

New records for the genus *Issus* Fabricius (Hemiptera: Auchenorrhyncha: Fulgoroidea: Issidae) from northern Africa and Spain

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Abstract

Issus kabylicus Dlabola, 1989 is recorded for the first time from Tunisia and *I. vaucheri* Gnezdilov, 2017 – from Spain. *I. kabylicus* is redescribed and illustrated. Male and female genitalia of *I. coleoptratus* (Fabricius, 1781) are described and illustrated based on the specimens from Germany (type locality). Relationships of African *Issus* species are discussed. Close relationships of *I. climacus* Fieber, 1876 to Madeiran and Canarian *Issus* species are revealed.

Key words: Issina, taxonomy, morphology, new record, Tunisia, Algeria, Spain

Introduction

The genus *Issus* Fabricius, 1803 currently comprises 32 valid species (Gnezdilov *et al.* 2014; Gnezdilov 2017a,b,c; Gnezdilov & Bourgoin 2017). From these species, four (*I. afrolauri*, *I. kabylicus*, *I. tubiflexus*, *I. vaucheri*) are known from the continental Northern Africa and three (*I. climacus*, *I. coleoptratus*, *I. vaucheri*) from Iberian Peninsula including new records below.

Until the present study, the Northern African *Issus* fauna was almost unknown except for the original descriptions. Thus, *Issus afrolauri* Sergel, 1986 is still known only from the holotype described from Northeastern Algeria (Collo) (Sergel 1986). The current depository of its type specimen is unknown. *Issus kabylicus* Dlabola, 1989 was described based on a single male from Northern Algeria (Tell Atlas—Kabylie) (Dlabola 1989) and recently recorded also from Yacouren (Gnezdilov 2017a). The redescription of this species is provided below, based on the series of specimens from Northern Tunisia (Jebel Chitana, Jebel El Feija, Ain Draham), a new record, and from another sites in Northern Algeria (surroundings of Tamanart, Jijel, Oued Melab, and Zeituna). Two other species were added to the African fauna two years ago. *Issus vaucheri* Gnezdilov, 2017 was described from Morocco (exact locality unknown) (Gnezdilov 2017a). This species is recorded for the first time from Southern Spain (Cadiz and Malaga Provinces). *Issus tubiflexus* Gnezdilov, 2017 is known from Northern Libya (Cyrenaica—Barqa) (Gnezdilov 2017a). There is no information on the genus fauna of Egypt. *Issus abdounouri* Dlabola, 1987 is distributed in the Middle East (Dlabola 1987; Gnezdilov *et al.* 2014). The record of *I. patruelis* Stål, 1861 from Tunisia (Ain Draham) by Linnavuori (1965) belongs to *I. kabylicus* (see the material listed below) as the first name is junior synonym of *Semissus acuminatus* (Lethierry, 1876) (Gnezdilov 2017a).

Issus species are mostly associated with Mediterranean habitats. *Issus kabylicus* was collected in Northern Tunisia on *Quercus canariensis* Willd. under the forest canopy at the height of 1–2 meters above the ground in Jebel El Feija and on *Q. suber* L. in open maquis habitats in Jebel Chitana (Figs 1–2).

The Iberian *Issus* fauna is also poorly known. *Issus climacus* Fieber, 1876 was described from Portugal (Fieber 1876) and recorded a hundred years later from Spain (Sergel 1986). However, the last record needs confirmation as the species was described based on a female specimen. The other Spanish record is made based on two males (Gnezdilov *et al.* 2011). The widespread and common European species, *I. coleoptratus* (Fabricius, 1781), is recorded from Spain (Bolívar & Chicote 1879) and Portugal (de Seabra 1930). However, authentically this species is



FIGURES 1–2. Collecting sites of *Issus kabylicus* in Northern Tunisia. 1. *Quercus canariensis* Willd. forest in Jebel El Feija; 2. maquis communities with *Quercus suber* L. in Jebel Chitana (photos by V.M. Gnezdilov).

known to the authors only from Eastern Spain (the specimens from Catalonia and Valencia listed below) while other records from Iberian Peninsula need confirmation. *Issus lauri* Ahrens, 1814 is currently known from Balkans to Apennines, including Sicily and Corsica (Gnezdilov *et al.* 2014), it was recorded from Spain and Portugal by Puton (1886), but these Iberian records are in need of confirmation by examination of male genitalia structure because, as recorded below from Southern Spain, *I. vaucheri* Gnezdilov has green yellowish general coloration similar to *I. lauri* and these two species could be easily confused.

Material and methods

Morphological terminology follows Gnezdilov (2003) and Gnezdilov *et al.* (2014), taxonomy of Issidae follows Gnezdilov (2016). The drawings were made using a Leica MZ 9.5 stereo microscope with a camera lucida attached. The photographs were taken using the same microscope and a Leica DFC 290 camera. Images were produced using the Helicon Focus and Adobe Photoshop software. Label information is quoted, with ‘/’ indicating new line and ‘//’ indicating next label.

The material studied is deposited in the following collections:

BMNH—the Natural History Museum, London, United Kingdom;

NMPC—National Museum, Prague, Czech Republic;

SNSD—Staatliche Naturhistorische Sammlungen, Dresden, Germany;

UMC—Dr. Dora Aguin-Pombo collection, University of Madeira, Portugal;

ZIN—Zoological Institute of the Russian Academy of Sciences, Saint Petersburg, Russia.

Taxonomy

Family Issidae Spinola, 1839

Subfamily Issinae Spinola, 1839

Tribe Issini Spinola, 1839

Subtribe Issina Spinola, 1839

Genus *Issus* Fabricius, 1803

Issus coleoptratus (Fabricius, 1781)

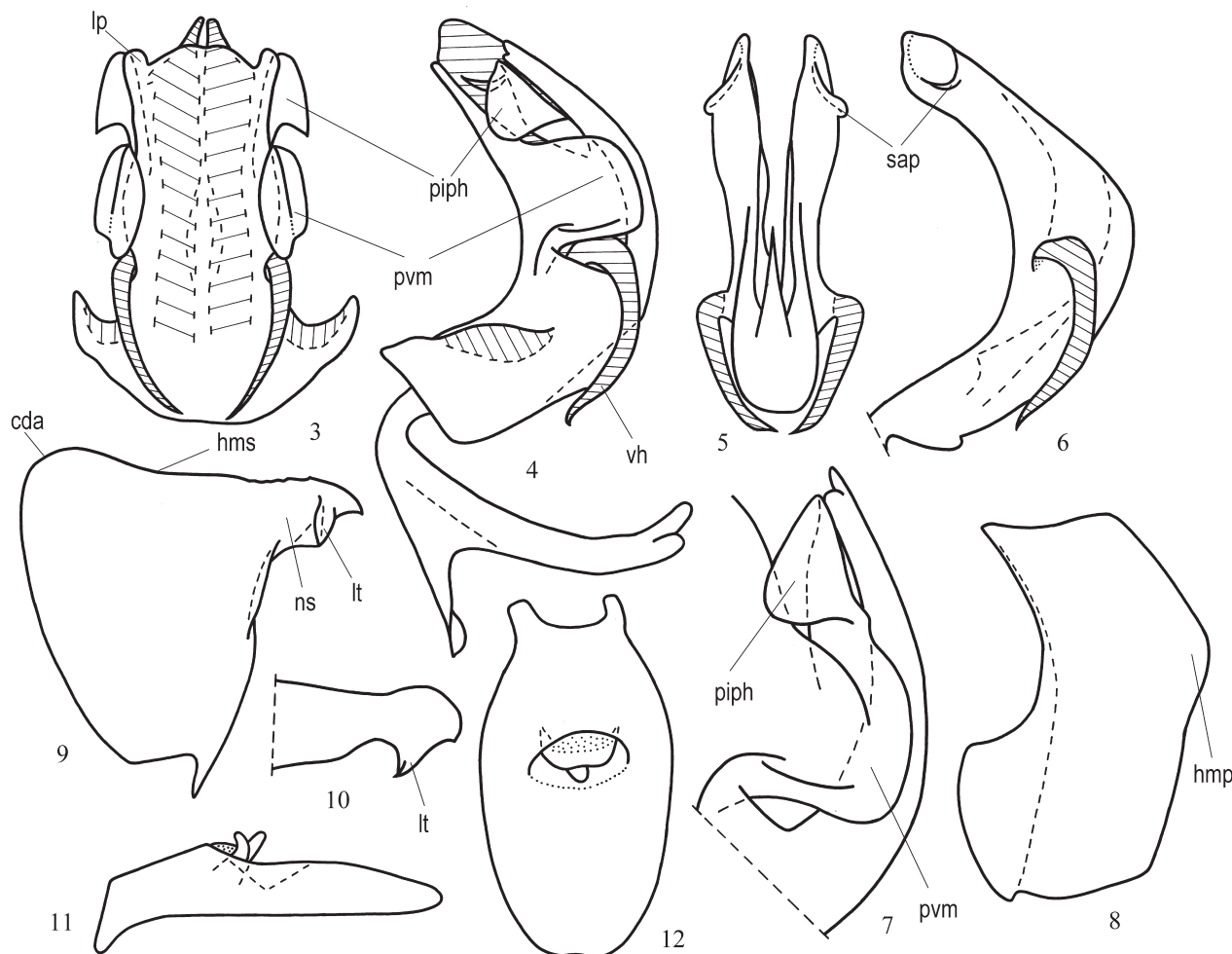
Figs 3–15

Material. Germany: 1 ♂, Berlin, 23.VI.2013, V.M. Gnezdilov leg. (ZIN); 1 ♀, “Herrenalb / 10-Schwarzwald. 12 / O. Adelung VII 98” (ZIN). **France:** 1 ♀, Parc naturel, reg. Vosges du Nord, env. La Petite Pierre, 24.IX.1999, A.C. Lukashuk leg. (ZIN). **Spain:** 1 ♂, 2 ♀, Catalonia, nr 80–100 km N of Barcelona, Toso de Mar, 10–14.VIII.2013, G.I. Ryazanova leg. (ZIN); 1 ♂, Alicante, nr. Puerta de Benifalín, 850 m, FASI 79-33, 2.VI.1979, M. Asche & H. Hoch leg. (ZIN).

Male genitalia (Figs 3–12). Anal tube nearly twice as long as wide in dorsal view; lateral margins not turned down in lateral view; apex with weak concavity (Figs 11, 12). Anal column (paraproct) short. Pygofer with strongly angularly convex hind margins (*hmp*) in its middle (in lateral view) (Fig. 8). Phallobase horseshoe shaped in lateral view, with weak median carina ventrally and with two large lateral folds basally (Figs 3, 4). Processes of inner walls of dorsolateral lobes of phallobase (*pip*) (or earlike processes in Gnezdilov 2017a) large, each with semicircular lobe. Projections of ventral margins of dorsolateral lobes of phallobase covering aedeagal hooks (*pvm*) (or subapical lobes of phallobase in Gnezdilov 2017a) large, nearly square. Ventral phallobase lobe long, wide, nearly as long as dorso-lateral lobes, convex apically, with two lateral processes (*lp*) (Fig. 1). Aedeagus horseshoe shaped in lateral view. Apical aedeagal processes long and wide in lateral view, weakly narrowing to rounded apices, slightly

surpassing upper phallobase margin, each with short and rounded subapical projection (*sap*) (Figs 5, 6). Ventral aedeagal hooks (*vh*) 0.3 times as long as aedeagus, slightly curved, acuminate apically and directed downwards (Figs 3–6). Connective with elongate cup-like apodeme (Fig. 4). Style with nearly straight hind margin (*hms*) and rounded caudo-dorsal angle (*cda*) (Fig. 9). Capitulum of style on wide neck (*ns*) (in lateral view), wide and not narrowing apically (in dorsal view), with wide lateral tooth (*lt*) (Fig. 10).

Female genitalia (Figs 13–15). Sternum VII with deeply concave hind margin (Fig. 13). Anal tube nearly twice as long as wide (in dorsal view) (Fig. 15). Anal column (paraproct) short. Each gonocoxa VIII with large rounded lobe (*gnl*) (Fig. 14).



FIGURES 3–12. *Issus coleoptratus* (Fabricius), Germany (Berlin), male genitalia. 3. penis, ventral view; 4. penis and connective, lateral view; 5. aedeagus, ventral view; 6. aedeagus, lateral view; 7. fragment of phallobase above ventral aedeagal hooks, lateral view; 8. pygofer, lateral view; 9. style, lateral view; 10. capitulum of style, dorsal view; 11. anal tube, lateral view; 12. anal tube, dorsal view. Abbreviations: *hmp*—hind margins of pygofer; *piph*—processes of inner walls of dorsolateral lobes of phallobase; *pvm*—projections of ventral margins of dorsolateral lobes of phallobase; *lp*—lateral processes of ventral phallobase lobe apex; *sap*—subapical projections of apical aedeagal processes; *vh*—ventral aedeagal hooks; *hms*—hind margin of style; *cda*—caudo-dorsal angle of style; *ns*—neck of capitulum of style; *lt*—lateral tooth of style.

Issus kabylicus Dlabola, 1989

Figs 16–37

Material. Algeria: Holotype, ♂ “Azazga / Kabylie / Alg. G.C.C.” (BMNH); 6 ♂, 6 ♀, “FASPMaAIT 82–104 / Algerien, nördl. Tamanart / [37°04′14″ N 6°30′07″ E, / Radius 1,5 km, alt. 50–350 m] // Korkeichen—Hangwald / + Bachtäler / 14.09.1982, leg./coll. / R. Remane, Museum Dresden” (SNSD and ZIN); 1 ♀, “FASMaAI 80–107 / Algerien, sw. Jijel / supra Oued Kissir / [36°48′05″ N 5°41′20″ E / Radius 1 km] / alt. ca. 170 m // Garrigue aus Qu. suber / Phillyrea, Myrthe, Erica arb. / Lentiske, Smilax, Cistus / “Calicot.”, 10.08.1980, leg./coll. / R. Remane,

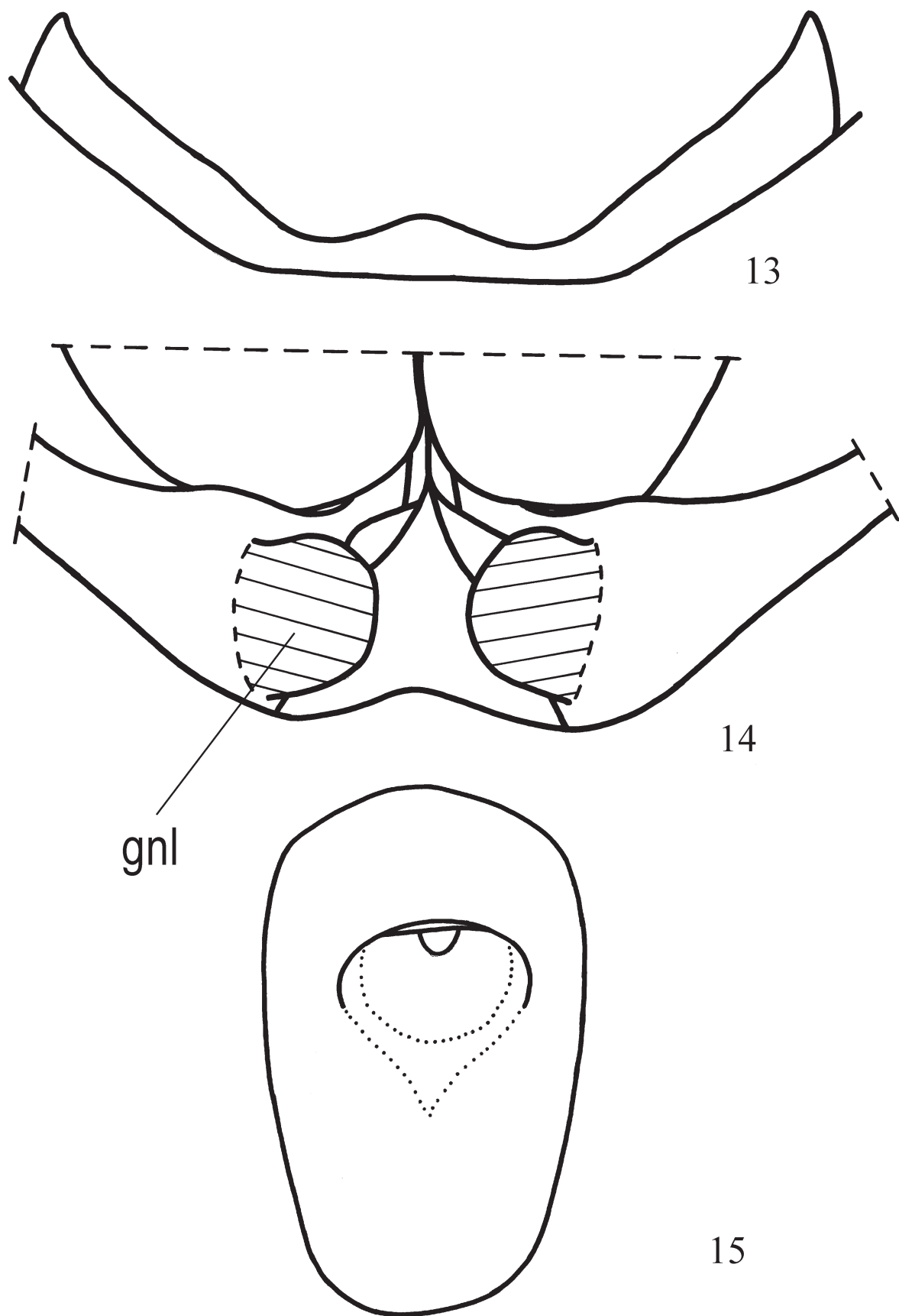
Museum Dresden // Issus spec. / (O. Abdomen) / det. R. Remane" (SNSD); 2 ♀, "FASMaAI 80–104 / Algerien, ö. sp. Oued Melab / [36°52'46" N 6°28'21" E / Radius 15 km, alt. 100–800 m] // Eichenwald m. Arbutus / Baumheide, Myrthe / 09.08.1980, leg. coll. / R. Remane, Museum Dresden // Issus spec. ♀ / det. R. Remane" (SNSD); 2 ♂, "FASMaAI 80–103 / Algerien, w. Zeituna / [36°59'41" N 6°23'40" E / Radius 7 km, alt. 600–900 m] // Eichenwald, m. verbiss. / Erica arb., behaarten Cytisus / 09.08.1980, leg./coll. / R. Remane, Museum Dresden // Issus spec. ♂ / det. R. Remane" (SNSD). **Tunisia:** 2 ♂, 24 km NE Nefza, Jebel Chitana, 37° 08.822' N 9°54.799' E, 343 m, maquis, 20.VIII.2018, F.V. Konstantinov leg. (ZIN); 1 ♂, 1 ♀, same locality, 22.VIII.2018, V.M. Gnezdilov leg. (ZIN); 3 ♂, 3 ♀, Jebel El Feija, 36°50.510' N 10°09.385' E, 850 m, 26.VIII.2018, V.M. Gnezdilov leg. (ZIN); 1 ♀, "ITAI 86–65, Tunesien, S. Ain / Draham, [36°45'21" N 8°41'30" E, Radius 1 km], alt. ca. 650 m / lichter Qu. suber—Hangwald // m. dichten Unterwuchs aus / Erica spp., Arbutus, Myrthe / u.a., 22.09.1986, leg./coll. / R. Remane, Museum Dresden" (SNSD); 1 ♀, Ain Draham, 16–18.VIII.1962, R. Linnavuori leg. (ZIN); 1 ♀, Camp des Chenes, 35 km S of Tabarka, 2.IX.1995, J. Batelka & H. Podrouzkova leg. (NMPC).

Supplementary description. Male. Structure (Figs 29–32). Metope with distinct median carina running from its upper margin to metopoclypeal suture which is in shape of deep hollow (Fig. 31). Sublateral carinae of metope well visible only in its upper part and above clypeus. Coryphe nearly square, with weak median carina; anterior margin angularly convex (at the corner of nearly 100°); posterior margin angularly concave (Figs 29, 32). Lateral margins of coryphe weakly diverging above pronotum. Ocelli absent. Pedicel barrel-shaped. Pronotum nearly equal in length to coryphe at midline, pressed in the middle; anterior margin strongly convex; posterior margin straight. Paradiscal fields of pronotum wide. Paranotal lobes large, without carinae. Mesonotum 1.3 times as long as pronotum at midline, with median and lateral carinae. Forewing sequences: R 2, furcating near to basal cell; M 2, CuA 2, both furcating near to wing middle (Fig. 30). Hind tibia with 2 lateral spines in its apical half and with 8–10 apical spines. First metatarsomere 1.5 times as long as second one, with 2 latero-apical and 7 intermediate spines.

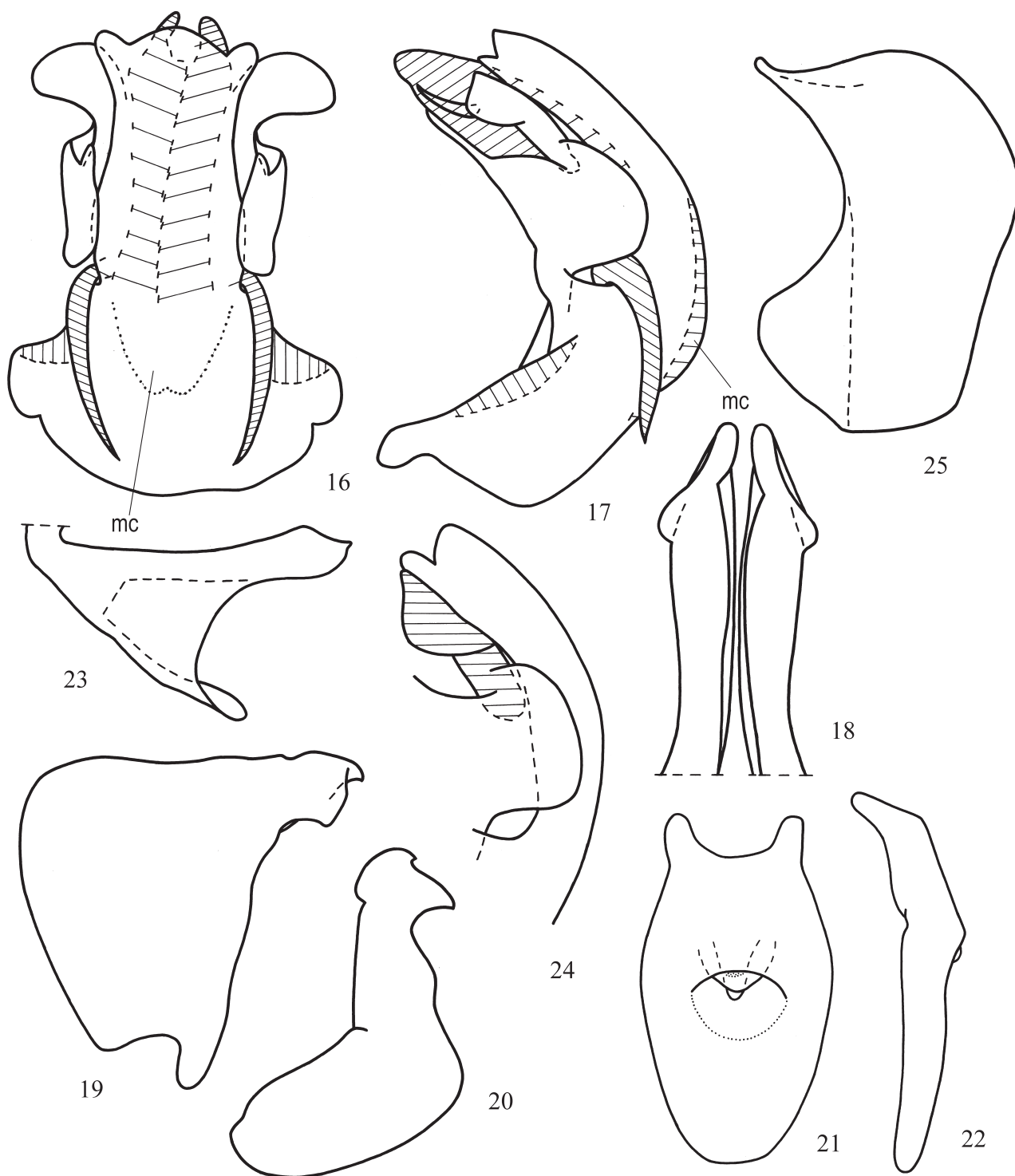
Male. Coloration (Figs 29–32). Metope yellowish light brown to dark brown between sublateral carinae and dark brown to black between lateral margins and sublateral carinae, with light yellow transverse carina and pustules (traces of larval sensory pits). Metope with black band above transverse carina. Preocular fields and genae yellowish light brown. Each preocular field with dark brown spot below coryphe margin. Postocular fields dark brown. Postclypeus brown frontally and yellowish light brown under metopoclypeal suture and laterally. Anteclypeus brown frontally and yellowish light brown laterally. Scapus yellow. Pedicel brown, with yellow apex. Rostrum yellowish or greenish light brown, with black apex. Coryphe and middle of pronotum and mesonotum greenish light brown. Paradiscal fields of pronotum and nearby areas of paranotal lobes dark brown to black, with greenish light yellow pustules. Lower margin of paranotal lobes at the level of costal margin of fore wing whitish. Fore wings greenish light brown (in freshly caught specimens), with dark brown to black veins; each wing sometimes with black spot between second radius vein and first median vein at the level of apex of clavus. Hind wings dark brown. Legs light brown greenish. Fore and middle femora and tibiae with brown crossbands. Hind femora dark brown dorsally. Tarsi sometimes green, with dark brown apices of third tarsomeres and claws. Leg spines dark brown to black. Abdominal sternites greenish light yellow, with dark brown middle parts on IV–VII ones in some specimens. Styles with dark brown to black margins in some specimens. Anal tube greenish light yellow.

Female. Structure (Figs 33–37). As male except fore wing with wave-shaped radius veins and first radius vein with reticulate venation apically (Fig. 34).

Female. Coloration (Figs 33–37). General coloration yellowish brown. Metope dark brown to black above transverse carina and between lateral margins and sublateral carinae in its upper part (Fig. 35). Pustules of metope yellowish light brown. Sometimes metope dark brown, except yellowish carinae and pustules. Postclypeus sometimes dark brown, except yellowish band below metopoclypeal suture. Anteclypeus sometimes dark brown. Preocular fields and genae yellowish. Scapus yellow. Pedicel dark brown, with yellow apex. Rostrum brown dorsally and yellowish brown ventrally, with black apex. Paradiscal fields of pronotum dark brown to black, with yellowish light brown pustules (Figs 33, 37). Paranotal lobes brown to dark brown, with yellowish light brown pustules, except lower margin. Fore wings with dark brown transverse veins, sometimes with two wide black crossbands basally and near to clavus (Fig. 37). Hind wings greyish brown. Hind coxae yellowish, with dark brown to black areas. Femora brown to dark brown dorsally. Apices of hind femora sometimes greenish. Tibiae sometimes with dark brown areas. Tarsi greenish, with dark brown claws and spines. Abdominal sternites yellowish, except sternites V–VII with dark brown areas medially. Laterotergites dark brown. Anal tube and gonocoxae yellowish (Fig. 36). Gonoplares yellowish light brown, with dark brown margins.



FIGURES 13–15. *Issus coleoptratus* (Fabricius), female genitalia (13, 14. Germany, Herrenalb; 15. France, La Petite Pierre). 13. hind margin of sternum VII; 14. gonocoxae VIII; 15. anal tube, dorsal view. Abbreviation: *gnl*—lobe of gonocoxa VIII.



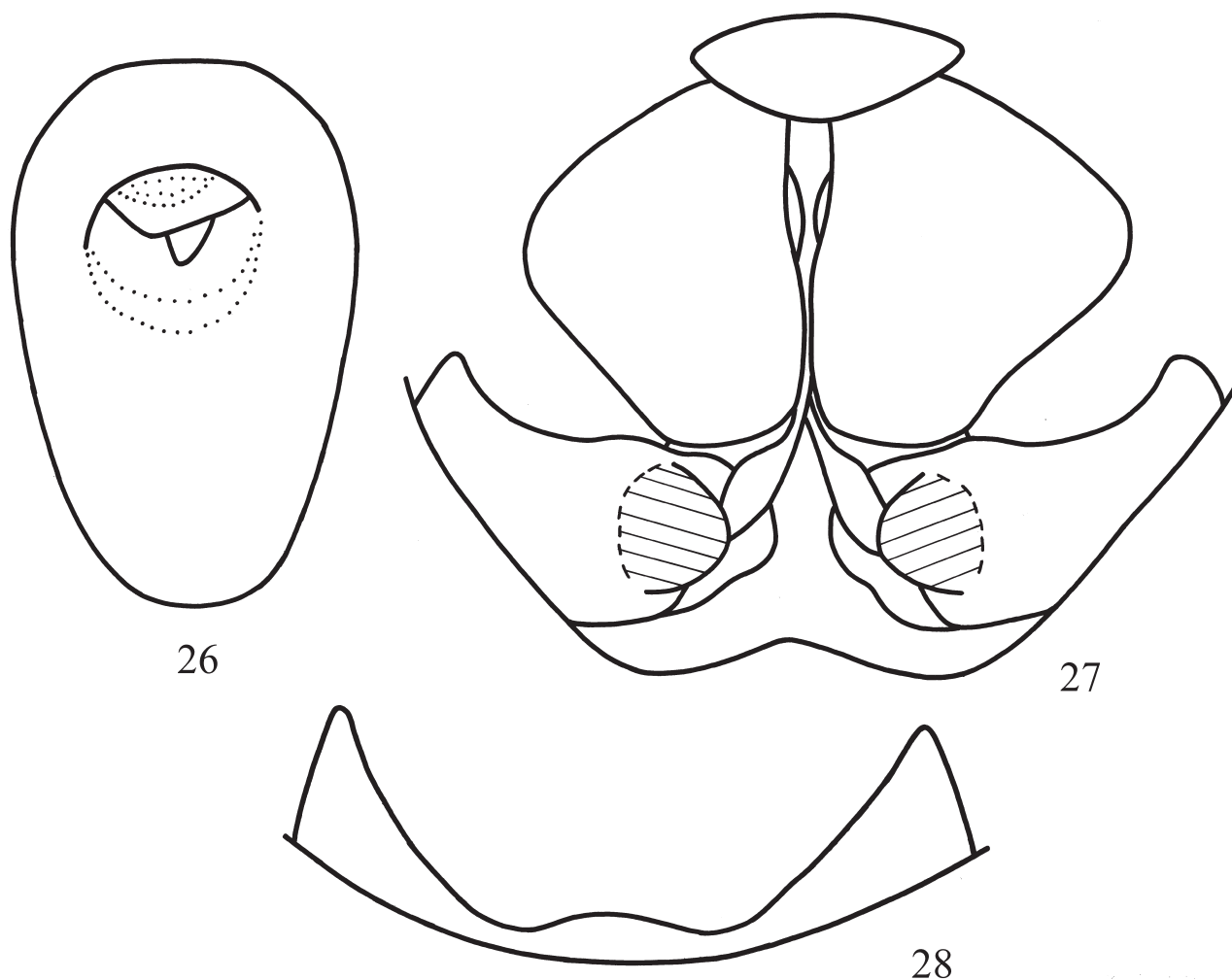
FIGURES 16–25. *Issus kabylicus* Dlabola, male genitalia (16–22. holotype; 23–25. Algeria, N of Tamanart). 16. penis, ventral view; 17. penis, lateral view; 18. apical processes of aedeagus, ventral view; 19. style, lateral view; 20. style, dorsal view; 21. anal tube, dorsal view; 22. anal tube, lateral view; 23. connective, lateral view; 24. fragment of phallobase above ventral aedeagal hooks, lateral view (process of inner wall of dorsolateral lobe of phallobase is shaded); 25. pygofer, lateral view. Abbreviation: *mc* – median carina of phallobase.

Male genitalia (Figs 16–25). Very close to *I. coleoptratus* described above. Anal tube nearly twice as long as wide, apex without concavity in dorsal view (Fig. 21); lateral margins not turned down (in lateral view) (Fig. 22). Anal column short. Pygofer with widely convex hind margins in lateral view (Fig. 25). Phallobase horseshoe shaped in lateral view, with weak two-lobed median carina (*mc*) (Fig. 16). Processes of inner walls of dorsolateral lobes

of phallobase large, each with semicircular lobe (Fig. 24). Projections of ventral margins of dorsolateral lobes of phallobase covering aedeagal hooks large, nearly square (Fig. 17). Ventral phallobase lobe wide and long, with two lateral processes apically (Fig. 16). Apical aedeagal processes long and wide (in lateral view), weakly narrowing to rounded apices, slightly surpassing upper phallobase margin, each with short and rounded subapical projection (Figs 17, 18). Ventral hooks of aedeagus 0.3 times as long as aedeagus, acuminate apically and directed downwards. Connective with wide cup-like apodeme (Fig. 23). Style with nearly straight hind margin, caudo-dorsal angle widely rounded (Fig. 19). Capitulum of style on wide neck in lateral view, wide and not narrowing apically in dorsal view, with wide lateral tooth (Fig. 20).

Female genitalia (Figs 26–28, 36). Sternum VII with deeply concave hind margin (Figs 28, 36). Anal tube nearly twice as long as wide, slightly narrowing apically in dorsal view (Fig. 26). Anal column (paraproct) short. Gonoplags convex. Each gonocoxa VIII with large rounded lobe (Fig. 27).

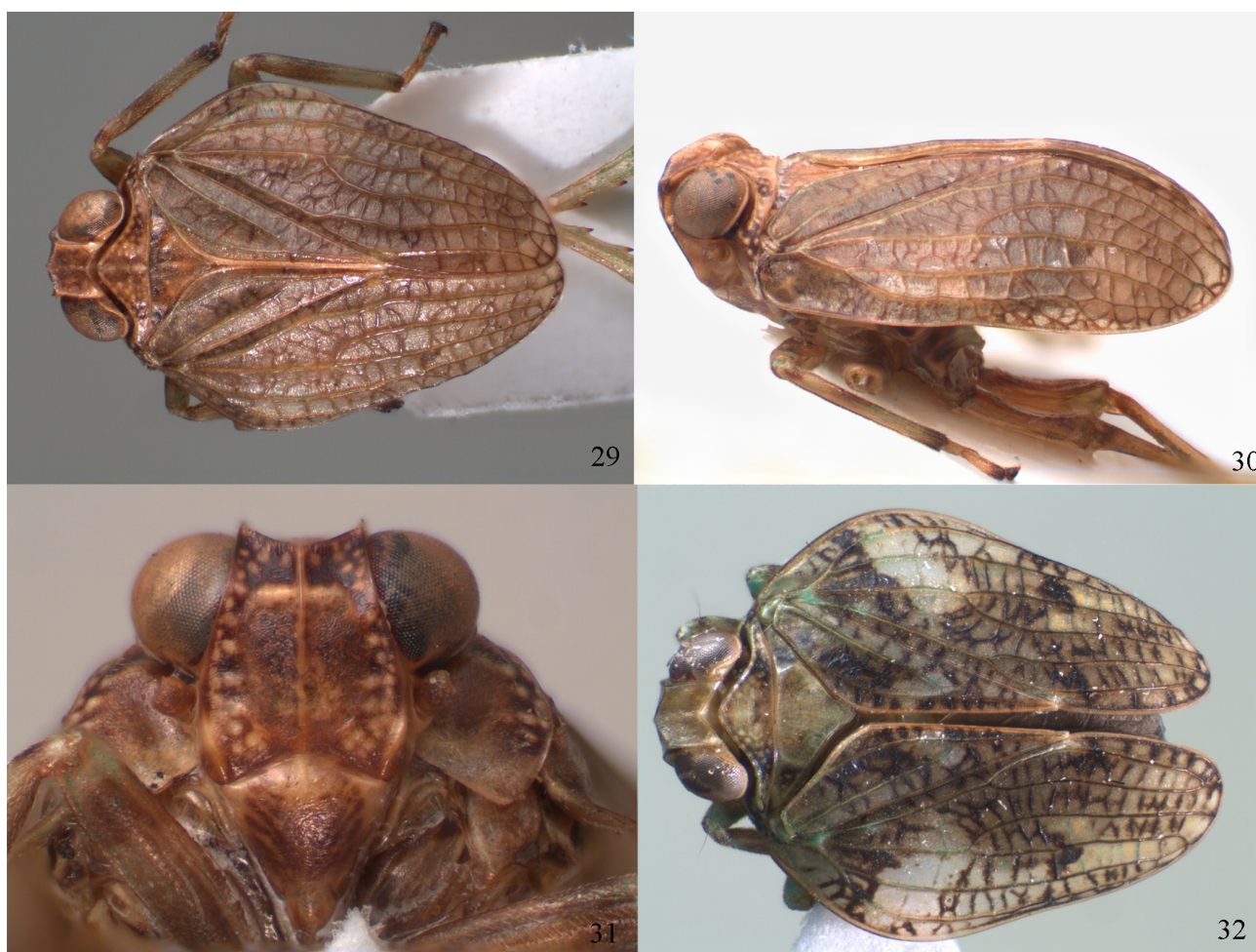
Total length. Males—5.1–5.9 mm. Females—5.2–6.0 mm.



FIGURES 26–28. *Issus kabylicus* Dlabola, Tunisia (Jebel El Feija), female genitalia. 26. anal tube, dorsal view; 27. gonocoxae VIII, gonoplags, and anal tube, caudal view; 28. hind margin of sternum VII.

Issus vaucheri Gnezdilov, 2017

Material. Spain: 1♂, “S^a Bermeja, Estepona / Málaga, SPAIN / Date: 2.VIII.1996 / Leg.: J. de Ferrer (UMC); 1♂, “FASMaAI 80–16, Spanien, w. / Grazalema (über Paß n. W / hinunter), östl. Benamaoma, [36°45′23″ N 5°26′25″ W, Radius / 2,2 km, alt. 450–1000 m] // Eichenwald m. Arbutus, Pist. / lent., (ohne Erica) u.v.m. / 16.07.1980, leg./ coll. / R. Remane, Museum Dresden” (SNSD).



FIGURES 29–32. *Issus kabylicus* Dlabola, male (29–31. holotype; 32. Tunisia, Jebel El Feija). 29, 32. dorsal view; 30. lateral view; 31. frontal view.

Discussion

Issus coleoptratus (Fabricius) was originally described from Germany (Fabricius 1781) and is illustrated here based on the specimens from Berlin (Figs 3–14). It is widely distributed in Europe and closely related to Northern African *I. kabylicus* Dlabola according to the presence of black spot on each fore wing in males (Fig. 32) and the peculiar reticulate venation between the costal margin and the first radius vein of the forewings of females (Fig. 34), although in *I. coleoptratus* this reticulation is wider and reaching the second radius vein. Both species are also characterized by almost identical structure of the male genitalia, which includes the ventral lobe of phallobase having two lateral processes apically and a weak median carina basally (Figs 3, 4, 16, 17). However, the two species differ from each other by the followings details: *I. kabylicus* has the anal tube without apical concavity, in dorsal view (*I. coleoptratus* has only a weak concavity) (Figs 12, 21); the pygofer of *I. kabylicus* has the widely convex hind margins in lateral view (*I. coleoptratus* has the pygofer with the strongly angularly convex hind margins) (Figs 8, 25).

Issus vaucheri Gnezdirov, *I. kabylicus* Dlabola, and *I. coleoptratus* (Fabricius) are similar to each other according to the shape of the phallobase, which has a weak median carina (*I. kabylicus* and *I. coleoptratus*) or without one (*I. vaucheri*), the hind margins of the pygofer is distinctly convex in the upper half (in lateral view), the style has a weakly concave hind margin, the male anal tube is elongate, having margins not turned down. *I. vaucheri* is also characterized by the yellowish green general coloration, at least in males, while two other species are brown. Another yellowish green species, *I. afrolauri* Sergel, is more close to *I. lauri* Ahrens according to the presence of distinct median carina on the phallobase (Sergel 1986, figs 6–8). Middle Eastern *I. abdounouri* Dlabola has no me-

dian carina of the phallobase, but characterized by the very wide male anal tube, which has the lateral margins in the shape of large lobes turned downwards, which is an exception within the genus *Issus* (Dlabola 1987, figs 29, 31).

Issus climacus Fieber is described based only on a single female specimen and characterized by a peculiar process of the hind margin of the sternum VII, which has a shape of two horns, and also by a characteristic dark brown postclypeus (Gnezdilov *et al.* 2011, fig. 1). These characters indicate the close relationship with *I. maderensis* Lindberg, 1954, described also based on a single female specimen from Madeira (Lindberg 1954, fig. 35n), and with *I. capala* Remane, 1985 and *I. capapi* Remane, 1985, both from the Canary Islands (Remane 1985). Additional material of *I. climacus* from Portugal, would help to better understand the relationships of these species.



FIGURES 33–37. *Issus kabylicus* Dlabola, female (33–36. Tunisia, Jebel El Feija, 37. Algeria, N of Tamanart). 33, 37. dorsal view; 34. lateral view; 35. frontal view; 36. ovipositor, caudal view.

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