

## A New Species of the Genus *Eusarima* Yang (Hemiptera: Fulgoroidea: Issidae) from Pakistan

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**Abstract**—*Eusarima albifrons* sp. n. is described from northern Pakistan (Islamabad). The new species is closely related to *Eu. iranica* Gnezdilov et Mozaffarian, 2011 and may be distinguished by details of coloration and male genital structure. This is the second species of the genus *Eusarima* Yang recorded from the Western Palaearctic. *Parasarima triphylla* Che, Zhang et Wang, 2012 is transferred to the genus *Eusarima*, which is thus recorded for the first time from continental China. The homologies in the genital structures of males and females are discussed for some genera of Oriental, Palaearctic, and Afrotropical Issidae.

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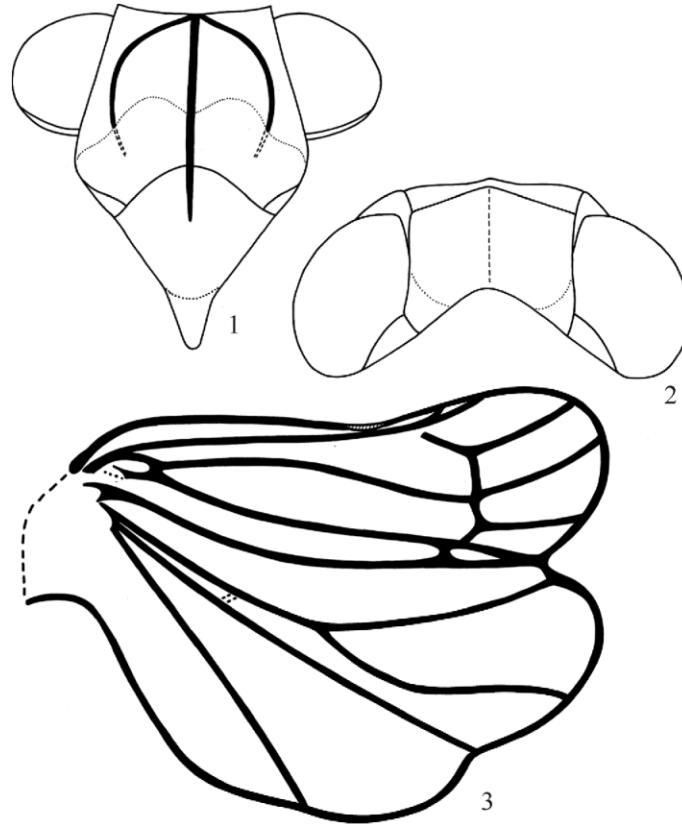
Pakistan remains terra incognita as concerns many groups of planthoppers, including the family Issidae Spinola. So far, two species of this family have been recorded for the territory of Pakistan: *Quadriva artemisiae* Ghauri, 1965 and *Ziartissus artemisiae* Qadri et Mirza, 1966 (Ghauri, 1965; Qadri and Mirza, 1966), but the latter species and genus, judging by the description, do not in fact belong to Issidae (Gnezdilov, 2013a). *Quadriva artemisiae* was described from the Palaearctic part of Pakistan, in particular from Baluchistan (Quetta) (Ghauri, 1965), and belongs to the genus that is mainly distributed in Iran and Tajikistan (Gnezdilov et al., 2014). Therefore, the new species of the genus *Eusarima* Yang, 1994 described herein is the second representative of the family Issidae known from Pakistan.

The genus *Eusarima* comprises 36 species and is one of the largest genera of the family (Gnezdilov, 2013b; Chen et al., 2014). Most of its species (31) were described from Taiwan (Chan and Yang, 1994; Chen et al., 2014) and belong to the nominotypical subgenus; two more species of this subgenus are known from Japan and one, from Southeast China (see below). At the same time, the other subgenus, *Nepal-ius* Dlabola, has until recently included only two species from Nepal and Iran (Dlabola, 1997; Gnezdilov and Mozaffarian, 2011). The new species from the north of Pakistan supplements the Western Palaearctic fauna of the genus *Eusarima*; this finding is very im-

portant since it is in the continental part of Eurasia that the center of origin of the genus seems to be located, whereas the Taiwanese species complex should be regarded as an example of extensive insular diversification.

All the species of the genus *Eusarima* are fairly uniform in habitus and male genitalis morphology. Species identification is based on coloration features of the metope, in particular combinations of light and dark areas or punctation, and also on the structural details of the male genitalia. The new species is very close to *Eusarima (Nepal-ius) iranica* Gnezdilov et Mozaffarian, 2011. Both species were collected in cities (Tehran and Islamabad, respectively); *Eu. iranica* was collected on the common ivy *Hedera helix* L. and the wahoo *Evonymus* sp. (Gnezdilov and Mozaffarian, 2011). One more species of this subgenus, *Eu. (N.) helleriana* (Dlabola), was collected in Nepal on dry herbage with wormwood (Dlabola, 1997).

The type specimens of the new species are kept in the collections of the Zoologische Staatssammlung (München, Germany; ZSM) and the Zoological Institute of the Russian Academy of Sciences (St. Petersburg; ZIN). The drawings of *Eupilis albilineola* Walker, 1857 and *Tempsa angusta* (Walker, 1858) are based on material of the Natural History Museum (London, United Kingdom). The morphological terminology follows my earlier publications (Gnezdilov, 2002; Gnezdilov et al., 2014).



**Figs. 1–3.** *Eusarima albifrons* sp. n., male: (1) head in ventral view (dotted line marks the upper margin of the light band on the metope); (2) head in dorsal view; (3) hind wing.

Genus *EUSARIMA* Yang

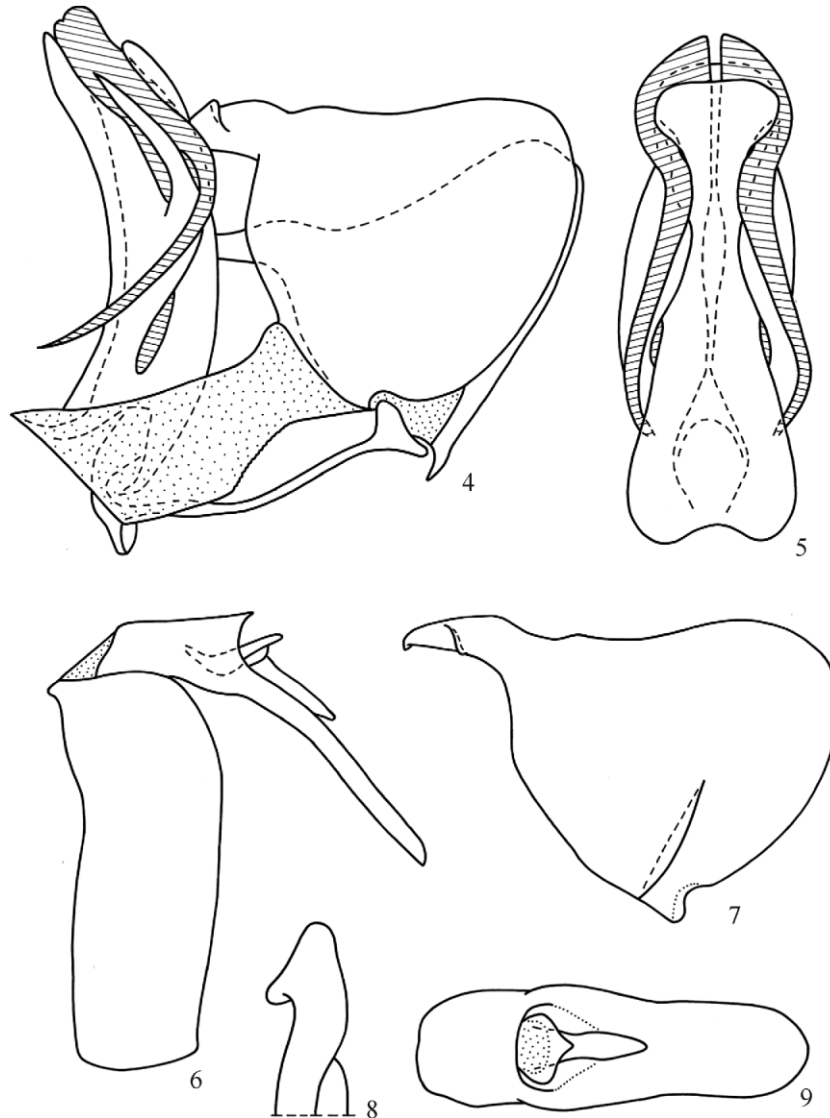
Subgenus *Nepalius* Dlabola

*Eusarima albifrons* Gnezdilov, sp. n.

**Description.** Metope wide, gradually dilated above clypeus, with distinct median carina extending onto postclypeus, with distinct sublateral carinae joined on upper margin of metope and reaching metopoclypeal suture but weaker in lower part of metope (Fig. 1). Pair of ocelli present. Coryphe slightly (by about 1.5 times) wider than its median length, with convex anterior margin forming obtuse angle, and concave posterior margin also forming obtuse angle; with weak median suture (Fig. 2). Proboscis reaching hind coxae, its apical segment shorter than subapical one (about 0.7 its length), narrowing apically. Pronotum shorter than mesonotum, with weak median carina; anterior margin of pronotum convex, forming obtuse angle, its posterior margin slightly emarginate. Mesonotum with distinct median carina and weak lateral carinae. Tegulae large. Forewing elongate, with narrow hypocostal plate. Basal cell narrow oval. Radius and anterior cubitus 2-branched, media 3-branched ( $R\ 2\ M\ 3\ CuA\ 2$ ).

Radius divided close to basal cell; media and anterior cubitus branched just distal to wing middle, at about the same level. Anterior branch of media divides again at its very apex. Transversal veins numerous. Hind wing well-developed, 3-lobed, with 2 distinct clefts on lateral margin (Fig. 3). Radius 3-branched distally but base of its posterior branch reduced; media simple; anterior cubitus branched in distal portion, its lower branch merged with posterior cubitus; one transversal vein present between posterior branch of radius and media, one more, between media and anterior branch of anterior cubitus; anastomosis also present between anterior cubitus (basal to its branching) and posterior cubitus; 1st anal vein divided basal to wing middle, its anterior branch merged with postcubitus along short segment in middle part and separated from it again distally; 2nd anal vein simple ( $R\ 3\ rm\ 1\ M\ 1\ mcua\ 1\ CuA\ 2\ CuP\ 1\ Pcu\ 1\ A_1\ 2\ A_2\ 1$ ). Hind tibia with 2 lateral spines. First metatarsomere with 2 latero-apical and 8 intermediate spines arranged in an arc.

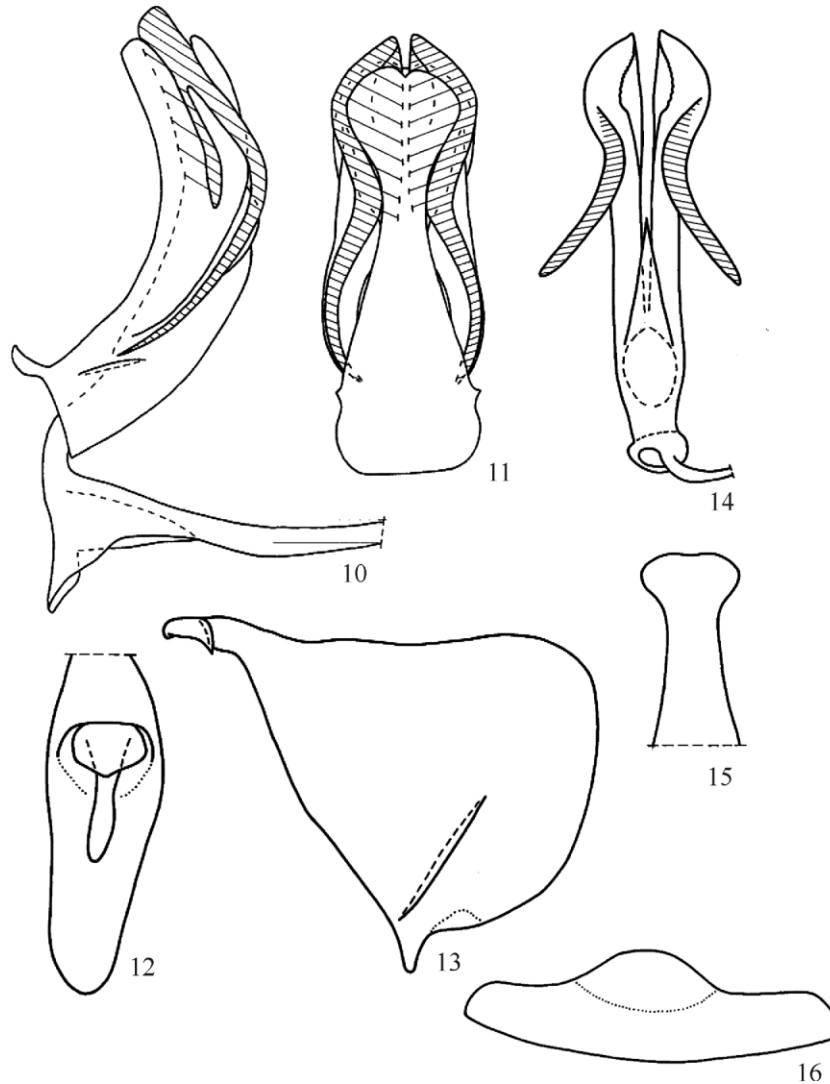
Metope dark grayish brown to black in upper half, excluding light yellow or yellowish brown carinae and traces of larval sensory pits. Lower part of metope



**Figs. 4–9.** *Eusarima albifrons* sp. n., paratype: (4) male genitalia in lateral view; (5) penis in ventral view; (6) pygofer and anal tube in lateral view; (7) stylus in lateral view; (8) capitulum of stylus in dorsal view; (9) anal tube in dorsal view.

above clypeus light yellow or bone-colored, with characteristic double-peaked outline (marked with dotted line in Fig. 1). Postclypeus and anteclypeus dark grayish brown to black. Temples dark grayish brown to black near eye margins and bone-colored along metope margin. Genae and scape yellowish or bone-colored. Pedicel dark grayish brown. Proboscis light grayish brown with dark brown tip. Coryphe dark grayish brown to black, with light grayish brown margins, median line, and pair of large spots lateral to it. Pronotum dark grayish brown to black, with light yellow median carina and traces of sensory pits. Paranotal lobes dark grayish brown to black above antennae, bone-colored below them. Mesonotum dark grayish brown to black, with light yellow upper and lower

angles and carinae. Forewings dark grayish brown, with light yellow costal margin, claval suture, and transversal veins. Tegulae and bases of longitudinal veins near them light yellow. Fore femora dark grayish brown, with light bases, apices, and longitudinal strips. Fore tibiae dark grayish brown with light transversal bands. Fore and middle tarsi grayish brown or dark grayish brown. Middle femora light with dark grayish brown preapical transversal bands. Middle tibiae dark grayish brown with light transversal bands. Hind femora and tibiae dark grayish brown dorsally, light ventrally. Apical spines on hind tibiae and 1st metatarsomere dark grayish brown, tips of other spines black. Abdominal sternites of males yellow, with dark grayish brown spots marking larval sensory pits (2 rows on



**Figs. 10–16.** *Eusarima* spp.: (10–13) *Eu. iranica* Gnezdilov et Mozaffarian, 2011: (10) penis and connective in lateral view; (11) penis in ventral view; (12) anal tube of male in dorsal view; (13) stylus in lateral view; (14–16) *Eu. albifrons* sp. n., paratype: (14) aedeagus in ventral view; (15) ventral lobe of phallobase in ventral view; (16) posterior margin of sternite VII of female in ventral view.

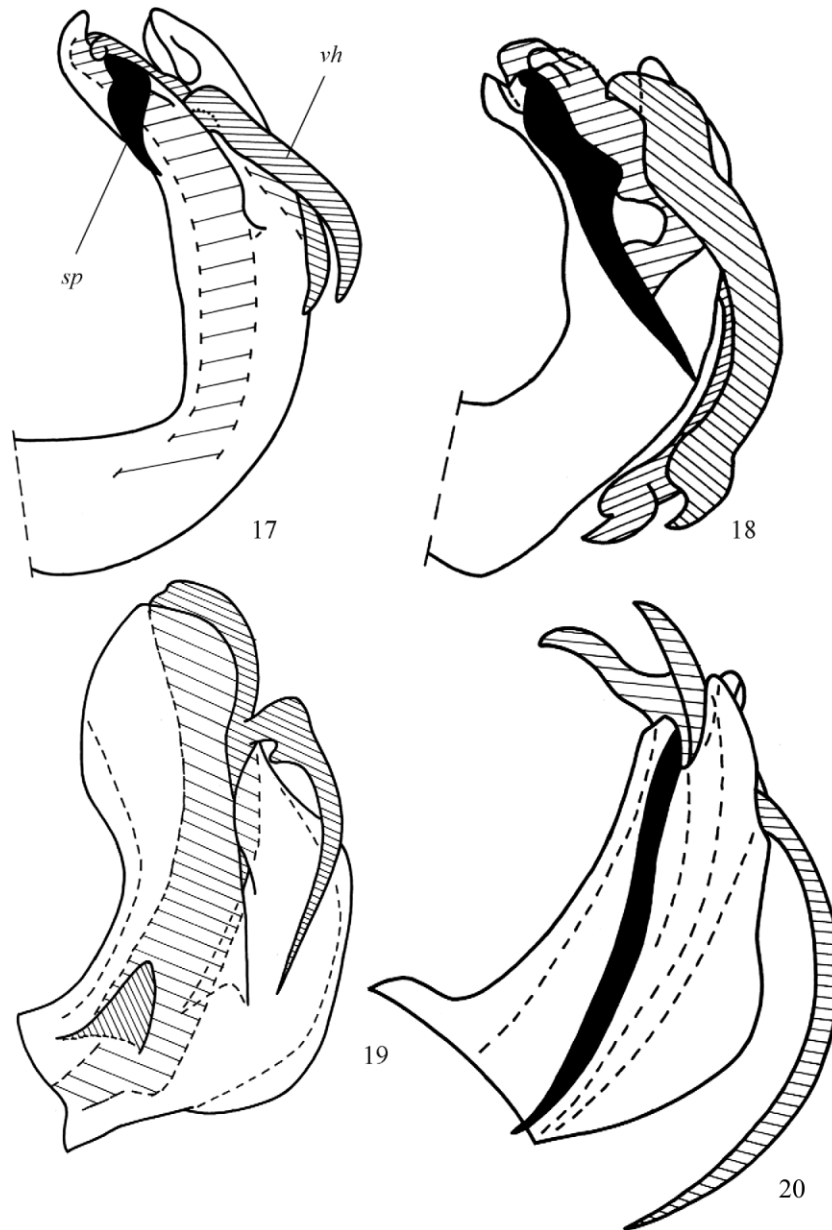
each side) and brownish middle portion. Gonoplasts and anal tube of females dark grayish brown.

**Male genitalia** (Figs. 4–9). Posterior margin of pygofer gently convex (Fig. 6). Anal tube elongated, weakly narrowing in middle portion, with rounded apex (dorsal view) (Fig. 9) and no outgrowths on lateral margins (Fig. 6). Paraproct long, about 0.3 times as long as anal tube. Phallobase weakly arched, deeply incised laterally (Fig. 4), its dorsolateral lobes merged distally. Ventral lobe of phallobase long, sharply dilated in upper part (Figs. 5, 15), ending short of apices of dorsolateral lobes (lateral view) (Fig. 4). Aedeagus conspicuous from the outside, incompletely covered with phallobase, with wide apical processes. Two long ventral hooks extend subapically from sides of aede-

agus (Fig. 14) toward its base. Aedeagal hooks narrow, with pointed tips. Plate of stylus massive, with convex margin under neck (lateral view), its posterior margin weakly concave, its dorso-caudal angle broadly rounded. Capitulum of stylus on long convex neck (lateral view) (Fig. 7), short and wide, narrowing toward rounded apex (dorsal view) (Fig. 8); lateral tooth wide. Connective with rudimentary (small) scoop articulated with base of aedeagus (Fig. 4).

**Female genitalia.** Posterior margin of sternite VII with large lip-shaped outgrowth bent outwards (Fig. 16). Anal tube long and narrow. Anal column (hypoproct—merged paraprocts) short.

Body length 4.6–4.8 mm in males, 5.2–5.4 mm in females.



**Figs. 17–20.** Penis in lateral view: (17) *Eupilis albilineola* Walker, 1857; (18) *Tempsa angusta* (Walker, 1858), holotype; (19) *Scorlupaster asiaticum* (Lethierry, 1878), topotype; (20) *Phasmena nigrodorsalis* Sidorski, 1938; *vh*, ventral aedeagal hooks; *sp*, subapical outgrowths of dorsolateral lobes of phallobase.

**Material. Pakistan.** Holotype, ♂: Punjab, Islamabad, 26–27.V.2007, K. Schönitzer leg. (ZSM). Paratypes: 2 ♂, 1 ♀, Punjab, Islamabad, 26–27.V.2007, K. Schönitzer leg. (1 ♂, 1 ♀ – ZSM, 1 ♂ – ZIN); 1 ♀, Rawalpindi Umg., 25 km NO, 600–700 m, 5.XII.1955, Chr. Lindemann leg. (ZSM).

**Etymology.** The name of the species reflects the characteristic coloration of the metope.

Subgenus *Eusarima* Yang

*Eusarima triphylla*

(Che, Zhang et Wang, 2012), comb. n.

*Parasarima triphylla* Che, Zhang et Wang, 2012 : 535, figs. 1–14.

**Remarks.** The species is transferred from the genus *Parasarima* Yang, 1994 to the genus *Eusarima* Yang,

1994 based on the complete development of the median and sublateral carinae of the metope, almost reaching the metopoclypeal suture (Che et al., 2012, fig. 2), whereas in *P. pallizona* (Matsumura, 1938), the type species of the monotypic genus *Parasarima*, the carinae extend only to the middle of the metope (Chan and Yang, 1994, fig. 39B). The species was described from Guangxi and Hubei Provinces in Southeast China (Che et al., 2012), being the first representative of the genus *Eusarima* known from continental China.

*Key to Species of the Subgenus Nepalius Dlabola*

1. Metope completely darkened (Dlabola, 1997, fig. 2). Phallobase with large lateral lobes under ventral aedeagal hooks (Dlabola, 1997, fig. 6) .....  
..... *Eu. helleriana* (Dlabola, 1997).
2. Metope with wide light band above clypeus. Phallobase without lobes or with narrow lateral lobes under ventral aedeagal hooks ..... 3.
3. Metope of lighter color, band above clypeus without double-peaked outline. Postclypeus light proximally. Forewings with large light spots at base and in middle portion near costal margin. Phallobase with narrow basal lobes under ventral aedeagal hooks (Fig. 10). Connective with large scoop. Anal tube of male narrowing toward apex (dorsal view) (Fig. 12). Plate of stylus almost flat under neck (lateral view) (Fig. 13). Neck of stylus not convex (lateral view). Iran .....  
..... *Eu. iranica* Gnezdilov et Mozaffarian, 2011.
4. Metope dark grayish brown to black in upper half, band above clypeus with characteristic double-peaked outline (Fig. 1). Postclypeus dark grayish brown to black. Forewings without large light spots. Phallobase without lobes under ventral aedeagal hooks (Fig. 4). Connective with rudimentary scoop. Anal tube of male weakly narrowing in middle portion (dorsal view) (Fig. 9). Plate of stylus convex under neck (lateral view) (Fig. 7). Neck of stylus convex (lateral view). Pakistan .....  
..... *Eu. albifrons* sp. n.

DISCUSSION

Based on the presence of well-developed three-lobed hind wings, *Eusarima* may be considered one of the “primitive” taxa of the Western Palaearctic fauna; however, the hind wing venation of representatives of this genus reveals some traits of specialization, in par-

ticular, apical merging and flattening of *CuA* and *CuP*. The similarity in the ovipositor morphology between *Eu. iranica* and the relict Afrotropical species *Chimetopon camerunensis* Schmidt, 1910 may indicate the Oriental origin of the ancestral forms of the Issidae fauna of the Western Palaearctic and tropical Africa (Gnezdilov, 2015). The following similar features may be named: the posterior connective laminae of gonapophyses IX (PCL) are wide in the apical part (lateral view); the gonocoxa VIII (Gx VIII) has a straight posterior margin and no lobe; the anal tube is long and narrow, narrowing in the middle portion (dorsal view) and bent (lateral view), with a concave ventral surface; the gonoplacs are flat, narrowing apically (lateral view), without carinae; the posterior margin of sternite VII has a large semicircular median protrusion.

Comparative analysis of the male genital morphology also reveals some similar features in the Oriental and Western Palaearctic taxa. One of them is the subapical attachment of the ventral aedeagal hooks (in the apical third of the aedeagus), which is known in planthoppers of the Western Palaearctic genus *Scorlupaster* Emeljanov, 1971, the Oriental–Palaearctic genus *Eusarima*, and the Oriental genera *Tempsa* Stål, 1866 and *Eupilis* Walker, 1857 (Figs. 17–19). By contrast, in the most common variant for Issidae the ventral hooks (if present) originate approximately at the middle of the aedeagus. The second similar feature is the presence of long and narrow subapical outgrowths of the dorsolateral lobes of the phallobase, directed toward its base, in the Oriental genera *Tempsa* and *Eupilis* and the Western Palaearctic genera *Phasmena* Melichar, 1902 and *Anatonga* Emeljanov, 2001 (Figs. 17, 18, 20). The genus *Eusarima* resembles the Iranian genus *Cavatorium* Dlabola, 1980 in the presence of a long vertical incision on the dorsolateral lobes of the phallobase (lateral view).

The genus *Eusarima* also resembles the Western Palaearctic genera *Latissus* Dlabola, 1974 and *Webbisanus* Dlabola, 1983 in forewing venation, in particular, the media branching near the wing middle or distal to it, far from the bifurcation of the radius.

Further studies, including molecular ones, are needed to assess the phylogenetic relations between the Oriental and Western Palaearctic faunas of Issidae. The presently available results of analysis of the *COI*, *18S*, and *28S* gene sequences yield no unambiguous solution to this problem (Gnezdilov et al., 2015).

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