

First record of the genus *Raunolina*
(Hemiptera: Fulgoroidea: Caliscelidae)
from tropical Africa with description of two new species
from Sudan and Saudi Arabia

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Abstract. *Raunolina* Gnezdilov & Wilson, 2006 erected as a subgenus of *Perissana* Metcalf, 1952 is upgraded to generic level. *Raunolina remanei* sp. nov. is described from northeastern Sudan, which is the first record of the genus and the tribe Adenissini Dlabola, 1980 from tropical Africa, and *R. jeddahica* sp. nov. is described from western Saudi Arabia. Two new combinations are provided: *Raunolina circularis* (Linnavuori, 1952), comb. nov. and *Raunolina arabica* (Gnezdilov & Wilson, 2006), comb. nov.; *R. arabica* is recorded for the first time from Yemen. A key to separate the genera *Perissana* and *Raunolina* as well as a key to species of *Raunolina* are given. The global distribution of Adenissini is discussed.

Key words. Hemiptera, Auchenorrhyncha, Fulgoromorpha, Caliscelidae, Ommatiotinae, Adenissini, *Perissana*, distribution, morphology, systematics, taxonomy, Saudi Arabia, Sudan, Yemen, Afrotropical Region

Introduction

Raunolina Gnezdilov & Wilson, 2006 was erected as a subgenus of the genus *Perissana* Metcalf, 1952 to accommodate *R. circularis* (Linnavuori, 1952), known from Israel and Egypt (Sinai), and *R. arabica* (Gnezdilov & Wilson, 2006) described from Saudi Arabia (GNEZDILOV & WILSON 2006). However, I think this group should be upgraded to generic level, based on significant differences in external characters (the form of the median carina on metope, forewing venation, and the form of gonoplasts in females – see the identification key below), which have been used to diagnose separate genera in Caliscelidae and other Fulgoroidea. Nevertheless, *Raunolina* and *Perissana* are probably closely related as both taxa are characterized by the same pattern of male genitalic structures consisting of a massive phallobase, with each dorso-lateral lobe bearing a large tooth-shaped process subapically on its dorsal

surface, and a large rounded lobe covering a ventral aedeagal hook, the ventral phallobase lobe wide and thick, the aedeagus with a pair of ventral hooks arising subapically, the style with a massive plate and a small capitulum with a finger-shaped tooth laterally and two teeth apically (GNEZDILOV & WILSON 2006).

In this paper, *R. arabica* is recorded for the first time from Yemen and two new species of *Raunolina* are described: *R. jeddahica* sp. nov. from the Red Sea coast of western Saudi Arabia, which increases the number of *Raunolina* species known from the country to two, and *R. remanei* sp. nov. from Sudan (its type locality, Erkowit, is situated 470 km NE of Kassala, near the Red Sea coast). Thus *Raunolina* has a Sumerian-Afrotropical pattern of distribution. *Perissana* includes three species distributed in Iran, northern Iraq, and Azerbaijan, which is an Irano-Turanian pattern of distribution.

Both genera belong to the tribe Adenissini Dlabola, 1980, subtribe Adenissina Dlabola, 1980 (GNEZDILOV 2013a). Until now, Adenissini has been known from the Afrotropical Region only after two species of *Adenissus* Linnavuori, 1973 – *A. brachypterus* Linnavuori, 1973, described from southern Yemen, and *A. riadicus* Dlabola, 1985, described from eastern Saudi Arabia (Haradh) and later recorded also from the UAE and Oman (LINNAVUORI 1973; DLABOLA 1985; GNEZDILOV et al. 2004; GNEZDILOV & WILSON 2006, 2011; GNEZDILOV & BOURGOIN 2009). Four other species of *Adenissus* are restricted in their distribution to Iran (DLABOLA 1980).

Material and methods

Morphological terminology follows EMELJANOV (1999) and GNEZDILOV (2003). Distributional patterns are named after EMELJANOV (1974).

The drawings were made using a Leica MZ 95 light 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.

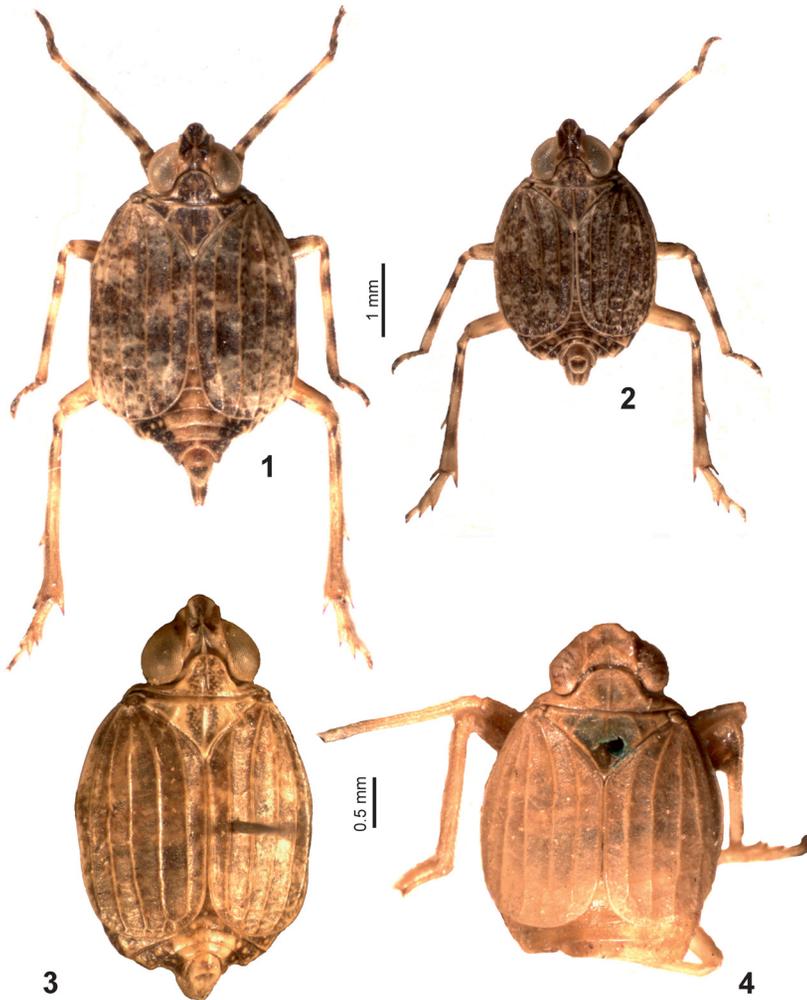
The material studied is deposited in the following collections:

BMNH	The Natural History Museum, London, United Kingdom;
MNHN	Muséum national d'Histoire naturelle, Paris, France;
SNSD	Staatliche Naturhistorische Sammlungen, Dresden, Germany;
TAUI	Tel-Aviv University, Tel-Aviv, Israel;
ZIN	Zoological Institute of the Russian Academy of Sciences, Saint Petersburg, Russia;
ZMUH	Zoologisches Museum, Universität Hamburg, Hamburg, Germany.

Taxonomy

Key to separate the genera *Perissana* and *Raunolina*

- 1 Metope with median carina not reaching its upper margin (GNEZDILOV & WILSON 2006: Fig. 1b). Fore wings with many transverse veins (reticulate venation) (GNEZDILOV & WILSON 2006: Fig. 1a); CuP distinct in proximal half of the wing. Gonoplasts rounded, with dorso-caudal angles in lateral view not protruding above apex of anal tube (GNEZDILOV & WILSON 2006: Fig. 5). *Perissana* Metcalf, 1952



Figs 1–4. *Raunolina* species, dorsal view. 1–2 – *R. remanei* sp. nov., paratypes (1 – female; 2 – male); 3 – *R. jeddahica* sp. nov., holotype; 4 – *R. circularis* (Linnavuori, 1952), holotype (dissected).

- Metope with median carina reaching its upper margin (Fig. 7). Fore wings only with longitudinal veins (Figs 1–4, 8); CuP indistinct. Gonopods triangular, with dorso-caudal angles in lateral view clearly protruding above apex of anal tube (Figs 10, 12).
 *Raunolina* Gnezdilov & Wilson, 2006, **stat. nov.**

***Raunolina* Gnezdilov & Wilson, 2006, stat. nov.**

Raunolina Gnezdilov & Wilson, 2006: 15 (subgenus of *Perissana*). Type species: *Perissus circularis* Linnavuori, 1952, by original designation.

Diagnosis. Median carina of metope complete, running from its upper margin through postclypeus. Fore wings with longitudinal veins simple; CuP reduced. Ventral phallobase lobe with denticles on its inner side. Gonoplags triangular, with dorso-caudal angles protruding.

***Raunolina remanei* sp. nov.**

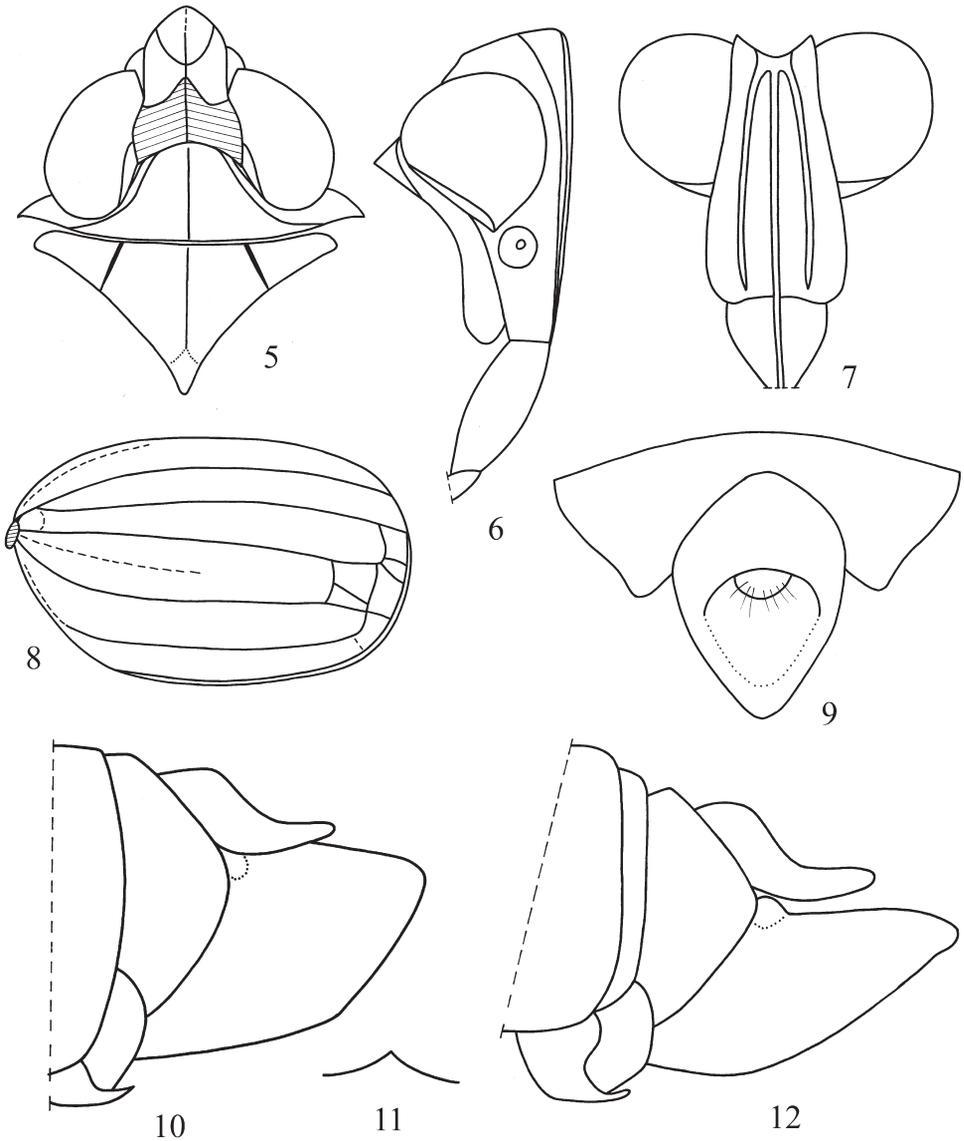
(Figs 1, 2, 5–11, 13–19)

Type locality. North-eastern Sudan, Red Sea state (wilayat), Erkowit (ca. 18°46'N, 37°7'E).

Type material. HOLOTYPE: ♂, “Sudan sept.-or. / Kassala Prov. / Red Sea Mts, 11–1300 m // Erkowit / 30.vi.1962 / R. Remane” (SNSD). The specimen is glued on a card label, genital segments detached, stored in glycerine in a plastic microvial pinned under the specimen. PARATYPES: 1 ♂, “Sudan sept.-or. / Kassala Prov. / Red Sea Mts, 11–1300 m // Erkowit / 21.vi.1962 / R. Remane” (ZIN); 1 ♀, “Sudan sept.-or. / Kassala Prov. / Red Sea Mts, 11–1300 m // Erkowit / 1.vii.1962 / R. Remane” (SNSD).

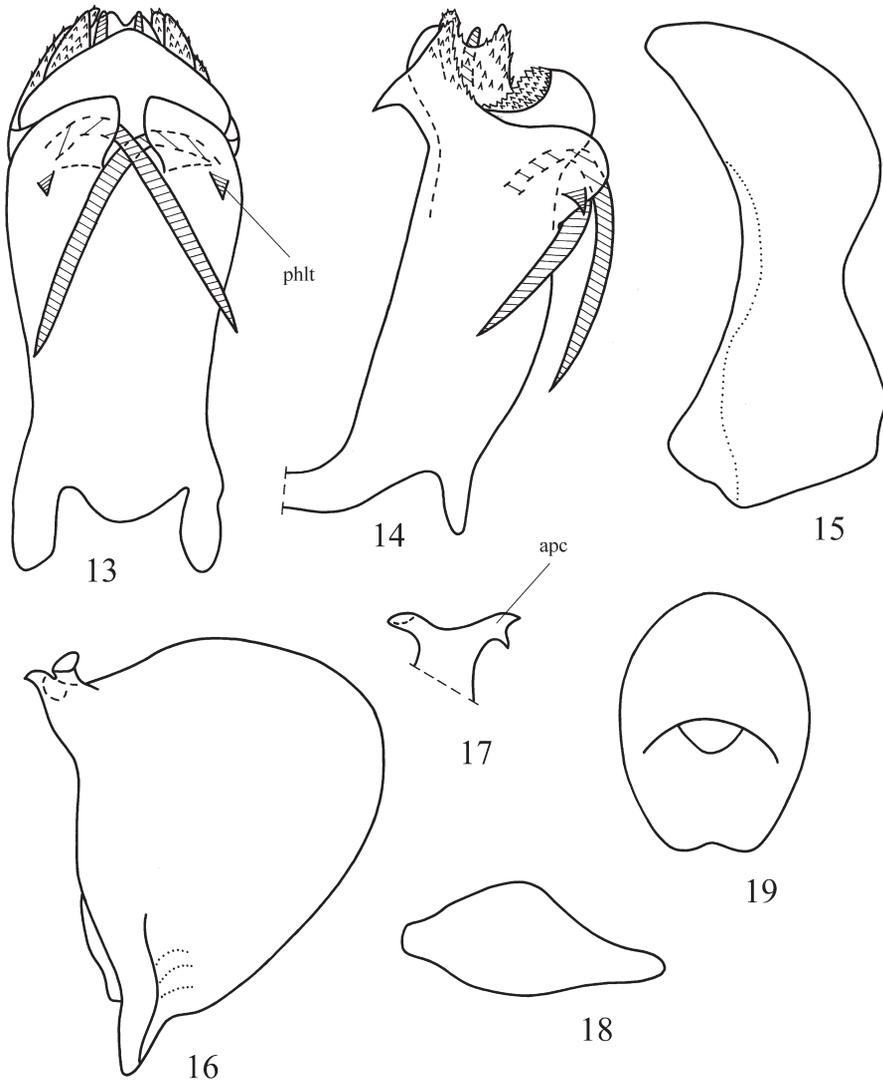
Description. Coloration. General coloration light brown yellowish with dark brown spots and dots (Figs 1, 2). Coryphe almost totally dark brown except light yellow carinae. Pro- and mesonotum with dense dark brown dots. Episterna and epimera of meso- and metanotum dark brown. Fore and middle femora light yellow, with pair of brown or dark brown bands – basally and subapically. Fore and middle tibiae light yellow, with three dark brown bands – basally, slightly proximally of their middle, and slightly distally of their middle. Apices of tibiae brown or dark brown. Hind femora light yellow, with dark brown spots apically. Hind tibiae light yellow, with dark brown spots in its proximal half and dark brown stripes in its distal half. Apices of hind leg spines black. Abdominal sternites of males sometimes yellow or brown, with yellow hind margins. Female sternite VII yellow. Abdominal tergites light yellow, with dark brown spots. Anal tube of male and female light brown yellowish, except dark brown below the paraproct, with brown spot apically on midline. Gonoplags yellow, with dense dark brown dots.

Structure. Metope narrow, slightly enlarged above postclypeus, with thick median and sublateral carinae (Fig. 7). Median and sublateral carinae of metope joined on its upper margin. Median carina of metope running through postclypeus. Metopoclypeal suture almost straight. Lateral (marginal) keels of metope running on lateral parts of postclypeus in its upper half. Postclypeus flattened dorso-ventrally and laterally. Ocelli absent. Metope and coryphe joined at acute angle (in lateral view, Fig. 6). Coryphe longer than wide medially, anterior margin strongly convex, posterior margin angulately concave (in dorsal view, Figs 1, 2, 5). Coryphe with median carina running from its posterior margin, but not reaching the anterior margin. Coryphe with areolet. Posterior part of coryphe (marked by shading on Fig. 5) almost vertically joined to its anterior horizontal part, forming obtuse angle (in lateral view). Pedicel globular, with several rows of rhinaria (around seven in each row). Pronotum shorter than mesonotum, with median carina; the anterior margin strongly convex between the eyes; its posterior margin straight. Paradiscal fields of pronotum very narrow behind the eyes. Paranotal lobes of



Figs 5–12. *Raunolina* spp. 5–11 – *R. remanei* sp. nov., paratypes (5–8 – male; 9–11 – female). 12 – *R. arabica* (Gnezdilov & Wilson, 2006). 5 – head, pro- and mesonotum, dorsal view; 6 – head and pronotum, lateral view; 7 – head, frontal view; 8 – fore wing; 9 – female anal tube and pygofer, dorsal view; 10, 12 – female genital block, lateral view; 11 – median part of hind margin of female sternite VII, ventral view.

pronotum wide. Mesonotum with median and lateral carinae. Fore wings nearly oval (Fig. 8), reaching hind margin of tergite VI; without hypocostal plate. Longitudinal veins keel-shaped and simple; transverse veins absent except between CuA and Pcu; R and M starting from one point on basal cell. CuP reduced. Hind femora and tibiae longer than fore and middle ones. Hind tibia with one lateral spine in distal half and with five apical spines. First metatarsomere



Figs 13–19. *Raunolina remanei* sp. nov., holotype, male genitalia. 13 – penis, ventral view; 14 – penis, lateral view; 15 – pygofer, lateral view; 16 – style, lateral view; 17 – capitulum of style, dorsal view; 18 – anal tube, lateral view; 19 – anal tube, dorsal view. Abbreviations: apc – apical part of capitulum of style; phlt – phallobase tooth.

nearly equal in length to second and third metatarsomeres combined. First metatarsomere with two latero-apical and five intermediate spines arranged in arc. Ventral and dorsal surfaces of first metatarsomere covered by long hair-shaped setae. Second metatarsomere with only two latero-apical spines. Claws nearly twice as long as arolium of pretarsus, the latter equipped with two narrow dorso-lateral plates.

Male genitalia (Figs 13–19). Hind margin of pygofer deeply concave medially (in lateral view, Fig. 15). Anal tube oval, with an apical concavity (in dorsal view, Fig. 19), gradually narrowing distally (in lateral view, Fig. 18). Paraproct short and wide. Phallobase wide and long, almost straight (in lateral view). Each dorso-lateral lobe of phallobase with a large tooth-shaped process subapically on its dorsal surface and with a large rounded lobe covering the ventral aedeagal hooks and bearing a small tooth-shaped process (Figs 13, 14: phlt). Ventral phallobase lobe thick and wide, with rows of denticles on its inner side. Apical aedeagal processes long and wide, bilobed, visible above the phallobase, with a pair of rod-shaped processes. Ventral aedeagal hooks short (nearly 1/3 of aedeagus length), pointed apically and directed to aedeagal base. Style with massive plate, hind margin convex (Fig. 16). Capitulum of style small, without neck, lateral tooth finger-shaped, apical part of capitulum with two teeth (Fig. 17: apc).

Female genitalia (Figs 10, 11). Sternum VII with hind margin bearing a pointed median projection (Fig. 11). Hind margin of pygofer convex medially (in lateral view, Fig. 10). Anal tube narrowing apically (in dorsal view). Gonoplags flat, much longer than anal tube, with rounded dorso-caudal angles (in lateral view, Fig. 10).

Measurements. Body length (from apex of coryphe to apex of anal tube in males or to apex of gonoplags in female): males – 4.1 mm, female – 6.1 mm.

Etymology. The species is named after the collector of the type series, the renowned German hemipterist Prof. Dr. Reinhard Remane (1929–2009).

Raunolina jeddahica sp. nov.

(Figs 3, 24–31)

Type locality. Western Saudi Arabia, Makkah region, Briman (= Buraiman, Bryman) near Jeddah (ca. 21°39'N, 39°14'E).

Type material. HOLOTYPE: ♂, “Arabia: / Buraiman / nr. Jedda / 26.1.46 / E.S. Brown. / B.M. 1946 - 289 [printed and hand written] // EB / 189” [hand written] (BMNH). The specimen dry-mounted on the pin attached to the piece of paralon, abdomen detached, stored in glycerine in a plastic microvial pinned under the specimen.

Description. Coloration. Metope and lateral parts of the head light yellow, with scarce dark brown dots. Postclypeus with dense dark brown dots excluding light yellow median carina. Rostrum light yellow with black apex. Coryphe light yellow, with large dark brown spots (Fig. 3). Pro- and mesonotum light yellow, with dense dark brown dots. Paranotal lobes of pronotum with black lower margins. Fore wings dark brown, with light longitudinal veins. Abdominal tergites dark brown, with light yellow median parts and traces of larval sensory pits. Laterotergites dark brown. Abdominal sternites brown yellowish. Coxae and trochanters light yellow. Fore and middle femora brown yellowish, with two wide black bands. Fore and middle tibiae brown yellowish, except dark brown basal and apical parts and with two wide black bands. Hind femora light yellow, with wide dark brown band apically. Hind tibiae light brown yellowish except black basal part and two wide black bands. Apices of leg spines black.

Structure. Resembling *R. remanei* sp. nov. Metope narrow – narrowest between the eyes and slightly enlarged above postclypeus, with distinct median carina running through postclypeus and with distinct sublateral carina joint with median carina on its upper margin, but not reaching metopoclypeal suture. Lateral (marginal) keels of metope running on lateral parts of postclypeus in its upper half. Postclypeus flattened dorso-ventrally and laterally. Ocelli absent. Pedicel globular, with rhinaria. Rostrum long, surpassing hind coxae on half length of third segment. Third rostral segment shorter than second one, slightly narrowing apically (Fig. 25). Metope and coryphe joint at acute angle (in lateral view). Coryphe concave, its anterior margin strongly convex, its posterior margin acutely angularly concave (Fig. 3). Coryphe longer than wide medially, with an incomplete median carina running from its posterior margin to its middle. Pronotum with strongly protruding anterior margin between the eyes and with a distinct median carina. Paradiscal fields of pronotum narrow. Paranotal lobes of pronotum wide, each with a short transverse carina (Fig. 24: tc). Mesonotum slightly longer than pronotum, with distinct median and lateral carinae. Fore wings reaching only hind margin of fifth abdominal tergite, without hypocostal plate and with widely rounded apices. Longitudinal veins of fore wings keel-shaped, simple, excluding short apical furcation of Pcu on left wing; CuP reduced. Transverse veins almost absent excluding single veins r-m, m-cua, and cua-pcu on right wing. Hind femora and tibiae longer than fore and middle ones. Hind tibia with single lateral spine in its distal half and with six apical spines. First metatarsomere as long as second and third metatarsomeres combined, with two latero-apical and six intermediate spines arranged at an arc. Second metatarsomere with only two latero-apical spines. Arolium of pretarsus distinctly shorter than claws.

Male genitalia (Figs 26–31). Hind margin of pygofer deeply concave in its lower half (in lateral view, Fig. 31). Anal tube wide, narrowing apically (in dorsal view, Fig. 28). Paraproct short and wide. Phallobase wide and long, almost straight (in lateral view). Dorso-lateral lobes of phallobase fused dorsally (Fig. 27). Each dorso-lateral lobe with a large tooth-shaped process subapically on its dorsal surface and with large rounded lobe covering the ventral aedeagal hooks and bearing a large tooth-shaped process (Fig. 26: phlt). Ventral phallobase lobe thick and wide, with rows of denticles on its inner side. Apical aedeagal processes long and wide, bilobed, visible above the phallobase. Ventral aedeagal hooks short (nearly 1/3 of aedeagus length), pointed apically and directed to aedeagal base. Style with massive plate, hind margin convex (Fig. 29). Capitulum of style small, without neck, lateral tooth finger-shaped, apical part of capitulum with one tooth (second teeth rudimentary) (Fig. 30: apc).

Measurements. Body length (from apex of coryphe to apex of of anal tube) – 4.5 mm.

Etymology. The species name is the adjective *jeddahicus* (-a, -um) given after its type locality.

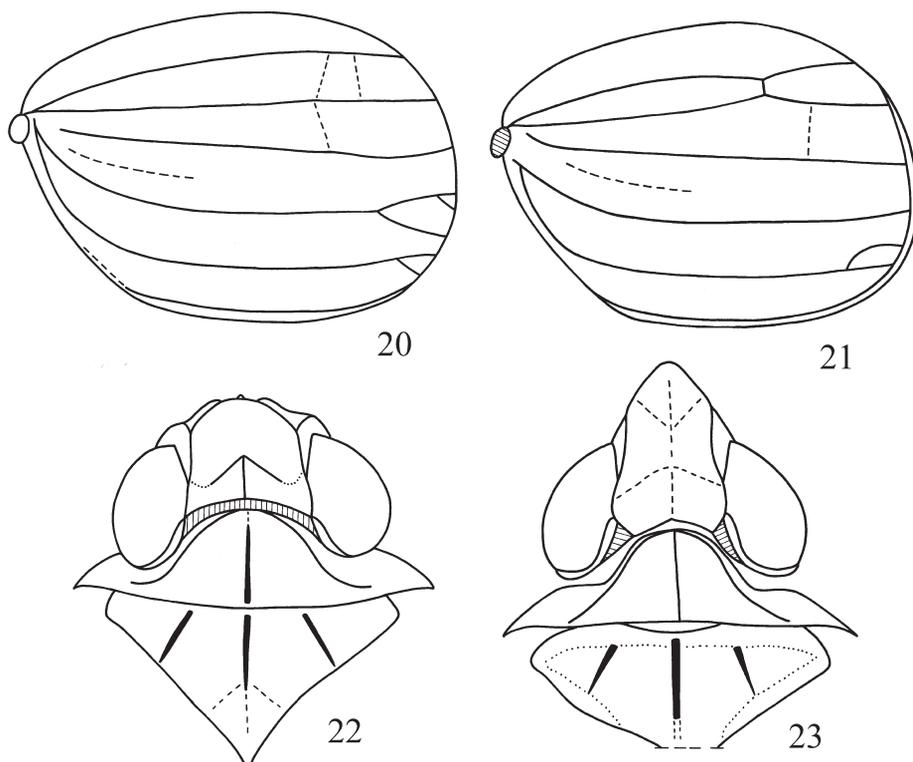
***Raunolina arabica* (Gnezdilov & Wilson, 2006), comb. nov.**

(Figs 12, 23)

Perissana (*Raunolina*) *arabica* Gnezdilov & Wilson, 2006: 16, Figs 3 a–b, 7.

Material examined. YEMEN: 1 ♀, “Arabien, Yemen, / Sanaa-El Geraas. / 20–24.2.1928. / Eing. Nr. 58. 1928” (ZMUH).

Distribution. Saudi Arabia (GNEZDILOV & WILSON 2006), Yemen (new record).



Figs 20–23. *Raunolina* spp. 20–22 – *R. circularis* (Linnavuori, 1952), holotype. 23 – *R. arabica* (Gnezdilov & Wilson, 2006). 20 – left wing; 21 – right wing; 22, 23 – head, pro- and mesonotum, dorsal view.

***Raunolina circularis* (Linnavuori, 1952), comb. nov.**

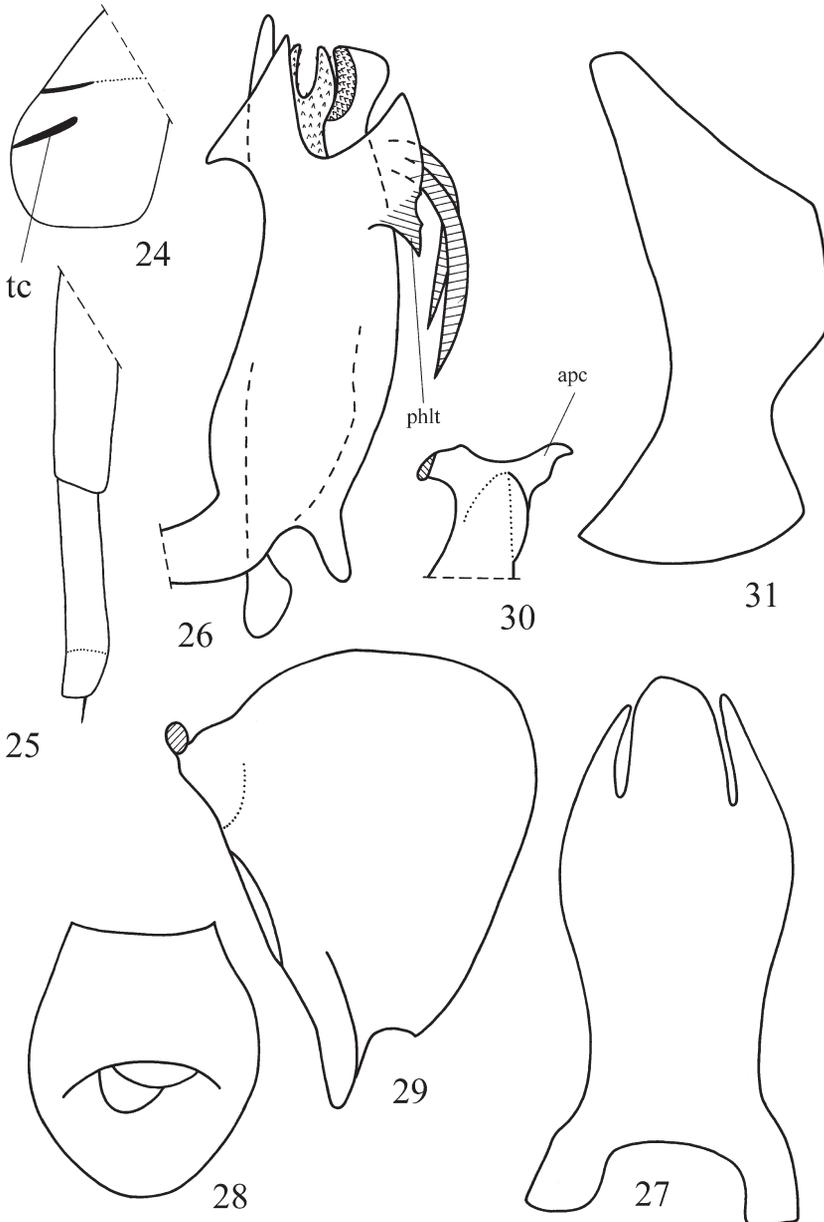
(Figs 4, 20–22)

Perissus circularis Linnavuori, 1952: 192, Fig. 5 a–h.

Perissana (Raunolina) circularis: GNEZDILOV & WILSON (2006): 16, Figs 2 a–c, 6, 23 a–f.

Type material examined. HOLOTYPE (specimen missing genital block): “H 329 [light green, hand written] //Jebel ‘Ureif / Israel / 4.12.1949 / Hebr. Univ. / J. Wahrman / Negev [printed and hand written] // typus [pink, hand written] // *Perissus / circularis* n. sp. / Linnavuori det. [printed and hand written] // 8144. [white, printed] // Holotypus [red, hand written]” (TAUI).

Other material examined. EGYPT: 1 ♂, “Egypte / W. Um Assad / 15.4.1934 / A. Rabinovitch // Coll. Alfieri / Egypte // Anastase Alfieri / Collection / 1962 // Museum Paris / collection Dlabola // *Perissana circularis* / in Dlabola collection // Museum Paris / MNHN(EH) / 4716 // *Perissana / circularis* Linnav. / det. Dlabola 1971.” (MNHN). ISRAEL: 1 ♀, “Israel, El / Arish-Libni / Road, 12.1.57 // P. Amitai lgt. // Museum Paris / collection Dlabola // *Perissana circularis* / in Dlabola collection // Museum Paris / MNHN(EH) / 4717 // *Perissana / circularis* / Linnav.” (MNHN).



Figs 24–31. *Raunolina jeddahica* sp. nov., holotype. 24 – paranotal lobe; 25 – rostrum, lateral view; 26 – penis, lateral view; 27 – penis, caudo-dorsal view; 28 – male anal tube, dorsal view; 29 – style, lateral view; 30 – capitulum of style, dorsal view; 31 – pygofer, lateral view. Abbreviations: apc – apical part of capitulum of style; phlt – phallobase tooth; tc – transverse carina.

Key to species of *Raunolina*

- 1 Coryphe with lateral margins straight (in dorsal view, Figs 1–5, 22). Gonoplacs with rounded apices (in lateral view, Fig. 10). 2
- Coryphe with lateral margins concave medially (in dorsal view, Fig. 23). Gonoplacs with tapered apices (in lateral view, Fig. 12). Saudi Arabia, Yemen.
..... ***R. arabica*** (Gnezdilov & Wilson, 2006)
- 2 Coryphe transverse, twice wider than long at midline (Figs 4, 22). Phallobase without teeth under the lobes covering ventral aedeagal hooks (GNEZDILOV & WILSON 2006: Fig. 23). Israel, Egypt. ***R. circularis*** (Linnavuori, 1952)
- Coryphe elongate, nearly as wide as long at midline or slightly longer than wide (Figs 1–3, 5). Phallobase with teeth on the lobes covering ventral aedeagal hooks (Figs 13, 14, 26: phlt). 3
- 3 Phallobase teeth small (Figs 13, 14). Male anal tube with an apical concavity (in dorsal view, Fig. 19). Hind margin of pygofer deeply concave medially (Fig. 15). Apical part of capitulum of style with two teeth (Fig. 17: apc). Sudan. ***R. remanei* sp. nov.**
- Phallobase teeth large (Fig. 26). Male anal tube convex apically, without concavity (in dorsal view, Fig. 28). Hind margin of pygofer deeply concave in its lower half (Fig. 31). Apical part of capitulum of style with one tooth (Fig. 30: apc). Saudi Arabia.
..... ***R. jeddahica* sp. nov.**

Discussion

The tribe Adenissini Dlabola, 1980 comprises four subtribes (GNEZDILOV 2013a). Two of them, Coinquendina Gnezdilov & Wilson, 2006 and Pterilliina Gnezdilov & Wilson, 2006 are plesiomorphic and almost limited in their distribution by the Oriental Region. Two other apomorphic subtribes, Bocrina Emeljanov, 1999 and Adenissina Dlabola, 1980 are distributed in the Palaearctic Region and not found in the Afrotropical Region except the genera *Adenissus* Linnavuori, 1973, recorded from south of the Arabian Peninsula, and *Raunolina* Gnezdilov & Wilson, 2006 recorded from Yemen and northeastern Sudan. This pattern of distribution of Adenissini apparently indicates a late dispersal of this group to the African continent as was postulated for the family Issidae as well (GNEZDILOV 2013b, 2016).

Within *Raunolina*, there are two groups of species characterised by the shape of the coryphe – the monotypical *R. circularis*-group with a transverse coryphe and *R. arabica*-group with an elongate coryphe, which includes *R. arabica*, *R. remanei* sp. nov. and *R. jeddahica* sp. nov.

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