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RESEARCH ARTICLE

Species of the genus *Trigonocera* Becker (Diptera: Dolichopodidae)

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Abstract: Systematic information on the Old World diaphorine genus *Trigonocera* Becker is reviewed. It comprises nine species: *T. rivosa* Becker (=*T. africana* Naglis **syn. nov.**), *T. guizhouensis* Wang, Yang et Grootaert, *T. lucidiventris* Becker, *T. munroi* (Curran), *T. obscura* De Meijere, *T. specialis* Becker, *T. tongshiensis* (Yang), *T. ethiopiensis* Grichanov **sp. nov.** from Ethiopia and *T. madagascarensis* Grichanov **sp. nov.** from Madagascar. *T. biseta* Olejníček is excluded from the genus [*Chrysotus biseta* (Olejníček) **comb. nov.**]. The distribution and diagnostic features of *Trigonocera* are discussed.

Key words: Diptera, Dolichopodidae, *Trigonocera*, Afrotropical, Oriental, Palaearctic, new species.

Introduction

The world fauna of the subfamily Diaphorinae numbers 20 genera (Capellari & Grichanov 2012) united in two tribes, Argyrini and Diaphorini (Negrobov 1986), and several generic groups with uncertain position. The long-legged fly genus *Trigonocera* was erected by Becker (1902) within the *Diaphorus* generic group to include one newly described species *T. rivosa* Becker from Egypt. The species was rarely collected, being found later on Taiwan and Cape Verde Islands (Becker 1922, Frey 1958). De Meijere (1916), Becker (1922), Naglis (1999), Yang (2002), Olejníček (2004) and Wang *et al.* (2008) described seven new species of the genus from the Afrotropical and Oriental Regions, and Grichanov & Mostovski (2009) transferred *Diaphorus munroi* Curran, 1926 to *Trigonocera*. Olejníček (2004) re-described and illustrated the Oriental *T. lucidiventris* Becker, 1922 and *T. specialis* Becker, 1922. The

genus was recently diagnosed and illustrated by Grichanov (2011), Yang *et al.* (2011) and Grichanov *et al.* (2011).

A new abundant material on the *Trigonocera* found in several museums has allowed me to re-define the borders of the genus, to revise the status of some species, to describe two new species and to compile a key to all known species.

Material and Methods

The holotypes and paratypes of the new species and other material cited are housed at the All-Russian Institute of Plant Protection, St. Petersburg, Russia (VIZR), the Finnish Museum of Natural History, Helsinki, Finland (MZH), the Museum of Zoology, Lund University, Lund, Sweden (MZLU), the Natal Museum, Pietermaritzburg, South Africa (NMSA), the National Museum, Bloemfontein, South Africa (BMSA), the National Museum of Natural History, Paris, France (MNHN), the Natural History Museum, London, United Kingdom (BMNH), the Royal Belgian Institute of Natural Sciences, Brussels, Belgium (IRSNB), the Royal Museum for Central Africa, Tervuren, Belgium (RMCA), the Zoological Institute of the Russian Academy of Sciences, St. Petersburg (ZIN), the Zoological Museum of the University of Amsterdam, the Netherlands (ZMA), the Zoological Museum of Moscow State University, Russia (ZMU), and the Zoological Museum of Tel-Aviv University, Israel (TAU).

The material was studied and illustrated with a ZEISS Discovery V–12 stereomicroscope and an AxioCam MRc5 camera. Morphological terminology and abbreviations follow Cumming & Wood (2009). The relative lengths of the podomeres should be regarded as representative ratios and not measurements. Body length is measured from the base of the antenna to the tip of abdominal segment 6. Antennal postpedicel is measured from posterior margins of basal lobes to the apex. Wing length is measured from the base to the wing apex. Male genitalia were macerated in 10% KOH. Figures showing the male genitalia in lateral view are oriented as they appear on the intact specimen, with the morphologically ventral surface of the genitalia facing up, dorsal surface down, anterior end facing right and posterior end facing left. Photos were made by the author of this paper.

Results

Genus *Trigonocera* Becker, 1902

Trigonocera Becker, 1902: 57. Type species: *Trigonocera rivosa* Becker, 1902, by monotypy.

Grichanov 2011: 6; Grichanov *et al.* 2011: 24; Yang *et al.* 2011: 1237, 1718.

Diagnosis: *Trigonocera* is distinguished from other diaphorine genera by the following combination of characters: small- to medium-sized species; male frons slightly wider (sometimes slightly narrower) than face; vertical seta absent in male, reduced in female; face wide in both sexes, slightly narrowed ventrally; occiput more or less flattened; antenna positioned slightly above or at about middle of head; antennal pedicel forming a thumb-like inner projection into postpedicel; postpedicel large in male, budlike, with abruptly drawn-out apex, small in female, with distinct pointed apex; arista-like stylus apical or slightly subapical; 5 dorsocentrals, with 4th bristles somewhat shifted medially, and 5th pair shifted laterally; acrostichals biseriate; wing suboval, not widened basally, with developed anal lobe;

costa reaching M_{1+2}; R_{4+5} and M_{1+2} straight or slightly curved, subparallel; femora without anterior preapical bristles; male tergum 6 bare; male segment 8 with 4 strong and long bristles, at least as long as height of epandrium; hypopygium rather uniform in all studied species, small, mainly hidden within pregenital segments; epandrial lobe flat, broad, ovate to subrectangular (ventral view), with 2-3 long and strong apical setae and 1 inner seta at middle; surstylus with ventral lobe long and thin, somewhat twisted at apex, usually with sparse minute setae, with dorsal lobe short, stick-shape, with 1-2 apical setae; male cercus with small rounded basal part and long distoventral projection, covered with long setae; postgonite well developed, bilobate from base, with narrow pointed lobes, more or less strongly curved ventrally.

Remarks: Becker (1902: 59) originally distinguished *Trigonocera* from *Diaphorus* Meigen, 1824 (worldwide) and *Lyroneurus* Loew, 1857 (Neotropical) by apical arista-like stylus, enlarged postpedicel, broad frons and face and by wing venation. These and other listed male secondary sexual characters (MSSC) are inappropriate for distinguishing females of those genera. In addition, some *Diaphorus* males also have subequal in width frons and face. The reliable diagnostic features for *Trigonocera* females are as follows: face usually slightly narrowed ventrally; antennal pedicel forming a small thumb-like inner projection into postpedicel; postpedicel with small, but distinct, pointed apex; 4th dorsocentral bristles somewhat shifted medially; wing suboval, not widened basally.

Key to the species of *Trigonocera* (males)

1. First three abdominal terga mostly yellow.....2
– Abdomen entirely dark, usually black-green, sometimes with yellow lateral spots on 1st and 2nd terga 3
2. Fore tarsus with claws and small pulvilli; mesonotum matt grey, densely pollinose; frons matt brown-green, densely pollinose; 2.7-3.0 mm..... *T. lucidiventris* Becker
– Fore tarsus without claws, with enlarged pulvilli; mesonotum shining metallic, weakly pollinose; frons shining blue-green; 2.0-2.3 mm..... *T. specialis* Becker
3. Femora mostly black-brown 4
– Femora entirely yellow 5
4. Fore tarsus with 1 claw; 3.0-3.5 mm..... *T. munroi* (Curran)
– Fore tarsus without claws; 3.6 mm .....*T. ethiopiensis* sp. nov.
5. Frons narrower than face; palpus dark brown; mid and hind coxae blackish.....6
– Frons wider than face; palpus yellow; mid and hind coxae various 7
6. Hind femur entirely yellow; postpedicel as long as high at base; 2.5 mm .... *T. tongshiensis* (Yang)
– Hind femur with blackish apex; postpedicel 2 times longer than high at base; 5.0-5.2 mm .... *T. guizhouensis* Wang, Yang et Grootaert
7. Fore tarsus without claws, with enlarged pulvilli; 3.5 mm..... *T. madagascarensis* sp. nov.
– Fore tarsus with claws and small pulvilli.....8
8. Hind coxa, trochanter and base of hind femur black; 2.0-2.5 mm..... *T. obscura* De Meijere
– Hind coxa yellow, at most dark at base; hind trochanter and femur yellow; 2.5-3.0 mm..... ..... *T. rivosa* Becker

***Trigonocera rivosa* Becker, 1902 (**Figs 1–10)

Trigonocera rivosa Becker, 1902: 58; Becker 1922: 92; Parent 1925: 154; Frey 1958: 14. Type locality: Egypt: Nile River from Luxor to Alexandria.

Trigonocera africana Naglis, 1999: 333, **syn. nov.**; Grichanov *et al.* 2006: 224 (females). Type locality: Zambia: Kafue River; paratypes from Namibia, Kunene Mouth, Skeleton Coast (all types in alcohol).

Material examined: Palaearctic: 1♂, [Egypt:] Kairo, XI, 44234 / *Trigonocera rivosa* Beck., det. Becker / Coll. J. Villeneuve: *Trigonocera rivosa* Beck. R.M.H.N.Belg. 15.392 (IRSNB); 1♀, [Upper Egypt:] Ob. Aegypte / *Trigonocera rivosa* Beck., det. Becker / Coll. J. Villeneuve: *Trigonocera rivosa* Beck. R.M.H.N.Belg. 15.392 (IRSNB); 1♂, Israel: R. Hyarden, 25.VI.1983, Nussbaum (TAU); Afrotropical: 1♂, Ins. Cabo Verde: Nicolau Chã da Preguisa, 13-17.XII.1953, Lindberg (MZH); 3♂, Senegal, M'Bour, St. ORSTOM, 18.XII.1980, B. Sigwalt leg. / Piège de Malaise (MNHP); 1♂: Botswana: Madiba Secondary School, Mahalapye, Malaise Traps, 25.IV-25.V.1986, M. De Meyer (RMCA); 1♂: Namibia: Kunene Mouth, Skeleton Coast, 17°16' S, 11°47' E, 20-22.IV.1994, Marais (MT) (NMNW); 2♂: Namibia: Katima Mulilo District, Salambala pan, 17°50'00"S, 24°35'58"E, 1-4.III.2001, A. Kirk-Spriggs (NMNW); Oriental: 1♂, Thailand: Chonburi, around Pattaya, 10-15.I.2006, N. Vikhrev (ZMU).

Redescription

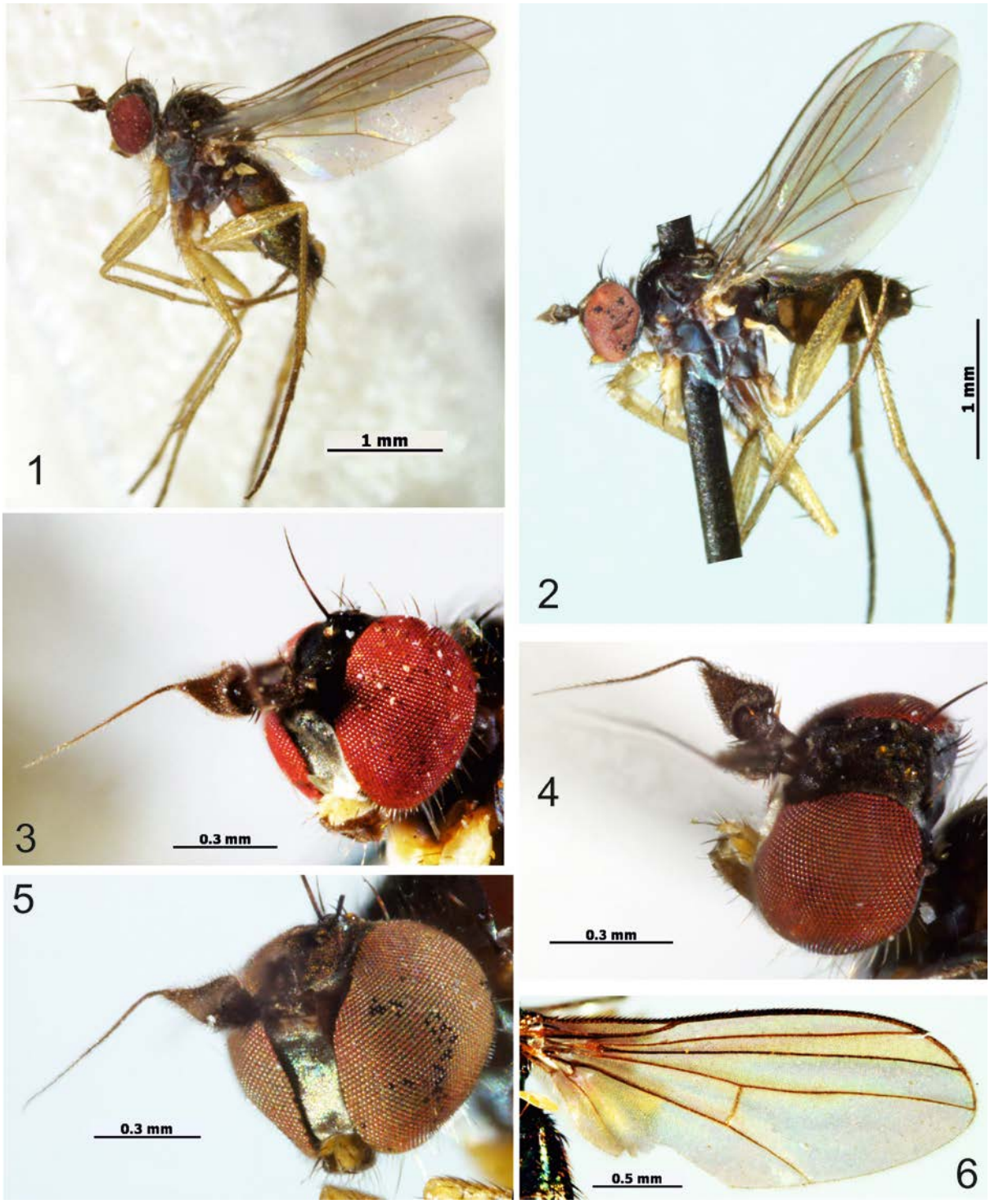
Male: Length (mm): body without antennae 2.5-3, antenna 0.9-1, wing 2.5-2.8/1.0.

Head: with well developed ocellar and shorter postvertical bristles; frons broad, 1.5 times wider than face, metallic violet, with dark pollinosity along margins; face with black ground colour, whitish grey pollinose, slightly shining under antennae, slightly narrowed ventrally, about as wide as height of postpedicel; antenna black, scape bare; pedicel with short dorsal and ventral setae and 1 long dorsoapical bristle, forming thumb-like inner projection into postpedicel; postpedicel haired, budlike, with abruptly drawn-out apex, 1.4-2 times as long as high at base; arista-like stylus strictly subapical and shortly haired, 1.7-2.7 times as long as postpedicel; palpus small, yellow, with short sparse cilia and 1 black apical seta; proboscis brown; 5-8 upper postocular bristles black, uniseriate; lateral and lower postoculars white, uniseriate.

Thorax: bluish-black, weakly pollinose, with black bristles; upper part of proepisternum with pair of brownish cilia; lower part of proepisternum with strong black bristle in addition to 1-2 cilia; 5 dorsocentrals, with 4th bristles somewhat shifted medially, and 5th pair shifted laterally; long acrostichals in 2 regular rows; scutellum with 1 pair of strong bristles and 1 pair of short lateral setae.

Legs: mainly yellow, with black bristles and cilia; mid coxa brown-black except yellow apex, or brownish, or entirely yellow; hind coxa brownish at extreme base or entirely yellow; distal tarsomeres brown; hind tibia partly brownish or entirely yellow; hind tarsus brown except extreme base or except basitarsus; fore and mid coxae with anterior cilia and apical setae; mid and hind coxae with 1 strong bristle at base; tarsi with pair of distinct claws and small pulvilli; fore femur with more or less developed anteroventrals in distal half, about as long as femur height; fore tibia with pair of short antero- and posterodorsal setae at base, 2-3 short apical setae; mid femur with more or less developed anteroventrals and posteroventrals in distal half; sometimes longer, than femur height; mid tibia with 2 pairs of antero- and posterodorsal bristles at base and at middle (anterodorsals stronger), with 1-3 small ventrals and 3-4 apical bristles; hind femur with 2-3 short subapical anteroventrals;

hind tibia with 3 dorsal and 3 apical bristles, not strong; hind tarsomeres 1 and 2 with ventral pectination of semierect setulae; tibia and tarsomere (from first to fifth) length ratio (measurements based on a male from Cape Verde Islands): fore leg: 63/34/16/13/12/11, mid leg: 80/42/25/12/9/7, hind leg: 102/32/27/14/13/10.



Figures 1–6. *Trigonocera rivosa* Becker. **1,** habitus (Namibia); **2,** habitus (Thailand); **3,** head (Namibia); **4,** head (Israel); **5,** head (Cape Verde Is.); **6,** wing (Cape Verde Is.).

Wing (measurements based on a male from Cape Verde Islands): hyaline, with brownish veins; length ratio of costal sections between R_{4+5} and M_{1+2} – 28/24; R_{4+5} and M_{1+2} almost parallel in distal half; M_{1+2} nearly straight; length ratio of apical section of CuA_1 and *dm-cu* – 55/22; halter yellow; lower calypter yellow with brown and yellow cilia.

Abdomen: shining dark bluish-green, weakly pollinose, with black setae and hairs; sometimes 1st and 2nd segments with yellow lateral spots; sternite 8 with short brown hairs and four strong black bristles; hypopygium black, weakly pollinose; epandrium globular; hypandrium short and broad, fused with epandrium; phallus simple, narrow; epandrial lobe flat, broad, ovate to subrectangular (ventral view), with 2-3 long and strong apical setae, close to each other, and 1 inner seta at middle; surstylus with ventral lobe long and thin, with sparse minute setae, with dorsal lobe short, stick-shape, with 1 apical seta; male cercus with small rounded basal part and long distoventral projection, covered with long setae; postgonite well developed, bilobate from base, with narrow pointed lobes, moderately curved ventrally.

Female: Similar to male except lacking MSSC.

Remarks: A male from "Kairo" (Egypt) examined may belong to the type series of *T. rivosa*. It generally corresponds to the description and figure provided by Becker (1902), including "fadenförmige lang behaarte Lamellen" (filiform long-haired cerci). A male from Botswana is quite discolourated due to long-term storage in alcohol.

The species is very variable in leg colouration, length ratio of postpedicel and arista, and ratio of length and width of postpedicel. These characters were considered significant by Naglis (1999), when he described his new species *T. africana*. In addition, the author incorrectly diagnosed *T. rivosa* as having "cerci basally broad, tapered to a triangle; surstyli [=epandrial lobes] with 3 well separated setae"; the diagnosis does not correspond with the generic concept of *Trigonocera*, being apparently based on a dry specimen. It is worth noting that the *T. rivosa* hypopygium morphology is rather constant in all specimens examined, and the epandrial lobe shape on micrographs depends greatly on a viewing angle, showing its true shape from ventral or ventro-lateral aspect. Therefore, I place *T. africana* in synonymy to *T. rivosa*.

Type locality: Egypt: Nile River from Luxor to Alexandria.

Distribution: Palaearctic: Egypt, Israel; Afrotropical: Botswana, Cape Verde Is., Namibia, Senegal, Zambia; Oriental: China (Taiwan), Thailand. New species for Botswana, Israel, Namibia, Senegal, Thailand, Zambia.

***Trigonocera madagascarensis* Grichanov sp. nov.** (Figs 11–14)

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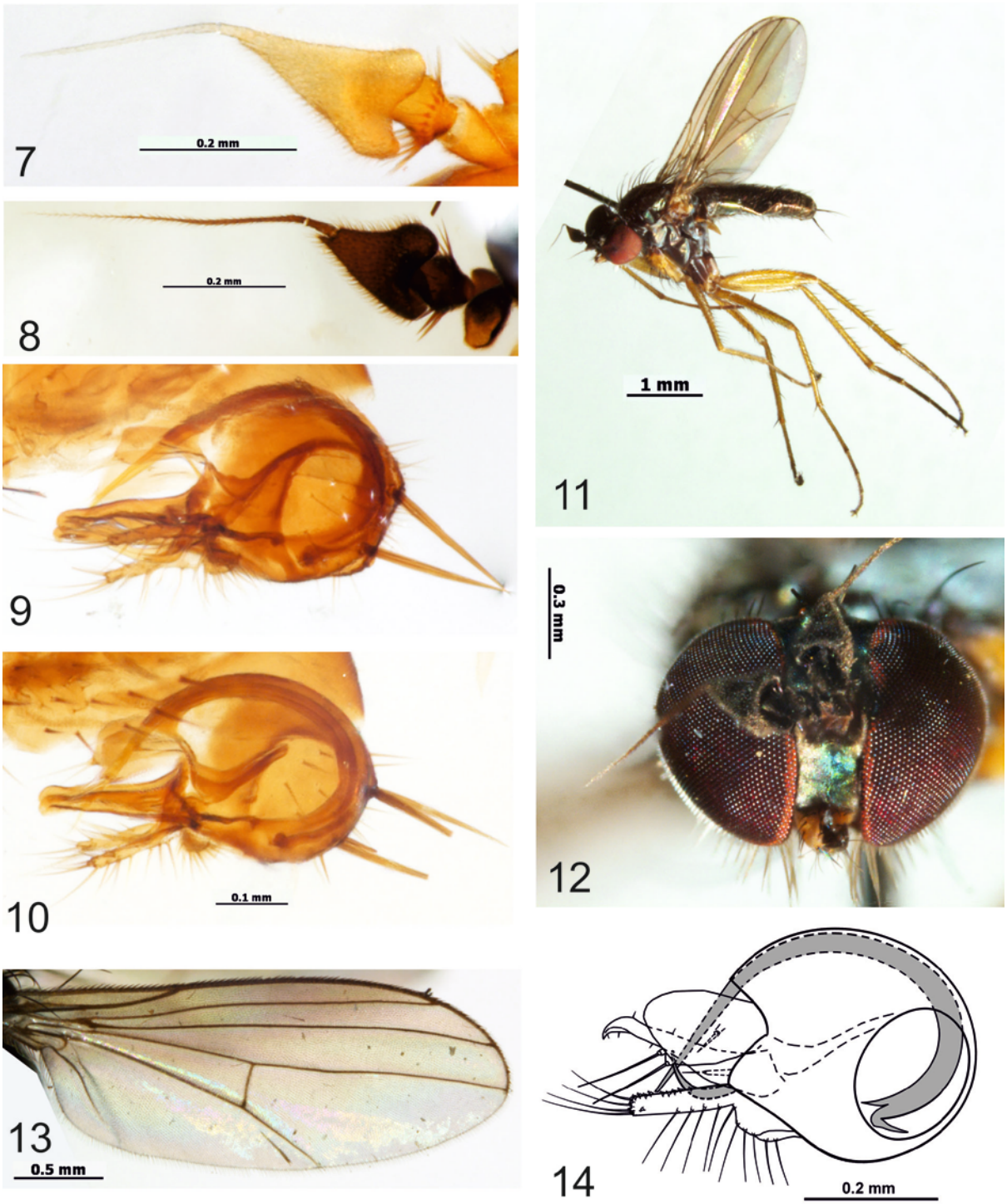
Diagnosis: The new species is close to *T. rivosa*, differing in fore tarsus lacking claws, with enlarged pulvilli.

Type material: Holotype: ♂ (pinned), Madagascar: North, Ambohitra, Montagne d'Ambre, 1000 m, 9.IV.1991, A. Freidberg & Fini Kaplan [TAU].
Paratypes: 1♂ (pinned), Madagascar: Antananarivo, Park Tsimbazaza, 18°55' S, 47°31' E, 19.X.2007, L. Friedman (TAU); (all in alcohol:) 13♂, 3♀, Madagascar: Ambatondrazaka, 21.IV.1992, A. Pauly (IRSNB); 16♂, 8♀, Madagascar: Ambatondrazaka, 22.IV.1992, A. Pauly (IRSNB); 3♂, Madagascar: Tam., Lac Alaotra, 23.IV.1992, A. Pauly (IRSNB); 10♂, Madagascar: Tam., 25 km W. Morarano-chrome, VII.1991, forêt, A. Pauly (IRSNB); 11♂,



Figures 7–14. (7–10) *Trigonocera rivosa* Becker. **7,** antenna with broken apex of stylus, in alcohol (Botswana); **8,** antenna (Senegal); **9,** hypopygium (Israel); **10,** hypopygium (Thailand). **(11–14)** *Trigonocera madagascarensis* Grichanov **sp. nov.**. **11,** habitus; **12,** head; **13,** wing; **14,** hypopygium.

Madagascar: Tam., 25 km W. Morarano-chrome, 1-15.VIII.1991, forêt, A. Pauly (IRSNB); 8♂, Madagascar: Tam., 25 km W. Morarano-chrome, 1-15.IX.1991, forêt, A. Pauly (IRSNB); 10♂, Madagascar: Tam., 25 km W. Morarano-chrome, 16-30.IX.1991, forêt, A. Pauly

(IRSNB); 11♂, Madagascar: Tam., Morarano-chrome, X.1991, A. Pauly (IRSNB); 6♂, Madagascar: Tam., 25 km W. Morarano-chrome, XI.1991, forêt, bac jaunes, A. Pauly (IRSNB).

Description

Similar to *T. rivosa* in all respects, except for the following features.

Male: Length (mm): body without antennae 3.5, antenna 1.0, wing 3.1/1.1.

Head: with well developed ocellar and rather short postvertical bristles, about 1/3 length of ocellars; frons broad, 1.3 times wider than face, metallic bluish-green, with dark pollinosity along extreme margins; face with metallic green ground colour, weakly grey pollinose, almost parallel-sided, about as wide as height of postpedicel; antenna black; postpedicel 1.5 times as long as high at base; length ratio of postpedicel and stylus (1st and 2nd segments), 20: 4: 37; palpus with rather long sparse cilia and 1 black apical seta; about 12 upper postocular bristles black, uniseriate; lateral and lower postoculars white, uniseriate.

Thorax: lower part of proepisternum with 1 strong and 1 shorter weak black bristles.

Legs: mainly yellow; mid and hind coxae black except yellow apex; hind femur dirty yellow dorsally at apex; distal tarsomeres brown-black; hind tarsus brown-black except yellow-brownish basal half; fore tarsus without claws, with enlarged pulvilli, as long as tarsomere 5; mid and hind tarsi with pair of distinct claws and small pulvilli; fore femur with 5-6 posteroventrals in distal third, slightly longer than femur height; fore tibia with pair of short antero- and posterodorsal setae at base and 2 dorsal setae at middle; mid femur with 4-5 posteroventrals in third quarter, longer than femur height; mid tibia with 1 anterodorsal at middle and 3 posterodorsal bristles, without ventrals; mid tarsus with elongate ventral setulae; hind tibia with 2-3 anterodorsal and 4-5 dorsal bristles, not strong; tibia and tarsomere (from first to fifth) length ratio: fore leg: 78/41/17/13/9/10, mid leg: 90/51/26/20/14/10, hind leg: 109/33/29/20/13/12.

Wing: length ratio of costal sections between R_{4+5} and M_{1+2} – 41/27; length ratio of apical section of CuA_1 and *dm-cu* – 57/25; lower calypter yellow with black bristles.

Abdomen: shining violet-black, weakly pollinose; sternite 8 with short black hairs and four strong black bristles; hypopygium and cercus black; epandrial lobe rather broad, ovate (ventral view), with 2 long and strong apical setae, close to each other, and 1 inner seta at middle; all setae pedunculate.

Female: Similar to male except lacking MSSC. Postpedicel as long as high at base.

Distribution: Madagascar.

Etymology: The species is named for the island of origin.

***Trigonocera ethiopiensis* Grichanov sp. nov.** (Figs 15–18)
urn:lsid:zoobank.org:act:1F3CA504-3DC6-48A1-AF8D-F728C796E1D0

Diagnosis: The new species is close to *T. munroi*, differing in fore tarsus lacking claws, with enlarged pulvilli.

Type material: Holotype: ♂, (in glycerol in vial, mounted on pin), Ethiopia: Ambo PPRC, neighbour cowshed, MT, 18.X-5.XI.2011, Rybalov L. (ZMU). Paratypes: 2♂ (pinned),

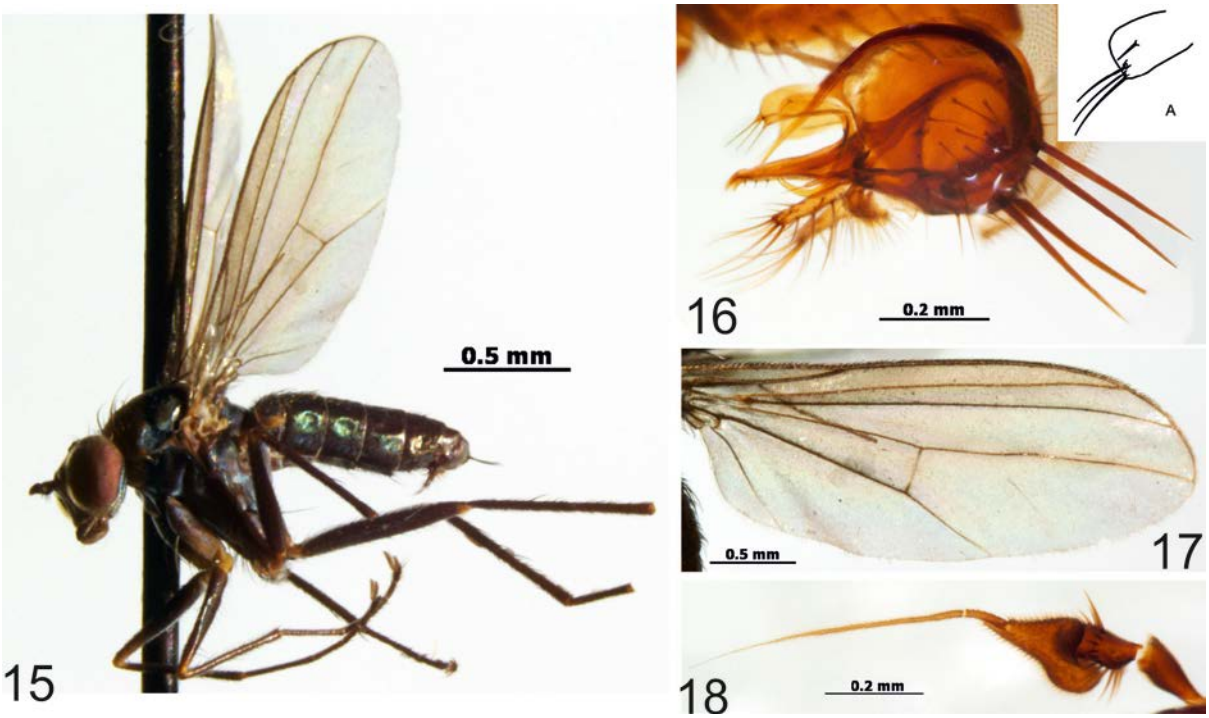
Ethiopia: Oromia reg., Shewa prov., Ambo PPRC, 8.057°S, 38.007°E, savanna, 16.X-16.XI.2009, L. Rybalov (ZMU); 3♂, 6♀ (in alcohol), Ethiopia: Shoa, Ambo, #1, savanna, YPT, 23.X-3.XI.2010, L. Rybalov (ZIN); 3♂ (in alcohol), Ethiopia: Shoa, Ambo, #1, cereal savanna, MT, 23-27.X.2010, L. Rybalov (ZIN).

Description

Similar to *T. rivosa* in all respects, except for the following features.

Male: Length (mm): body without antennae 3.6, antenna 1.1, wing 3.3/1.2.

Head: frons broad, only slightly wider than face, metallic violet, with grey pollinosity along ventral margins face densely white pollinose, slightly narrowed at middle, 1.5 times as wide as height of postpedicel; postpedicel nearly 2 times as long as high at base; arista-like stylus strictly subapical and shortly haired; length ratio of postpedicel and stylus (1st and 2nd segments), 25: 8: 54; palpus black, whitish pollinose; proboscis black; about 12 upper postocular bristles black, uniseriate; lateral and lower postoculars white; lowest setae long, biseriate, flattened.



Figures 15–18. *Trigonocera ethiopiensis* Grichanov **sp. nov.**. **15,** habitus; **16,** hypopygium (A – epandrial lobe); **17,** wing; **18,** antenna.

Thorax: lower part of proepisternum with 1 strong and 1 shorter weak black bristles.

Legs: mainly black, fore trochanter and adjacent narrow parts of coxa and femur, as well as fore knee, yellow or pale brown; mid and hind trochanters and knees brown or pale brown; fore tarsus without claws, with enlarged pulvilli, longer than tarsomere 5; mid and hind tarsi with pair of distinct claws and small pulvilli; fore femur with 2-3 subapical posteroventrals, nearly as long as femur height; fore tibia with pair of short antero- and posterodorsal setae at base, 1 dorsal at middle, somewhat elongate posteroventral setulae along entire length; tibia and tarsomere (from first to fifth) length ratio (measured from

holotype): fore leg: 102/57/28/21/15/13, mid leg: 120/74/35/24/17/13, hind leg: 153/53/41/28/21/15.

Wing: hyaline, slightly darkened in anterior half, with brown veins; length ratio of costal sections between R_{4+5} and M_{1+2} – 38/33; length ratio of apical section of CuA_1 and *dm-cu* – 63/27; halter brownish; lower calypter yellow with black cilia.

Abdomen: shining bluish-greenish black, weakly pollinose; sternite 8 with short black hairs and four strong black bristles; hypopygium and cercus black; epandrial lobe broad, subrectangular (ventral view), with 2 or 3 long and strong pedunculate apical setae, close to each other, and 1 inner seta at middle.

Female: Similar to male except lacking MSSC. Postpedicel as long as high at base.

Distribution: Ethiopia.

Etymology: The species is named for the country of origin.

***Trigonocera guizhouensis* Wang, Yang et Grootaert, 2008**

Trigonocera guizhouensis Wang *et al.* 2008: 255.

Type locality: China: Guizhou, Xishui.

Distribution: Oriental: China (Guizhou).

***Trigonocera lucidiventris* Becker, 1922** (Figs 19–20)

Trigonocera lucidiventris Becker, 1922: 91; Olejníček 2004: 167, figs. 1-4.

Type locality: China: Taiwan, Sokotsu, and Kosempo.

Material examined: 1♂, Thailand: Khao Yai NP, 14.44ºN, 101.37ºE, 11.II.2009, N. Vikhrev (ZMU).

Remarks: The picture of male genitalia drawn by Olejníček (2004: fig. 3) is rather schematic, differing from the true hypopygium as follows. Sternite 8 bearing 4 much longer bristles, about as long as epandrium; epandrial lobe ovate, leaf-like (ventral view); ventral lobe of surstylus slightly thickened at apex, with strong mid-dorsal seta, longer than height of surstylus; dorsal lobe of surstylus (not figured) longer that that in other species of the genus, with 2 apical setae; postgonite (not figured) well developed, narrow, bilobate, nearly right-angularly curved.

Distribution: Oriental: China (Taiwan), Laos, Thailand. New record for Thailand.

***Trigonocera munroi* (Curran, 1926)** (Fig 21)

Diaphorus (*Lyroneurus*) *munroi* Curran, 1926a: 266.

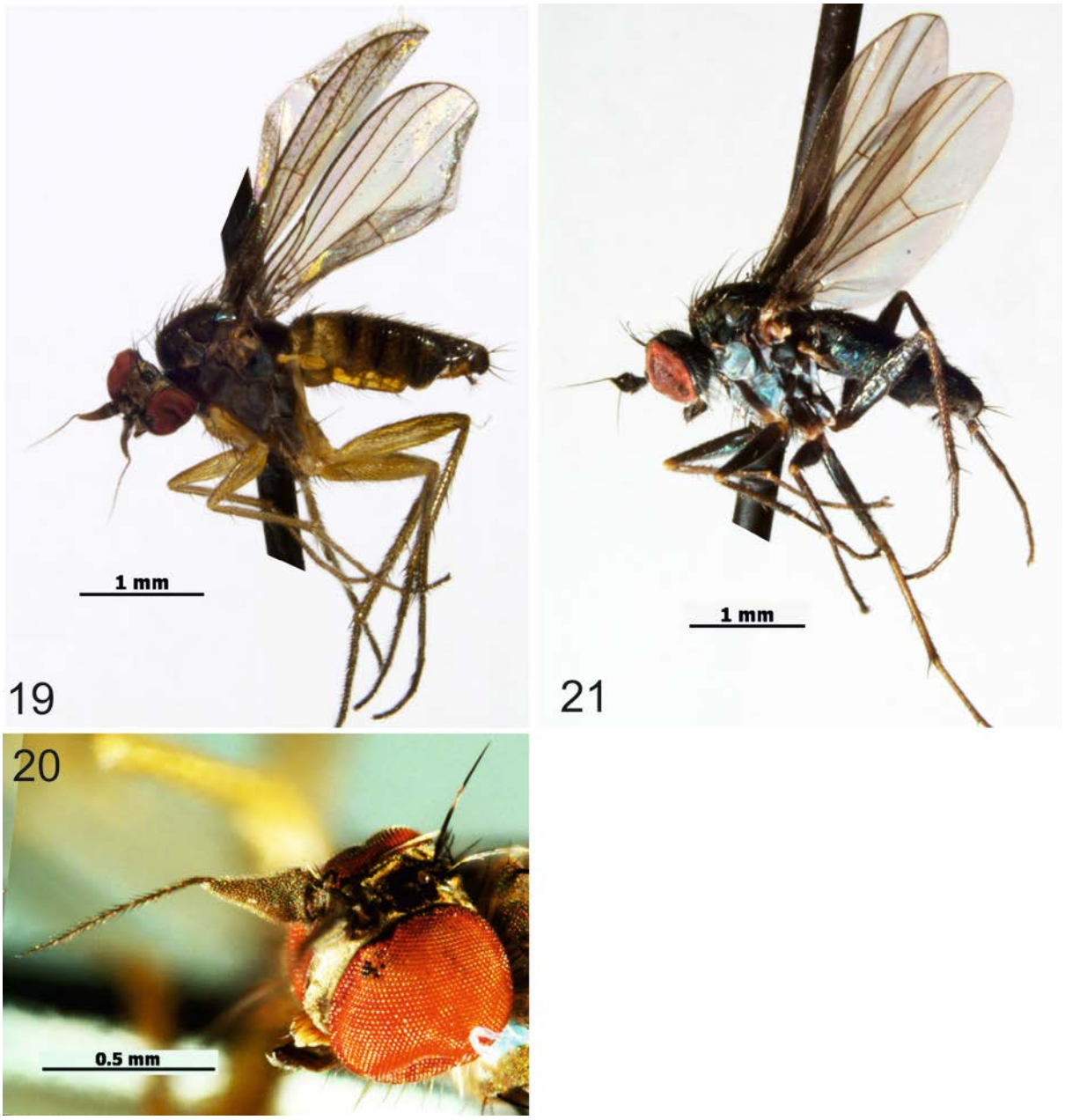
Diaphorus munroi: Curran, 1926b: 34; Curran 1926c: 412; Vanschuytbroeck 1951: 121; Vanschuytbroeck 1952: 52.

Trigonocera munroi: Grichanov & Mostovski, 2009: 45; Grichanov 2011: 56, figs. 40-43.

Type locality: South Africa: Mpumalanga: Barberton.

Material examined: 1♂, [South Africa]: Plat River, 6-18.IV.1905, Waterberg distr., C. Swierstra (NMSA); 4♂, RSA: Cape Prov. 10 km S Bredasdorp, 34°37'S, 20°03'E, 12.X.1994, Loc. 15, leg. R. Danielsson (ZMLU); 2♂, RSA: Cape Prov. Cedarberg, 3 km ESE

Kriedowkrans, 32°22'S, 18°59'E, 350 m, 6.X.1994, Loc. 10, leg. R. Danielsson (ZMLU); 1♂, South Africa: Cape Province, 10 km S of Citrusdal, Koomlandskloof, 32°40'S, 19°02'E, Malaise-trap, marshy meadow at riverside, 5-7.X.1994, M. Söderlund (ZMLU); 1♂, Swaziland: 3 km N Simunye, 26°11'S, 31°57'E, 27.X.1994, Loc. 36, leg. R. Danielsson (ZMLU); 2♂, [Namibia:] S.W. Africa (W30): Ameib Farm, 31.I-2.II.1972, On vegetation around pools / Southern African Exp. B.M. 1972-1 (BMNH); 1♂, Kenya, 17.XII.1970, A.E. Stubbs, B.M. 1972-211 / Molo, N of Nakuru (BMNH); 1♀, Kenya, 15-16.XII.1970, A.E. Stubbs, B.M. 1972-211 / Lake Nakuru, 5767 feet (BMNH); 1♂, Kenya: Ngare Naro River, 2330 m, 0.042ºN, 36.373ºE, 25.XI.2012, D. Gavryushin (ZMU); 1♂, Ethiopia: Oromya, Awasa L., 1690 m, 7.079ºN, 38.478ºE, 15-16.III.2012, N. Vikhrev (ZMU).



Figures 19–21. (19–20) *Trigonocera lucidiventris* Becker. **19,** habitus; **20,** head. **21,** *Trigonocera munroi* (Curran), habitus (Ethiopia).

Remarks: The species is variable in colour. Legs are mainly black; trochanters are black, brown or yellow; sometimes tibiae are entirely yellow (belonging possibly to immature specimens or specimens dried and mounted from alcohol).

Distribution: Afrotropical: DR Congo, Ethiopia, Kenya, Namibia, South Africa, Swaziland. New record for Ethiopia, Kenya, Namibia and Swaziland.

***Trigonocera obscura* De Meijere, 1916**

Trigonocera obscura De Meijere, 1916: 242; Becker 1922: 92.

Type locality: Indonesia: Batavia [=Djakarta], Java.

Type material examined: Holotype ♂, Batavia, October 1, Jacobson leg. (ZMA).

Remarks: The holotype is very close to *T. rivosa*, differing in mainly colour characters (genitalia were not dissected). Hind coxa, trochanter and base of hind femur black; hind femur dirty yellow on apex dorsally; antennal postpedicel 1/3 longer than high at base; mid femur with short subapical setae; mid tibia with 2 pairs of dorsal setae; hind tibia with 2-3 short setae. It is quite probable that the *T. obscura* is a synonym of *T. rivosa*.

Distribution: Oriental: Indonesia, Myanmar.

***Trigonocera specialis* Becker, 1922**

Trigonocera specialis Becker, 1922: 92; Olejníček 2004: 169, figs. 9-10.

Type locality: India: Calcutta.

Distribution: Oriental: Nepal, India (West Bengal).

***Trigonocera tongshiensis* (Yang, 2002)**

Diaphorus tongshiensis Yang, 2002: 745 (in key), 746, figs. 21-22.
Trigonocera tongshiensis: Wang *et al.* 2006: 18.

Type locality: China: Hainan, Tongshi.

Distribution: Oriental: China (Hainan).

Species excluded from *Trigonocera*

***Chrysotus biseta* (Olejníček, 2004) comb. nov.**

Trigonocera biseta Olejníček, 2004: 168, figs. 5-8.

Type locality: Laos: Louang Phrabang.

Distribution: Laos.

Remarks: The species was referred to *Trigonocera* due to enlarged triangular postpedicel of male antenna, twice longer than high at base, and was diagnosed by the presence of a pair of strong, but short bristles on male sternite 8, half as long as height of epandrium (Olejníček 2004). Nevertheless, the species description and illustrations do not correspond with the generic concept of *Trigonocera* (see above) and fit better the present concept of the genus *Chrysotus*. The following specific characters clearly refer the species to the latter genus: face narrow, eyes touching each other on bottom of face; postpedicel regularly triangular in male, not budlike, semicircular in female; 6 pairs of dorsocentrals; acrostichals weakly developed

(at least in female); male genitalia with epandrial lobe widely rounded distally, with short setae; surstylus short and broad, curved ventrally, bearing short apical spine; male cercus without distoventral projection. Short modified bristles on male sternite 8 are not uncommon in *Chrysotus* species, being present, e.g., in the Palaearctic *C. blepharosceles* Kowarz, *C. femoratus* Zetterstedt and *C. cupreus* Macquart (Grichanov - unpublished data).

Discussion

Nothing is known about the biology and immature stages of *Trigonocera* species. Information on the ecology of species found on collection labels shows their presence on vegetation around pools, in marshy meadows at riverside within savanna and forest ecoregions.

The genus is known from the Afrotropical, Oriental and Palaearctic Regions. Nevertheless, only *T. rivosa* is widely distributed in all these zoogeographical regions from southern and western Africa across eastern Mediterranean to eastern Oriental. *T. munroi* is widespread in Afrotropics from South Africa to Ethiopia. Oriental *T. lucidiventris* is found from Taiwan, Laos and Thailand. The other species of the group are rarely collected, being confined to some local regions. *T. madagascarensis* is known from Madagascar, *T. ethiopiensis* – from Ethiopia, *T. specialis* – from Nepal and West Bengal province of India, *T. guizhouensis* and *T. tongshiensis* – from two provinces of China, and *T. obscura* – from Java.

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References

Becker Th. 1902. Aegyptische Dipteren. *Mitteilungen aus dem Zoologischen Museum in Berlin* 2(2): 1–195.

Becker Th. 1922. Dipterologische Studien. Dolichopodidae der Indo-Australischen Region. *Capita Zoologica* 1(4): 1–247.

Capellari R. S. & Grichanov I. Ya. 2012. Review of the Afrotropical genus *Aphasmaphleps* Grichanov (Diptera: Dolichopodidae). *African Invertebrates* 53(1): 35–46.

Cumming J. M. & Wood D. M. 2009. Adult morphology and terminology [Chapter] 2. *In*: *Manual of Central American Diptera*, Volume 1. Brown B. V., Borkent A., Cumming J. M., Wood D. M., Woodley N. E. & Zumbado M. A., eds. Ottawa: NRC Research Press: 9–50.

Curran C. H. 1926a. The dolichopodid genus *Diaphorus* in South Africa. *Annals of the Transvaal Museum* 11: 264–267.

Curran C. H. 1926b. Records of African Dolichopodidae with descriptions of new species. *Revue zoologique africaine* 14(1): 1–39.

Curran C. H. 1926c. The Dolichopodidae of the South African Museum. *Annals of the South African Museum* 23: 377–416.

De Meijere J. C. H. 1916. Studien uber Südostasiatischen Dipteren XII Javanische Dolichopodiden und Ephydriden. *Tijdschrift voor Entomologie* 59(4): 225–273.

Frey R. 1958. Kanarische Diptera brachycera p.p., von Håkan Lindberg gesammelt. *Commentationes biologicae* 17(4):1–63.

Grichanov I. Ya. 2011. An illustrated synopsis and keys to Afrotropical genera of the epifamily Dolichopodoidae (Diptera: Empidoidea). *Priamus Supplement* 24: 1–98.

Grichanov I. Ya., Kirk-Spriggs A. H. & Grootaert P. 2006. An annotated checklist of Namibian Dolichopodidae (Diptera) with the description of a new species of *Grootaertia* and a key to species of the genus. *African Invertebrates* 47: 207–227.

Grichanov I. Ya. & Mostovski M. B. 2009. Long-legged flies (Diptera: Dolichopodidae) in the collection of the Natal Museum: A review of C. H. Curran's types, new synonyms, and new combinations. *Zootaxa* 2194: 37–53.

Grichanov I. Ya., Negrobov O. P. & Selivanova O. V. 2011a. Keys to Palaearctic subfamilies and genera of the family Dolichopodidae (Diptera). *CESA News* 62: 13–46.

Grichanov I. Ya., Selivanova O. V. & Negrobov O. P. 2011b. A brief synopsis of Palaearctic genera of the family Dolichopodidae (Diptera). *Ukrainska entomofaunistyka* 2(2): 11–40.

Naglis St. M. 1999. A new species of *Trigonocera* Becker (Diptera: Dolichopodidae) from tropical Africa. *Studia Dipterologica* 6(2): 333–335.

Negrobov O. P. 1986. On the system and phylogeny of flies of the fam[ily]. Dolichopodidae. *Entomologicheskoye obozreniye* 65 (1): 182–186. [in Russian], [English translation in *Entomological Review* 66 (1987): 16–20.].

Olejníček J. 2004. A note on the genus *Trigonocera* Becker, 1902 with description of a new species (Insecta, Diptera, Dolichopodidae). *Acta Musei Moraviae, Scientiae biologicae* 89: 167–173.

Parent O. 1925. Contribution a l'étude de la faune diptérologique d'Egypte. *Bulletin de la Société Royale Entomologique d'Égypte* 9: 153–185.

Vanschuytbroeck P. 1951. Dolichopodidae. *Exploration du parc National Albert, Mission G. F. De Witte (1933–1935)* 74: 1–153.

Vanschuytbroeck P. 1952. Dolichopodidae (Diptera, Brachycera, Orthorrhapha). *Exploration du parc National de l'Upemba. Mission G. F. De Witte* 12: 1–70.

Wang M., Yang D. & Grootaert P. 2006. Four new species of the genus *Diaphorus* (Diptera: Dolichopodidae) from China. *Zootaxa* 1166: 1–20.

Wang M., Yang D. & Grootaert P. 2008. New species of Dolichopodidae (Diptera) from China. *Bulletin de l'Institut Royal des Sciences Naturelles de Belgique, Entomologie* 78: 251–257.

Yang D. 2002. Diptera: Therevidae, Dolichopodidae. *In: Forest Insects of Hainan*. Huang F. S., ed. Science Press, Beijing, China: 741–749. [in Chinese with English summary].

Yang D., Zhang L., Wang M. & Zhu Y. 2011. Dolichopodidae. *Fauna Sinica, Insecta*, Vol. 53. Beijing: Science Press: 1–1912. [in Chinese, with English summary].

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