

RESEARCH PAPER

## Revision of the genus *Exosehirus* (Heteroptera: Cydnidae), with the description of two new species

Dmitry A. GAPON

Zoological Institute, Russian Academy of Sciences, 1 Universitetskaya Emb., St Petersburg 199034, Russia; e-mail: tentatdag@gmail.com;  
ORCID: <https://orcid.org/0000-0002-4927-9845>

Accepted:  
12<sup>th</sup> March 2021

Published online:  
21<sup>st</sup> April 2021

**Abstract.** The present work is a revision of the Palaearctic burrower bug genus *Exosehirus* Wagner, 1963 (Heteroptera: Cydnidae: Sehirinae). New data on the morphology and distribution are given. Structures of the female internal ectodermal genitalia and the completely inflated aedeagi are described and illustrated for the first time. An extended differential diagnosis as a comparison of the genus with representatives of all Palaearctic genera of the tribe Sehirini is provided. Based on characters of the terminalia of both sexes, two new species are described: *E. elamensis* sp. nov. from Southwest Iran, and *E. essedonius* sp. nov. from Kazakhstan. ‘*Exosehirus*’ *steini* (Signoret, 1884) nom. dub. is excluded from the genus *Exosehirus* and treated as a species *incertae sedis*. *Exosehirus marginatus* (Signoret, 1881) is recorded for Azerbaijan for the first time.

**Key words.** Arthroidignatha, Heteroptera, Cydnidae, taxonomy, morphology, male and female terminalia, new species, distribution, Palaearctic Region

Zoobank: <http://zoobank.org/urn:lsid:zoobank.org:pub:FE96D8BE-6087-436C-8728-7BE849CA13B7>

© 2021 The Authors. This work is licensed under the Creative Commons Attribution-NonCommercial-NoDerivs 3.0 Licence.

### Introduction

The genus *Exosehirus* was erected by WAGNER (1963), based primarily on the characters of male and female terminalia as well as the shape of fore tibiae and the head. Wagner pointed out *Legnotus* Schiødte, 1848, as the closest member of the tribe Sehirini to *Exosehirus*. He included three species in his new genus: *Legnotus validus* (Jakovlev, 1877), *Sehirus marginatus* (Signoret, 1881) and *S. steini* (Signoret, 1884). The latter was included in the genus conditionally only based on the original description, since Wagner did not examine specimens of this species. PUTSHKOV (1965) considered *Exosehirus* to be heterogeneous, doubted the necessity of its erection and continued to consider *E. validus* in the genus *Legnotus*. LINNAVUORI (1984) described a fourth *Exosehirus* species, *E. sargon*, from one male collected in northern Iraq.

While revising the Heteroptera collection of the Zoological Institute, Russian Academy of Sciences, I discovered two more new species belonging to this genus. This article presents a revision of the genus, redescrpti-

ons of it, *E. marginatus* and *E. validus* (the holotype of *E. sargon* was not available to me) and descriptions of two new species, including the structure of internal female genitalia and the completely inflated aedeagi, which are provided for the first time for this genus.

### Material and methods

Male and female terminalia were examined in wet preparations; aedeagi were also examined in an entirely inflated condition in dry preparations made using the method of inflation by means of glass microcapillaries (GAPON 2001). The method of preparing female internal genitalia is described in the revision of *Canthophorus* Mulsant & Rey, 1866 (GAPON 2018). Pygophore and parameres are described in repose; structures of aedeagus are described according to its position in inverted pygophore, i.e. in copula.

The terminology for parts of the endosoma is based on the topographic principle and follows KONSTANTINOV & GAPON (2005) and GAPON (2018); terminology for parts



of the internal ectodermal genitalia of females follows SCUDDER (1959), ŠTYS (1961) and GAPON (2007, 2018). The term “triangulum” used in GAPON (2018) to designate the membrane between gonapophyses II, which is the ventral wall of the posterior part of the gynatrial sac and has a triangular or broadly rounded anterior margin, is inappropriate because it is homonymous with the term designating a triangular membranous fold or sclerite in place of the gonapophyses I in Pentatomidae. Therefore, here instead of this term, I use “posterior intervalvular membrane”.

All measurements are given in millimetres. The ocular index is accepted as a ratio of the dorsal synthlipsis (minimum interocular distance) to the maximum width of the eye; this is most easily measured using the following formula: twice synthlipsis / (maximum width across eyes – synthlipsis).

When listing the material examined for each species, specimens whose terminalia were dissected and studied are marked with an asterisk (\*).

The material examined, including the types of the new species, is stored in the Zoological Institute of the Russian Academy of Sciences, St Petersburg, Russia (ZISP).

The following genera and species were compared with *Exosehirus* for its differential diagnosis (in this paragraph, ♂ marks the species whose male terminalia were examined, and ♀ the species whose female terminalia were examined): *Adomerus* Mulsant & Rey, 1866 [*A. biguttatus* (Linnaeus, 1758)<sup>♂♀</sup>, *A. congener* (Jakovlev, 1879)<sup>♂♀</sup>, *A. fuscipennis* (Horváth, 1899)<sup>♂♀</sup>,<sup>1)</sup> *A. maculipes* (Mulsant & Rey, 1852)<sup>♂♀</sup>,<sup>1)</sup> *A. notatus* (Jakovlev, 1882)<sup>♂♀</sup>, *A. rotundus* (Hsiao, 1977)<sup>♂♀</sup>, *A. triguttulus* (Motschulsky, 1866)<sup>♂♀</sup>, *A. variegatus* (Signoret, 1884)<sup>♂♀</sup>], *Canthophorus* [all species<sup>♂♀</sup> – see GAPON (2018)], *Crocistethus* Fieber, 1860 [*C. aeneus* (Brullé, 1839)<sup>♂</sup>, *C. basalis* (Fieber, 1861)<sup>♂♀</sup>, *C. waltlianus* (Fieber, 1837)<sup>♂♀</sup>], *Lalervis* Signoret, 1881 [*L. alticola* (Linnavuori, 1993), *L. expansa* (Signoret, 1881)<sup>♂♀</sup>, *L. tibialis* (Stål, 1854)<sup>♂</sup>], *Legnotus* Schiødte, 1848 [*L. fumigatus* (A. Costa, 1853), *L. limbosus* (Geoffroy, 1785)<sup>♂♀</sup>, *L. picipes* (Fallén, 1807)<sup>♂♀</sup>], *Ochetostethus* Fieber, 1860 [*O. opacus* (Scholtz, 1847)<sup>♂♀</sup>], *Sehirus* Amyot & Serville, 1843 [*S. luctuosus* Mulsant & Rey, 1866<sup>♂</sup>, *S. morio* (Linnaeus, 1761)<sup>♂♀</sup>, *S. ovatus* (Herrich-Schaeffer, 1840)<sup>♂♀</sup>, *S. parens* Mulsant & Rey, 1866<sup>♂♀</sup>], *Tacolus* Schouteden, 1910 [*T. majusculus* (Schouteden, 1910)<sup>♀</sup>], and *Tritomegas* Amyot & Serville, 1843 [*T. bicolor* (Linnaeus, 1758)<sup>♂♀</sup>, *T. sexmaculatus* (Rambur, 1839)<sup>♂♀</sup>, *T. theryi* (Lindberg, 1932)<sup>♂</sup>]. Characters of *Ochetostethomorpha nollothensis* Schumacher, 1913, *O. secunda* J. A. Lis & B. Lis, 2014, *Singeria brevipennis* Wagner, 1955 and *Legnotus pericarti* Magnien, 1999 are given according to the original descriptions (WAGNER 1955; LINNAVUORI 1993; MAGNIEN 1999; LIS et al. 2014).

## Taxonomy

### *Exosehirus* Wagner, 1963

*Exosehirus* Wagner, 1963: 106. Type species by original designation: *Adomerus marginatus* Signoret, 1881.

**Diagnosis.** The genus can be recognised by the combination of the following characters of external morphology: preocular part of head broadly rounded, with very weak notches before eyes, anterolateral margins of pronotum without contrasting pale stripe, lateral margins of hemelytra with such stripe present; also by corpus of each paramere strongly widened on mesal part; by unique characters in structure of aedeagus: in *E. marginatus*, conjunctiva curved at right angle in middle, ventrolateral lobes of conjunctiva short, finger-like, strongly displaced distally, distal part of vesica (see below) extremely long, filiform, and, in all other species, ventrolateral lobes at bases extended along ventral wall of conjunctiva, adjacent to this wall and possessing sclerotised serrate band at short apices directed anteriorly; in female terminalia, distinguished by combination of the following characters: anterior part of gynatrial sac with large arcuate sclerites, gynatrial cone transverse on posterior part (uniformly narrow in *E. marginatus*), posterior part of gynatrial sac posteriorly with a pair of pouches reinforced with ring sclerites along their posterior margins, dorsal surface of this part of gynatrial sac with transverse or paired C-shaped folds, and spermathecal duct consisting of two very long parts in *E. marginatus* or three parts in all other species.

**Differential diagnosis.** In colouration of pronotum and hemelytra, *Exosehirus* is most similar to *Legnotus limbosus* and *L. picipes*, but differs from them and other genera of the tribe by the preocular part of the head shaped as in *Sehirus*. *Exosehirus* can be distinguished from *Adomerus*, *Crocistethus*, *Lalervis*, *Legnotus*, *Singeria*, *Tacolus*, and *Tritomegas* by the juga being contiguous with the front of clypeus; from *Adomerus*, *Canthophorus* [except for *C. coeruleus* (Reuter, 1902)], *Lalervis*, *Tacolus* and *Tritomegas* by the absence of pale stripe or spots on anterolateral margins of pronotum; from *Canthophorus coeruleus*, *Crocistethus*, *Legnotus fumigatus*, *L. pericarti*, *Ochetostethus*, *Ochetostethomorpha*, *Sehirus* and *Singeria* by presence of a pale stripe on lateral margins of hemelytra; from all species of *Adomerus* [except for *A. congener*, *A. fuscipennis*, *A. maculipes*], *Canthophorus* [except for *C. dubius dubius* (Scopoli, 1763), *C. impressus impressus* (Horváth, 1880), *C. melanopterus contrarius* (Wagner, 1956)], *Lalervis*, some specimens of *Sehirus* [not species-specific character], all *Tacolus*, *Tritomegas* [except for *T. bicolor*] by semitransparent, not darkened and not very shortened [vs. *Singeria*] membrane with brownish veins [latter character as in *Adomerus notatus*, *A. rotundus*, *A. variegatus*, *Crocistethus*, *Ochetostethus* and *Ochetostethomorpha*]; from *Adomerus biguttatus*, *A. fuscipennis*, *A. maculipes*, *A. rotundus*, *A. variegatus*, *Canthophorus* [except for *C. coeruleus*], *Crocistethus*, *Lalervis* and *Tritomegas* by the absence of a pale stripe or spots on the lateral margins of abdominal sternites and laterotergites; from *Adomerus biguttatus*, *A. notatus*, *A. tri-*

<sup>1)</sup> The names of these two species are used in accordance with the nomenclature changes by AUKEMA et al. (2021).

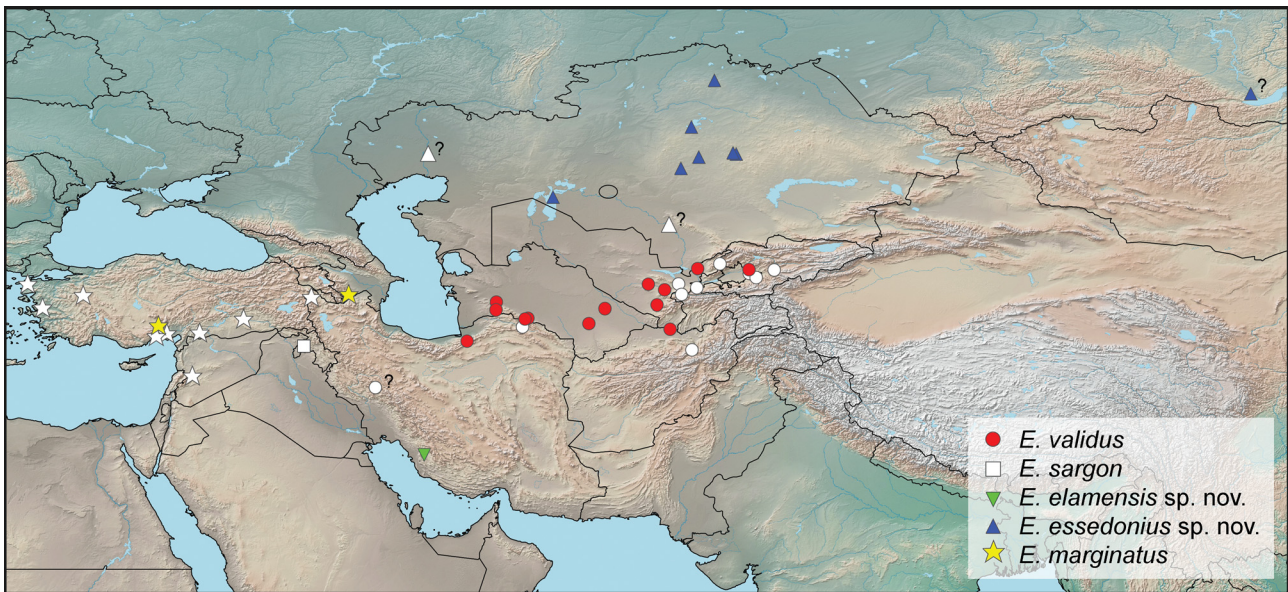


Fig. 1. Distribution of *Exosehirus* species based on the examined material (coloured buttons) and literature (white buttons).

*guttulus*, *A. variegatus*, *Crocistethus*, *Lalervis*, *Tacolus*, and *Tritomegas* by the absence of pale spots and areas on pronotum, scutellum and hemelytra (not including lateral margins of coria); from *Adomerus*, *Crocistethus*, *Lalervis*, *Tacolus* and *Tritomegas* by the absence of pale rings on tibiae; from *Adomerus rotundus*, *A. triguttulus*, *Lalervis*, *Ochetostethus*, *Ochetostethomorpha*, *Singeria*, *Tacolus*, *Tritomegas sexmaculatus* and *T. theryi* by the wide and long evaporatoria; from *Canthophorus*, *Lalervis*, *Ochetostethus*, *Ochetostethomorpha*, *Singeria*, *Tacolus* and *Tritomegas* by the long and straight ostiolar peritremes; and from *Adomerus variegatus*, *Canthophorus*, *Crocistethus* and *Tritomegas* by the absence of metallic luster of body surface.

Pygophore similar to that of *Legnotus*, *Sehirus*, *Tritomegas sexmaculatus*, *T. theryi* and *Adomerus congener*, differing in greater width relative to length, posterolateral angles not protruding in ventrocaudal view [excluding *L. limbosus*], obtuse convex or slightly notched posteroventral margin [excluding *T. theryi*], and absence of denticles on lateral margins of genital opening. It can be distinguished from the pygophore of *Legnotus* and *Sehirus* by the dorsal infolding with distinct medial desclerotised line and absence of tubercles on sides near margin of genital opening.

Parameres most similar to that of *Adomerus triguttulus*, *Tritomegas sexmaculatus* and *Tacolus*, but with even wider distal part of corpus and, in contrast to latter genus, with sensory process directed posteriad, not outward.

Aedeagus in *Exosehirus*, in general, readily distinguished from those of other *Sehirinae*. Paired ventrolateral lobes present [vs. *Canthophorus* having unpaired ventral lobe, *Ochetostethus*, *Adomerus notatus*, *A. rotundus*, *A. triguttulus*, *Tritomegas*], mostly membranous [vs. *Adomerus congener*, *A. biguttatus*, *A. fuscipennis*, *A. maculipes*, *Crocistethus*, *Lalervis*], without spicules and large prominent sclerites [vs. *Adomerus variegatus*, *A. biguttatus*, *Crocistethus*, *Lalervis*, *Sehirus*], without any armature

at all in *E. marginatus* sharing this character only with *Legnotus*, or with sclerotised bands on mesal margins [as in *Adomerus biguttatus*, *A. variegatus*, *Sehirus*] and with serrate band at apex [same denticles present only at apex and on anterior surface of same lobe in *Adomerus biguttatus* and *A. variegatus*, respectively]. Paired dorsolateral lobes present [vs. *Adomerus biguttatus*, *Ochetostethus* (bearing small, apically sclerotised tubercle in place of these lobes), *Sehirus*], membranous [vs. *Adomerus maculipes*, *Lalervis*, *Tritomegas bicolor*], without spicules [vs. *Adomerus fuscipennis*, *A. triguttulus*, *Canthophorus*, *Crocistethus*, *Lalervis*, *Legnotus*, *Tritomegas*] or serrate band on lateral margin [vs. *Adomerus maculipes*], with longitudinal sclerotised band as in *Adomerus congener*, *A. notatus* and *A. rotundus* but much shorter and wider. Paired dorsoapical lobes (referred to as dorsal lobes in GAPON 2018) present [vs. *Adomerus biguttatus* (having small sclerotised apically tubercle in place of these lobes), *A. maculipes*, *A. notatus*, *A. triguttulus*, *A. variegatus* (having long membranous projection of dorsal wall, directed anteriad, with thin, weakly sclerotised bands on sides), *Canthophorus*, *Legnotus limbosus*], not fused in base [vs. *Lalervis*, *Sehirus*], membranous [as in *Legnotus picipcies* vs. *Adomerus congener*, *A. fuscipennis*, *A. rotundus*, *Lalervis*, *Ochetostethus*, *Sehirus*], with spicules or completely transformed into spicules [as in *Adomerus congener*, *A. rotundus*, *Crocistethus*, *Lalervis*, *Ochetostethus*, *Sehirus*, *Tritomegas*]. Paired apical lobes present (only in *E. marginatus*) [vs. *Adomerus congener*, *A. variegatus*, *Crocistethus*, *Ochetostethus*, *Sehirus*, *Tritomegas sexmaculatus*, *T. theryi*] and transformed into sclerotised spicules [as in *Adomerus biguttatus*, *A. triguttulus*, *Lalervis*, *Legnotus limbosus*, *Tritomegas bicolor* vs. *Adomerus notatus*, *A. rotundus*, *Canthophorus*, *L. picipes*], without membranous base [vs. *Lalervis*]. Vesica rather wide at least basally [vs. *A. biguttatus*, *Legnotus*, *Tritomegas bicolor*], with membranous or weakly sclerotised walls [vs. *Adomerus biguttatus*, *A. notatus*, *A. rotundus*, *Legnotus*, *Tritomegas bicolor*].

Female terminalia most similar to those of *Sehirus* in the presence of large arcuate sclerites anterior to gynatrial cone [in latter genus, these sclerites extending posteriorly in form of plates, as in *E. marginatus*]; in the transverse posterior part of gynatrial cone [except for *E. marginatus*] and longitudinal its anterior part; in the spermathecal duct consisting of three parts [except for *E. marginatus* having only two very long, tubular parts in duct: wider proximal and narrower distal ones]; short proximal part with annular folds, widened middle part, and very thin distal part [except for *S. ovatus* having only two short parts in duct: wide conical proximal and narrow distal one]; in large ring sclerites [small in *S. ovatus*] reinforcing posterior margin of gynatrial sac; in gonapophyses I with sclerotised bands connected to anterior angles of gonocoxites I [excluding *E. marginatus*]; in large gonapophyses II with concave anterior margin, convex posterior one, acute apex directed posteriorly; and in presence of second rami. Female terminalia of *Exosehirus* distinguished from those of all *Sehirini* genera except for *Sehirus* and *Tacolus* by above-mentioned structure of gynatrial cone; from all the genera except *Crocistethus*, *Sehirus* and *Tritomegas bicolor* by spermathecal duct consisting of three parts [except for *E. marginatus*]. In *Exosehirus*, paratergites IX not greatly enlarged [vs. *Tritomegas*]; anterior limb of gonangulum rather long [except for *E. marginatus*] and wide [vs. *Adomerus biguttatus*, *Crocistethus*, *Lalervis*, *Legnotus*, *Tacolus*], but not so long as in *A. congener*, *A. notatus*, *A. rotundus*, *A. triguttulus*, *A. variegatus*, *Canthophorus*, *Ochetostethus*, *Sehirus ovatus*, *Tritomegas*; posterior limb of gonangulum longer than in other *Sehirini* [except for *Crocistethus*, *A. congener*, *A. variegatus*]; gonocoxites I not strongly transverse, gonocoxites II not fused with paratergites IX [vs. *Legnotus*, *Ochetostethus*]; mesal parts of gonocoxites II large [vs. *Adomerus biguttatus*, *A. fuscipennis*, *A. macilipes*, *A. notatus*, *A. rotundus*, *Ochetostethus*, *Sehirus*, *Tacolus*, *Tritomegas sexmaculatus*], not longitudinally elongated and widened anteriorly [vs. *Crocistethus*]; lateral parts of gonocoxites II sharply narrowed, long [excluding *E. marginatus*], narrower than in other *Sehirini*; posterior intervalvular membrane with transverse fold [vs. *Adomerus biguttatus*, *A. rotundus*, *A. triguttulus*, *A. notatus*, *Canthophorus*, *Crocistethus*, *Lalervis*, *Ochetostethus*, *Sehirus* (excluding *S. ovatus*), *Tacolus*]; gonapophyses II present [vs. *Crocistethus*, *Legnotus*], not shortened [vs. *Adomerus biguttatus*, *A. congener*, *A. notatus*, *Ochetostethus*, *Tritomegas*], not largely reduced, spaced, lying at posterior margin of posterior intervalvular membrane leaving it open [vs. *Adomerus maculipes*, *A. rotundus*, *A. triguttulus*, *Lalervis*, *Tacolus*]; first rami present [vs. *Adomerus biguttatus*, *Crocistethus*, *Legnotus*], fused with anterior limb of gonangulum [except for *E. marginatus*] [vs. *Adomerus biguttatus*, *A. fuscipennis*, *A. maculatus*, *Sehirus parens*, *S. morio*, *Tacolus*]; second rami present [vs. *Adomerus biguttatus*, *A. notatus*, *A. triguttulus*, *A. rotundus*, *Crocistethus*, *Lalervis*, *Legnotus*, *Tacolus*], not widened at anterior ends as in *Canthophorus*; posterior part of gynatrium with paired pouches [vs. all species of *Adomerus* excluding *A. rotundus* and *A. triguttulus*], those

being short and wide [vs. *Crocistethus*, *Ochetostethus*, most species of *Canthophorus*], not raised dorsally [vs. *Adomerus rotundus*], not shifted ventrally [vs. *Tacolus*]; unpaired dorsal pouch at posterior margin of gynatrium absent [vs. *Adomerus biguttatus*, *A. notatus*, *A. variegatus*, *Tacolus*].

**Redescription. Body** (Fig. 2) oval or rather broadly oval (in *E. marginatus*), slightly widened behind middle, moderately convex, slightly more convex ventrally than dorsally. Main colour of body brown, dark brown or blackish (black in *E. sargon*, according to LINNAVUORI 1984); lateral margins of hemelytra each with ivory stripe. Body surface glabrous, with dull shine (very shiny in *E. sargon*, according to LINNAVUORI 1984) always being non-metallic, and covered with rather dense and fine punctation.

**Head** (Figs 3A–F) transverse, moderately inclined, rather convex in middle dorsally, with more convex vertex. Preocular part of head ovally or trapezoidally rounded. Juga contiguous in front of clypeus or rarely (in some specimens of *E. marginatus*) converging but not touching in front of clypeus; their lateral margins with obsolete notch in front of eyes, rather curved upward so that clypeus is not visible in lateral view, except for its base. Eyes moderately large, hemispherical and slightly transverse in anterior view, subconical in dorsal view, prominently protruding beyond lateral margins of head. Dorsal surface of head covered with fine, dense punctation except for smooth or slightly wrinkled posterior part of vertex; punctures on ventral surface of head slightly larger and deeper, less dense, absent on juga and lorae. Bucculae rather high, with arcuate ventral margins, slightly higher anteriorly than on posterior part. Rostrum unicolourous, reaching middle coxae. Antennae brown, with basal segments paler, apical ones slightly darker.

**Thorax.** Pronotum (Figs 3G–K) broader than long, tapering anteriorly, evenly and not strongly convex (pronotal disk very convex in *E. sargon*, according to LINNAVUORI 1984). Pronotal anterolateral margins almost straight on posterior part and strongly convex, rounded anteriorly, bordered along entire length by smooth, rounded, uniformly very thin rib of the same colour as disc of pronotum or paler brown, but not contrastingly pale (in *E. marginatus*, this rib sometimes looking rather contrastingly pale due to blackish pronotal disc). Posterolateral margins of pronotum straight; posterior margin gradually and weakly convex, almost straight. Anterior angles of pronotum reaching lateral margins of eyes, wide, obtuse, with lateral margins convex, mesial margins straight. Humeri broadly rounded, often with pale brown spot on posterior part. Punctation slightly less dense than on dorsal surface of head, but with slightly larger punctures. Calli strongly smooth (elevated in *E. sargon*, according to LINNAVUORI 1984), without punctation at least on their perimeter or punctured by small shallow punctures in centre. Transverse depression on pronotal disc absent. Posterior part of disc often smoothly transversely rugose.

Scutellum long, convex at base, slightly protruding beyond posteriomesal angles of corium; its lateral margins slightly convex on basal part and slightly concave before

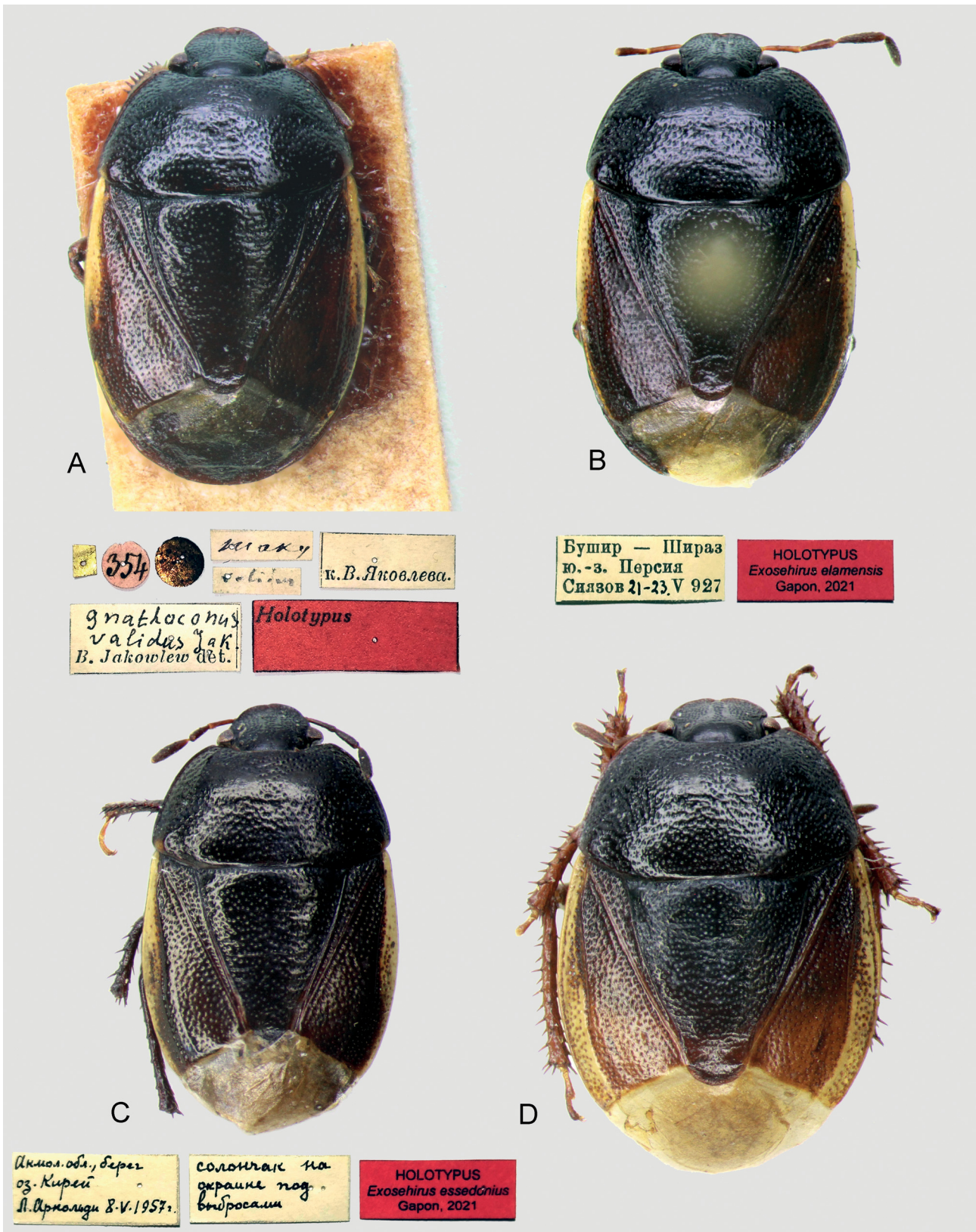


Fig. 2. *Exosehirus* species, general appearance from dorsal side and type labels. A – *E. validus* (Jakovlev, 1877), holotype; B – *E. elamensis* sp. nov., holotype; C – *E. essedonius* sp. nov., holotype; D – *E. marginatus* (Signoret, 1881), without abdomen, from Turkey.

apex. Apex of scutellum rather narrow, rounded, curved downwards. Punctuation on scutellum slightly denser than on pronotum, but punctures slightly smaller, shallower, absent at extreme basal corners and extreme apex.

Lateral margins of hemelytra straight or slightly convex (in *E. marginatus*) anteriorly and more strongly convex behind middle, with wide yellowish or ivory stripe (including marginal rib) extending beyond middle of exocorium

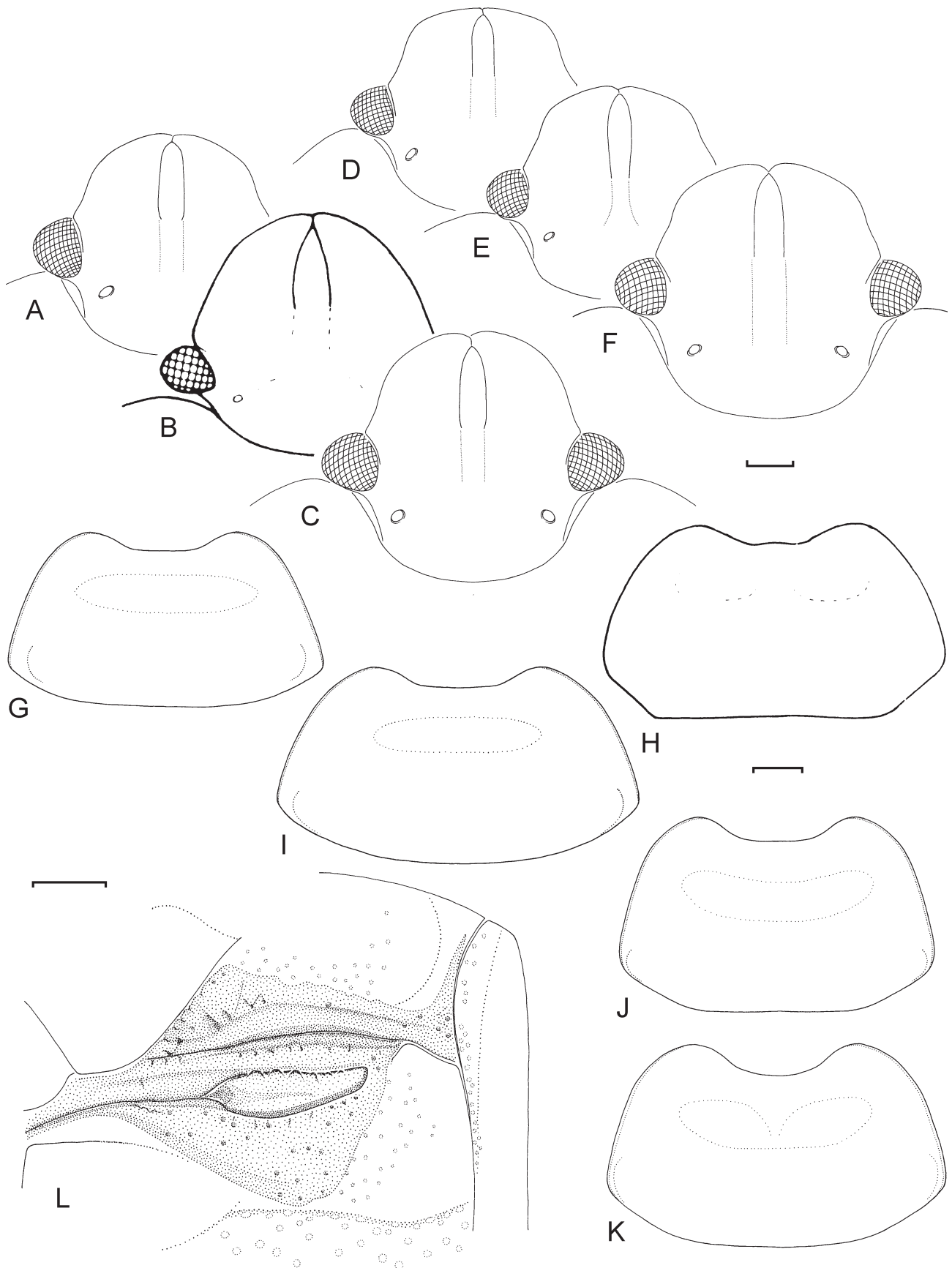


Fig. 3. Head (A–F), pronotum (G–K) and external scent efferent system (L) of *Exosehirus* species. A, G, L – *E. validus* (Jakovlev, 1877); B, H – *E. sargon* Linnavuori, 1984; C, I – *E. elamensis* sp. nov.; D, E, J – *E. essedonius* sp. nov.; F, K – *E. marginatus* (Signoret, 1881). Scale bars: 0.25 mm (A, C–F, L) and 0.5 mm (G, I–K). B and H after LINNAVUORI (1984).

and usually tapering on posterior part up to very narrow edging reaching apical angle of corium or evenly wide in *E. marginatus* (Figs 2A–D). Main colouration of corium usually slightly lighter than that of pronotum and scutellum. Hemelytra mostly punctured exactly as pronotum, but punctures in middle of corium becoming smaller and shallower; exocorium anteriorly with very sparse small punctures. Posterior margin of corium almost straight, slightly concave near mesal and lateral ends. Membrane slightly protruding beyond apex of abdomen, uniformly whitish, semitransparent, with indistinct brownish longitudinal veins, almost without transverse veins.

Propleuron anteriorly covered with rather dense, large, deep punctation; posteriorly with several small, shallow punctures, and nearly smooth along lateral margin. Punctation on mesopleuron less dense and coarse than on anterior part of propleuron; metapleuron with several large, shallow punctures. Prosternum with rather wide, deep, punctate groove, without medial carina; mesosternum slightly convex, transversely finely rugose, without groove, with thin longitudinal carina; metasternum very narrow, flat between ribs flanking coxal cavities. Mesopleural evaporatorium (Fig. 3L) long, lying along entire posterior margin of mesopleuron, continued in form of narrow strip along its lateral margin and widened triangularly on mesal part. Metapleuron evaporatorium large, slightly not quite reaching lateral margin of metapleuron, with triangularly rounded posterior margin. Entire evaporatorium diamond-shaped. Ostiole of metathoracic scent gland small, transversely elongated. Ostiolar peritreme thin, straight, sharply elevated, with dull shiny, rugose surface, and acutely rounded lateral angle, often slightly bent anteriad. Legs uniformly brown or dark brown or blackish, usually slightly paler than head, pronotum and scutellum; tarsi proximally paler than other parts of legs.

**Abdomen.** Ventral surface on lateral parts finely longitudinally rugose and densely covered with rather small, very shallow punctures becoming sparse and shallower towards anterior part of middle of venter. Entire abdomen, including connexivum and angles of all ventrites unicolourous brown, reddish brown, dark brown or blackish, usually slightly paler than ventral parts of thoracic segments, without any pale spots and stripes.

**Pygophore** (Figs 4A–F) slightly wider than long, with strongly oblique posterior surface from high ventral wall to lower dorsal one; at rest, dorsal surface of pygophore hidden under hemelytra, not visible externally. In ventro-caudal view, lateral margins of pygophore converging at its base, slightly concave in middle, slightly convex before posterolateral angles; latter in form of small triangular protrusions; posteroventral margin of pygophore convex laterally, slightly concave in middle or gradually convex towards middle (in *E. marginatus*). Ventral wall of pygophore convex just behind base, slightly concave before posteroventral margin; latter slightly bent ventrally; part of pygophore visible externally, with fine punctures, very finely rugose laterally and smooth basally. Dorsal wall of pygophore narrowly desclerotised along midline. In dorsal view, posterolateral angles of pygophore broadly rounded.

Ventral infolding relatively long, lateral infoldings wide, dorsal infolding as long as or longer than ventral one. Surface of dorsal infolding rather densely covered with thin, short setae directed laterad. Each lateral infolding with slightly depressed wide area on dorsal part; these areas and dorsal infolding finely punctured, rest of infoldings smooth. Lateral infoldings on dorsal part near margin of genital opening with narrow, deeper depressions. Genital opening trapezoidally rounded, wider ventrally than dorsally, without distinct sclerotised denticles on sides; ventral margin with low wide tubercle. Posterior ends of lateral ridges of subgenital plate arising from ventral margin of genital opening; lateral ridges high, gradually arising anteriad, their anterodorsal angles elongated, triangular, directed dorsally and anteriad, their apices connected to suspensory apodemes of aedeagal phallobase. Transverse ridge of subgenital plate high, with concave dorsal surface, tapering parabolic on dorsal part directed dorsally, its posterior wall with longitudinal striation.

**Parameres** (Figs 4G–J). Basal plate narrow, moderately long, located at right angle to axis of corpus of paramere. Corpus flattened dorsoventrally; in dorsal view, narrow at base, slightly widening distally and sharply widening on most distal part; its dorsal wall cylindrically convex on lateral part and concave on mesal part at base of hypophysis; mesal and most distal part of wall oblique. Ventral wall of paramere corpus rather strongly convex on distal part. Sensory process flattened dorsoventrally, short, rather wide, triangular, directed posteriad. Its dorsal wall and oblique part of dorsal wall of corpus densely covered with long setae. Hypophysis more or less long, strongly flattened dorsoventrally, sharply curved dorsally and outwardly, tapering towards apex. Dorsal wall of hypophysis before apex with finest transverse ribs, anterior margin with smallest denticles.

**Aedeagus** (Figs 4K, 5–11). Phallobase regular-sized; in lateral view, tapering sharply anteriorly, relatively wide posteriorly, with slightly convex dorsal margin, slightly protruding, trapezoidally rounded anterodorsal angle and with short, apically pointed arms. Ventral processes rather long, narrow, directed ventrolaterad and posteriad, with triangularly rounded apices. Suspensory apodemes slightly shorter than basal plates. Capitulate processes rather large, with distinct stem. Erection fluid pump not so long, narrow, slightly sclerotised apically.

Theca cylindrical, rather long, relatively narrow, rather weakly sclerotised in middle of its length over considerable extent. Ventral wall of theca concave, dorsal wall convex, lateral walls almost parallel. Extreme base of theca membranous, hemispherically inflated; phallobase attached to its ventral wall. Extreme apical part of theca also membranous. Sclerotised area finely transversely rugose, especially its dorsal and lateral walls.

Conjunctiva differing greatly in *E. marginatus* and other species of the genus, but having main structural characters as follows. Conjunctiva longitudinal, cylindrical, conventionally subdivided into basal and apical parts, slightly arched in ventral direction or curved dorsally at a right angle (in *E. marginatus*). Basal part of conjunctiva deflected

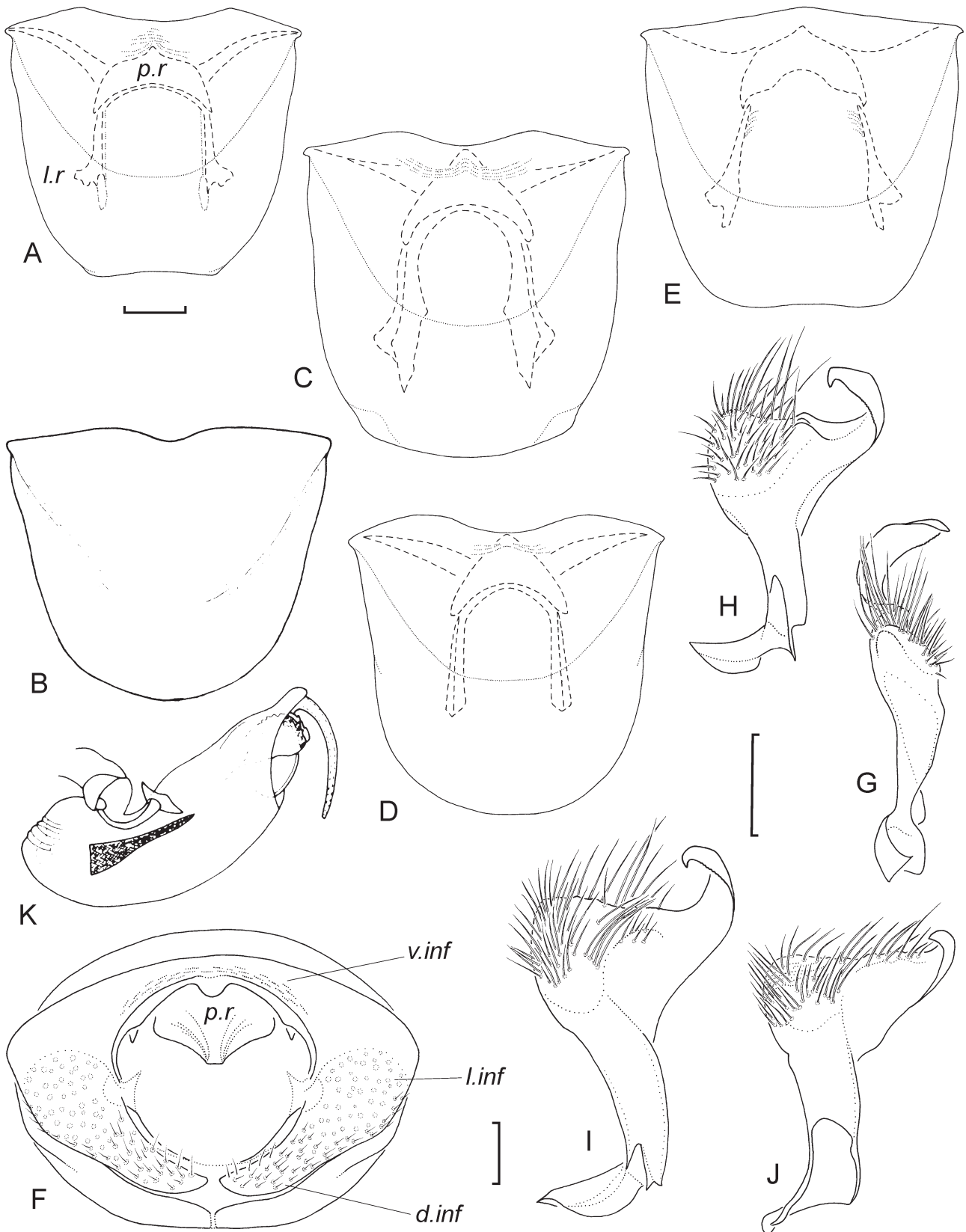


Fig. 4. Pygophore, paramere and aedeagus of *Exosehirus* species. A, F, G, H–E. *validus* (Jakovlev, 1877); B, K – *E. sargon* Linnavuori, 1984; C – *E. elamensis* sp. nov.; D, I – *E. essedonius* sp. nov.; E, J – *E. marginatus* (Signoret, 1881). Pygophore in ventrocaudal (A–E) and dorsal (F) view; paramere in lateral (G) and dorsal (H–J) view; aedeagus in lateral view (K). Abbreviations: *d.inf* – dorsal infolding of pygophore; *l.inf* – lateral infolding of pygophore; *l.r* – lateral ridge of subgenital plate; *p.r* – posterior ridge of subgenital plate; *v.inf* – ventral infolding of pygophore. Scale bars: 0.25 mm (A, C, D, E, F) and 0.14 mm (G–J). B and K after LINNAVUORI (1984).



ventrally from longitudinal axis of theca at an obtuse angle, with a pair of membranous ventrolateral and a pair of dorsolateral membranous lobes. Ventrolateral lobes bordered by sclerotised bands (except for *E. marginatus*) bearing denticles at lobe apex. Dorsolateral lobes with sclerites

of various shapes. Apical part of conjunctiva narrowed or wide (in *E. marginatus*), with a pair of dorsoapical lobes bearing spicules or sclerites of complex shape (in *E. marginatus*). Basal part of ejaculatory reservoir [see the note below] rather small, sclerotised, lying near base of vesica.

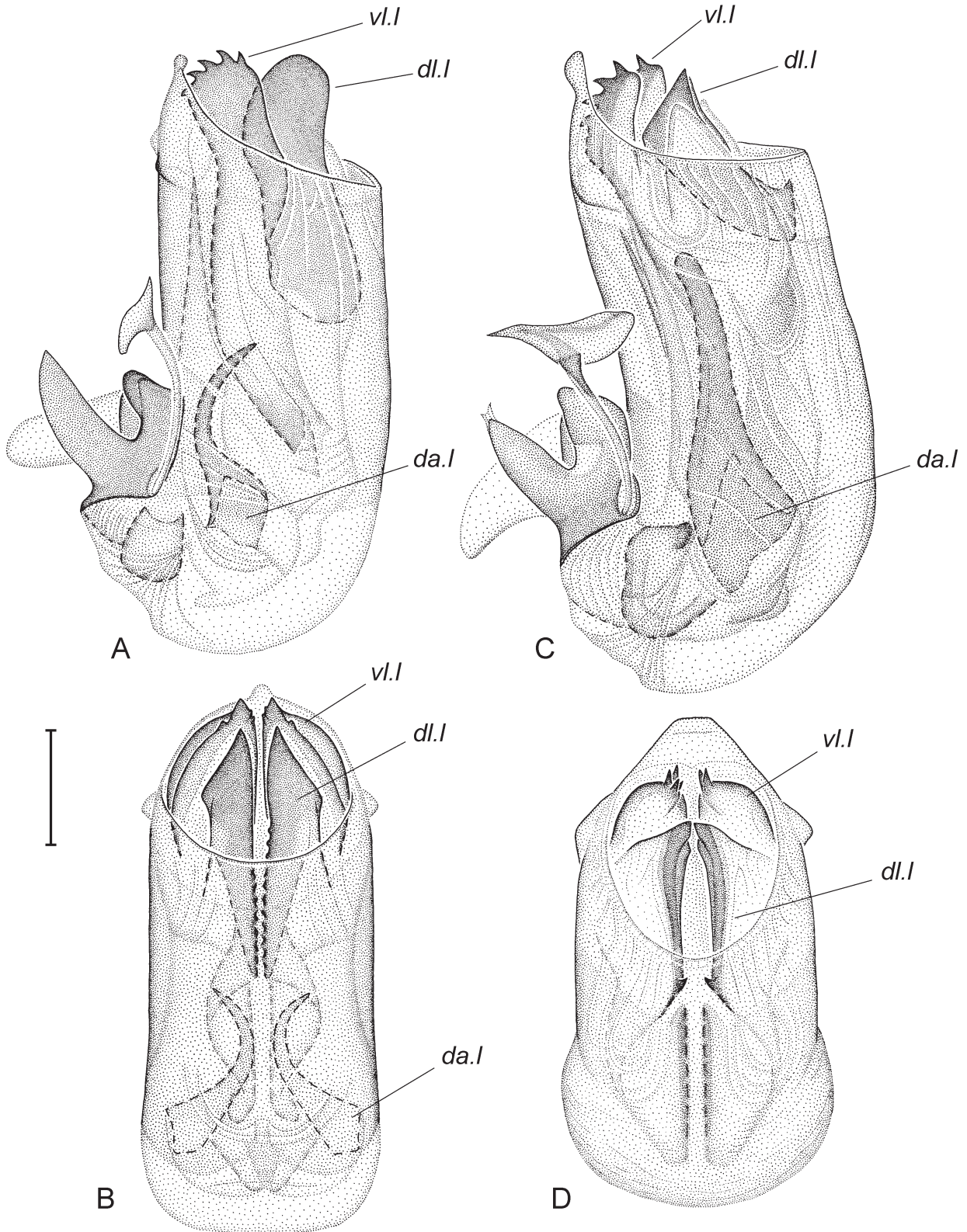


Fig. 5. Uninflated aedeagi of *Exosehirus* species. A, B – *E. validus* (Jakovlev, 1877); C, D – *E. essedonius* sp. nov. Lateral (A, C) and ventral (B, D) view. Abbreviations: *vl.l* – ventrolateral lobe of conjunctiva; *dl.l* – dorsolateral lobe; *da.l* – dorsoapical lobe. Scale bar: 0.14 mm.

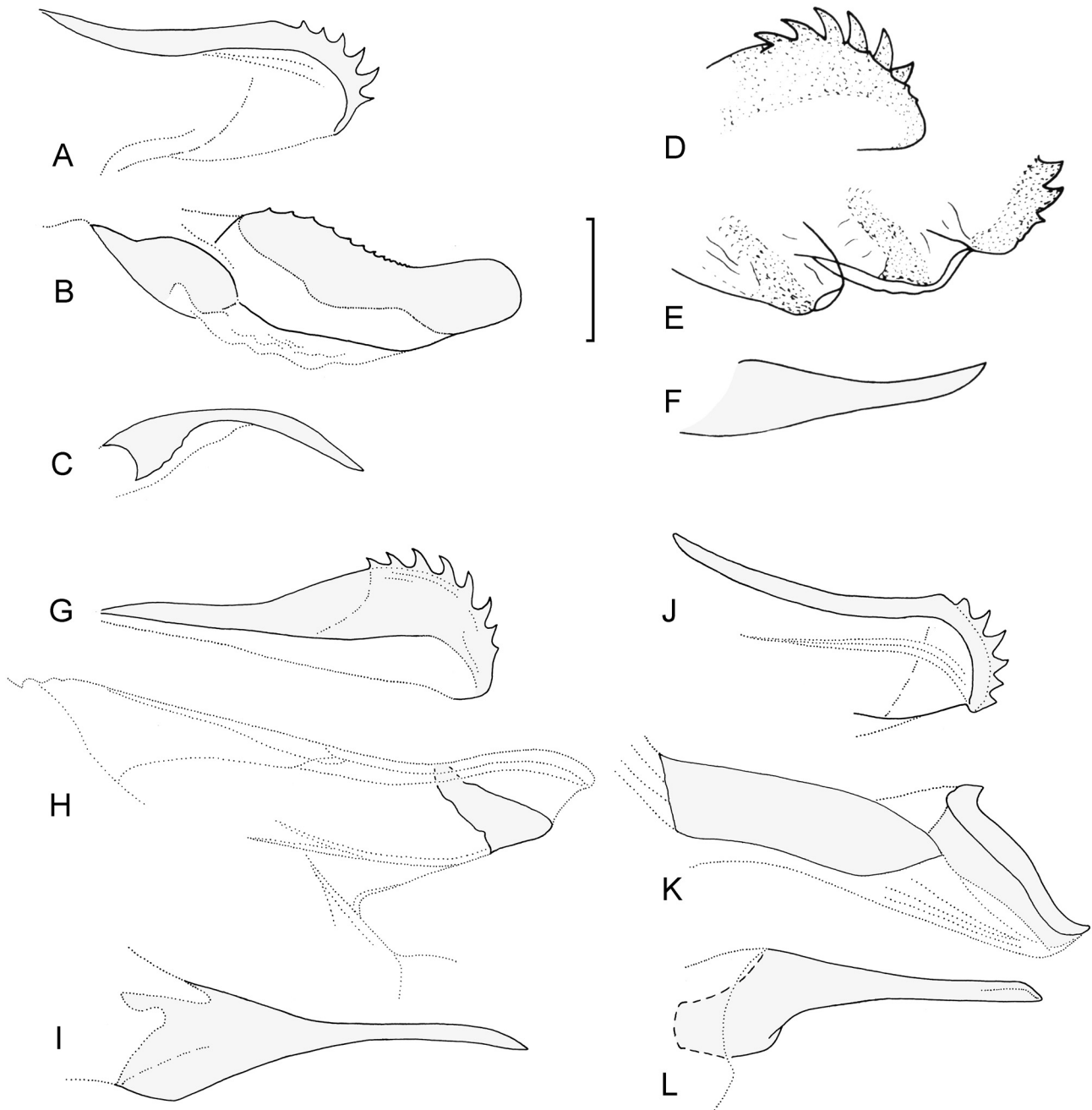


Fig. 6. Wet preparations of conjunctival lobes of *Exosehirus* species. A–C – *E. validus* (Jakovlev, 1877); D–F – *E. sargon* Linnavuori, 1984; G–I – *E. elamensis* sp. nov.; J–L – *E. essedonius* sp. nov. Ventrolateral lobe (A, D, G, J); dorsolateral lobe (B, E, H, K); dorsoapical lobe (C, F, I, L). Scale bar: 0.14 mm. D–F after LINNAVUORI (1984).

Vesica complex [see the note below], lying on ventral wall of extreme apex of conjunctiva and separated from its walls by narrow depression formed by fold of conjunctival wall protruding inward; this fold attached to basal part of ejaculatory reservoir ventrally by short articular sclerites. Main part of vesica rather long, with membranous or partially weakly sclerotised walls, tapering apically and directed ventrad, on distal part sharply narrowing as a short or long filament (very long in *E. marginatus*).

**Note on the structure of the vesica.** The part of aedeagus that looks like a vesica actually has a complex structure (partly described in GAPON 2018). Since this structure has membranous or weakly sclerotised walls, the sclerotised

efferent duct and also some longitudinal membranous walls are visible internally (Fig. 7). These walls are a fold of the dorsal wall of the conjunctiva, which is protruded deep into the “vesica”. This internal fold is arcuate in section and covers the basal part of the efferent duct from the dorsal and lateral sides. The internal fold is accreted to the efferent duct by the distal margin, and to internal surfaces of the walls of the “vesica” by the lateral margins; the dorsal surface of this fold is weakly sclerotised and also is accreted on basal part to the membranous wall of the “vesica”. Since the place of fusion of the conjunctival wall with the efferent duct on the dorsal side is far displaced distally from such place on the ventral side, the part of the

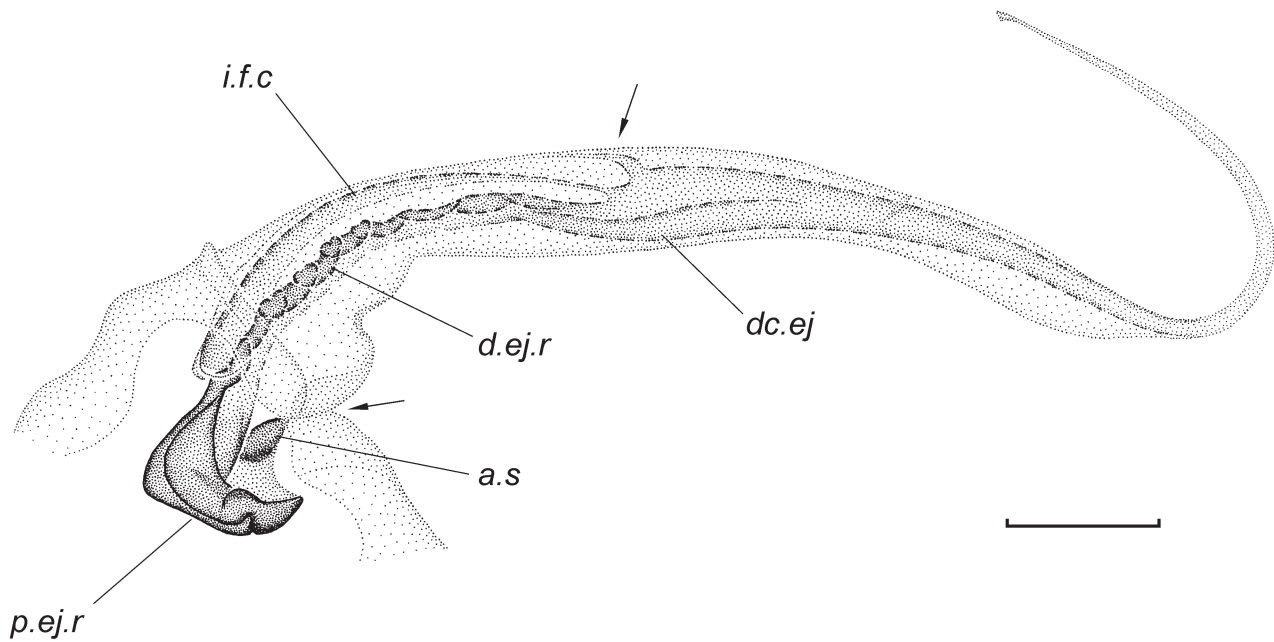


Fig. 7. Vesica of *Exosehirus elamensis* sp. nov., lateral view. Abbreviations: *a.s* – articular sclerites; *d.ej.r* – distal part of ejaculatory reservoir; *dc.ej* – ductus ejaculatorius; *i.f.c* – internal fold of wall of conjunctiva; *p.ej.r* – proximal part of ejaculatory reservoir. Border between conjunctiva and vesica shown by arrows. Scale bar: 0.14 mm.

efferent duct between these places of the fusion (marked with arrows at Fig. 7), looking as a ductus ejaculatorius, actually is the distal part of the ejaculatory reservoir. A probe can be easily inserted from the cavity of the conjunctiva into the “vesica” ventrolaterally and between the internal fold and dorsal wall of the ejaculatory reservoir. A probe can be inserted into the “vesica” from the dorsal side with some difficulty up to the place where the internal fold is accreted to the wall of the “vesica”. The proximal part of ejaculatory reservoir is rather thin, with membranous ventral and sclerotised, convoluted dorsal wall. The true ductus ejaculatorius arising distal to the place where the internal fold is accreted with the efferent duct is wide, gradually tapering towards the apex and has smooth walls throughout. The external wall of the conjunctiva is accreted to the ductus ejaculatorius dorsally at its extreme base. The complex structure described above, which includes the true vesica and part of the conjunctiva, could be called “conjunctivesica”, but for simplicity, I use the term “vesica” for it in the remaining parts of the article.

I could not locate the morphologically pronounced secondary gonopore, but I speculate that it is located at the distal end of the distal filiform part of the “vesica”, which is not a processus gonopori or titillator.

**Female terminalia** (Figs 12–17). In dry specimens, paratergites VIII merged without distinct suture, rather long medially, smooth, with fine punctures. Paratergites IX smooth, finely punctured, shaped as nearly equilateral triangles, with slightly longer lateral margin than mesal one, and with rounded posterior angle. Posterior limb of gonangulum in form of weakly sclerotised plate fused by its posterior margin with anterior margin of paratergite IX, and by mesal angle connected with margin of

gonocoxite II, widening laterad, not reaching lateral angle of paratergite IX, at rest located under posterior margin of gonocoxite I. Anterior limb of gonangulum elongated, more or less long. Ventral surfaces of gonocoxites I convex, longitudinally rugose, with fine punctures. Posterior margin of each gonocoxite I curved dorsad near mesal angles; anterior margin forming rather large triangular, weakly sclerotised projection extending under posterior margin of ventrite VII. Small rhomboid mesal parts of gonocoxites II visible between paratergites IX and gonocoxites I. Highly sclerotised operculum of proctiger transverse, with slightly convex, almost straight posterior margin, and strongly convex, almost semicircular anterior one. Gonocoxites II rather slightly sclerotised, transverse, wide, long in mesal area; their mesal margins straight, posterolateral angles elongated into triangular processes continuing in form of long sclerotised bands under paratergites IX. Lateral parts of gonocoxites II directed laterally and dorsally, narrow and long or short (in *E. marginatus*), their lateral ends attached to ventral surfaces of posterolateral corners of posterior part of gynatrial sac.

Posterior intervalvular membrane wide, long; its anterior margin medially with narrowly triangular projection (anterior parts of ring sclerites located on sides of this projection). Ventral surface of posterior intervalvular membrane with wide transverse fold directed posteriad and adjacent to wall of posterior intervalvular membrane; laterally, this fold passing into posterior margins of gonapophyses II. Each gonapophysis II wide, long, with narrowly triangular, rather long apex; its ventral wall with large, slightly sclerotised transverse area along anterior margin. Anterior margins of gonapophyses II reinforced with very thin second rami extended posteriad and merged

there with lateral ends of gonocoxites II. Gonapophyses I entirely membranous, transverse, with pointed apices and with posterior surfaces reinforced by anterior ends of first rami; those being slightly wider than second rami, extended posteriorly and connected to anterior limb of gonangulum (except for *E. marginatus*). Olistheter present; in normal state, rhachis of each second ramus clamped in aulax (groove at inner margin of first ramus). Only in *E. marginatus*, vestibulum with a pair of pouches formed by transverse fold of posterior intervalvular membrane.

Gynatrial sac large, membranous, somewhat flattened dorsoventrally, conditionally subdivided into two parts. Anterior part looking like capacious, thin-walled receptacle. Its dorsal wall with transverse fold curved posteriorly and extending to lateral walls of sac, and with two arcuate sclerites lying medially under this fold in frontal plane; those being contiguous dorsally, widely spaced ventrally, forming arched structure. Gynatrial cone adjacent to these sclerites posteriorly, having the form of transverse or longitudinal (in *E. marginatus*) flattened pouch with thickened membranous walls varying in shape and size in different species of genus. Anteriorly, gynatrial cone extended as narrow membranous fornix continuing under arcuate sclerites. Spermathecal duct consisting of three or two (in *E. marginatus*) parts. Spermathecal pump normally developed, with rather equal flanges or with somewhat reduced proximal flange. Capsule of spermatheca entirely sclerotised, consisting of long, tubular proximal and spherical distal parts, without any processes. Posterior part of gynatrial sac short, transverse, posteriorly forming two wide pouches with rounded posterior margins; these margins and ventral wall of gynatrial sac reinforced with large separate ring sclerites with rather thin margins.

**Notes on functional morphology.** Based on the structure of male and female terminalia, the following scheme of their functioning can be assumed. In all species of the genus except for *E. marginatus*, the ventrolateral lobes of the conjunctiva during copulation hook onto the gonapophyses I; the dorsolateral lobes enter the posterior pouches of the gynatrial sac; and the dorsoapical lobes and vesica enter the gynatrial cone. In *E. validus*, the spicules of the dorsoapical lobes penetrate into the pouches of the gynatrial cone, while the same spicules of other species enter the grooved canals inside it. The total length of the spermathecal duct correlates with the length of the vesica, including its terminal filamentary part, and the length of the middle (proximal in *E. marginatus*) part of the spermathecal duct correlates with the length of the proximal expanded part of the vesica. It can be concluded that the entire vesica penetrates into the spermathecal duct, and possibly the terminal filamentary part of the vesica penetrates up to the spherical part of the spermathecal capsule. In *E. marginatus*, the ventrolateral lobes perform the function of directing the vesica; the dorsolateral lobes hook onto the gonapophyses II (ventral pouches of gynatrium); the dorsoapical lobes enter the posterior pouches of the gynatrial sac (the shape of the pouches corresponds to the shape of these lobes and their sclerites); the spicules reinforcing the base of the vesica enter jointly into the short gynatrial cone.

**Composition.** The genus includes five species: *E. elamensis* sp. nov., *E. essedonius* sp. nov., *E. marginatus* (Signoret, 1881) [type species], *E. sargon* Linnavuori, 1984 and *E. validus* (Jakovlev, 1877). *Exosehirus steini* (Signoret, 1884) is considered here as a *nomen dubium*, and I suggest it should be excluded from the genus. The reasons for this decision are given below. *Exosehirus validus*, *E. elamensis*, *E. essedonius* and apparently *E. sargon* are very poorly distinguished by characters of external morphology. Even those that look distinctive in the majority, vary in some specimens and overlap with characters of other species; in particular, these include the intensity of the dark colour and shine of the body, the shape and length of the preocular part of the head, punctuation and sculpture of the dorsum, etc. Only the shape and proportions of the pronotum seem to distinguish these species. Nonetheless, they differ very well in the structure of the aedeagus and gynatrial sac (unfortunately, the latter is unknown for *E. sargon*).

*Exosehirus marginatus* is very different from other species of the genus in a number of characters of the general appearance and the structure of terminalia in both sexes, but nevertheless this species also has similarities with its congeners (broadly rounded anterior margin of the head; absence of light stripes at the anterolateral margins of the pronotum and the presence of such stripes on the lateral margins of coria; filamentous distal end of the vesica, sclerites on the conjunctival dorsolateral lobes like in *E. essedonius* sp. nov.; very narrow lateral ends of gonocoxites II, paired arcuate sclerites anterior to the gynatrial cone, ring sclerites reinforcing the posterior margins of pouches of the posterior part of gynatrial sac, and other characters), which allow the inclusion of this species to *Exosehirus*.

### *Exosehirus validus* (Jakovlev, 1877)

(Figs 2A, 3A, G, L, 4A, F, G, H, 5A, B, 6A–C, 8, 12, 13)

*Gnathoconus validus* Jakovlev, 1877: 76; PUTON (1886: 9); OSHANIN (1906: 19, 1910: 5).

*Legnotus validus*: HOBERLANDT (1961: 199); PUTSHKOV (1965: 55).

*Exosehirus validus*: WAGNER (1963: 107); LIS (1999: 223; 2006: 142).

**Type material.** HOLOTYPE: ♀ [mounted on short rectangle], “[golden square] // 354 [pink circle with numbers] // [golden circle] // “Shaku [IRAN, GOLESTAN PROV., Shahkuh Range near Shahrud, 36°30′00.9″N 54°24′21.3″E]” // “soli... [illegible handwriting; probably “solitarius”]” // “k. V. Yakovleva [coll. of B. Jakovlev]” // “Gnathoconus / validus Jak. / B. Jakowlew det. // Holotypus [red rectangle]” (ZISP).

**Additional material examined** (all in ZISP). Without exact locality, “A. Gekk”, date unknown, coll. B. Jakovlev, 1\* ♂. **KAZAKHSTAN: TURKESTAN PROV.:** “st.[ation] Arys” [Arys Town, 42°25′60.0″N 68°48′00.0″E], 20.iv.1938, F. Lukjanovitch, 1\* ♂. **UZBEKISTAN: NAVOI PROV.:** Khatyrchi Distr.: Yargak near “Khatyrchi [Yangirabad]”, 19,20.vi.1929, L. Zimin leg., 2 ♂♂, 1 ♂; Changir near “Khatyrchi [Yangirabad]”, 40°06′00.0″N 65°56′00.0″E, 15.vi.1930, 4\*+39 ♂♂, 3\*+37 ♀♀, 28.iv.1930, 1 ♂, L. Zimin leg. **KASHKADAR’INSKAYA PROV.:** Guzar Distr.: Guzar, 38°35′13.4″N 66°17′01.8″E, 7.vii.1929, Elizarova, 1 ♀; Kammashi, 38°48′34.6″N 66°28′52.9″E, 27.vi.1930, 5.vii.1931, V. Gussakovskij leg., 1\*+1 ♂♂, 1 ♀; Kamchashi, NE of Guzar, c. 38°47′29.5″N 66°29′15.1″E, 30.vi.1932, V. Gussakovskij leg., 2\*+1 ♂♂. **SAMARKAND PROV.:** environs of Samarkand, date unknown, L. Barshchevskiy leg., 1 ♀; Samarkand, 5.iv.1921, Z. Ivanova leg., 1\* ♂. **SURKHANDAR’INSKAYA PROV.:** Termez, 37°15′43.1″N 67°19′08.7″E, 18.v.1912, A-r Kiritshenko, 1 ♀, 1912, M. Siyazov leg., 1\* ♀. **TASHKENT PROV.:** Tashkent, vii.1912, Seslavin leg., 1 ♀; Yangiyul’ Distr., Yangiyul’ near Tashkent, 41°05′44.5″N 69°04′14.5″E, 2.iv.1940,

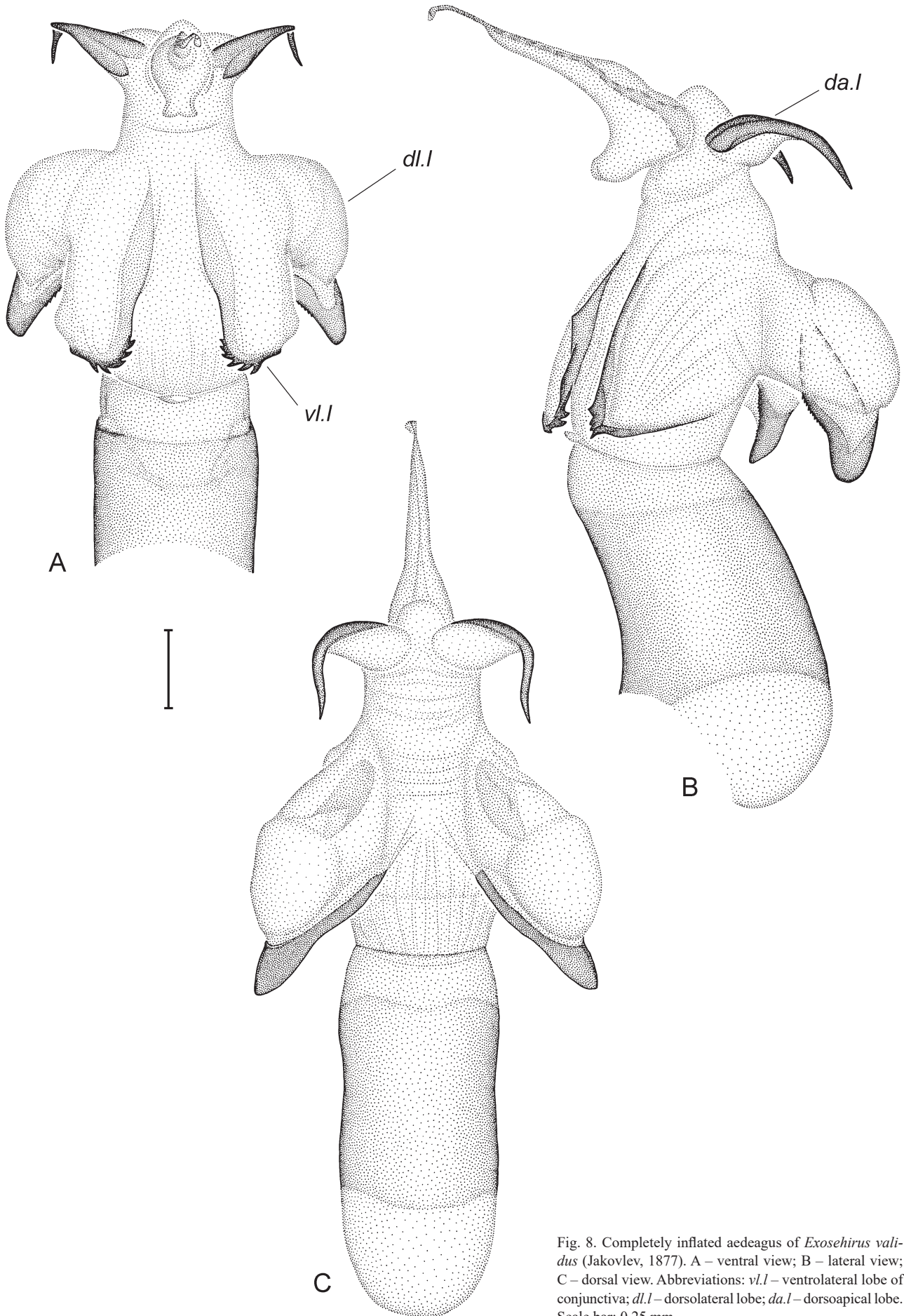


Fig. 8. Completely inflated aedeagus of *Exosehirus validus* (Jakovlev, 1877). A – ventral view; B – lateral view; C – dorsal view. Abbreviations: *vl.l* – ventrolateral lobe of conjunctiva; *dl.l* – dorsolateral lobe; *da.l* – dorsoapical lobe. Scale bar: 0.25 mm.

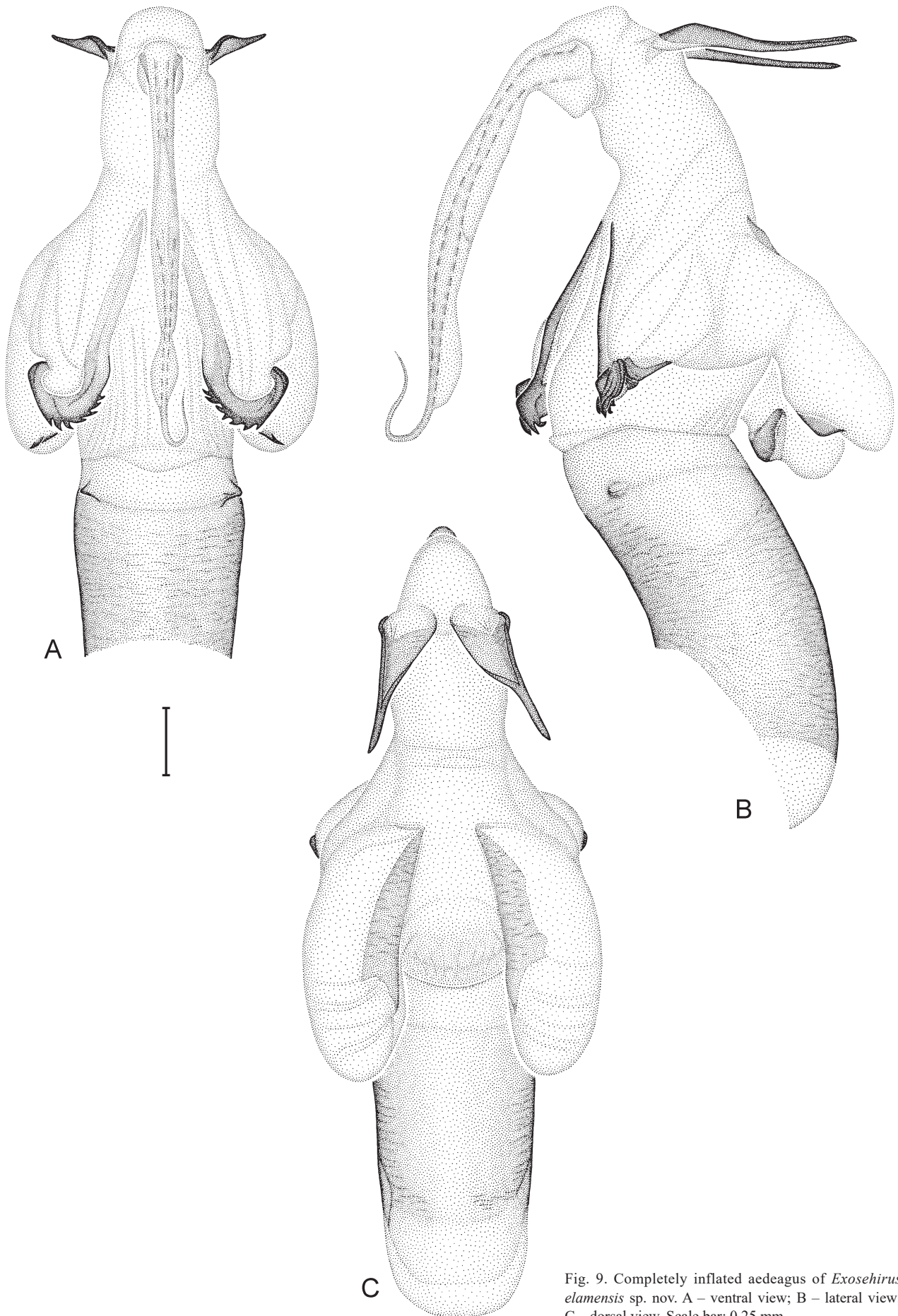


Fig. 9. Completely inflated aedeagus of *Exosehirus elamensis* sp. nov. A – ventral view; B – lateral view; C – dorsal view. Scale bar: 0.25 mm.

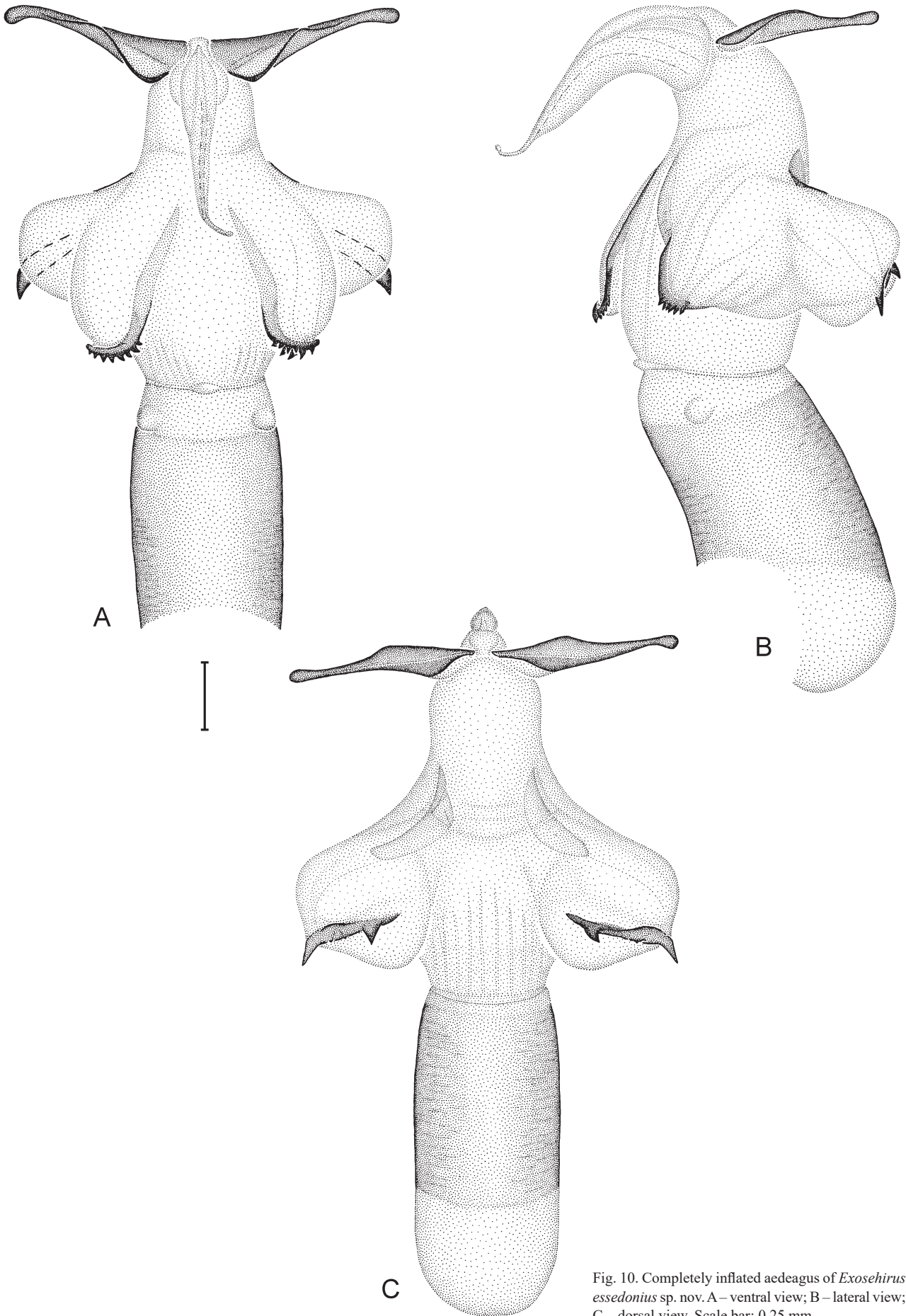


Fig. 10. Completely inflated aedeagus of *Exosehirus essedonius* sp. nov. A – ventral view; B – lateral view; C – dorsal view. Scale bar: 0.25 mm.

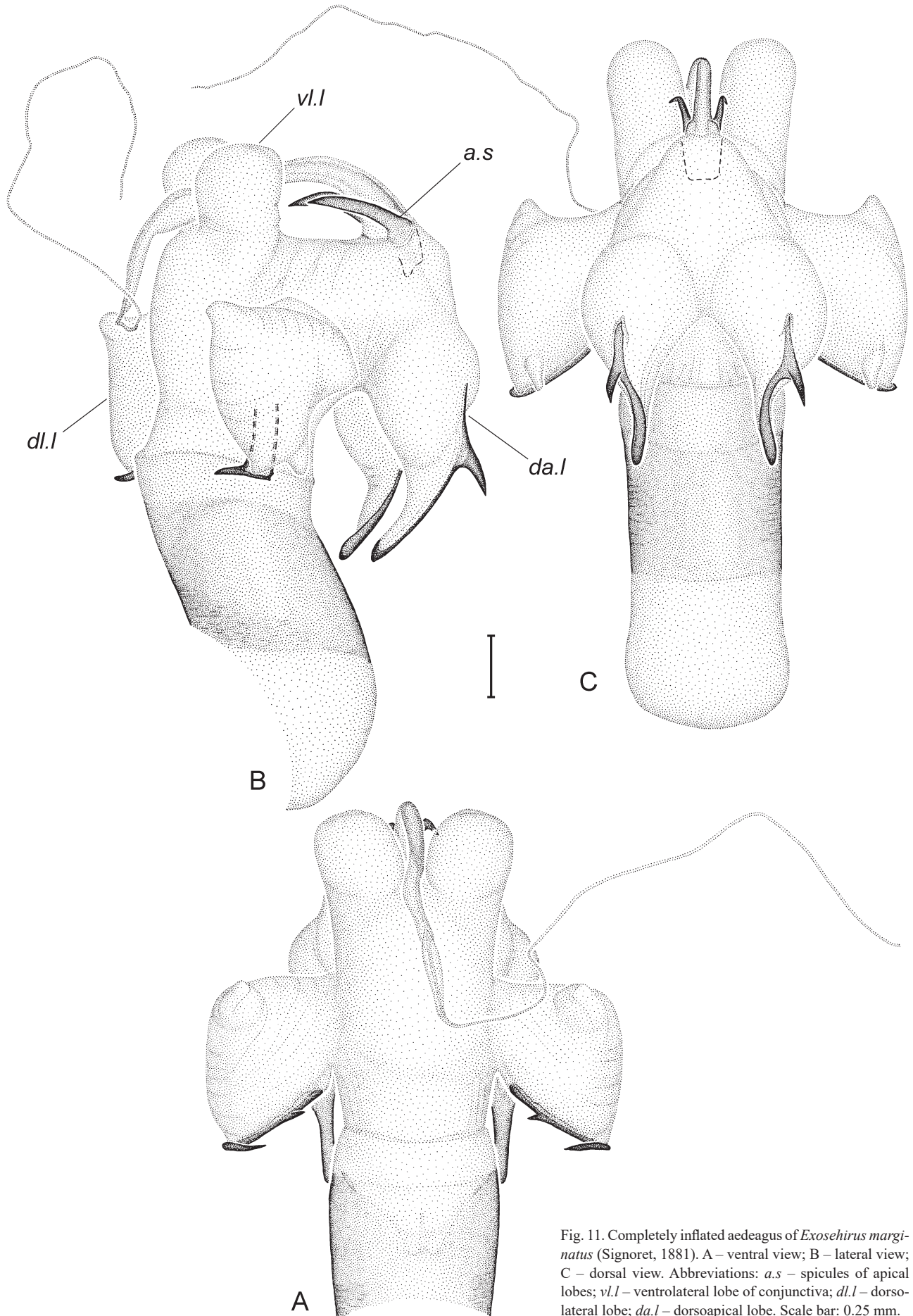


Fig. 11. Completely inflated aedeagus of *Exosehirus marginatus* (Signoret, 1881). A – ventral view; B – lateral view; C – dorsal view. Abbreviations: *a.s* – spicules of apical lobes; *vl.l* – ventrolateral lobe of conjunctiva; *dl.l* – dorso-lateral lobe; *da.l* – dorsoapical lobe. Scale bar: 0.25 mm.



Chirkun leg., 2 ♀♀. **ANDIZHAN PROV.:** Pakhtaabad Distr., “Fergana, Ispaskan [Izboskan]”, 41°01'56.0"N 72°20'27.9"E, 12.vi.1913, A-r Kiritshenko, 1\* ♀. **TURKMENISTAN: BALKAN PROV.:** “Kizyl-Arvat [Serdar]” Town, 38°58'00.0"N 56°16'00.0"E, 11.vi.1953, O. Kryzhanovskij leg., 1 ♂, 1\*+1 ♀♀, 13.iv.1953, E. Arens, 1 ♂; Kopet Dag, 15 km S Iskander station, 38°56'29.4"N 55°55'42.9"E, 13.vi.1953, O. Kryzhanovskij leg., 1 ♀; foothills of N slope of Syunt-Khasardag Range, 38°34'58.7"N 56°26'12.3"E, 17.v.1956, G. Medvedev leg., 1 ♀; Parhay gorge, 38°28'50.4"N 56°14'57.8"E, 25.v.1981, A. Gorochov, 1\* ♂, 2 ♀♀. **ASHKHABAD:** 11.vi.1928, V. Gussakovskij leg., 2 ♀♀, 11.iv.1930, Shul'... [illegible handwriting], 1 ♀, 29.v.1934, V. Popov leg., 1 ♀; Archabil Distr. of Ashkhabad, Firyuza Settln., 37°54'49.8"N 58°05'26.3"E, 21.v.1972, V. Golub leg., 1\* ♀. **LEBAP PROV.:** Repetek railway station, 38°33'45.0"N 63°10'37.9"E, 18.iii.1958, G. Medvedev leg., 1\* ♀, 8.vi.1981, at light, S. Podlipaev, 1 ♀, 1 specimen of unknown sex. **MARY PROV.:** Bayramali Town, 37°37'00.0"N 62°09'00.0"E, 10–11.viii.1930, Bogush leg., 1\* ♂; Badkhyz, 12 km W of Kala-i-Mor station, 35°39'19.9"N 62°25'22.9"E, 9,17.iv.1957, G. Medvedev, 1\* ♂, 1 ♀. **TAJIKISTAN: SOGDIYSKAYA PROV.:** Kanibadam Town, 40°16'60.0"N 70°25'00.0"E, 15.vi.1913, Minkevits leg., 1\* ♂. **IRAN: GOLESTAN PROV.:** Shahkuh Range near Shahrud, 36°30'00.9"N 54°24'21.3"E, 5.vii.1914, A-r Kiritshenko, 1\* ♂. **SISTAN AND BALUCHESTAN PROV.:** Taftan volcano, 28°36'00.0"N 61°07'57.0"E, 13.v.1901, A. Zarudny, 1\* ♂, 1\* ♀.

**Note.** HOBERLANDT (1961) redescribed the external morphology of this species; for this reason, and because the external structure of the species almost completely corresponds to the description of the genus, I provide here only diagnostic characters necessary for comparison with other species of the genus and provide the first description of the male and female terminalia.

**Diagnosis.** Body usually dark brown, with dull sheen, but head, pronotum and scutellum in some specimens blackish, hemelytra blackish-brown, less often entire dorsum almost black; some specimens with fairly strong sheen. Punctuation on body as a whole slightly smaller than in other congeners, sometimes punctures rather large and deep. Pale stripes on lateral margins of hemelytra broad anteriorly, narrow in posterior about two-thirds or two-fifths, almost always reaching posterior margins of coria (Fig. 2A). Posterior part of each stripe relatively wide like in *E. essedonius* sp. nov. or extremely narrow, disappearing like in *E. elamensis* sp. nov. Eyes relatively large. Preocular part of head usually rather smoothly rounded (Fig. 3A). Anterolateral margins of pronotum moderately diverging posteriad (Fig. 3G). Apex of scutellum narrower than in *E. marginatus*. Peritreme of metathoracic scent glands slightly widened on mesal part. Evaporatorium with only several scattered punctures (Fig. 3L).

**Pygophore** (Figs 4A, F). Notch in middle of posteroventral margin of pygophore slightly deeper and wider than in other congeners. Posterodorsal margin and mesal parts of posterolateral margins of pygophore and dorsal infolding along midline narrowly desclerotised. Dorsal infolding without depressions. Narrow depressed areas of lateral infoldings near margin of genital opening shallower than in *E. marginatus* and strongly sclerotised. Genital opening with very weak paramere sockets.

**Parameres** (Figs 4G, H). Posterior margin of paramere corpus relatively deeply concave. Dorsal wall of paramere corpus at base of hypophysis with longitudinal, strongly sclerotised tubercle (clearly visible dorsally, especially so from ventral side). Hypophysis long; its extreme apex strongly narrowed and curved anteriorly, sharp.

**Aedeagus** (Figs 5A, B, 6 A–C, 8). Ventrolateral walls of theca with a pair of small conical tubercles at border of sclerotised and narrow apical membranous parts of walls. Ventral side of apical thecal margin medially with a small transverse membranous tubercle.

Conjunctiva slightly shorter than theca and phallobase combined, tapering apically, slightly curved ventrally. Basal part of conjunctiva wide, long; apical part narrow, short. Basal part of conjunctiva ventrally with ventrolateral lobes; their bases very wide, long, occupying most of ventral and lateral walls of basal part of conjunctiva. On ventral side, these lobes rather wide, with rounded apices, bordered by thin, highly sclerotised band with denticles directed inward; mesal margins of lobes with wider, smooth, slightly less sclerotised band nearly reaching base of apical part of conjunctiva; both left and right bands slightly converging and tapering towards apex of conjunctiva. In lateral view, ventrolateral lobes triangularly tapering, directed ventrally and towards base of conjunctiva; anterior (facing base of conjunctiva) wall of each lobe with thin sclerotised band passing into serrate band bordering apex of lobe. Dorsolateral lobes located distally on basal part of conjunctiva, rather long, finger-shaped, curved, directed anteriorly (towards base of conjunctiva) and slightly outward. Mesal wall of each lobe with longitudinal, long, wide sclerite protruding far beyond apex of lobe; dorsal surface and mesal margin of each sclerite covered with extremely small denticles; apex of sclerite broadly rounded. Dorsomesal wall of each dorsolateral lobe basally with short, wide, weakly sclerotised band, strongly narrowing proximally, dilating distally. Dorsoapical lobes lying on dorsolateral walls of apical part of conjunctiva subapically. Membranous parts of these lobes short, conical, directed dorsolaterally; posterior (facing apex of conjunctiva) wall of each lobe with spicule, that being long, thin strongly curved in middle, directed anteriorly (to base of conjunctiva) and dorsally; apices of both spicules almost parallel. Vesica lying on ventral wall of apical part of conjunctiva distal to bases of dorsoapical lobes. Its walls membranous, ventral wall at base with membranous tubercle having rectangular shape in ventral view, located at acute angle to conjunctival wall. Vesica gradually narrowing apically; its extreme apex elongated into short filament.

**Female terminalia** (Figs 12, 13). Notch of posterior margin of sternite VII parabolic, slightly tapering anteriorly. Common posterior margin of paratergites VIII slightly convex in middle, without notch. Paratergites IX large. Anterior limb of gonangulum long, very thin anteriorly. Gonocoxites I with straight posterior margins lying in one line, with acute, non-rounded lateral angles; their ventral surfaces weakly, evenly convex, finely rugose, without rib along mesal margins. Mesal parts of gonocoxites II relatively narrow, longer than their width, with sharp, long anteromesal angles; lateral parts thin, very long, slightly widened at extreme lateral ends, those being not curved inward.

Posterior intervalvular membrane very long; transverse fold on its ventral surface located behind its anterior margin, with middle part forming long wide triangular projection directed posteriorly. Gonapophyses II overlying

and almost completely covering posterior intervalvular membrane; their posterior margins concave, anterior margins straight laterally, strongly convex mesally, mesal margins straight, posteriomasal angles elongate into acute apices directed posteromesad. Gonapophyses I wide, with contiguous, short, triangular apices; their ventral margins armed with thin sclerotised band with lateral end being connected to anterior angle gonocoxite I. Posterior ends of first rami fused with anterior limbs of gonangula; inner margin of each first ramus with thin groove clamping second ramus along its entire length.

Anterior part of gynatrial sac large, with convex anterior and lateral margins, tapering posteriorly, there its lateral margins almost straight. Arcuate sclerites reinforcing base of gynatrial cone relatively small, narrow, without lamellar outgrowths. Gynatrial cone posteriorly transverse, short, wide, with two wide triangular pouches on sides; dorsal margin of each pouch posteriorly with small rounded projection; anterior part of gynatrial cone longitudinal, short, narrow, tapering conically distad. Spermatheca attached to gynatrial cone at its apex. Proximal part of spermathecal duct relatively short, wide, widening towards middle, with annular folds on usually weakly sclerotised walls; middle part longest, slightly protruding beyond anterior margin of gynatrial sac, with membranous thickened walls; distal part very narrow, rather longer than proximal part of duct, with membranous thin walls. Proximal convoluted part of spermathecal capsule relatively short, several times longer than diameter of spherical part. Dorsal wall of posterior part of gynatrial sac flat, with deep transverse fold extending along its entire width, lying at posterior margin of sac medially and at bases of its posterior pouches laterally, having obtuse margin directed anteriorly, overlying dorsal wall of sac. Posterior pouches located rather close to each other, their posterior margins rounded, without membranous protrusion on mesal part, slightly concave on lateral part.

**Measurements** (n = 12; mm). **Body**: length 4.25–5.75, width 2.60–3.35; ratio body length / pronotum width 1.78–1.98; **head**: length 0.90–1.12, width 1.08–1.36, ratio width / length 1.20–1.29; **synthlipsis** 0.70–0.87; **ocular index** 3.31–3.70; length of antennal segments I–V: 0.22–0.32 : 0.31–0.43 : 0.29–0.41 : 0.45–0.59 : 0.59–0.67; **pronotum**: length 1.10–1.53, width 2.33–3.03, ratio width / length 1.97–2.11; **scutellum**: length 1.78–2.40, width 1.53–2.05, ratio length / width 1.13–1.19.

**Variability**. In two examined females from Turkmenistan (Kyzyl-Arvat and Repetek), the margins of the ring sclerites are very wide and the middle part of the spermathecal duct is weakly sclerotised; one of them has the pouches of gynatrial cone with internal areas of sclerotisation; in another specimen, the middle part of the spermathecal duct is somewhat shortened and slightly widening in the middle.

**Bionomics**. According to PUTSHKOV (1965), the species lives on *Krascheninnikovia ceratoides*, less often on *Atriplex cana* (both from Amaranthaceae), although this data may refer to *E. essedonius* sp. nov.

**Distribution** (Fig. 1). Afghanistan (HOBERLANDT 1961: Puli Khumri), northern Iran (type locality; MODARRES

AWAL 2008: Khorasan Razavi Province, Shirvan), southern Kazakhstan, Kirgizia (OSHANIN 1910: Osh; PUTSHKOV 1965: Fergana Range, Chatkal Range), Tajikistan (OSHANIN 1910: “Ura-Tyube” [Istaravshan]; KIRITSHENKO 1964: “Kshtut” [tributary of Zeravshan River]), Turkmenistan (PUTSHKOV 1965), Uzbekistan (OSHANIN 1910: Andizhan, Dzhezak; KIRITSHENKO 1964: Tashkent, Changir near “Khatyrchi [Yangirabad]”, Samarkand, Guzar, Yargak, Ispaskan [Izboskan], Termez).

The record for northern Iraq (HOBERLANDT 1961) probably concerns *E. sargon*; for Kazakhstani Atyrau Province, Lake Inder (KIRITSHENKO 1954) and Kyzylorda Province, “Yani-Kyrgan” [Zhanakorgan] (OSHANIN 1910), to *E. essedonius* sp. nov. The record for Lorestan Province of Iran (GHAHARI et al. 2009) raise some doubts.

### *Exosehirus sargon* Linnavuori, 1984

(Figs 3B, H, 4B, K, 6D–F)

*Exosehirus sargon* Linnavuori, 1984: 2; LIS (1999: 223; 2006: 142).

**Notes on morphology**. The only known specimen of this species, stored in the American Museum of Natural History, was not available to me for study, and therefore here I list the characters of this species based on the original description.

Body black, very shiny and very convex. Eyes smaller than in *E. validus*, *E. elamensis* sp. nov. and *E. marginatus*; preocular part of head longer and more sharply rounded anteriorly than in other congeners (Fig. 3B). Anterolateral margins of pronotum moderately diverging posteriorly, roundedly curvate, anterolateral angles broadly rounded (Fig. 3H). Disk of pronotum very convex, calli elevated; anterior margin, sides and disk behind calli densely and coarsely punctate. Disc of scutellum densely and strongly punctate and slightly rugose. Elytra densely and distinctly punctate. Pale stripes on lateral margins of hemelytra wide in anterior two-thirds and very narrow posteriorly, reaching posterior margins of coria.

The brief description and drawings of the male terminalia provide little information. Judging by these data, the pygophore (Fig. 4B) has its ventral wall more convex and its posteroventral margin is less broadly notched than in *E. validus* (Fig. 4A) and *E. elamensis* sp. nov. (Fig. 4C). Parameres as in *E. validus* [i.e., probably with tubercle near base of hypophysis]. Vesica (Fig. 4K) very long and curved [assuming that it protrudes strongly from the theca not as a consequence of damage and incomplete retraction of the vesica; it is also important to note that the filiform distal part of the vesica is not shown in the figure]; each ventrolateral lobe (“conjunctival appendage”, probably denoted by the letter e in the original drawing; Fig. 6D) and dorsolateral lobe (“conjunctival appendage”, probably denoted by the letter d; Fig. 6E) with sclerotised denticles on some common sclerotised base. In the latter case, three sharp denticles are depicted, namely two large curved and one small straight one. Spicules of dorsoapical lobes (“aedeagal appendage”; Fig. 6F) straight, wide at base and narrowing distally, with sloping apex, longer than in *E. validus* (Fig. 6C), but probably shorter than in

*E. elamensis* sp. nov. (Fig. 6I) [judging by the size of the figure of the spicule relative to the figures of parts of other conjunctival lobes].

Female terminalia unknown.

**Measurements** (n = 1; mm). Body length 6.75; ratio body length / pronotum width 1.70; ratio head width / head length 1.22; ocular index 3.60; proportions between antennal segments I–V: 8 : 12: 10: 16: 18; ratio width / length c. 2.00; ratio scutellum length / scutellum width 1.20.

**Distribution.** Northern Iraq (LINNAUVUORI 1984).

***Exosehirus elamensis* sp. nov.**

(Figs 2B, 3C, I, 4C, 6G–I, 7, 9, 14)

**Type material.** HOLOTYPE: ♂ [pinned, with dissected terminalia placed in microvessel], “Bushir – Shiraz / yu.-z. Persiya / Sijazov 21–23. V 927 [IRAN, between Bushehr and Shiraz, c. 29°16'31.3"N 51°40'51.1"E, 21–23.v.1927, M.M. Sijazov leg.]” (ZISP). PARATYPES: 2\* ♂♂, 3\*+1 ♀♀, same label as for holotype (ZISP).

**Diagnosis.** In habitus, most similar to *E. sargon*, differing mainly in slightly smaller size and wider body, in narrower scutellum, and, probably, in its less shiny and less dark body [vs. “very shiny” in *E. sargon*; body of this new species slightly shinier and slightly darker than usual in *E. validus* and less shiny than usual in *E. essedonius* sp. nov.], less convex disk of pronotum and calli, larger eyes, more widely rounded preocular part of head. Pale stripe of lateral margins of hemelytra posteriorly extremely narrow, disappearing (Fig. 2B). Preocular part of head usually as in *E. validus*, but slightly less narrowly rounded anteriorly (Fig. 3C). Pronotum with anterolateral margins more widely diverging posteriorly (Fig. 3I) than in *E. validus*, *E. essedonius* sp. nov., *E. marginatus* and slightly more widely diverging than in *E. sargon*. Punctuation usually slightly larger and deeper than usual in *E. validus*. Other characters of habitus as in *E. validus*.

**Pygophore** (Fig. 4C) and **paramere** mostly as in *E. validus*. Median notch of posteroventral margin of pygophore less wide and deep than in *E. validus* and less wide than in *E. essedonius* sp. nov. Dorsal wall of paramere corpus before base of hypophysis without distinct tubercle as in *E. essedonius* sp. nov. (Fig. 4I).

**Aedeagus** (Figs 6G–I, 7, 9) similar to that of *E. validus*. Conjunctiva longer, about as long as theca and phallobase combined. Ventrolateral lobes slightly narrower, with slightly narrower apices bordered by wider band; bands on mesal margins of lobes more convergent; bands on anterior margins of lobes shorter. Dorsolateral lobes slightly longer, becoming wider apically in lateral view, directed anteriorly (towards base of conjunctiva); ventral wall of each lobe before apex with short, narrow transverse sclerite, its lateral rounded margin protruding beyond lateral wall of lobe; any denticles on sclerites absent [vs. *E. sargon* and *E. essedonius* sp. nov.]. Dorsal apical lobes almost completely transformed into spicules, being long, straight, directed dorsally and slightly anteriorly, slightly diverging. In anterior view, each spicule wide at base, gradually tapering distally, with grooved concave surface; apically, spicule very narrow, without depression; in lateral view, spicule narrow throughout, thinning apically, slightly curved; membranous

wall preserved only at extreme base of spicule at anterior side; apex of spicule acute. Vesica (Fig. 7) very long, directed ventrally and anteriorly, parallel to ventral wall of conjunctiva and reaching its base. Membranous tubercle at base of ventral wall trapezoidally rounded, adjacent to conjunctival wall. Walls of proximal part of conjunctiva slightly sclerotised in middle, membranous and slightly swollen just before apex. Distal part of vesica extended into relatively long filament.

**Female terminalia** (Fig. 14) similar to those of *E. validus*. Extreme lateral ends of gonocoxites II curved inward.

Anterior part of gynatrial sac slightly smaller; its lateral walls almost parallel, dorsal wall slightly concave anterior to transverse fold [perhaps this shape is a consequence that the gynatrial sac in the studied females did not fully expand and swelled under the action of osmotic forces when boiling in alkali]. Gynatrial cone about three times as long as in *E. validus*; its posterior part shorter and wider, without pouches on sides, anterior part much longer, more flattened, with a straight [not ventricose vs. *E. essedonius* sp. nov.] posterior wall, with parallel lateral margins in middle, tapering triangularly apically [in one of the two studied females, gynatrial cone is straight (Fig. 14B), in the other female, it is folded twice at the base (Fig. 14A); I do not know which state of this structure is normal]. Spermatheca attached to gynatrial cone at its apex. Proximal part of spermathecal duct slightly wider and longer than in *E. validus*, not narrowed distally; middle part substantially wider, longer (not less than twice), with parallel walls throughout; distal part slightly longer. Margins of ring sclerites slightly wider than that in typical cases in *E. validus*. Posterior pouches spaced apart, with widely rounded posterior margins.

**Measurements** (n = 7; mm). **Body:** length 5.25–6.25, width 3.25–3.93; ratio body length / pronotum width 1.75–1.84; **head:** length 1.05–1.19, width 1.33–1.46; ratio width / length 1.22–1.29; **synthlipsis** 0.85–0.95; **ocular index** 3.54–3.89; length of antennal segments I–V: 0.35–0.42 : 0.43–0.49 : 0.36–0.41 : 0.59–0.67 : 0.71–0.73; **pronotum:** length 1.53–1.75, width 3.00–3.45, ratio width / length 1.94–1.97; **scutellum:** length 2.18–2.58, width 1.95–2.33, ratio length / width 1.09–1.11.

**Etymology.** The species name is an adjective derived from the Sumerian name of the state that existed until the 6th century BC in the territory where the new species was found.

**Distribution** (Fig. 1). Southwest Iran.

***Exosehirus essedonius* sp. nov.**

(Figs 2C, 3D, E, J, 4D, I, 5C, D, 6J–L, 10, 15)

**Type material.** HOLOTYPE: ♂\* [mounted on rectangle, with dissected terminalia placed in microvessel], “Akmol. obl., bereg / oz. Kirey / L. Arnoldi 8.V.1957 g. [KAZAKHSTAN, KARAGANDA PROV., Nura Distr., shore of Lake Kerey, 50°05'15.7"N 68°40'15.7"E] // solonchak na okraine pod vybrosami [edge of salt marsh, under coastal debris] (ZISP). PARATYPES (all in ZISP): Without exact locality: “Sch...” [illegible handwriting; possibly “Shalkar” in Akmola Prov., taking into account the participation of the collector in A. Negri’s trip to Bukhara in 1820, whose route passed near this lake], date unknown, E. Eversmann leg., 1\* ♂. **RUSSIA: IRKUTSK PROV.:** Irkutsk [possibly incorrect labeling], date unknown, B. Jakovlev leg., 1\* ♀. **KAZAKHSTAN: ARKOLA PROV.:** Burabay Distr., Kokshetau

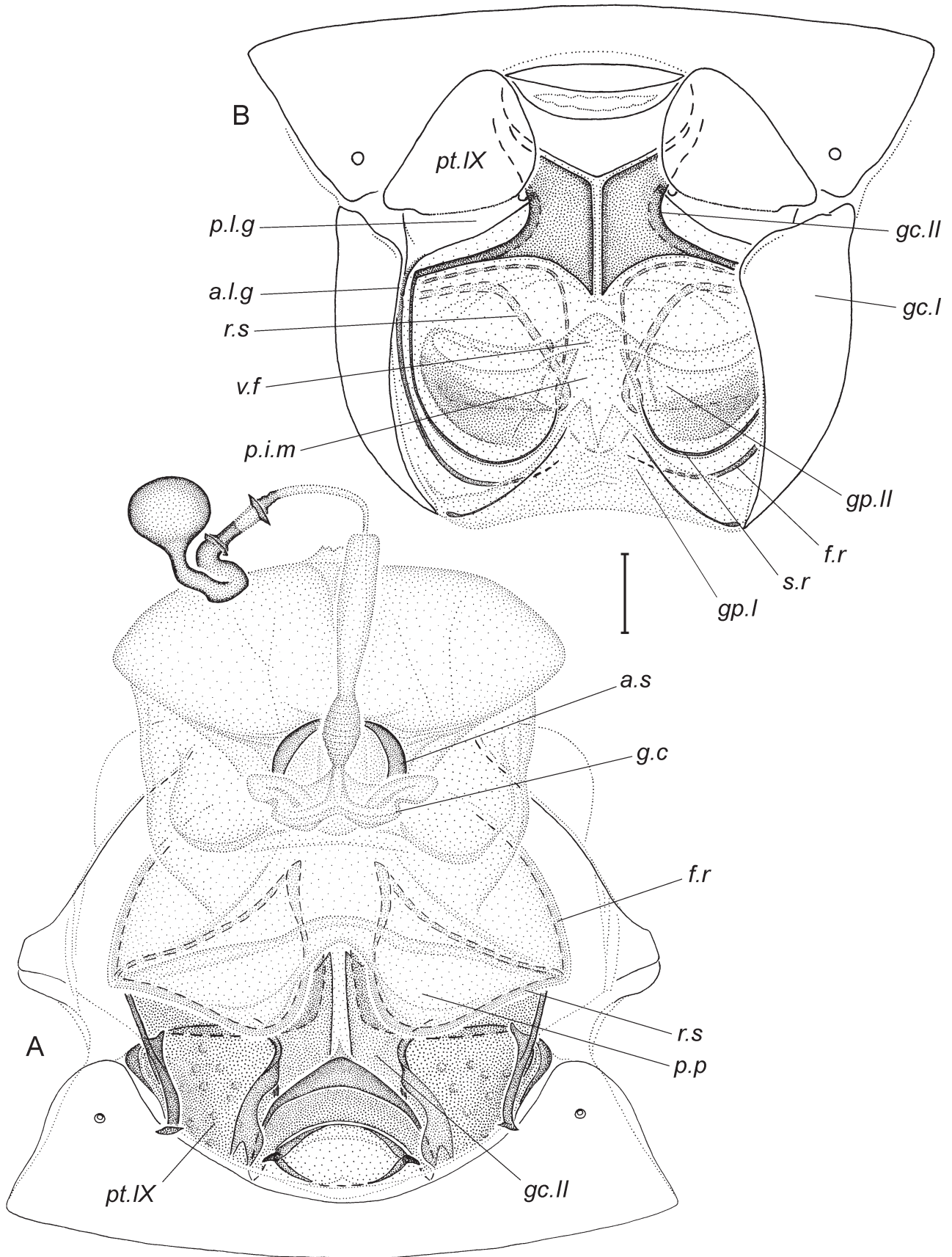


Fig. 12. Female terminalia of *Exosehirus validus* (Jakovlev, 1877). A – dorsal view; B – ventral view. Abbreviations: *a.s* – arcuate sclerites; *a.l.g* – anterior limb of gonangulum; *f.r* – first rami; *g.c* – gynatrial cone; *gc.I* – gonocoxites I; *gc.II* – gonocoxites II; *gp.I* – gonapophyses I; *gp.II* – gonapophyses II; *p.i.m* – posterior intervalvular membrane; *p.l.g* – posterior limb of gonangulum; *p.p* – pouches of posterior part of gynatrial sac; *pt.IX* – patatergites IX; *r.s* – ring sclerites; *s.r* – second rami; *v.f* – ventral fold of posterior intervalvular membrane. Scale bar: 0.25 mm.

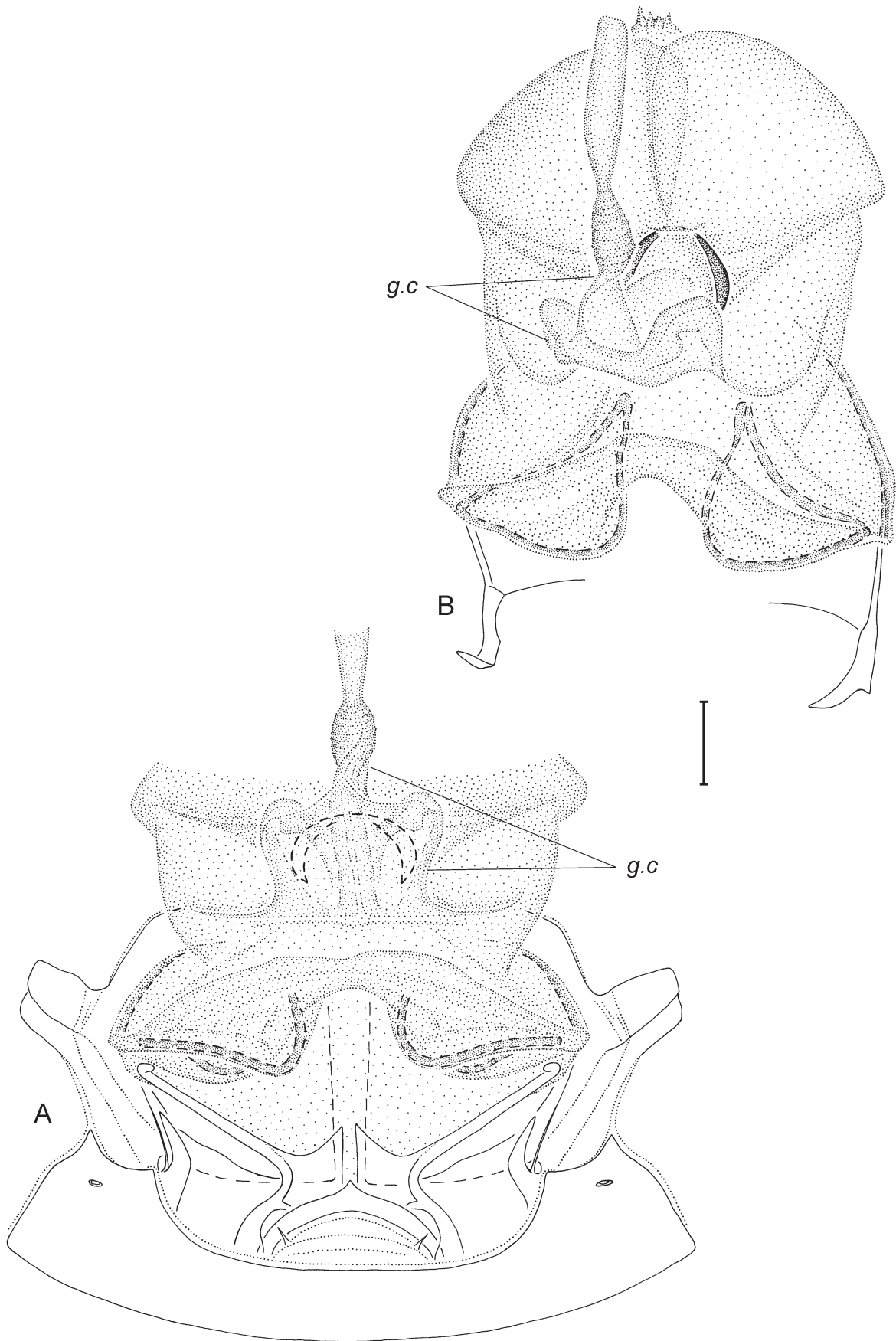


Fig. 13. Posterior part of gynatrial sac of *Exosehirus validus* (Jakovlev, 1877). A – dorsoposterior view; B – dorsolateral view. Abbreviation: *g.c* – gynatrial cone. Scale bar: 0.25 mm.

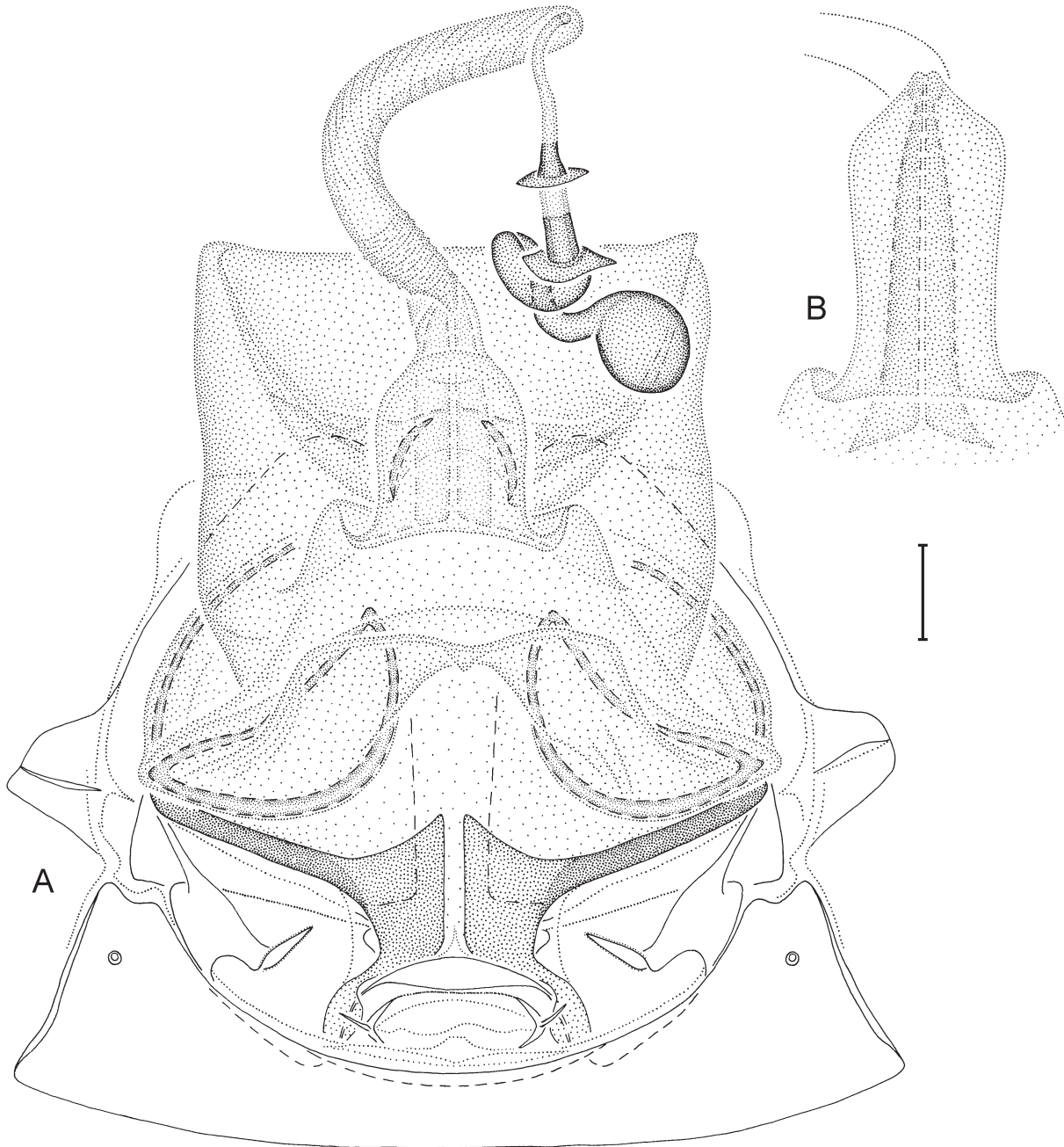


Fig. 14. Female terminalia of *Exosehirus elamensis* sp. nov. A – terminalia in dorsal view (female with folded gynatrial cone); B – straight gynatrial cone of another female, in dorsoposterior view. Scale bar: 0.25 mm.

Mts near Tersakkan River, 53°03'07.2"N 70°08'12.6"E, 31.v.1958, Sokolova leg., 1\* ♀. **KYZYLORDA PROV.:** Aral Distr., N coast of Barsa-Kelmes, former island in the Aral Sea, 45°38'04.2"N 59°52'00.8"E, 1977, collector unknown, 1\* ♀. **KARAGANDA PROV.:** Ulytau Distr.: Dzhezkazgan – Manadyr, c. 48°10'56.6"N 69°08'54.3"E, 31.v.–1.vi.1958, L. Arnoldi leg., 1\* ♂; Karazhar locality, near the confluence of Kara-Kengir and Sarysu Rivers, 47°27'59.6"N 68°00'30.6"E, 27.v.1962, G. Medvedev leg., 1\* ♂; Zhanaarka Distr.: floodplain of Taldy-Manaka [intermittent salt stream], 48°26'52.8"N 71°19'24.7"E, 6.v.1959, I. M. Kerzhner leg., 1\* ♂; Sopka Koksengir S of Zhanaarka railway station, 48°22'17.0"N 71°31'25.0"E, 10.vii.1959, on *Ceratocarpus*, A. F. Emeljanov leg., 1\* ♀, 13.viii.1960, on *Atriplex cana*, I. Kerzhner leg., 1 ♂.

**Additional material examined. KAZAKHSTAN: ALMATY PROV.:** Zhambylskiy Distr., Ak-kul' Lake, 30 km W of "Aulie-ata [Termez]", 7.8.v.1937, F. Lukjanovitsh, 1 ♀ [the specimen is included in this species conditionally, since it lacks the head and genitalia necessary for species identification].

**Diagnosis.** Eyes smaller than in *E. validus*, *E. sargon* and *E. elamensis* sp. nov. (ocular index 4.07–4.69 vs. 3.31–3.89). Preocular part of head usually with more sharply curved lateral margins than in all previous species (Figs 3D, E). Body usually slightly shinier, head, pronotum, and scutellum usually slightly darker than those in *E. validus* and *E. elamensis* sp. nov. Punctuation on pronotum, scutellum, and hemelytra slightly larger and deeper than usual in *E. validus*. Pale stripes on lateral margins of hemelytra posteriorly wider than in *E. elamensis* sp. nov. (Fig. 2C). Pronotum with anterolateral margins less widely diverging posteriorly than in other congeners (Fig. 3J). Other characters of habitus as in *E. validus*.

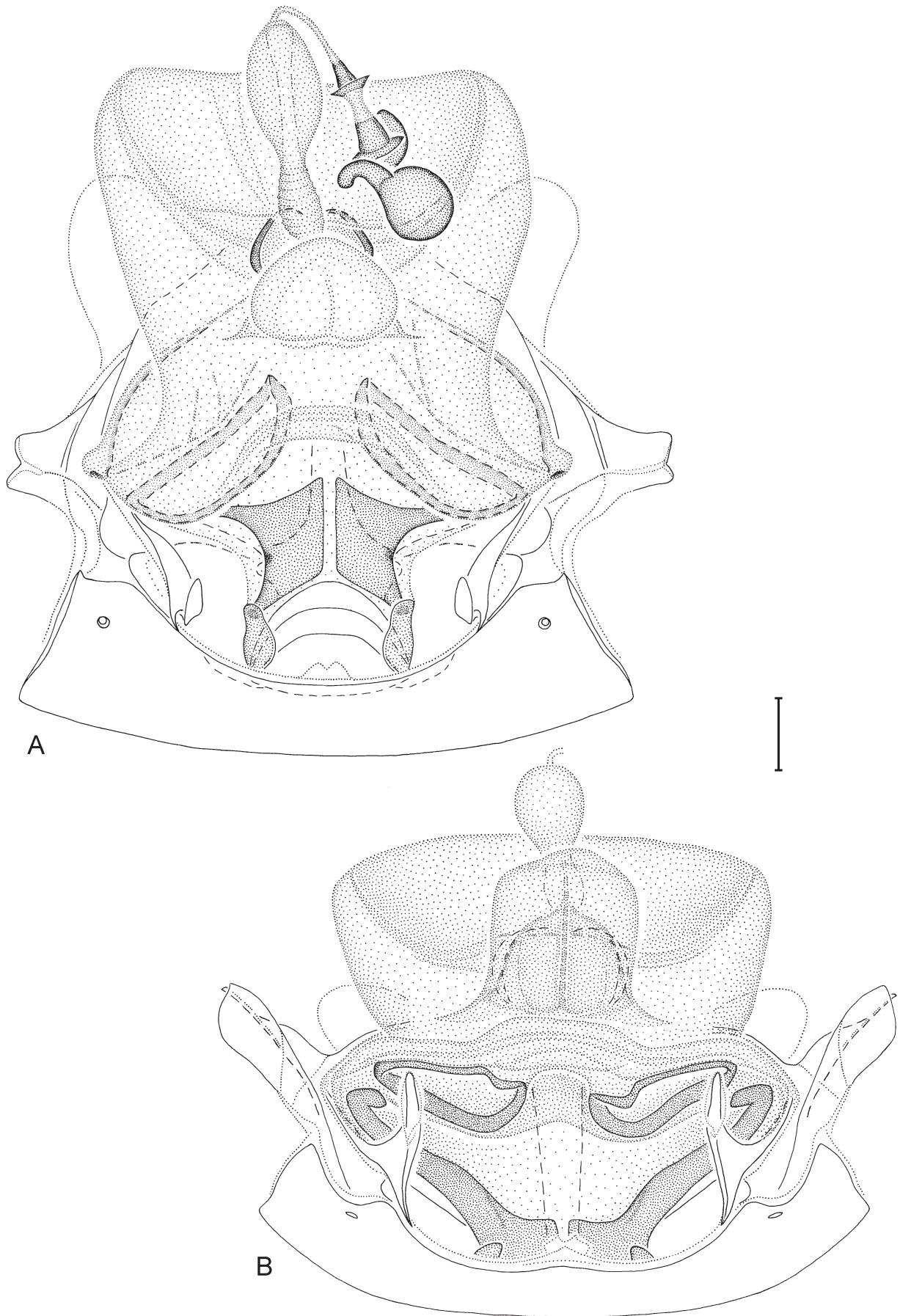


Fig. 15. Female terminalia of *Exosehirus essedonius* sp. nov. A – dorsal view; B – dorsoposterior view. Scale bar: 0.25 mm.

**Pygophore** (Fig. 4D) as in *E. validus* and *E. elamensis* sp. nov. Median notch of posteroventral margin of pygophore slightly wider and deeper than in *E. elamensis* sp. nov.

**Parameres** (Fig. 4I) as in *E. elamensis* sp. nov.

**Aedeagus** (Figs 5C, D, 6J–L, 10) similar to that of *E. validus*. Ventrolateral lobes slightly narrower, with narrower bands at mesal margins. Dorsolateral lobes much shorter, dilated and broadly rounded apically; apex of each lobe ventrally with transverse sclerite bearing rather large denticle at each end, directed anterodorsad. Dorsoapical lobes similar to those of *E. elamensis* sp. nov., but their spicules slightly thicker, much more strongly diverging apically; bases of spicules in anterior view without groove-like impression, their ventral margins convex, dorsal margin almost straight; extreme apex of spicule slightly curved ventrally, pointed in posterior view, and slightly widened and rounded in dorsal view. Vesica as long as in *E. validus*, but much wider at base, without membranous tubercle at base of ventral wall.

**Female terminalia** (Fig. 15) similar to those of *E. validus*. Extreme lateral ends of gonocoxites II curved inward even more than in *E. elamensis* sp. nov. Transverse fold on ventral surface of posterior intervalvular membrane medially very short, not forming triangular projection.

Anterior part of gynatrial sac similar to that of *E. validus*, but arcuate sclerites reinforcing base of gynatrial cone slightly thicker. Gynatrial cone longer than in *E. validus*, but slightly shorter than in *E. elamensis* sp. nov.; its posterior wall before apex significantly ventricose, resulting in base of spermatheca displaced anteriorly and not visible in posterior view. In this view, lateral margins of gynatrial cone parallel, rectangularly rounded apically. [In the female from Kokshetau, inside the gynatrial cone, there are two small sclerotised areas visible apically, probably located at the ends of the canals, which are poorly distinguishable due to the strongly thickened walls of the gynatrial cone]. Proximal part of spermathecal duct wider, slightly longer than in *E. validus*; middle part slightly shorter, considerably widening towards middle; distal part slightly shorter. Basal part of spermathecal capsule slightly longer. Ring sclerites smaller than in *E. validus* and *E. elamensis* sp. nov., with broader margins than in typical cases in *E. validus*. Posterior pouches spaced apart, their posterior margins widely rounded on lateral parts, slightly convex on mesal parts.

**Measurements** (n = 10; mm). **Body**: length 4.65–6.05, width 2.85–3.45; ratio body length / pronotum width 1.80–1.92; **head**: length 0.91–1.09, width 1.20–1.36, ratio width / length 1.22–1.35; **synthlipsis** 0.81–0.95; **ocular index** 4.07–4.69; length of antennal segments I–V: 0.25–0.32 : 0.34–0.43 : 0.35–0.39 : 0.52–0.57 : 0.67–0.70; **pronotum**: length 1.30–1.60, width 2.68–3.15, ratio width / length 1.91–2.06; **scutellum**: length 1.83–2.48, width 1.70–2.13, ratio length / width 1.07–1.22.

**Etymology**. The species name is an adjective derived from the Ancient Greek Ἐσσηδόνες [= Essēdónes], the name of the people who, according to Herodotus, inhabited Central Kazakhstan in ancient times.

**Bionomics**. According to the label data, some specimens of this species were collected on *Atriplex cana* and *Cera-*

*tocarpus* spp. (both Amaranthaceae), as well as from salt marshes.

**Distribution**. Kazakhstan; the record from Irkutsk Province of Russia seems doubtful and requires confirmation.

The records of *Exosehirus validus* for Kazakhstani Atyrau Province, Lake Inder (KIRITSHENKO 1954) and Kyzylorda Province, “Yani-Kyrgan” [Zhanakorgan] (OSHANIN 1910) probably concerns *E. essedonius* sp. nov.

### *Exosehirus marginatus* (Signoret, 1881)

(Figs 2D, 3F, K, 4E, J, 11, 16, 17)

*Lalervis marginatus* Signoret, 1881: 656 [laps. cal., the specific name *marginatus* is mistakenly placed under the generic name *Lalervis* Signoret, 1881 instead of the specific name *expansa* Signoret, 1881 placed under *Adomerus* Mulsant & Rey, 1866]

*Adomerus marginatus*: SIGNORET (1884: 48).

*Sehirus marginatus*: PUTON (1886: 9); OSHANIN (1906: 26); VIDAL (1950: 44).

*Sehirus (Tritomegas) marginatus*: STICHEL (1961: 677).

*Exosehirus marginatus*: WAGNER (1963: 108); LINNAUORI (1984: 2); LIS (1999: 223; 2006: 142).

**Material examined**. **AZERBAIJAN: DZHEBRIL DISTR.**: Karabakh Range, “Sirak [Sirik Setlm.] 45 km [25 km on a map] SW Füzuli”, 39°28'26.1"N 46°52'22.5"E, 14.vi.1985, M. G. Volkovitch, 1 ♀ (ZISP). **TURKEY: NIĞDE PROV.**: Çiftahan Town, 37°30'52.9"N 34°46'47.4"E, “Toros”, 22.v., 11.vi.1958, G. Seidenstücker leg., 1\* ♂, 2\*+1 ♀♀ (ZISP).

**Diagnosis**. Head, pronotum and scutellum blackish, hemelytra blackish-brown. Body with dull sheen; as a whole, coarser punctured than usual in *E. validus*. Pale stripes on lateral margins of hemelytra wide throughout up to posterior margins of coria, occupying entire width of each exocorium, sometimes only very narrow mesal part of latter remaining dark anteriorly (Fig. 2D). Dorsum substantially more convex than in all previous species. Eyes relatively small. Preocular part of head usually about the same shape as in *E. essedonius* sp. nov., but slightly more widely rounded anteriorly (Fig. 3F). Pronotum with anterolateral margins diverging posteriorly more widely than in *E. essedonius* sp. nov. and less widely than in other congeners (Fig. 3K). Apex of scutellum wider than in all previous species. Peritreme of scent glands narrow throughout. Evaporatorium clearly punctate.

**Pygophore** (Fig. 4E) slightly wider than in previous species. Its posteroventral margin slightly obtuse angularly convex, straight laterally. Posterolateral angles of pygophore slightly more prominent in dorsal view. Posterodorsal margin and mesal parts of posterolateral margins without thin line of desclerotisation. Dorsal infolding slightly longer than ventral one. Each lateral side of dorsal infolding near margin of genital opening with deep, sharply outlined, semicircular impression. Mesal parts of lateral infoldings more strongly depressed than in previous species, weakly sclerotised. Genital opening with deep paramere sockets.

**Parameres** (Fig. 4J). Distal part of corpus wider on its mesal part. Hypophysis shorter, its extreme apex less sharply curved anteriorly than in previous species.

**Aedeagus** (Fig. 11) is significantly different from those of all other species of the genus. It is difficult to homologise parts of the conjunctiva with those of other species; I present below the version of homology that seems to



me to be the most probable, and which requires some deviation from the topographic principle of naming structures.

Theca without paired tubercles before apex on ventrolateral walls and without unpaired tubercle on ventral part of apical margin.

Conjunctiva robust, longer than theca and phallobase combined; in middle at border of basal and apical parts, sharply curved dorsally at a right angle. Basal part of conjunctiva slightly narrowed after its base, with slightly concave ventral wall here. Ventrolateral lobes lying most distally on basal part of conjunctiva along its longitudinal axis; those lying on slightly elevated common base and looking like slightly spaced, short, finger-like outgrowths with widely rounded apices directed posteriad and slightly diverging; any sclerites on these lobes absent. Dorsolateral lobes large, utricular, located on lateral walls of basal part of conjunctiva much more basal than ventrolateral lobes. These lobes with two short apices. In ventral view, each lobe widening triangularly from its base, one of apices (slightly longer) directed posteriad, other one directed anteriad, lateral wall between them straight. Anterior margin of lobe along its entire length with long, narrow plate-like sclerite forming two sharp denticles directed inward; denticle located at extreme lateral end of sclerite larger, denticle lying before of mesal sclerite end smaller [the shape of these sclerites strongly resembles that of the sclerites on the dorsolateral lobes of *Exosehirus essedoni* sp. nov.; this provide additional support to the chosen scheme of homologisation]. In lateral view, shape of dorsolateral lobe close to triangular, anterodorsal margin of lobe at its extreme base with wide conical tubercle adjacent to lateral wall of conjunctiva; this margin before apex with small, narrow, flattened triangular tubercle. Distal part of conjunctiva, lying at right angles to axis of its basal part, not separated by any depression or constriction, slightly wider than basal part, truncate apically. Dorsoapical lobes, lying on anterior wall of distal part of conjunctiva, slightly spaced, rather large, utricular basally, tapering at apex, directed anteriad. Dorsal wall of each lobe with long, narrow sclerite; this sclerite very narrow on extreme posterior part, forming there subterminally long narrow curved conical spine directed dorsally and curved anteriad; remainder of sclerite weakly C-shaped, slightly widening towards diverging rounded anterior ends; ventral wall of sclerite membranous, except for extreme apex. Vesica lying on anterior wall of extreme apex of conjunctiva; its basal part rather long, approximately as wide as in *E. validus*, tapering distally, arcuately curved, directed ventrally and passing between ventrolateral lobes of the conjunctiva. Walls at extreme base of vesica slightly sclerotised, base of ventral wall without membranous tubercle. Two thin and rather long sclerotised apical spicules extending close to extreme base of vesica and fused with its lateral walls; these spicules slightly arcuate, directed ventrally, with slightly diverging apices. Distal part of vesica prolonged as very thin filament much longer than vesical basal part.

**Note.** Another version of the homologisation of conjunctival parts is that the structures recognised above as dorsolateral lobes correspond to the ventrolateral lobes of

other species, dorsoapical lobes to the dorsolateral lobes, spicules at the base of vesica to the dorsoapical lobes, and ventrolateral lobes are a new formation. In this case, the conjunctiva is not subdivided into the basal and apical parts.

If the bend in the middle of the conjunctiva is mentally straightened and the length of its ventral wall at the base is reduced, the conjunctiva will become similar to that of other species of the genus. And then it will be clear that the scheme of homologisation, chosen here as the main one is more realistic.

**Female terminalia** (Figs 16, 17). Notch of posterior margin of sternite VII broadly rounded, almost semicircular. Common posterior margin of paratergites VIII almost straight. Paratergites IX smaller than in previous species. Posterior limb of gonangulum rather longer than in other species of the genus. Gonocoxites I with slightly convex posterior margins converging at an obtuse angle, with rounded lateral angles; their external surfaces strongly convex on anterior part, more coarsely rugose than in previous species, with high and wide rib along mesal margin. Mesal widened parts of gonocoxites II larger than in previous species, with wide truncated anterior angles, gradually tapering laterad; extreme lateral parts very short and thin, with lateral ends bent mesad.

Posterior intervalvular membrane shorter than in previous species, with transverse fold. Lateral parts of latter transverse, wide and very long, originating from anterior margin of posterior intervalvular membrane, with mesal ends forming flaps with pointed apices directed mesad and contiguous; median part small, triangular, originating at some distance from anterior margin of posterior intervalvular membrane, directed posteriad. Extreme lateral parts of posterior margin of transverse fold sharply curved anteriad and continuing into gonapophyses II. Ventral pouches of gynatrium, being formed by double folds in this way, closed laterally and posteriorly, open medially and anteriorly. Apices of gonapophyses II lying anterior to transverse fold, pointed and directed medially. Second rami very thin. Gonapophyses II short, spaced, with apices directed posteriad, without areas of sclerotisation. First rami in form of two thin, closely spaced sclerotised bands, with posterior ends not fused with anterolateral angles of paratergites IX. Anterior limb of gonangulum in form of short acute angle. In normal state, second rami clamped between paired bands of first rami.

Anterior part of gynatrial sac with strongly convex lateral walls. Arcuate sclerites reinforcing base of gynatrial cone very large; on anterior part, those thicker than in *E. validus*; their lateral ends prolonged posteriad in form of wide and long, weakly sclerotised plates with convex lateral and straight mesal margins; anteromesal ends continued into narrow, parallel sclerotised bands directed posteriad, reaching base of gynatrial cone. The latter short, triangular, with longitudinally elongated base, flattened laterally. Spermathecal duct attached to its apex, consisting of two parts. Proximal part of duct (corresponding to middle part of all previous species) extremely long, slightly widened at base, slightly narrowed at apex, with almost parallel walls for most of its length; distal part of duct thin, relatively very long. Pump slightly

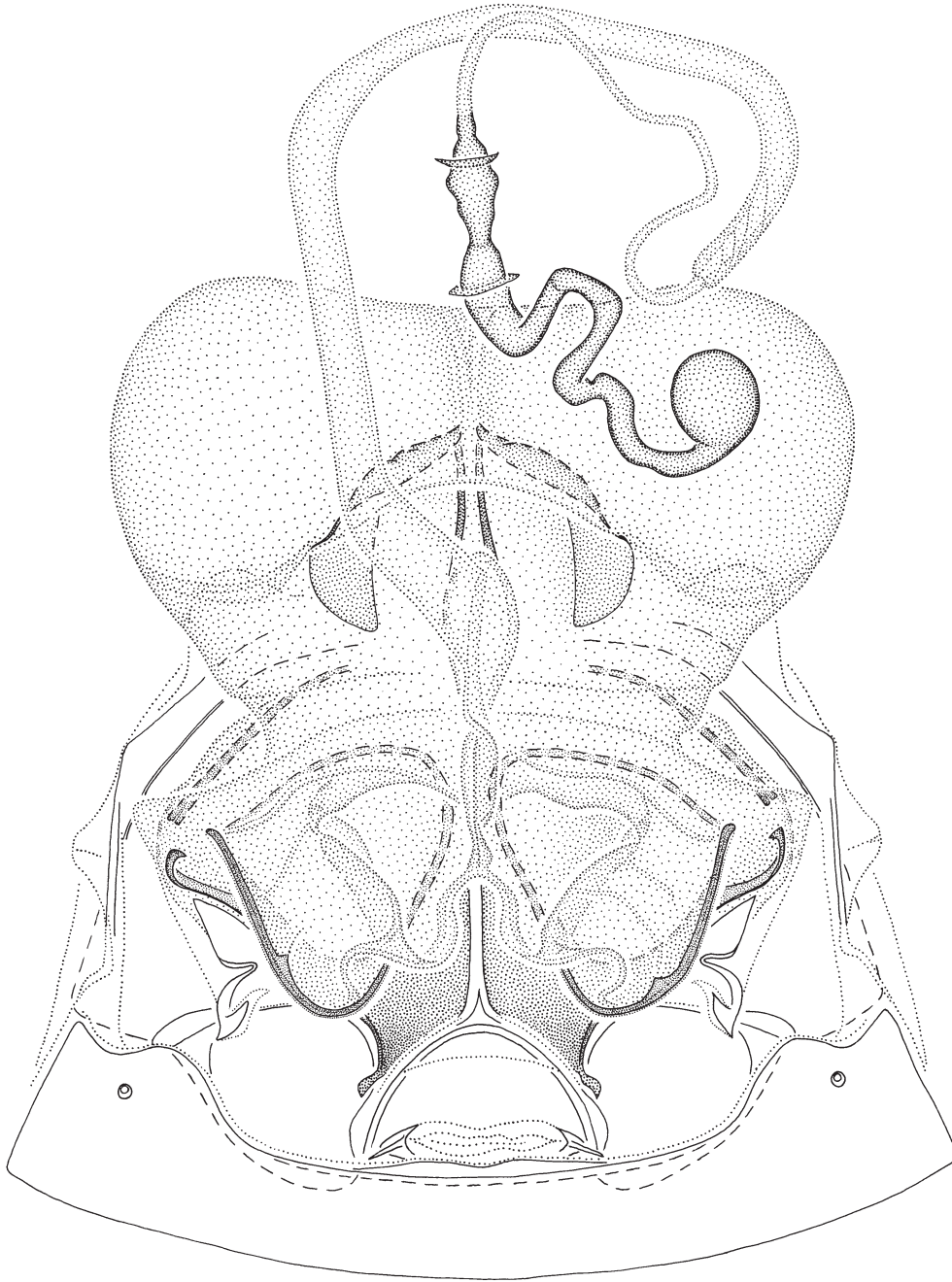


Fig. 16. Female terminalia of *Exosehirus marginatus* (Signoret, 1881) in dorsal view. Scale bar: 0.25 mm.

longer, proximal part of spermathecal capsule significantly longer than in other species of the genus. Pouches on posterior part of gynatrial sac narrower than in other species, spaced; each with small rounded projection at base of mesal wall. Dorsal wall of posterior part of gynatrial sac with deep C-shaped folds on sides of midline; along midline, with longitudinal fold passing into gynatrial cone.

**Measurements** (n = 5; mm). **Body**: length 4.90–5.70, width 3.25–3.90; ratio body length / pronotum width 1.69–1.74; **head**: length 1.09–1.20, width 1.39–1.48, ratio width / length 1.21–1.33; synthlipsis 0.94–1.04; ocular index 4.19–4.93; length of antennal segments I–V: 0.32–0.35 : 0.36–0.41 : 0.36–0.45 : 0.51–0.59 : 0.62–0.67; **pronotum**:

length 1.45–1.68, width 2.90–3.38, ratio width / length 2.00–2.01; **scutellum**: length 2.10–2.55, width 2.00–2.30, ratio length / width 1.05–1.11.

**Distribution** (Fig. 1). Azerbaijan (new record), Turkey (SIGNORET 1881; LINNAVUORI 1984; LIS 1999: Taurus Mountains – type locality; ÖNDER et al. 2006: Çanakkale, Diyarbakır, Gaziantep, Kütahya, Manisa, Mersin), Syria (SIGNORET 1881 [exact locality unknown, the point on the map is set approximately in the center of Syria as in 1881]), Iran (GHAHARI et al. 2009: West Azarbaijan Province); the records of this species from the north of the former Iranian Province of Khorasan (MODARRES AWAL 1996) and from Iraq (AL-ALI 1968) raise some doubts.

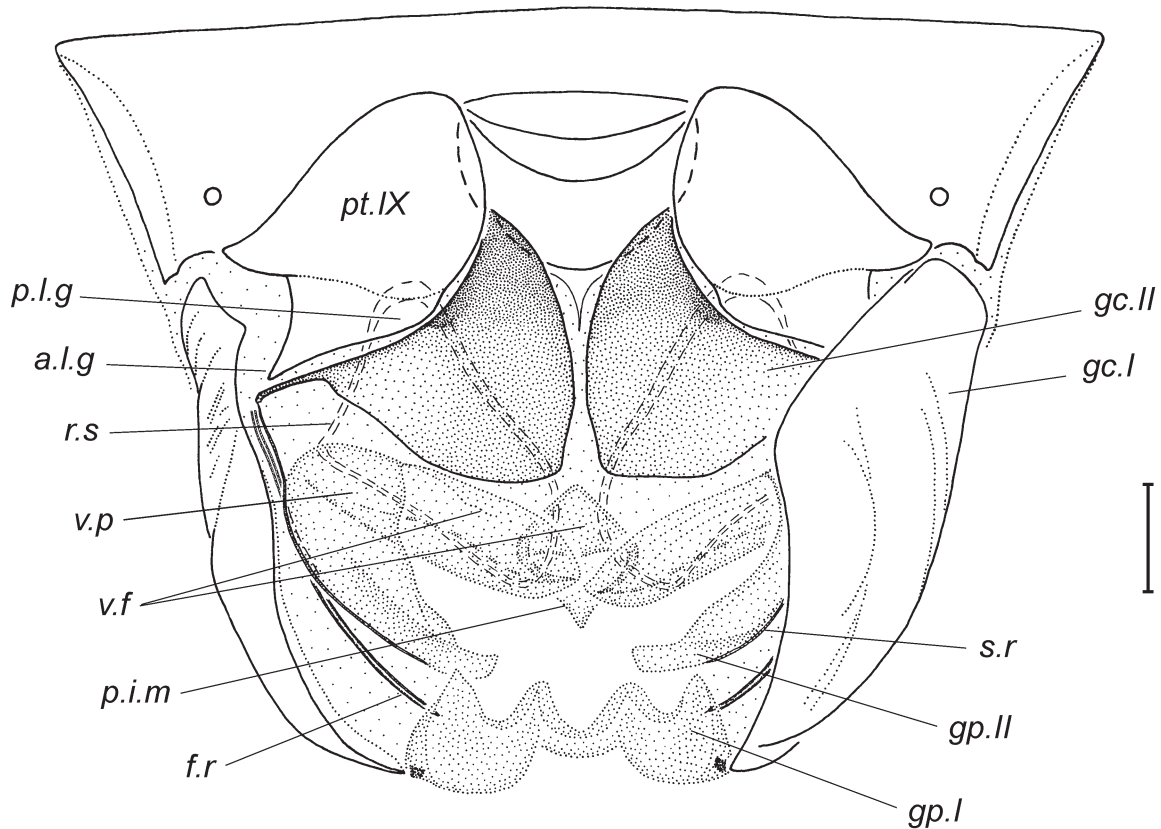


Fig. 17. Female terminalia of *Exosehirus marginatus* (Signoret, 1881) in ventral view. Abbreviations: *a.l.g.* – anterior limb of gonangulum; *f.r.* – first rami; *gc.I* – gonocoxites I; *gc.II* – gonocoxites II; *gp.I* – gonapophyses I; *gp.II* – gonapophyses II; *p.i.m.* – posterior intervalvular membrane; *p.l.g.* – posterior limb of gonangulum; *pt.IX* – patatergites IX; *r.s.* – ring sclerites; *s.r.* – second rami; *v.f.* – ventral fold of posterior intervalvular membrane; *v.p.* – ventral pouches of gynatrium. Scale bar: 0.25 mm.

### Species *incertae sedis*, not *Exosehirus*

#### '*Exosehirus*' *steini* (Signoret, 1884)

(Fig. 18)

*Canthophorus steini* Signoret, 1884: 58.

*Sehirus steini*: PUTON (1886: 9); OSHANIN (1906: 25); VIDAL (1950: 44); LINNAVUORI (1984: 2).

*Sehirus (Tritomegas) steini*: STICHEL (1961: 677).

*Exosehirus steini*: WAGNER (1963: 107); LIS (1999: 223, 2006: 142).

**Comments.** SIGNORET (1884) described *Canthophorus steini* based on a single male from Sarepta [now in the Volgograd Province of Russia]. He hesitated between assigning this species to *Gnathoconus* (= *Legnotus*) (due to the anterior margin of head with an enclosed clypeus and by the punctured evaporatorium, “plaques ostiolaires perforées”) or to *Canthophorus* (due to the second segment of the antennae shorter than the third segment). Later, this species was transferred by PUTON (1886) to the genus *Sehirus*, and then conditionally included by WAGNER (1963) in *Exosehirus*. It seems that after Signoret described this species, no other researcher examined the holotype or any other specimen: VIDAL (1950) and STICHEL (1961) included it in their keys to species, but these were explicitly based on the same characters provided in Signoret's original description; WAGNER (1963) and LINNAVUORI (1984) wrote that this species was unknown

to them. The characters given in the original description of the species and depicted in the figure (Fig. 18) do not correspond to the other species of *Exosehirus*: i.e., the preocular part of the head with deep notches before eyes and with a deeply concave anterior margin; the bucculae high and truncated posteriorly; the hemelytra with very thin white stripes only on lateral ribs; the mesopleural evaporatorium not continued along the lateral margin of the mesopleuron. Therefore, it cannot be assumed that this is a repeated description of *E. validus*, which is not mentioned in the work of Signoret. Also, this description does not correspond with any other *Sehirinae* genera and species. It is not possible to solve this conundrum, since the holotype (it can be concluded that it was a single specimen, since the measurements in the original description are given as separate numbers, and not a range of values, as in other cases), which should be stored in the Zoologisches Museum, Humboldt Universität, Berlin (LIS 1999), is absent there (Jürgen Deckert, pers. comm.). It is also remarkable that for more than 130 years, not a single specimen of this species has been found either in the south of Russia, or in western Kazakhstan, or anywhere else. Due to the impossibility of attributing this *nomen dubium* to any of the *Sehirinae* genera, I regard *E. steini* as a species *incertae sedis*.

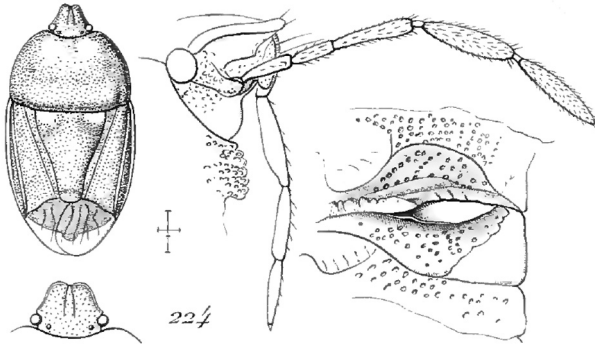


Fig. 18. Drawings of '*Exosehirus steini*' (Signoret, 1884) from original description.

### Key to species of the genus *Exosehirus*

- 1 (2) Pale stripes on lateral margins of hemelytra uniformly wide, occupying almost entire exocorium (Fig. 2D). Posteroventral margin of pygophore convex medially (Fig. 4E). Hypophysis of paramere short (Fig. 4J). Ventrolateral lobes of conjunctiva unarmed; dorsoapical lobes with bifurcated sclerite; distal filiform part of vesica extremely long (Fig. 11). Arcuate sclerites anterior to gynatrial cone very large; gynatrial cone narrow; spermathecal duct very long, consisting of two parts (Fig. 16). Azerbaijan, Turkey, Syria, Iran. .... *E. marginatus* (Signoret, 1881)
- 2 (1) Pale stripes on lateral margins of hemelytra tapering posteriorly (Figs 2A–C). Posteroventral margin of pygophore concave medially (Figs 4A–D). Hypophysis of paramere long (Figs 4G–I). Ventrolateral lobes of conjunctiva with sclerotised bands, serrate apically (Figs 6A, D, G, I); dorsoapical lobes with non-bifurcated spicula (Figs 6C, F, I, L); distal filiform part of vesica not very long (Figs 7–10). Arcuate sclerites anterior to gynatrial cone rather small; gynatrial cone wide posteriorly; spermathecal duct shorter, consisting of three parts (Figs 12A, 13–15).
- 3 (4) Posteroventral margin of pygophore with wide, deep notch (Fig. 4A). Paramere with tubercle near base of hypophysis (Fig. 4H). Dorsolateral lobes of conjunctiva with large sclerite rounded at apex (Figs 5A, B, 6B); spicules of dorsoapical lobes short, curved (Fig. 6C). Gynatrial cone short, with lateral pouches; middle part of spermathecal duct short, with parallel lateral walls (Figs 12A, 13). Afghanistan, Iran, Iraq, Central Asia. .... *E. validus* (Jakovlev, 1877)
- 4 (3) Posteroventral margin of pygophore with narrow notch (Figs 4B–D). Paramere without tubercle near base of hypophysis (Fig. 4I). Dorsolateral lobes of conjunctiva with sclerotisation of different shape (Figs 6E, H, K); spicules of dorsoapical lobes long, straight (Figs 6F, I, L). Gynatrial cone long, without lateral pouches; middle part of spermathecal duct

with convex lateral walls or very long (Figs 14, 15). (Female genitalia of *E. sargon* unknown.)

- 5 (6) Dorsolateral lobes of conjunctiva with several closely spaced denticles (Fig. 6E), same as on ventrolateral lobes (Fig. 6D). Vesica long (Fig. 4K). Larger: 6.75 mm. Northern Iraq. .... *E. sargon* Linnavuori, 1984
- 6 (5) Armature of dorsolateral lobes different (Figs 6H, K). Vesica long or short. Smaller: 4.65–6.25 mm.
- 7 (8) Posteroventral margin of pygophore with narrow, shallow notch (Fig. 4C). Dorsolateral lobes of conjunctiva with smooth triangular sclerite, without denticles (Fig. 6H); spicules of dorsoapical lobes longer, pointed apically (Fig. 6I). Vesica long (Figs 7, 9). Gynatrial cone long, its posterior wall not ventricose near apex, base of spermatheca visible in posterior view; middle part of spermathecal duct very long, with almost parallel walls (Fig. 14). Southwestern Iran. .... *E. elamensis* sp. nov.
- 8 (7) Posteroventral margin of pygophore with wide, deep notch (Fig. 4D). Sclerites on dorsolateral lobes of conjunctiva elongate, with denticle at each end (Figs 5C, D, 6K); spicules of dorsoapical lobes shorter, with apices pointed in posterior view, slightly widened and rounded in dorsal view (Fig. 6L). Vesica short (Fig. 10). Gynatrial cone shorter, its posterior wall ventricose near apex, base of spermatheca not visible in posterior view; middle part of spermathecal duct short and widening medially (Fig. 15). Kazakhstan. .... *E. essedonius* sp. nov.

### Acknowledgments

I am immensely grateful to my colleagues Jerzy A. Lis (University of Opole, Poland), David A. Rider (North Dakota State University, USA) and Petr Kment (National Museum, Prague, Czech Republic) for their valuable advice to an earlier version of the manuscript. The work was performed within the framework of the Russian State research project No. AAAA-A19-119020690101-6. The author was also funded by the Russian Foundation for Basic Research (RFBR) according to research project No. 19-54-18002.

### References

- AL-ALI A. S. 1968: List and distribution of Hemiptera of Iraq. *Iraqi Journal of Agricultural Science* 3: 43–58.
- AUKEMA B., GAPON D. & HEIJERMAN T. 2021: To the nomenclature of two species of the genus *Adomerus* (Heteroptera: Cydnidae). *Zootaxa*, in press.
- GAPON D. A. 2001: Inflation of Heteropteran aedeagi using microcapillaries (Heteroptera, Pentatomidae). *Zoosystematica Rossica* 9(1) [2000]: 157–160.
- GAPON D. A. 2007: Structure, function, and morphological conformity of the male and female genitalia in the true bug genus *Pyrrhocoris* Fall. (Heteroptera, Pyrrhocoridae). *Entomologicheskoe Obozrenie* 86(4): 729–741 (in Russian; English translation: *Entomological Review*, 2007, 87(9): 1099–1108. <https://doi.org/10.1134/S0013873807090011>).
- GAPON D. A. 2018. Morphology of male and female terminalia and taxonomic revision of the burrower bugs genus *Canthophorus* (Hete-

- roptera: Cydnidae). *Annales de la Société Entomologique de France (Nouvelle Série)* **54(3)**: 183–228.
- GHAHARI H., CHÉROT F., LINNAVUORI R. E. & OSTOVAN H. 2009: Annotated catalogue of Iranian burrower bugs (Heteroptera, Pentatomoidea, Cydnidae). *ZooKeys* **26**: 1–31.
- HOBERLANDT L. 1961: Ergebnisse der Deutschen Afghanistan-Expedition 1956 der Landessammlungen für Naturkunde in Karlsruhe. Heteroptera. *Beiträge zur Naturkundlichen Forschung in Südwestdeutschland* **19(3)**: 197–222.
- KIRITSHENKO A. N. 1954: Obzor nastoyashchikh poluzhestkokrylykh rayonov srednego i nizhnego techeniya r. Urala i volzhsko-ural'skogo mezhdurech'ya. [Survey of true hemipterans in regions of the middle and the lower reaches of the Ural River and the Volga-Ural interfluvium.] *Trudy Zoologicheskogo Instituta Akademii Nauk SSSR* **16**: 285–320 (in Russian).
- KIRITSHENKO A. N. 1964: *Poluzhestkokrylye (Hemiptera–Heteroptera) Tadzhikistana*. [Bugs (Hemiptera–Heteroptera) of Tadzhikistan]. Institute of Zoology and Parasitology, Dushanbe, 258 pp (in Russian).
- KONSTANTINOV F. V. & GAPON D. A. 2005: On the structure of the aedeagus in shield bugs (Heteroptera, Pentatomidae): 1. Subfamilies Discocephalinae and Phyllocephalinae. *Entomologicheskoe Obozrenie* **84(2)**: 334–352 (in Russian; English translation: *Entomological Review*, 2005, **85(3)**: 221–235. <https://doi.org/10.1002/zamm.200590013>).
- LINNAVUORI R. E. 1984: New species of Hemiptera Heteroptera from Iraq and the adjacent countries. *Acta Entomologica Fennica* **44**: 1–59.
- LINNAVUORI R. E. 1993: Cydnidae of west, central and north-east Africa (Heteroptera). *Acta Zoologica Fennica* **192**: 1–148.
- LIS J. A. 1999: Burrower bugs of the Old World – a catalogue (Hemiptera: Heteroptera: Cydnidae). *Genus* **10(2)**: 165–249.
- LIS J. A. 2006: Family Cydnidae Billberg, 1820 – burrowing bugs (burrower bugs). Pp. 119–147. In: AUKEMA B. & RIEGER CH. (eds): *Catalogue of the Heteroptera of the Palaearctic Region. Vol. 5, Pentatomomorpha II*. The Netherlands Entomological Society, Amsterdam, xiii + 550 pp.
- LIS J. A., LIS B., ZIAJA D. J. & DOBOSZ R. 2014: Description and DNA barcoding of *Ochetostethomorpha secunda*, a new species of the South African endemic burrower bug genus (Hemiptera: Heteroptera: Cydnidae) from Namibia. *Zootaxa* **3884(6)**: 561–566.
- MAGNIEN PH. 1999: Contribution à l'étude du genre *Legnotus* Schiödte et description d'une nouvelle espèce de Turquie (Heteroptera, Cydnidae). *Bulletin de la Société Entomologique de France* **103** [1998]: 463–473.
- MODARRES AWAL M. 1996: Studies on some Pentatomomorpha (Heteroptera) fauna in north of Khorasan province. *Journal of Agriculture and Science Technology* **9(2)**: 121–144.
- MODARRES AWAL M. 2008: Contribution to Heteroptera fauna of Khorasan Razavi province of Iran. *Turkish Journal of Entomology* **32(4)**: 243–253.
- ÖNDER F., KARSAVURAN Y., TEZCAN S. & FENT M. 2006: Türkiye Heteroptera (Insecta) kataloğu. İzmir, 164 pp (in Turkish).
- OSHANIN B. 1906: Verzeichnis der palaearktischen Hemipteren mit besonderer Berücksichtigung ihrer Verteilung im Russischen Reiche. I. Band. Heteroptera. I. Lieferung Pentatomidae-Lygaeidae. *Ezhogodnik Zoologicheskago Muzeya Imperatorskoy Akademii Nauk*, **11 (Prilozhenie)**: i–lxxiv + 1–393 pp.
- OSHANIN B. 1910: Verzeichnis der palaearktischen Hemipteren mit besonderer Berücksichtigung ihrer Verteilung im Russischen Reiche. III. Band. Nachträge und Verbesserungen zum I und II. Bande. *Ezhogodnik Zoologicheskago Muzeya Imperatorskoy Akademii Nauk* **15 (Prilozhenie)**: i–xvi + 1–217.
- PUTON A. 1886: *Catalogue des Hémiptères (Hétéroptères, Cicadines et Psyllides) de la faune paléarctique, 3me éd.* Blanc-Hardel, Caen, 100 pp.
- PUTSHKOV V. G. 1965: *Shchitniki Sredney Azii (Hemiptera, Pentatomidae)*. [Shield bugs of Middle Asia (Hemiptera, Pentatomidae).] Ilim, Frunze, 322 pp (in Russian).
- SCUDDER G. G. E. 1959: The female genitalia of the Heteroptera: morphology and bearing on classification. *Transactions of the Royal Entomological Society of London* **111(14)**: 405–467. doi:10.1111/j.1365-2311.1959.tb02873.x
- SIGNORET V. 1881: Revue des Cydnides contenus dans la collection du Musée Civique d'Histoire Naturelle de Gênes. *Annali del Museo Civico di Storia Naturale di Genova* **16**: 621–657.
- SIGNORET V. 1884: Revision du groupe des Cydnides de la famille des Pentatomides. 13<sup>e</sup> et dernière partie. *Annales de la Société Entomologique de France, Série 6* **4**: 45–62.
- STICHEL W. 1961: *Illustrierte Bestimmungstabellen der Wanzen. II. Europa. (Hemiptera–Heteroptera Europae). Vol. 4*. Berlin–Hermesdorf, Stichel, pp. 545–768.
- VIDAL J. P. 1950: Hémiptères de l'Afrique du Nord et des pays circum-méditerranéens. *Mémoires de la Société des Sciences Naturelles du Maroc* **48** [1949]: 1–238.
- WAGNER E. 1955: Eine neue Cydnidengattung aus dem Mittelmeergebiet. *Nachrichten des Naturwissenschaftlichen Museums der Stadt Aschaffenburg* **46**: 57–60.
- WAGNER E. 1963: Untersuchungen über den taxonomischen Wert des Baues der Genitalien bei den Cydnidae (Hem. Het.). *Acta Entomologica Musei Nationalis Pragae* **35**: 73–115.

