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A Review of the Genus *Ikonza* Hesse with Notes on Evolution of the Family Issidae (Hemiptera: Auchenorrhyncha: Fulgoroidea)

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Abstract—*Ikonza angolensis* sp. n. is described from southwestern Angola which is the first record of the family Issidae from this country. The fore and hind wing structure and venation are illustrated for *Kovacsiana abyssinica*, *Chimetopon camerunensis*, *Issus pospisili*, and *Tempsa* sp. Ecological data on *Tetrica fusca* in Vietnam are provided for the first time. The evolution and distribution of the family Issidae are briefly discussed.

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The fauna of the family Issidae Spinola in tropical Africa is very poorly known, only six genera with 20 species being recorded in the region (Gnezdilov, 2013b). Five genera are endemic to the Afrotropical Realm (*Chimetopon* Schmidt, 1910; *Hemisobium* Schmidt, 1911; *Ikonza* Hesse, 1925; *Katonella* Schmidt, 1911; *Kivupterum* Dlabola, 1985), and only the genus *Kovacsiana* Synave, 1956 is also represented by the species *K. abyssinica* Synave, 1956 on Rhodes Island in the southern Mediterranean (Gnezdilov et al., 2014). The taxonomic position of many species described from tropical Africa needs to be clarified. In this communication I describe a new species of the genus *Ikonza* which is important for understanding the evolution of the family and the history of its dispersal in the Old Worldc (Gnezdilov, 2015b).

Most of the Afrotropical species of the family are known from East Africa (Eritrea, Sudan, Ethiopia, Tanzania), whereas the fauna of the equatorial West Africa is totally unstudied, with the only species *Chimetopon camerunensis* Schmidt, 1910 recorded in Cameroon, Gabon, and Central African Republic (Gnezdilov, 2013b). One more, undescribed species of the genus *Kovacsiana* is known to me by collection material from Nigeria. Only two species are known from the south of Africa: *Ikonza lawrencei* Hesse, 1925 from the north of Namibia (Hesse, 1925) and a new species from southwestern Angola that is described below. No representatives of Issidae are known from Madagascar, Comoro and Mascarene Islands, and the Seychelles, except for two introduced species of Oriental origin (Gnezdilov, 2009, 2013b, 2015a).

Until now, the genus *Ikonza* has been considered monotypic. Its type species *I. lawrencei* was described from a single specimen, probably a female though its exact sex remains unknown. The description and drawings of *I. lawrencei* here are based on the photographs of the holotype. The new species described below is placed in the genus *Ikonza* based on its similarity with *I. lawrencei* in the forewing venation, in particular, the trifurcate radius and media.

The holotype of the new species is kept in the collection of the British Museum of Natural History (London; BMNH).

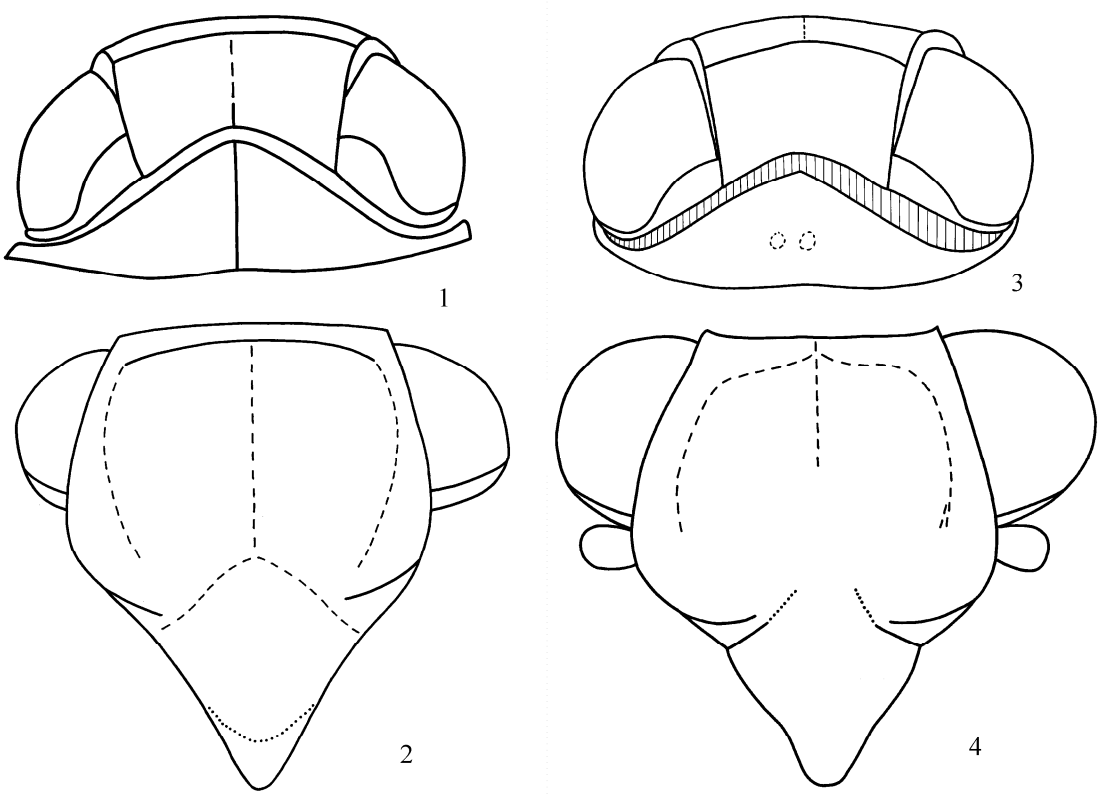
Genus ***IKONZA*** Hesse, 1925

Type species *Ikonza lawrencei* Hesse, 1925.

Ikonza lawrencei Hesse, 1925 (Figs. 1, 2, 6, 22)

Ikonza lawrencei Hesse, 1925 : 160.

Description. Metope with sublateral carinae joined in a horseshoe-shape under its upper margin, with traces of median carina starting from its upper margin; microsculpture present (Fig. 2). Lateral parts of sublateral carinae indistinct. Postclypeus without carinae. Coryphe transversal, 3 times as wide as its median length, with weak median carina (Fig. 1). Pronotum with distinct median carina. Forewing with nar-



Figs. 1–4. *Ikonza* spp.: (1) *I. lawrencei* Hesse, 1925, head and pronotum in dorsal view; (2) *I. lawrencei* Hesse, 1925, head in ventral view; (3) *I. angolensis* sp. n., head and pronotum in dorsal view; (4) *I. angolensis* sp. n., head in ventral view.

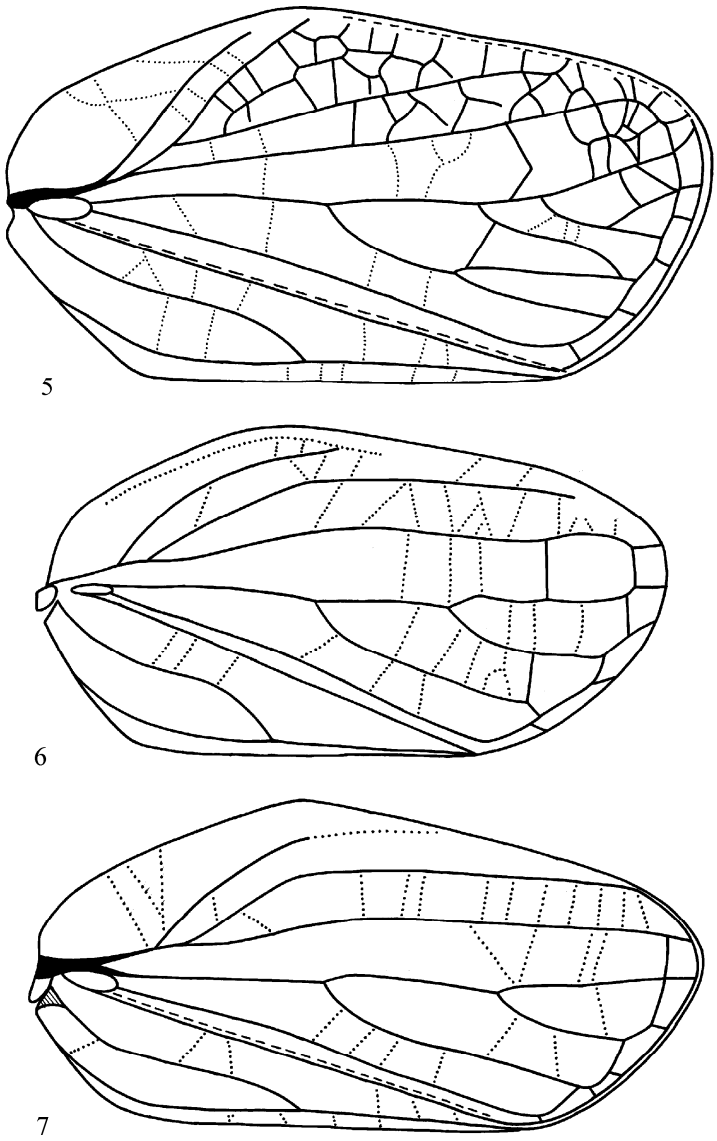
row hypocostal plate. *R* 3 *M* 3 *CuA* 1 (Fig. 6), as in *Chimetopon camerunensis* (Fig. 5). Clavus open, with $Pcu + A_1$ joining its apex. Hind tibia with 2 lateral spines distally and 10 spines apically. First metatarsomere with 2 latero-apical and 9 intermediate spines.

Material. Holotype, "Otjimbumbe, Kunene R., Mar. 1923" (printed), "*Ikonza lawrencei* Hesse Type" (handwritten in drawing ink), "Type" (printed, red), "SAM–HEM–A001573" (printed).

Ikonza angolensis Gnezdilov, sp. n.
(Figs. 3, 4, 7, 9–15, 19–21)

Description. Metope wide, noticeably dilated above clypeus (Fig. 4). Metopoclypeal suture bent in a sharp wedge-shape. Median carina of metope smoothed, extending from its upper margin to its middle. Sublateral carinae smoothed, joined in a horseshoe-shape under upper margin of metope, bent toward its median line above clypeus, with swollen ends (Fig. 20). Clypeus without carinae. Coryphe transversal, about 2 times as wide as long, its anterior margin weakly arched, convex, posterior margin arched, concave (Fig. 3). Pro- and mesonotum without carinae. Pronotum with granular sculpture. Paradiscal fields narrow. Paranotal lobes wide, without carinae. Tegulae small. Forewings elongate, apically truncated, with narrow hypocostal plate. *R* 3 *M* 3 *CuA* 1 (Figs. 7, 21). Transversal veins scarce, located mostly between branches of radius and distally between radius and media. Apices of radius, media, and cubitus joined by transversal veins. Clavus open, with $Pcu + A_1$ joining its apex. Hind wings 3-lobed, about as long as forewings (Fig. 9). Hind tibia with 2 lateral spines. First metatarsomere with 2 latero-apical and 7 intermediate spines, the latter bearing subapical setae.

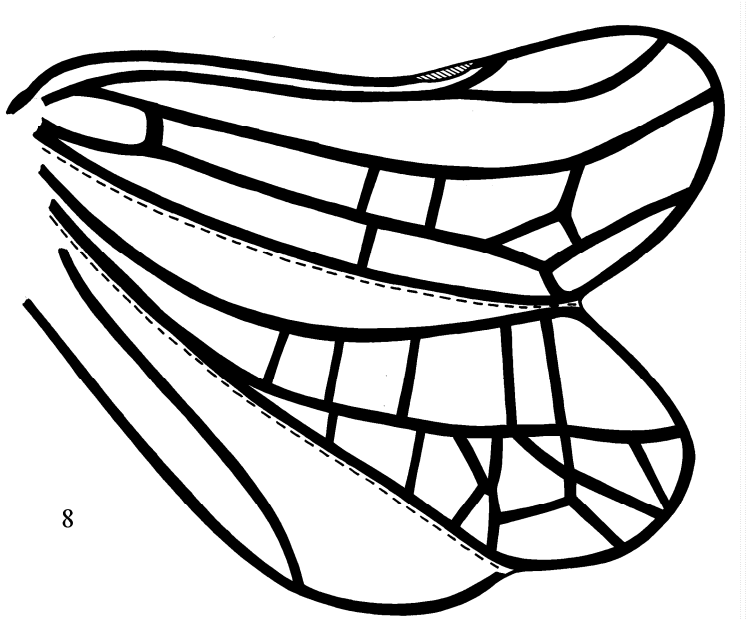
Upper part of metope between its upper margin and sublateral carinae dark grayish brown to black (Fig. 20). Sublateral carinae with vertical rows of yellow spots on either side. Middle part of metope light yellow with dense brown punctation, or grayish brown with light yellow spots forming cross-shaped pattern (Fig. 20). Lower part of metope above clypeus light yellow. Postclypeus light yellow frontally, with dark grayish brown oblique stripes laterally. Anteclypeus and lateral parts of postclypeus dark grayish brown. Temples dark grayish brown. Genae light yellow.

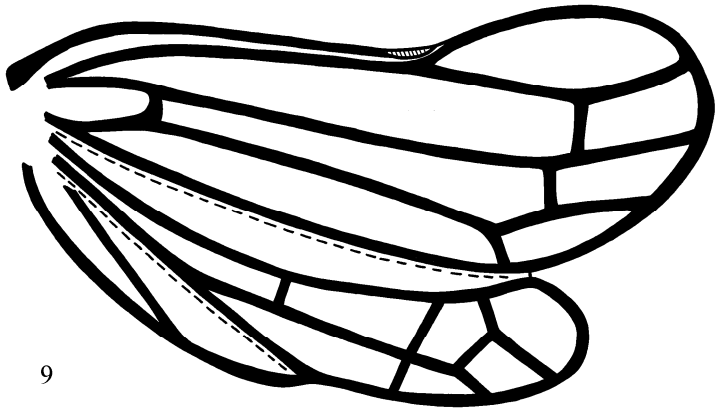


Figs. 5–7. Issidae, forewing: (5) *Chimetopon camerunensis* Schmidt, 1910; (6) *Ikonza lawrencei* Hesse, 1925; (7) *I. angolensis* sp. n.

Scape and pedicel yellowish brown. Proboscis light yellow, tip of its apical segment black. Coryphe light yellow medially, dark grayish brown along margins on the inside (Fig. 19). Pro- and mesonotum yellowish, pronotum behind eyes dark grayish brown, angles of mesonotum with 2 round grayish brown spots. Paranotal lobes light yellow. Forewings brown to dark grayish brown, each with 2 large irregular light yellow spots: one extending to clavus but not touching costal margin, the other starting at about mid-wing on costal margin and extending along radius and anterior branch of media (Fig. 21). Claval suture and some transversal veins light yellow. Hind wings light brown. Fore femora dark grayish brown with light yellow base and apex. Fore and middle tibiae dark grayish brown with several light yellow transversal bands. Middle femora light yellow with dark grayish brown spots. Fore and middle tarsi light brown, hind tarsi light yellow. Tips of spines black. Abdominal sternites light yellow.

Male genitalia (Figs. 10–15). Pygofer with large apodemes, with straight posterior margin (Fig. 12). Anal tube short, wide, dilated apically, with median incision (dorsal view; Fig. 14); its lateral margin straight (lateral view; Fig. 13). Hypoproct long, wide, about half as long as anal tube. Phallobase bent at almost right angle (lateral view), with dorsal lobe un-





Figs. 8–9. Issidae, hind wing: (8) *Chimetopon camerunensis* Schmidt, 1910; (9) *Ikonza angolensis* sp. n.

der its bend, not narrowing toward apex, broadly rounded apically (lateral view), approximately parallel-sided (ventral view; Fig. 10), with 2 long and narrow, tapering subapical processes bent toward its base (Fig. 11). Ventral lobe of phallobase long and wide, narrowing to pointed apex (ventral view), ending short of apices of dorsolateral lobes (lateral view), with 2 large processes covering bases of ventral aedeagal hooks. Apical processes of aedeagus tapering. Aedeagus with 2 long ventral hooks, about half as long as aedeagus, bent laterally toward its base, slightly dilated before pointed tips. Stylus with massive plate, without neck, its posterior margin near head convex (lateral view). Lateral tooth wide. Capitulum of stylus short and wide, apically truncated at right angle (dorsal view; Fig. 15).

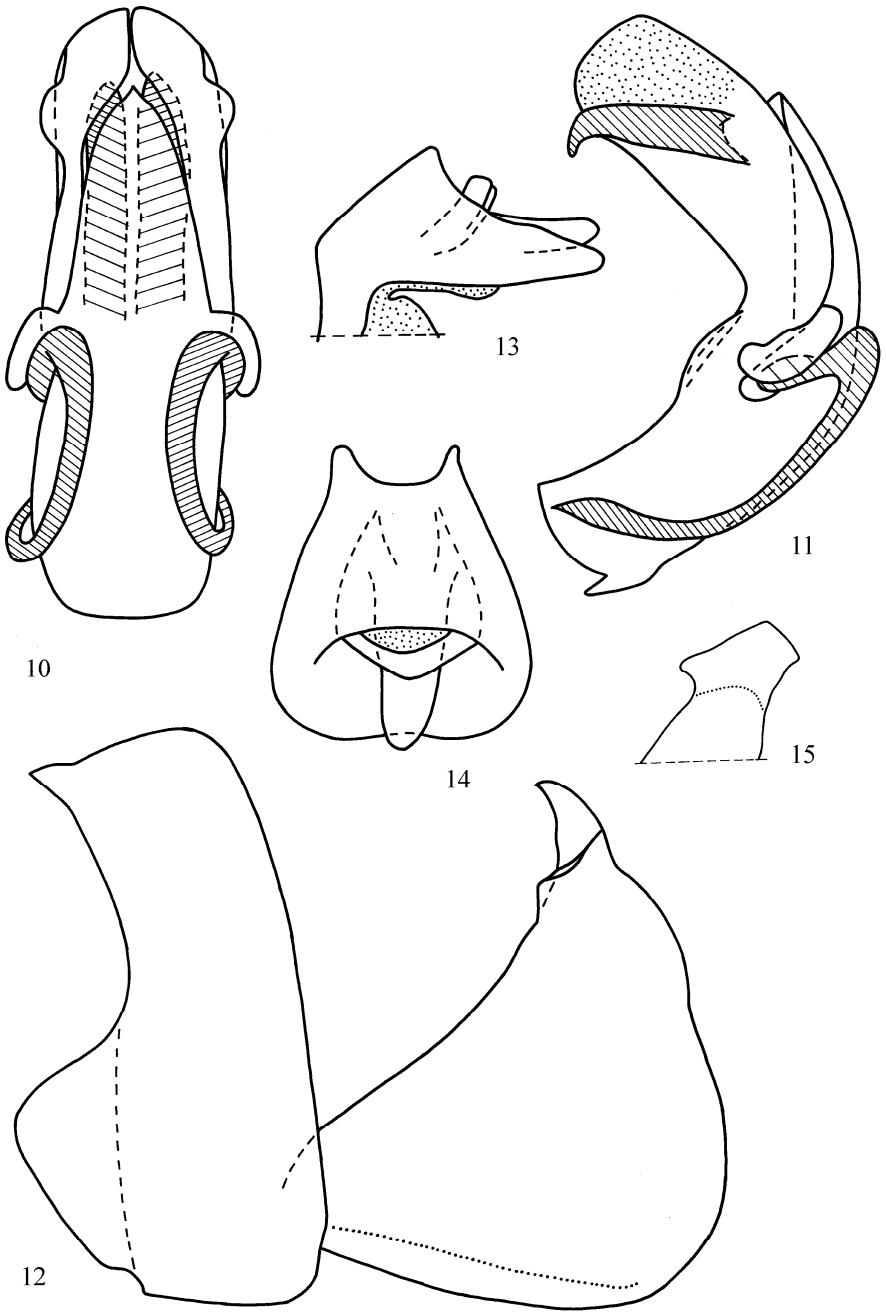
Body length of male 4.3 mm.

Material. Holotype, ♂: **Angola**, "Angola (A11), Bruco, 26.II–2.III.1972, beaten from *Haplocoelum foliolosum*", "Southern African Exp. B.M. 1972–1" (BMNH).

Comparative remarks. The new species differs from *I. lawrencei* in the narrower upper part of the metope and in the less distinct sublateral carinae of the metope below its upper margin (see Figs. 2, 4).

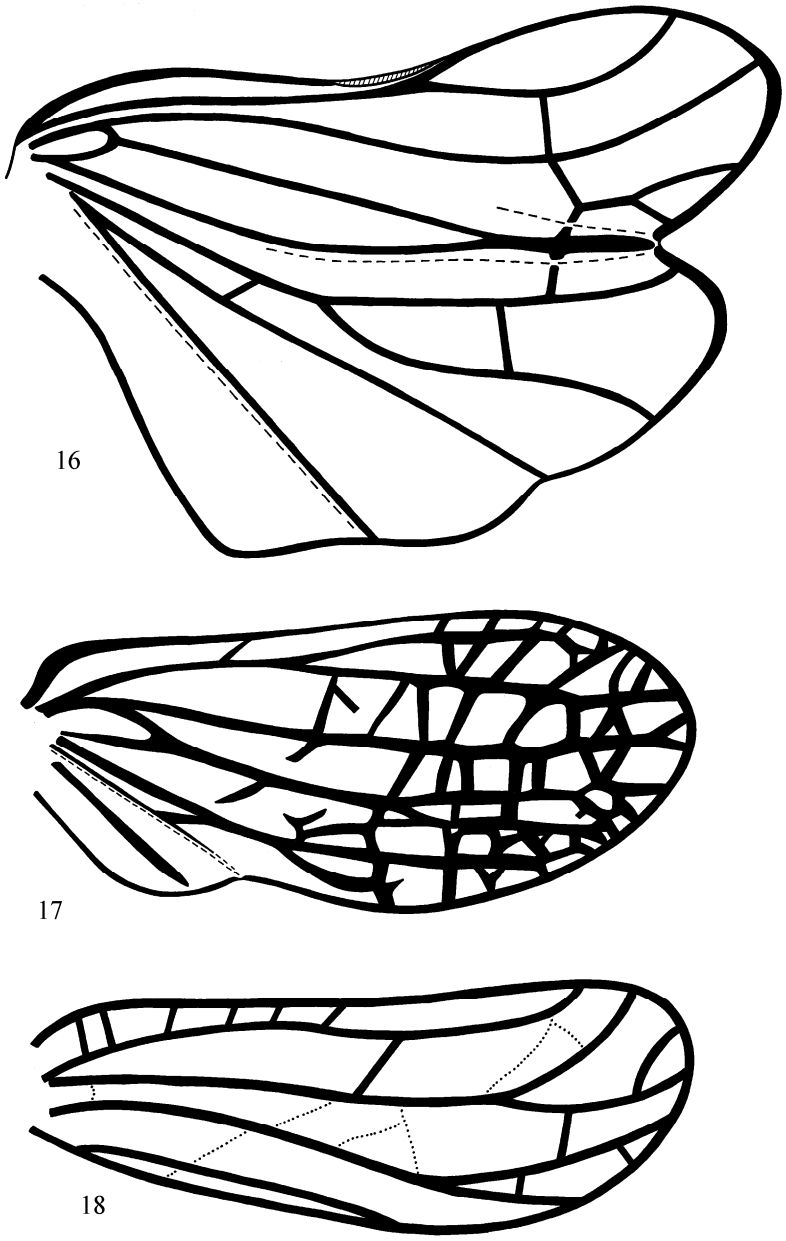
DISCUSSION

The type locality of *Ikonza angolensis* sp. n. lies in the landscape classified into the group of "tropical and subequatorial arid and semi-arid (savanna, sparse for-



Figs. 10–15. Issidae, *Ikonza angolensis* sp. n., male genitalia: (10) penis in ventral view; (11) penis in lateral view; (12) pygofer and stylus in lateral view; (13) anal tube in lateral view; (14) anal tube in dorsal view; (15) stylus head in dorsal view.

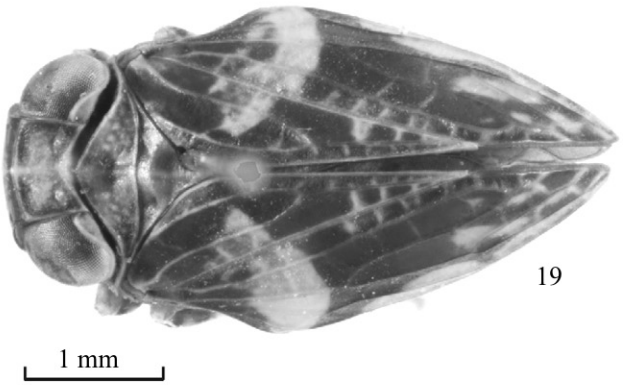
est, and seasonally humid forest) landscapes" (Isachenko and Shlyapnikov, 1989). Similar to *Chimetopon camerunensis* Schmidt, 1910, the new species possesses well-developed three-lobed hind wings (Figs. 8, 9). Such wings are typical of many tropical forest members of Issidae, for example, the Oriental species *Tetrica fusca* Stål, 1870 (Gnezdilov et al., 2015a, fig. 22) that occurs under the forest canopy on plants 1–2 m tall within the lower forest layer in Dong Nai and Ba Ria–Vung Tau Provinces of southern Vietnam. This is also true of representatives of other Oriental genera, in particular *Tempsa* Stål, 1866 (Fig. 16) living in the tree crowns (Gnezdilov, 2015c). However, it should be noted that not all the species living on trees or in forest communities possess well-developed three-lobed hind wings. For example,

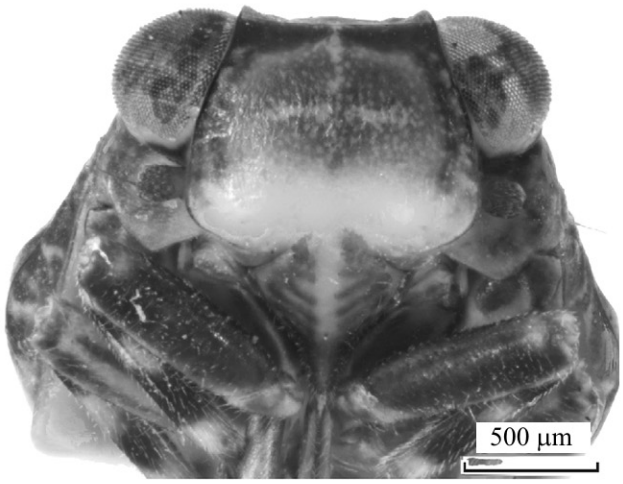


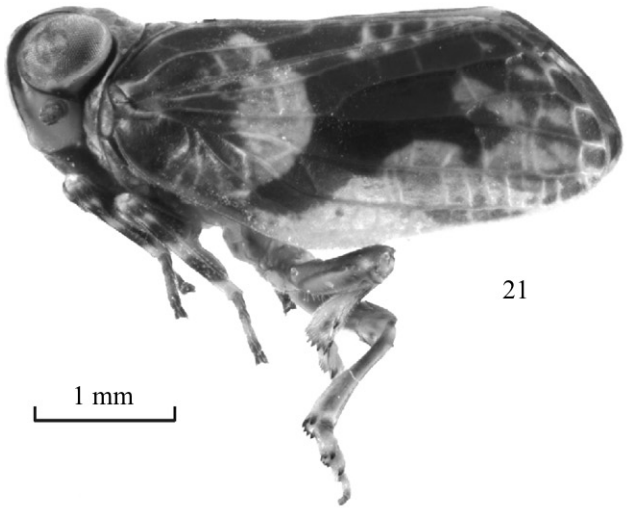
Figs. 16–18. Issidae, hind wing: (16) *Tempsa* sp.; (17) *Issus pospisili* (Dlabola, 1958); (18) *Kovacsiana abyssinica* Synave, 1956.

nymphs of *Issus coleoptratus* (Fabricius, 1781) with their rudimentary wings can be found in tree crowns at heights of up to 8 m (Badmin, 2010).

Besides the three-lobed hind wings, representatives of the genera *Chimetopon* and *Ikonza* are characterized by the free first anal vein which has two or three branches and does not merge, even partially, with the postcubitus. The latter character, namely the free *Pcu* and A_1, may be regarded as a plesiomorphy since the same vein pattern is typical of an Miocene issid planthopper found in the Mexican amber (Grimaldi and Engel, 2005, figs. 2.25, 2.26) and of representatives of the families Tropiduchidae (Gnezdilov, 2013c, figs. 23, 26, 27) and Nogodinidae (Gnezdilov, 2012, fig. 15). In some members of Tropiduchidae, for example, *Trypetimorpha occidentalis* Huang et Bourgoin, 1993, these veins form a secondary terminal anastomosis (Anufriev and Emeljanov, 1988, fig. 387, 2). Partial merging of the postcubitus and the anterior branch of the first anal vein is very typical of the Oriental genera (Fig. 16) but is seldom found in the New World ones (Gnezdilov, 2012).







Figs. 19–22. *Ikonza* spp., habitus: (19) *I. angolensis* sp. n., dorsal view; (20) *I. angolensis* sp. n., frontal view; (21) *I. angolensis* sp. n., lateral view; (22) *I. lawrencei* Hesse, 1925, head in ventral view.

Based on the above features of hind wing venation, the tropical African members of Issidae, in particular *Ikonza angolensis* sp. n. and *Chimetopon camerunensis*, may be considered to be close to the ancestral form of the Western Palaearctic Issidae (Gnezdilov, 2015b). On the other hand, the presence of the forewing radius with three or more branches distinguishes the group of genera distributed in tropical Africa and the Mediterranean: *Chimetopon* Schmidt, 1910, *Hemisobium* Schmidt, 1911, *Ikonza* Hesse, 1925, *Kovacsiana* Synave, 1956, *Latilica* Emeljanov, 1975, *Numidius* Gnezdilov, Guglielmino et D'Urso, 2003, *Semissus* Melichar, 1906, and *Palaeolithium* Gnezdilov, 2003. A characteristic feature of the Western Palaearctic species is gradual reduction of the hind wings. For example, *Issus pospisili* (Dlabola, 1958) still has the anal lobe with one anal vein (Fig. 17), while *Kovacsiana abyssinica* Synave, 1956 already has a single-

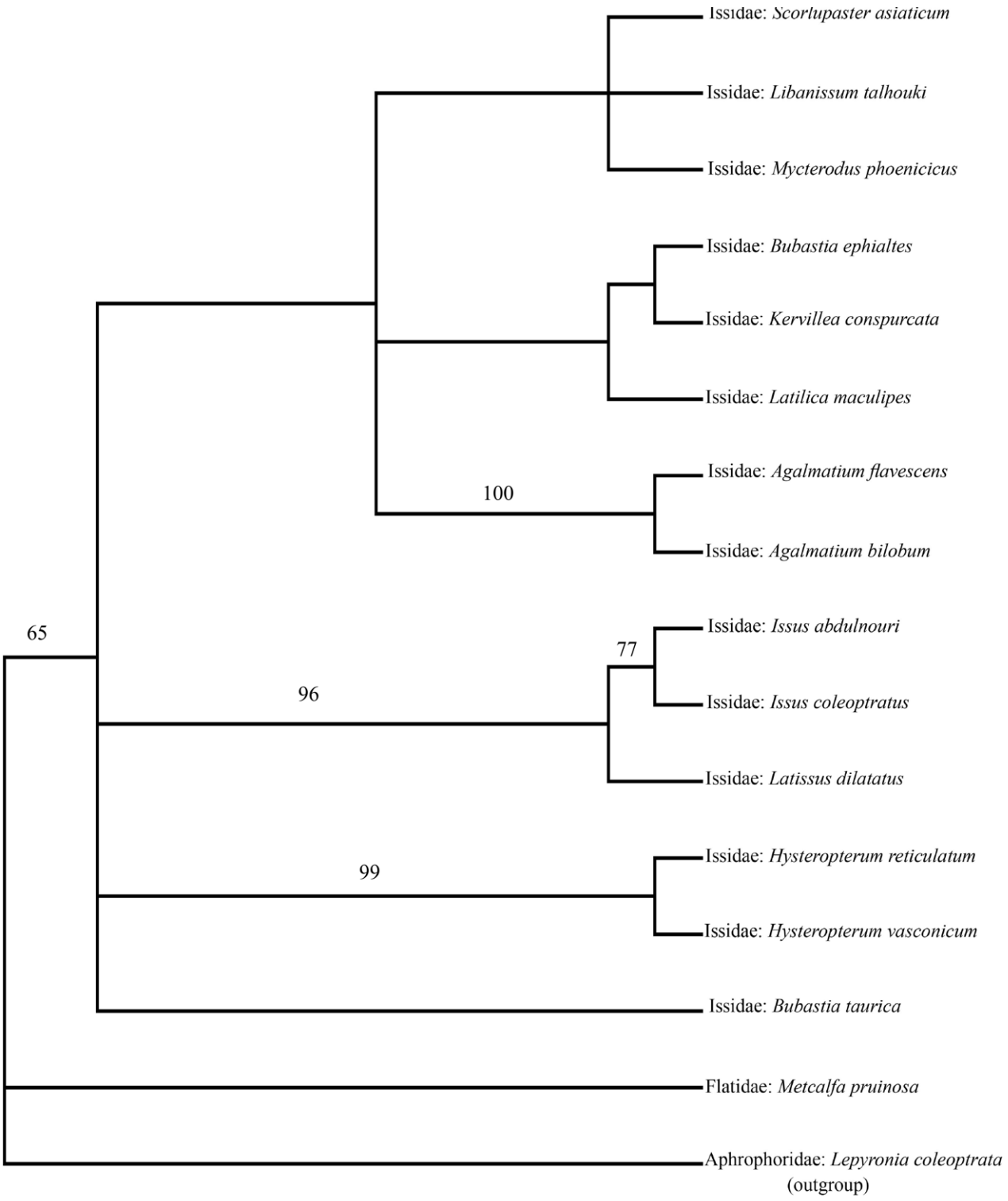


Fig. 23. The consensus tree of Issidae of the Western Palaearctic inferred from *COI*, *18S*, and *28S* gene sequences (after Gnezdilov et al., 2015b).

lobed wing (Fig. 18). Most of the Western Palaearctic representatives of Issidae have rudimentary hind wings.

The center of origin of the family Issidae seems to lie in the modern Oriental Realm, where all its tribes are represented (Gnezdilov, 2013b). The richest fauna

of Issidae of the Western Palaearctic may be formed by a single monophyletic group, as suggested by the recent molecular study (Gnezdilov et al., 2015b) (Fig. 23). The Eastern Mediterranean is the largest center of diversity of the family, where most (4 out of 6) of its polytypic genera occur: *Mycterodus* Spinola, *Tshurtshurnella* Kusnezov, *Bubastia* Emeljanov, and *Kervillea* Bergevin.

Mammals of Asian origin repeatedly migrated into Africa as early as in the Middle and Late Eocene, via Iran and Arabia or via Anatolia, the Balkans, and Western Europe, even though extensive water barriers between Africa and Eurasia still existed at that time (Popov et al., 2009, fig. 3). However, already in the Miocene (18 Mya) connection was established between Africa–Arabia and Asia (Macey et al., 2000), and terrestrial faunal exchange became possible. In particular, the genus *Rhinogaster* Fennah, 1949 of the family Caliscelidae Amyot et Serville, one of the issidoid families (Gnezdilov, 2013a) probably originated in Eurasia, since two out of its three species occur in India. At the boundary of Miocene and Pliocene (5–7 Mya), this genus may have migrated into South Africa, where it is represented by the endemic species *Rh. stilleri* Gnezdilov, 2011 (Gnezdilov, 2011).

The absence of Issidae in the very south of the African continent still remains to be explained, since southern Angola, northern Namibia, and the Republic of South Africa have similar landscape types (Isachenko and Shlyapnikov, 1989). The absence of this group, except for the introduced Oriental species (Gnezdilov, 2009, 2013b), on Madagascar and adjacent islands might be explained by the difficulty of dispersal of subbrachypterous forms over water areas, were it not for the presence of Issidae on such remote islands as Madeira and the Canaries which have endemic faunas of their own (Remane, 1985). Another example is that of the family Caliscelidae including many subbrachypterous and brachypterous species: a peculiar fauna of this family with a large fraction of endemics occurs on Madagascar, and one species is also present on the Comoro Islands (Gnezdilov and Bourgoin, 2009). Thus, members of this family were probably able to traverse the Mozambique Channel, perhaps on floating plant fragments (Gnezdilov, 2014). Besides, the species with well-developed hind wings may have been carried over water barriers by air currents. In view of this, it would be more feasible to assume that Issidae were simply absent in the south and southeast of Africa at the time when representatives of other families, such as Tropiduchidae, Ricaniidae, and Caliscelidae, colonized Madagascar, the Comoro and Mascarene Islands, and the Seychelles. Therefore, representatives of Issidae may have colonized the Afrotropical Realm relatively late; the same may be true of the Australian and Oceanic regions where species of this family are relatively scarce in general and are absent on many islands, including Tasmania and New Zealand (Gnezdilov, 2013b).

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