new samples were collected from *Ovis ammon severtzovi* Nasonov, 1914 in Uzbekistan. The flies we studied were compared with the holotype. Discrepancies with literature data on morphology and distribution have been clarified. The specimens we studied and the holotype have a greater number of humeral, laterocentral and parafrontal setae. The data that tergites 3–6 are successively widen were not confirmed. Localities of *L. arianae* are mapped. The estimated distribution range of this species is discussed. This ked supposedly can parasitize all species of the genus *Ovis*.

***Key words*:** Diptera, Hippoboscidae, keds, *Lipoptena*, *Ovis*, Uzbekistan.

Муха-кровососка *Lipoptena arianae* Maa, 1969 (Diptera: Hippoboscidae) и дикий *Ovis* Linnaeus, 1758 (Mammalia: Bovidae)

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Резюме. Род *Lipoptena* Nitzsch, 1818 – одна из специализированных групп эктопаразитов млекопитающих из семейства Hippoboscidae Samouelle, 1819. Одним из широко распространенных видов в Азии является *L. arianae* Maa, 1969. Он был найден на разных видах *Ovis* Linnaeus, 1758 в Иране, Казахстане и Узбекистане. В исследованиях разных авторов наблюдаются заметные расхождения и противоречия в рисунках и в морфологических данных. В данной статье представлены новые сведения о строении, распространении и хозяевах *L. arianae*. Материал был собран в Узбекистане с *Ovis ammon severtzovi* Nasonov, 1914. Изученные нами особи мух были сравнены с голотипом. Обнаружены расхождения с литературными данными о строении и распространении вида. У изученных нами экземпляров и у голотипа выявлено большее количество плечевых, латероцентральных и парафронтальных щетинок. Данные о последовательном расширении 3–6-го тергитов не подтвердились. Местонахождения *L. arianae* закартированы. Обсуждается предполагаемый ареал этого вида. Вероятно, вид может паразитировать на всех видах рода *Ovis*.

***Ключевые слова*:** Diptera, Hippoboscidae, мухи-кровососки, *Lipoptena*, *Ovis*, Узбекистан.

Introduction

The genus *Lipoptena* Nitzsch, 1818 is a specialized group of hematophagous ectoparasites from the family Hippoboscidae Samouelle, 1819. There are 26 species of these keds [Visagie, 1992; González et al., 2024; Yatsuk et al., 2024]. Their hosts are mammals from Bovidae Gray, 1821 and Cervidae Goldfuss, 1820 [Doszhanov, 1980, 2003]. These small and medium sizes flies transmit many dangerous pathogens such as Anaplasma spp., Babesia spp., Bartonella spp., Borellia spp., Coxiella spp., Rickettsia spp. and Theileria spp. [Doszhanov, 1980, 2003; Ganez et al., 2002; Farajollahi et al., 2005; Hornok et al., 2011; de Bruin et al., 2015; Buss et al., 2016; Foley et al., 2016; Lee et al., 2016; Skvarla, Machtinger, 2019; Werszko et al., 2020; Gałęcki et al., 2021; ElHamdi et al., 2022; Peña-Espinoza et al., 2023; Tiawsirisup et al., 2023].

To date, four species of the genus *Lipoptena* have been recorded on the territory of Russia and the CIS countries [Doszhanov, 1980, 2003]: *L. cervi* Linnaeus, 1758, *L. fortisetosa* Maa, 1965, *L. arianae* Maa, 1969, *L. doszhanovi* Grunin, 1974. One of them, *L. arianae*, was recorded from different species of *Ovis* Linnaeus, 1758 in Iran, Kazakhstan and Uzbekistan [Doszhanov, 1980, 2003]. This species can be easily distinguished from other keds by a body length more than 2 mm, only longitudinal suture on mesoscutum, 6–8 scutellar and 42–52 laterocentral mesonotum setae [Yatsuk et al., 2024]. However, when describing the species,

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Maa [1969] presented only individual drawings of body parts. In the studies of other authors, Doszhanov [2003] and Salvetti et al. [2020], the drawings of the fly's body differ from each other and from the morphological data in corresponding texts.

The purpose of this study was to clarify the limits of morphological variability of key features of *L. arianae*.

Material and methods

The new specimens of *L. arianae* were collected in Uzbekistan in 2005. Than this samples were transferred to G.V. Farafonova (Moscow, Russia), were kept in her collection and were recently given to us. The samples are currently deposited in the A.N. Severtsov Institute of Ecology and Evolution of the Russian Academy of Sciences (Moscow, Russia) collection. The material is fixed in 96% ethanol. For illustration purposes images of the new *L. arianae* sample were taken with Canon EOS 90D and Canon EOS M6 Mark II cameras with a Canon EF 100 mm/2L Macro lens, stitched and processed using Helicon Focus 7 software. Photographs of the holotype and allotype were obtained from the Bishop Museum (Honolulu, Hawaii, USA). Morphological terminology follows Maa [1969], Doszhanov [2003] and Thanwiset et al. [2024], where data on the morphology of the *L. arianae* species are presented.

Lipoptena arianae Maa, 1969
(Figs 1–8)

Type material. 1♀, holotype, 1♂, allotype (Bishop Museum, Honolulu, Hawaii, USA), "Lipoptena avianae Maa Holotype ♀ Allotype ♂" (handwritten, white with red border on the top and right edges), "Iran: 2–6 km SE of Emamghali, 16 km N of Emamghali, & 38–52 km N of Quchan, N. Khurasan Prov., ex *Ovis* sp. (# 2798, 2816, 2817, 2818), 7–13.X.1962. G.L. Ranck" (handwritten), "BisHop 7599" (print) (Figs 4–8).

Material. 3♀, Uzbekistan, Nuratau-Kyzylkum Biosphere Reserve, Nuratau Mountains, from Severtzov argali *Ovis ammon severtzovi* Nasonov, 1914, 13.11.2005 (Kuzenkov).

The studied specimens (Figs 1–3) are conspecific to the holotype (Figs 4, 5). The morphological study of Uzbekistan flies allows making additions and changes to the description previously presented in the literature.

Additions to description. Head and thorax length combined 2.3–2.5 mm.

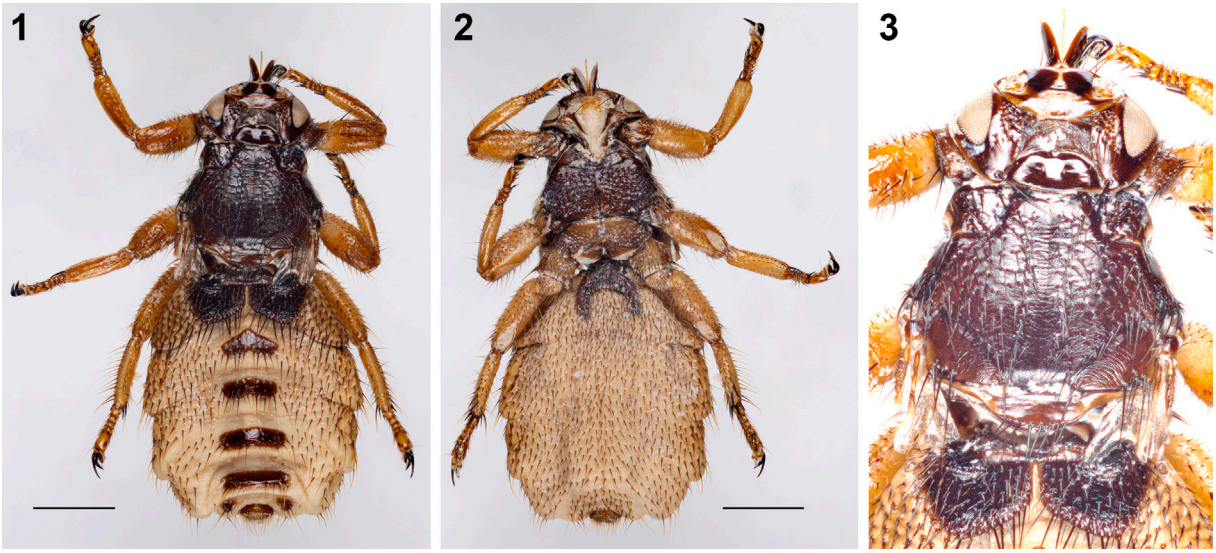
Head narrowed behind eyes. Eyes small. Laterally not reaching head edge. Ocelli very small. Palpi longer than antennal depression. Parafrontalia wide, with 18–20 setae and 1 parietal seta on each head side. Postvertex width twice as long. Ventral side of head light.

Thorax dark. Only longitudinal suture. Suture does not reach scutellum. Humeral tubercles small. Mesonotum setae: 15–19 humeral, 10–11 acrostichal, 65–70 laterocentral, 15–18 notopleural, 5 postalar, 1 prescutellar, 6–8 (often 8) scutellar (Fig 3). Ventral side of thorax dark. Prosternum pointed in front, with 2 rows of setae at posterior margin. Mesosternum uniformly setose. Metabasisternum with 3 rows of setae. Setae of last row noticeably longer.

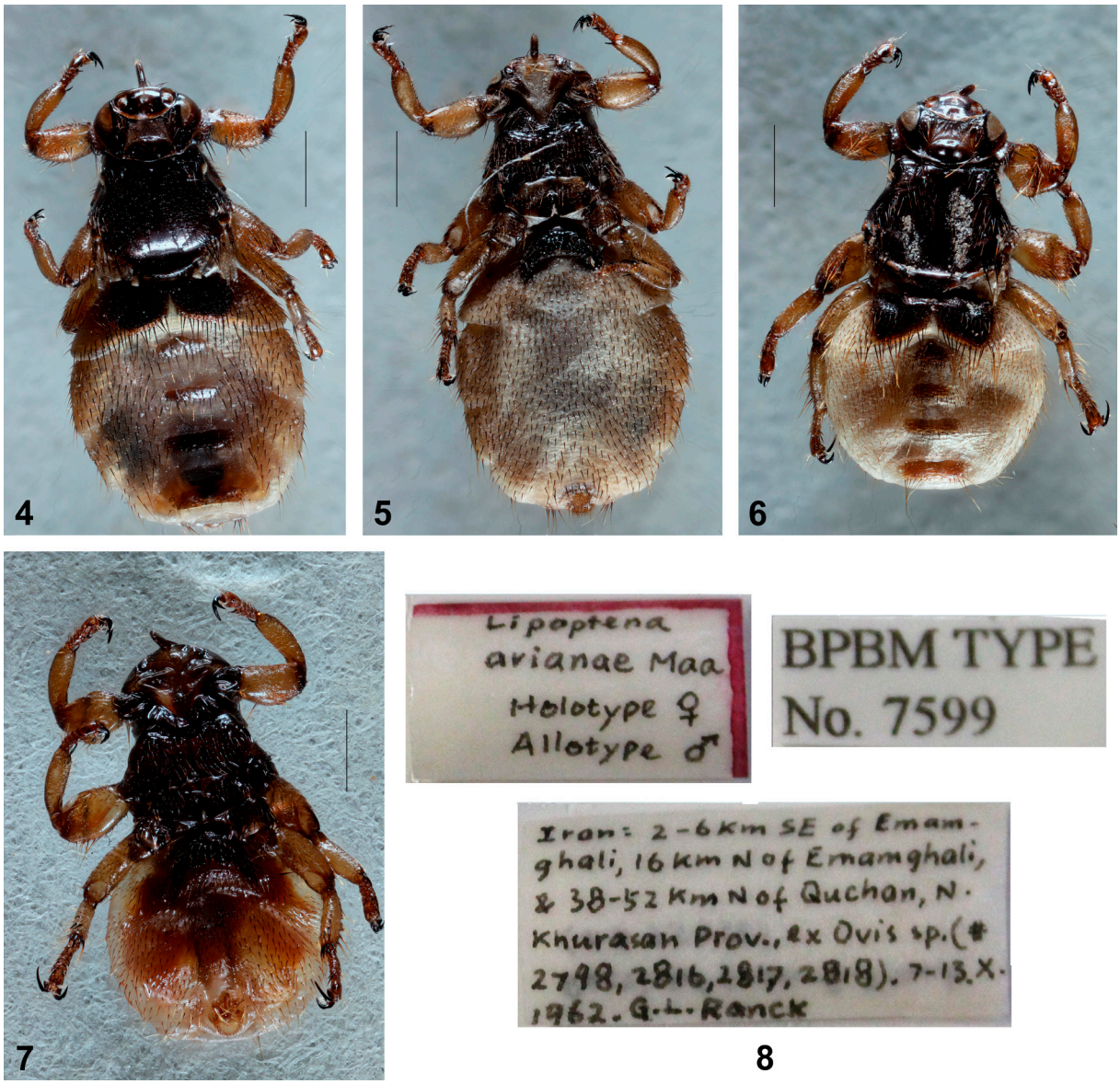
Abdomen light, covered with two-coloured setae. Pleurite 1 large, the inner, outer and back edges almost straight. At the back edge with fringe of long setae. In addition, 4–5 rows of short setae on the surface of the pleurite. Pleurite 2 short, narrowly rounded at the apex, and almost straight along the inner edge. Tergites 3–6 similar in width. Tergite 3 three and a half times the width of the abdomen. Tergite 4 four times narrower than the width of the abdomen. Tergite 5 three times narrower than the width of the abdomen. Tergite 6 twice as narrow as the width of the abdomen. Tergite 7 represented by 2 small sclerites. Each with 3–8 setae. Medial part of sternite 1 longer than length of its posterior lobe. Posterior edge of notch uniformly softly rounded.

Discussion

Some of the data we obtained on the limits of morphological variability are consistent with those



Figs 1–3. Female of *L. arianae*, habitus and details (Nuratau, Uzbekistan).
1–2 – habitus: 1 – dorsal view, 2 – ventral view; 3 – the setae arrangement on the thorax, dorsal side. Scale bars 1 mm. Photographs by S.A. Shchedrin.
Рис. 1–3. Самка *L. arianae*, габитус и детали строения (Нуратау, Узбекистан).
1–2 – внешний вид: 1 – дорсально, 2 – вентрально; 3 – расположение щетинок на дорсальной стороне торакса. Масштабные линейки 1 мм. Фотографии С.А. Щедрина.



Figs 4–8. *L. arianae*, holotype and allotype, habitus.

4–5 – female, holotype: 4 – dorsal view, 5 – ventral view; 6–7 – male, allotype: 6 – dorsal view, 7 – ventral view; 8 – labels of holotype and allotype. Scale bars 1 mm.

Рис. 4–8. *L. arianae*, голотип и аллотип, габитус.

4–5 – самка, голотип: 4 – вид сверху, 5 – вид снизу; 6–7 – самец, аллотип: 6 – вид сверху, 7 – вид снизу; 8 – этикетки голотипа и аллотипа. Масштабные линейки 1 мм.

reported in the literature. At the same time, although the literature indicates that *L. arianae* has 5–8 humeral, 42–52 laterocentral, 3–5 postalar, 9–12 mesopleural [Maa, 1969; Doszhanov, 2003], 5–10 parafrontal setae [Doszhanov, 2003], the analysis of the new samples and the holotype shows a greater number of setae – 15–19 humeral, 65–70 laterocentral, 18–20 parafrontal setae (Fig. 3). Their number also does not agree with the figure in Salvetti et al. [2020]. The data that tergites 3–6 are successively widen [Maa, 1969; Doszhanov, 2003] were also not confirmed. This feature was not observed in specimens we studied (Fig. 1) and in the female holotype (Fig. 4). Furthermore, it is also absent on the figures in Maa [1969] and Doszhanov [2003]. However, it is present in the male allotype (Fig. 6) and on the figure in Salvetti et al. [2020].

Considering that this species was found in northeastern and southern Iran [Maa, 1969], southern Kazakhstan and Uzbekistan (the Kyzylkum desert, Nuratau Mountains and Samarkand) [Doszhanov, 1980, 2003] (Fig. 9), it can be assumed that it is also present in Turkmenistan and possibly in Tajikistan, Kyrgyzstan and Afghanistan. It can also be assumed that this species is thermophilic. When describing *L. arianae*, Maa [1969: 214] wrote: "At present known only from NE and S. Iran (N. Khurasan and Laristan Provs.), ex *Ovis* sp., most probably *O.* (*Ovis*) *laristanica* Nasonov or *O.* (*O.*) *orientalis* Gmelin. The former species is endemic

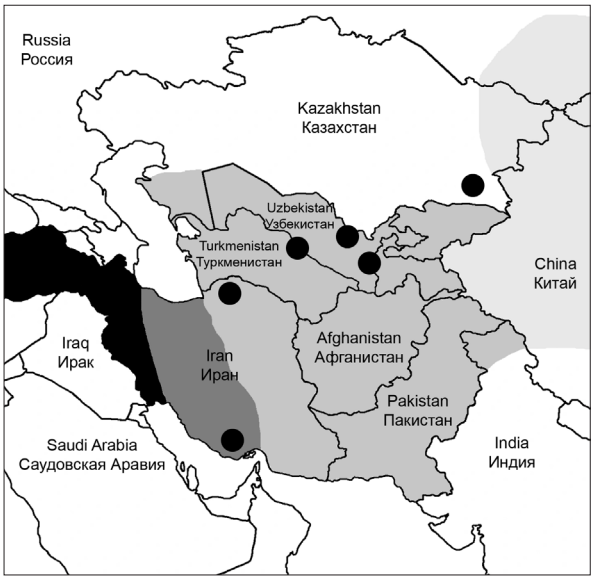


Fig. 9. Locaties of *L. arianae* (black circles) superimposed on the *Ovis* distribution map (according to Rezaei et al. [2010]): light grey background – *O. ammon*, grey – *O. vingei*, dark grey – hybrids of *O. orientalis* and *O. vignei*, black – *O. orientalis*.

Рис. 9. Места находок *L. arianae* (черные круги), наложенные на карту распространения *Ovis* (по [Rezaei et al., 2010]): светло-серый фон – *O. ammon*, серый – *O. vingei*, темно-серый – гибриды *O. orientalis* и *O. vignei*, черный – *O. orientalis*.

to Iran, whereas the latter spreads from Asia Minor, Cyprus, Iran, Afghanistan, Baluchistan, Kashmir to Punjab". *Lipoptena arianae* has not yet been found in Cyprus, but some authors write about its presence, based on Maa's words [Soos, Hurka, 1986; Salvetti et al., 2020].

Different species of *Ovis* spp. (Bovidae) were recorded as hosts of *L. arianae* flies. Maa [1969] considered Laristan mouflon *O. orientalis laristanica* (Nasonov, 1909) or European mouflon *O. orientalis musimon* Pallas, 1811 as probable primary hosts. Doszhanov [2003] listed *O. ammon* (Linnaeus, 1758) and *O. ammon severtzovi* Nasonov, 1914. The genus *Ovis* has a Central Asian origin. The evolution of these animals took place along migration routes from the ancestral area both to Europe and to the New World [Rezaei et al., 2010]. According to the data of Rezaei et al. [2010], *L. arianae* supposedly can parasitize all subspecies of the species *O. ammon*, *O. orientalis* Linnaeus, 1758, *O. vignei* Blyth, 1841 and their hybrids. Based on the analysis of the locations of this fly's finds and the *Ovis* distribution map from Rezaei et al. [2010], it can be assumed that the main hosts of *L. arianae* are *O. orientalis* and *O. vignei*.

The relationship between wild and domestic sheep deserves special attention, as parasites tend to migrate from wild relatives to domesticated ones. The domestic sheep *O. aries* Linnaeus, 1758 originated from the Asiatic mouflon *O. gmelini* Blyth, 1841 (in other sources – *O. orientalis*) approximately 10000 years ago in the Fertile Crescent [Chessa et al., 2009; Barbato et al., 2017; Kaptan et al., 2024; Mereu et al., 2025]. However, for some reason, only another genus of keds, *Melophagus* Latreille, 1802, parasites *O. aries*, even though the habitats of domestic sheep and its wild relatives overlap [Doszhanov, 1980, 2003; Peña-Espinoza et al., 2023]. It has been suggested in the literature that the wool structure of domestic sheep is not suitable for representatives of *Lipoptena* [Haarlov, 1964]. The wool of wild *Ovis* species consist of contour and woolen hairs [Danilkin, 2005], but the domestic sheep wool – only of woolen hairs. Legs of *Lipoptena* simultaneously attached to hairs of both types for secure fixation [Haarlov, 1964]. Thus, *L. arianae* is unlikely to pose a threat to domestic sheep, but may pose a threat to protected wild species.

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