Zootaxa 4221 (1): 142–150
http://www.mapress.com/j/zt/

Article

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

https://doi.org/10.11646/zootaxa.4221.1.8
http://zoobank.org/urn:lsid:zoobank.org:pub:7781C42B-1334-4035-9CCF-1CE2A5237C62

Revision of *Terellia amberboae* group of species (Diptera: Tephritidae)

EBRAHIM ZARGHANI[1,4], SAMAD KHAGHANINIA[1], SAEED MOHAMADZADE NAMIN[2] & VALERY A. KORNEYEV[3,4]

[1]*Department of Plant Protection, Faculty of Agriculture, University of Tabriz, Iran. E-mail: khsz.zarghani@gmail.com*
[2]*Department of Plant Protection, Faculty of Agriculture, Varamin-Pishva Branch, Islamic Azad University, Varamin — Iran. E-mail: mohamadzade@iauvaramin.ac.ir*
[3]*Schmalhausen Institute of Zoology, NAS of Ukraine, vul. B. Khmelnytskogo, 15, Kyiv, 01601 Ukraine E-mail: valery.korneyev@gmail.com*
[4]*Corresponding authors*

Abstract

Terellia barughii **new species** from Tabriz (East Azerbaijan Province) and *T. babaki* **new species** from Qazvin Province (Iran) are described and figured, and *Terellia amberboae* V. Korneyev & Merz, 1996 is redescribed. A new species group is established, host plant and phylogenetic relationships are briefly discussed, and a key to species is provided.

Key words: Tephritidae, Tephritinae, Terelliini, *Amberboa*, Asteraceae, Iran, Kazakhstan, Russia, Uzbekistan

Introduction

The genus *Terellia* Robineau-Desvoidy 1830 includes about 50 species in the Palaearctic, two species in the Oriental Region and three species in the Nearctic Region (Norrbom *et al.* 1999; Korneyev 2006). Most attack the flower heads of knapweeds and thistles; some are potential biological control agent against weeds (White, 1989). The taxonomic details, diagnoses and descriptions of *Terellia* have been discussed by Korneyev (1985), Freidberg & Kugler (1989), and Korneyev (1999). Korneyev (1985) reviewed the classification of *Terellia*, and subdivided the genus into several species groups based on structure of the male terminalia. There is no comprehensive and complete key to all species of *Terellia* of the Palaearctic Region, except for the keys to the species of the *quadratula*, *tarbinskiorum* and *virens* species groups and the subgenus *Cerajocera* (Korneyev 2003, 2006; Korneyev et al. 2013; Mohamadzade Namin *et al.* 2011).

While studying tephritid fly fauna in East Azerbaijan and Qazvin Provinces (Iran), hitherto undescribed species of *Terellia* similar to *T. amberboa* Korneyev & Merz were collected. They are described and figured below, along with a redescription and new photos of *T. amberboae*.

Material and methods

The material examined is deposited in collections of the following institutions: Insect Collection of Professor Hasan Maleki Milanii, Plant Protection Department, Faculty of Agriculture, University of Tabriz, Iran (ICHMM), Saeed Mohamadzade Namin private collection (SMNC), Dmitry A. Evstigneev private collection, Ulyanovsk (DECU), I. I. Schmalhausen Institute of Zoology, National Academy of Sciences of Ukraine, Kiev, Ukraine (SIZK), and will be deposited in some other important collections.

Photographs were taken with digital cameras attached to dissecting binocular microscopes and compound microscopes at Schmalhausen Institute of Zoology, Kyiv, Museum für Naturkunde, Berlin and Tabriz University. The software Combine ZM (Hadley, 2007) was used to assemble serial photographs into one sharp image.

 Accepted by D. Bickel: 9 Nov. 2016; published: 16 Jan. 2017

Terminology. Morphological terminology was generally adopted from White *et al.* (1999), except for a few details of the phallic glans and aculeus. The following characters with their abbreviations are used for each species: head ratio (HR = head length: head height: head width); wing length (WL); aculeus length (AL); aculeus length: costal cell length (AL/C2). The measurements are used as additional characters only.

Results

Terellia amberboae group of species

Diagnosis. Species of the *amberboae* group are superficially similar to *T. serratulae* (Linnaeus, 1758) in having pointed flagellomere 1, hyaline wing and mainly white setulose abdomen, differing from that species by anteriorly narrowed head (in profile), produced facial carina, apically acute first flagellomere, and light yellow setae of head and body without black spots at their bases.

Species of the *amberboae* group can be differentiated from all other species of the genus by the combination of the first flagellomere sharply pointed apicodorsally; wing with 1–3 large yellow or brown spots distally of vein R_1 apex; mesonotum with wide black anteromedial and 2 narrowly separated posterolateral vittae, and no dark spots at the bases of any mesonotal setae; abdominal tergites shining yellow, each with 1 medial pair of rows of shining black spots, but no lateral spots; posterolateral margin of male tergite 5 entirely yellow.

By the discovery of the two new species, a new group, namely the ***amberboae* group of species** is established here. Its position within the genus *Terellia* remains unclear. It is possibly either related to the *serratulae* or *virens* groups of species (sharing light yellow setose and white setulose abdomen), or with the *virens* +*megalopyge* +*colon* cluster (sharing association with *Centaurea* and other Centaureineae), or even appearing as basal lineage to both of them, showing no unequivocal evidences in phylogenetic analyses based on morphological (Korneyev, 1999) or molecular data (V. Korneyev, unpublished data).

Key to species of *amberboae* group

1. Wing: cell r_1 distal to pterostigma with two large pale yellow round spots. In male, black spots on abdominal tergites very small, often hidden. Aculeus acute at apex. Aculeus length > 1.5 (1.6–1.9 mm) (Fig. 20); host plants. *Amberboa bucharica.* South eastern European Russia (Volga basin), Eastern Kazakhstan, Uzbekistan. . . . . *Terellia amberboae* Korneyev et Merz
   Wing: cell r_1 distal to pterostigma with one or two small dark brown spots. In male (unknown for *Terellia babaki*), black spots on abdominal tergites large, as wide as yellow space between them. Shape of aculeus variable. Iran. 2
2. Flagellomere 1 with convex dorsal margin (Fig. 9). Aculeus acute at apex (Fig. 12); wing pattern: cell r_1 distal to pterostigma with two dark brown spots (Fig. 10). Iran (Qazvin). . . . . *Terellia babaki* **new species**
   Flagellomere 1 with concave dorsal margin (Fig. 15). Aculeus blunt at apex (Fig. 21, 29, 30); wing pattern: one dark brown spot at vein R_{2+3} apex (Figs. 13, 14, 16), rarely additional small spot on vein R_{4+5} midway between apices of R_1 and R_{2+3}. Iran (East Azerbaijan). . . . . *T. barughii* **new species**

Descriptions

Terellia amberboae V. Korneyev & Merz, 1996

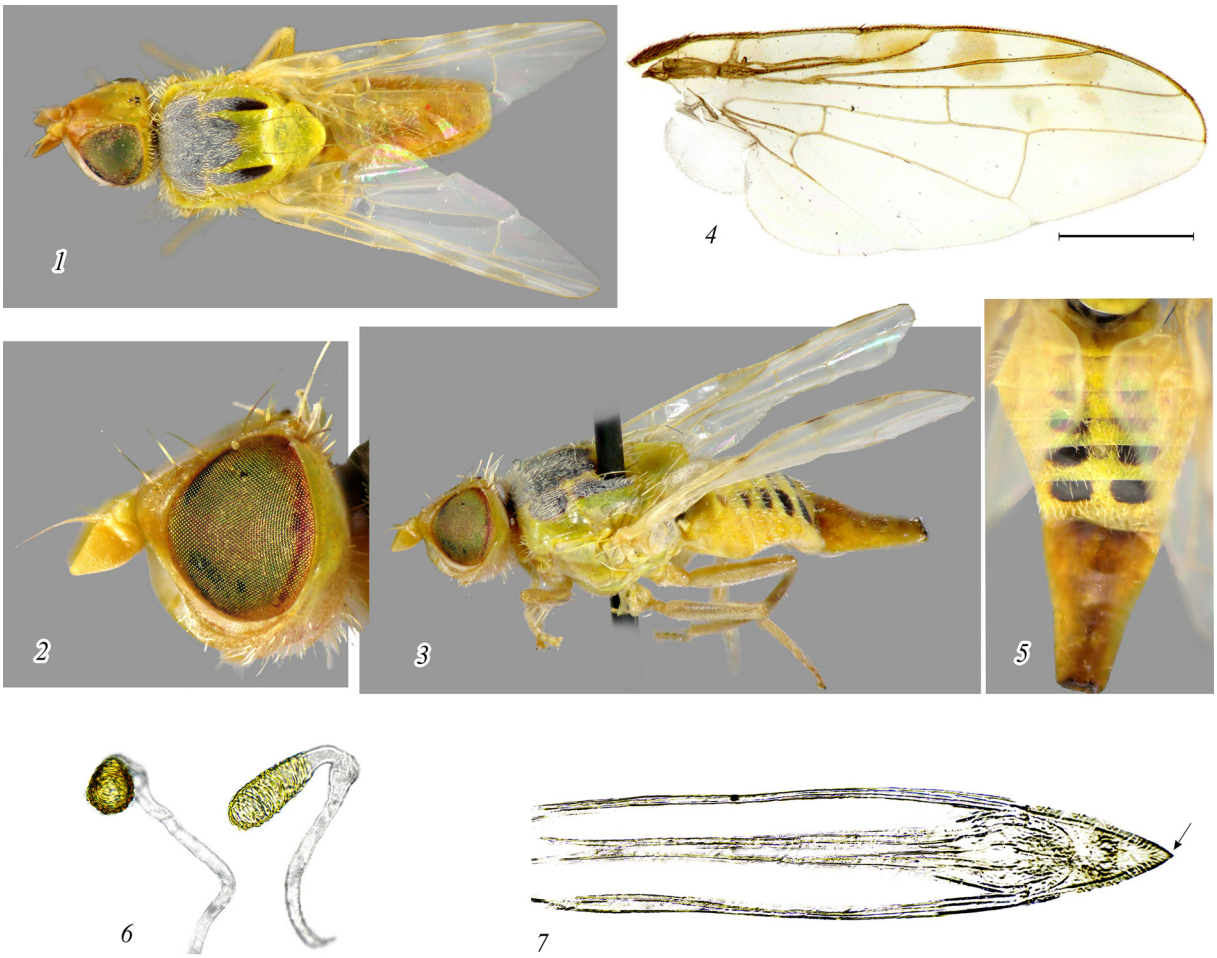
Figs. 1–7.

Korneyev & Merz, 1996: 57; Korneyev & Evstigneev, 2007: 70.

Type material. Holotype ♂: "Uzbekistan: 470 m, Fergana valley, Yaz'yavan region, 18.v.1994, ex flower heads of *Amberboa bucharica*, em. 19.v–7.vi.1994" (Merz) (MHNG). **Paratypes**: 13 ♂, 15 ♀, same data as in the holotype; 3 ♂, 6 ♀, same locality, [swept], 17.v.1994; 15 ♂, 1 ♀, same locality, [swept], 18.v.1994 (Merz); 30 ♂, 60 ♀, same, 17.v.1994, ex flower heads of *A. bucharica*, em. 21–30.v.1994 (Korneyev) (SIZK, ETHZ, MHNG and some other collections).

Non-type specimens: **Kazakhstan**: Ili River 10 km N of Utsh-Zharma, 2.vi.1977, 1 ♂, 1 ♀ both in poor

condition (Ivannikov) (SIZK); **Russia**: Ulyanovsk Region: Malaya Atmala near Srednikovo, Radischevo District (52°56' N, 48°55' E), chalky steppe, 9.v.2004, 1 ♂ (Evstigneev) (DECU).



FIGURES 1–7. *Terellia amberboae* (1, 4— ♂; 2, 3, 5–7— ♀): 1, habitus, dorsal view; 2, head, left view; 3, habitus, dorsolateral view; 4, wing; 5, abdomen, dorsal view; 6, spermatheca; 7, aculeus.

Description. Head (Fig. 2): slightly longer than high; HR = 1: 1–1.1 : 1.35–1.45; frontofacial angle acute; frontal ratio 1.0–1.3; first flagellomere ratio 1.4–2.1; ratio of genal height/length of first flagellomere 0.4–0.6; genal height / eye height ratio 0.2–0.3; haustellum-antennal ratio 1.5–2.2. Frontal plate with light yellow setulae. Postocular setae all white. Peristomal setulae white, not spread anterodorsally beyond vibrissal edge, shorter than 0.5 of distance between genal and ventral margin of gena; setulae anterior to genal seta short, yellow, subequal peristomal setulae; occipital setae white. Flagellomere 1 with convex dorsal margin (Figs. 2, 3). Palp pale yellow, moderately long and narrow, mostly with yellow and 2–5 brown setae at apex; not extending beyond oral cavity.

Thorax (Fig. 1): scutum with black lyrate pattern, white microtrichose, lateral postsutural vittae separated; central mark posteriorly reaching dorsocentral setae; one postsutural dorsocentral seta aligned with postsutural supra-alar setae, presutural dorsocentral setae not developed; no black shining spots at bases of setae; pleura light yellow with orange stripe and black to red triangular mark on katepisternum in male and unicolorous yellow with brown or reddish mark on katepisternum in female; pleura sparsely microtrichose; postpronotum and dorsal portion of anepisternum densely and moderately long white setulose; scutellum bright shining yellow, without black spots, with 2 pairs of subequal setae and 7–9 white marginal setulae; bases of scutellar setae in yellow field; mediottergite black, microtrichose laterally.

Legs orange-yellow, fore femur with two rows of posterodorsal brownish-yellow setae and one row of white posteroventral setae.

Wing: hyaline with pattern consisting of yellow pterostigma, in male three yellow spots: one in pterostigma,

two in cell r_1, sometimes with faint additional spots in cell r_{2+3} (Figs. 1, 4), in female wing almost hyaline, with two pale yellow spots only in cell r_1; distal section of vein M 1.5–2.2 times longer than section between crossveins r-m and dm-cu; cell bcu (=cup) with short posteroapical lobe not reaching level of bm-cu crossvein. WL♂ = 3.5–4.2 (mean 3.8), WL♀ = 3.9–6.0 (mean 4.5) mm.

Abdomen: yellow; all tergites white setulose, with yellow or brownish-yellow marginal setae; tergites 3–5 (–6) each with 2 black spots mediobasally; in male these dark spots very small, usually hidden underneath margin of preceding tergite (Fig. 1); male tergite 5 slightly longer than broad, shorter than 0.4 of abdomen length, without lateroapical black marks; in female dark spots on tergites 3–6 large, as wide as or wider than yellow area between them.

Male terminalia: epandrium oval; lateral surstylus apicomedially densely papillose; cerci papillose and wrinkled (Korneyev & Merz 1996: fig. 3).

Female terminalia: aculeus apically acute (Fig. 7); AL = 1.2–1.6 mm (mean 1.47), AL/C2 = 1.4–1.7 (mean 1.51); spermathecae with short and narrow apical portion of duct (Fig. 6).

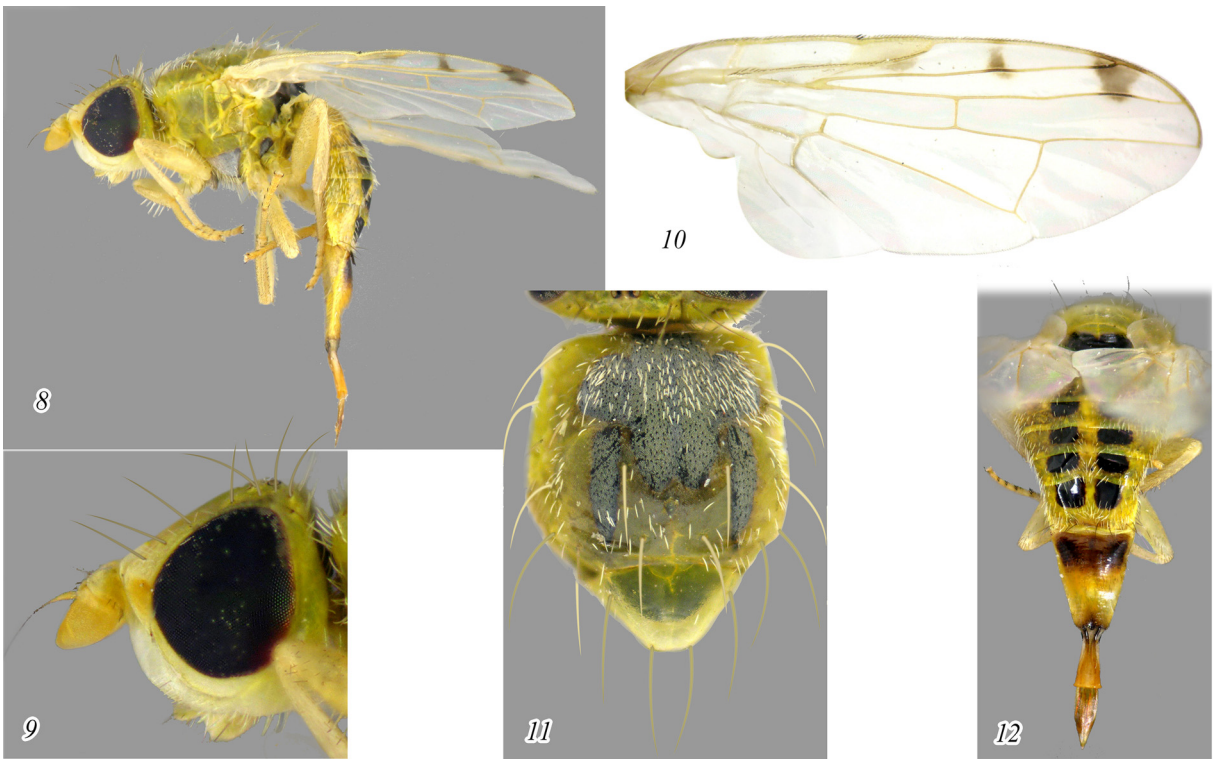
Host plant (Fig. 16–17). The larvae develop in flower heads of *Amberboa bucharica* and very probably *A. turanica* (Asteraceae: Asteroideae: Cardueae: Centaureinae); the latter plant is the only species of *Amberboa* occurring in Malaya Atmala, Russia, where the species was collected by sweeping.

Terellia babaki V. Korneyev, new species

Figs. 8–12.

Type material. Holotype ♀: **Iran:** Qazvin, Kallaj, olive orchards on Tarom Rd. 36°41'00"N 49°17'00"E, 556 m a. s. l., 8.vi.2014, swept from ?*Amberboa* sp. (V. Korneyev leg.) (SIZK).

Description. Head (Fig. 9): shape generally as described for *T. amberboae*; HR = 1 : 1.1 : 1.6; genal height / eye height ratio 0.25. Peristomal setulae white, not spread anterio-dorsally beyond vibrissal edge, shorter than 0.5 of distance between genal and lower margin of gena; setulae anterior to genal seta short, yellow, subequal to peristomal; occipital setae white. Flagellomere 1 with convex dorsal margin. Palp pale yellow, moderately short, narrow.



FIGURES 8–12. *Terellia babaki* **new species**, holotype ♀: 8, habitus, left; 9, head, left; 10, wing; 11, mesonotum, dorsally; 12, abdomen, dorsally.

Thorax (Figs. 8, 11) as described for *T. amberboae*.

Legs (Fig. 8) as described for *T. amberboae*, orange-yellow, fore femur with two rows of posterodorsal yellow setae and one row of white posteroventral setae.

Wing: hyaline with pattern consisting of yellow pterostigma, and two brown spots in cell r_1, (Fig. 10); distal section of vein M 1.75 times as long as section between crossveins r-m and dm-cu; cell bcu (=cup) with short posteroapical lobe not reaching level of bm-cu crossvein. WL♀ = 4.7 mm.

Abdomen: yellow; all tergites white setulose, with yellow or brownish-yellow marginal setae; tergites 3–6 each with 2 large black spots mediobasally wider than yellow area between them.

Female terminalia (not dissected): aculeus apically acute, as in *T. amberboae* (Fig. 12); AL = 1.25 mm; AL/C2 = 1.1.

Male unknown.

Host plant unknown.

Discussion. This species is closely related to *T. amberboae* in having an acute aculeus, differing from it by the smaller dark brown spots on wing (large and pale yellow in *T. amberboae*).

Etymology. The species is named in honour of Dr. Babak Gharali, Research Center for Agriculture and Natural Resources, Ghazvin, Iran.

Terellia barughii Zarghani, Khaghaninia, Mohamadzade & Korneyev, new species

Figs. 13–30.

Type material. Holotype ♀: **Iran:** East Azerbaijan Province, Tabriz, University campus, 1440 m a. s. l., 23.vi.2015, swept from *Amberboa* sp. (Zarghani leg.) (ICHMM).

Paratypes: 16 ♂, 6♀, same collection data as in the holotype (ICHMM, SIZK, and SMNC).

Description. Head (Fig. 9): shape generally as described for *T. amberboae*; HR = 1 : 1–1.2 : 1.45–1.6; frons length/width ratio 1–1.1; genal height / eye height of ratio 0.24–0.28. Flagellomere 1 with concave dorsal margin (Fig. 15). Palp pale yellow, moderately long, narrow.

Thorax (Figs. 13–14, 18–19) as described for *T. amberboae*.

Legs (Fig. 13, 15) as described for *T. amberboae*, orange-yellow, fore femur with two rows of posterodorsal yellow setae and one row of white posteroventral setae.

Wing: hyaline with pattern consisting of yellow pterostigma, and one dark brown spot at apex of vein R_{2+3} (Figs. 13, 14, 16), rarely in male with second, small dark brown spot on vein R_{2+3}, at middle of cell r_1 (Fig. 17); distal section of vein M 2.2–3.5 times as long as section between crossveins r-m and dm-cu; cell bcu (=cup) with short posteroapical lobe not reaching level of bm-cu crossvein. WL♂ = 3.1–3.5 mm; WL♀ = 3.5–3.9 mm.

Abdomen: yellow; all tergites white setulose, with yellow or brownish-yellow marginal setae; syntergite 1+2 with 1–2 pairs of small brown spots; tergites 3–5 (–6) each with 2 black spots mediobasally, wider than yellow area between them in both sexes (Figs. 19–20).

Male terminalia (Figs. 22–26) as in *A. amberboae*: epandrium oval (Fig. 22); lateral surstylus apicomedially densely papillose (Fig. 24, lower arrow); cerci papillose and wrinkled (Fig. 24, upper arrow); phallus glans (Figs. 25–26) as in *A. amberboae*.

Female terminalia (Figs. 20–21, 27–30): oviscape yellow, with wide black spot dorsobasally; eversible membrane with short taeniae, with blunt, rounded, almost uniform scales (Figs. 20, 28); aculeus apically rounded, (Fig. 30, arrow); AL = 0.95–1.1 mm; AL/C2 = 1.45–1.65; spermathecae (Fig. 27) as in *T. amberboae*.

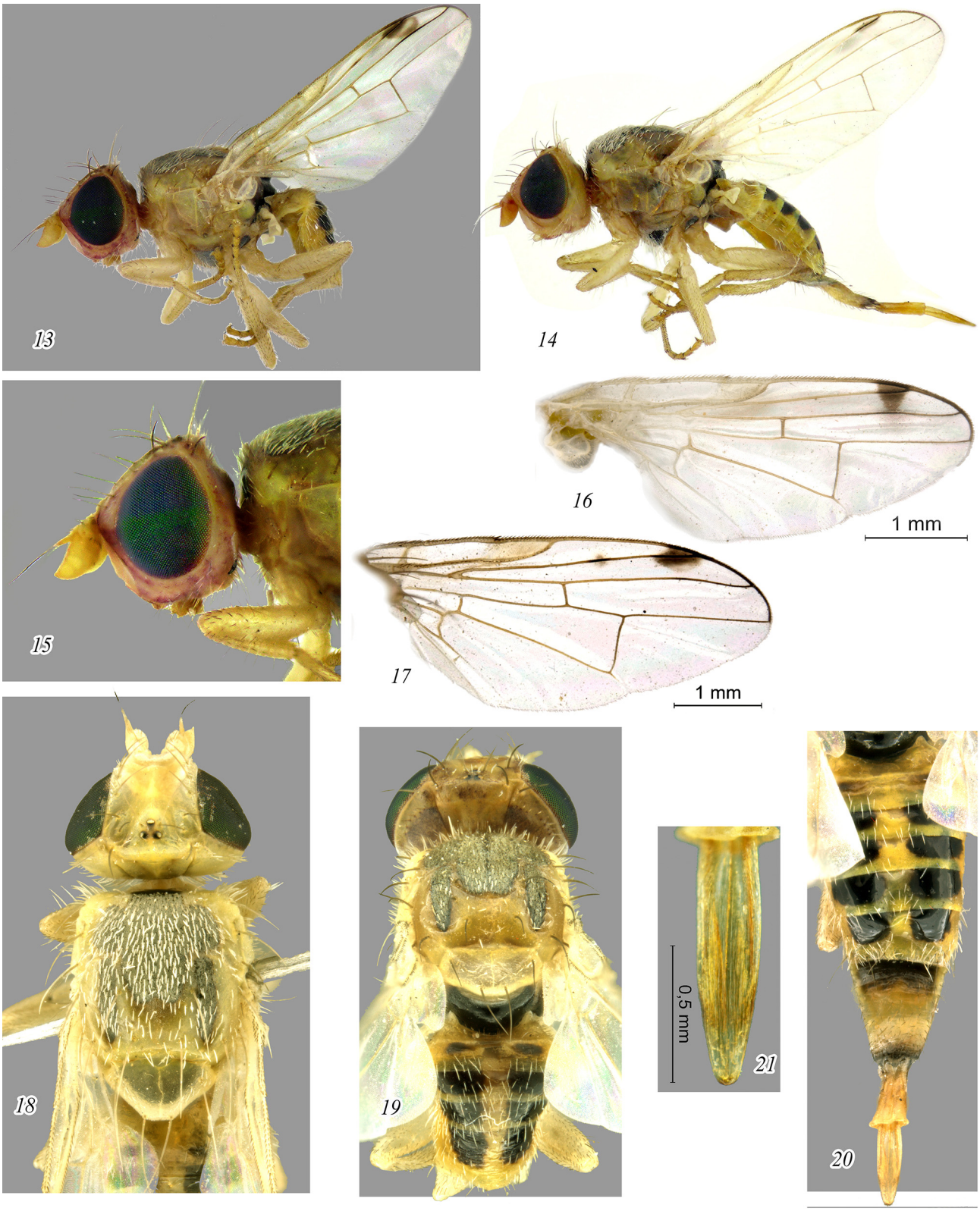
Host plant. The larvae possibly develop in flower heads of *Amberboa* sp. (Asteraceae: Asteroideae: Cardueae: Centaureinae), along with larvae of *Acanthiophilus helianthi* (Rossi).

Etymology. The species is named in honour of Dr. Hassan Barughi, an outstanding professor, in Department of Plant Protection, University of Tabriz.

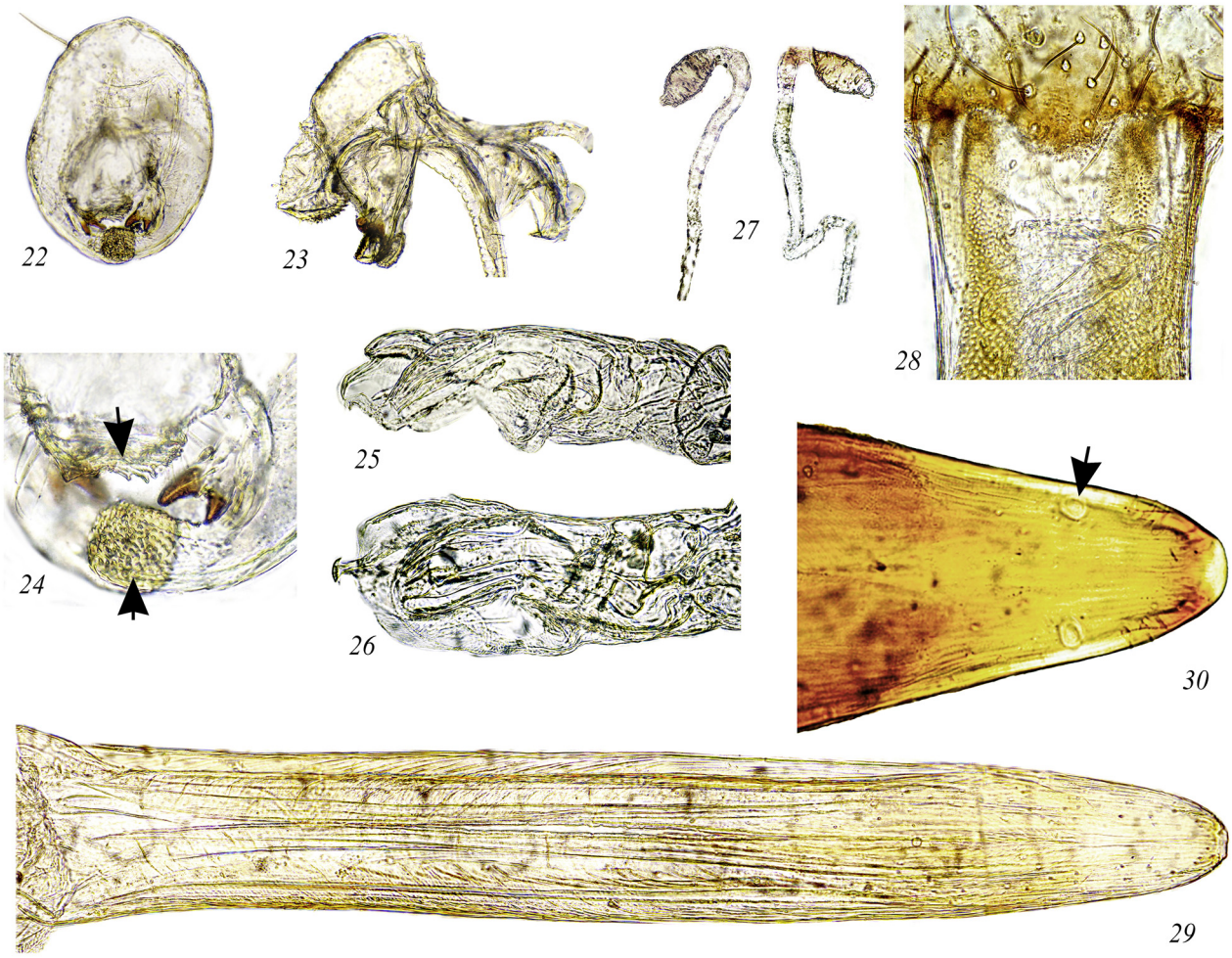
Discussion. The new species can be distinguished from other species of *Terellia* by the combination of the following characters: acute first flagellomere, absence of black spots at the bases of scutal setae, lack of black lateral marks on abdominal sternites both in males and females, presence of large subquadrate black spot on mediodorsal part of abdominal tergites, all setae yellowish and all setulae white to yellow.

Terellia barughii most closely resembles *Terellia amberboae*, but can be differentiated by the wing pattern (one

brownish spot at the end of vein R_{2+3} in *T. barughii* versus two pale spots beyond the pterostigma present in *T. amberboae*). Additionally, the black abdominal spots in *T. barughii* are larger than in *T. amberboae*, and the aculeus tip is rounded (pointed in *T. amberboae*).



FIGURES 13–21. *Terellia barughii* **new species**, paratype (13, 15, 17, 19— ♂, 14, 16, 18, 20–21— ♀): 13, 14, habitus, left view; 15, head, left view; 16, 17, wing; 18, mesonotum, dorsal view; 19, mesonotum and abdomen, postero- dorsal view; 20, abdomen, dorsal view; 21, aculeus, enlarged.



FIGURES 22–30. *Terellia barughii* **new species**, postabdomen (22–26— ♂, 27–30—♀): 22, epandrium, posterior; 23, epandrium and hypandrium, right view; 24, surstyli and cerci posterior, enlarged (arrows indicates papillose structures); 25, 26, phallus glans, right and ventrally; 27, spermathecae; 28, apex of oviscape and anterior portion of eversible membrane; 29, aculeus; 30, same, apex, enlarged (arrow indicates campaniform sensilla).

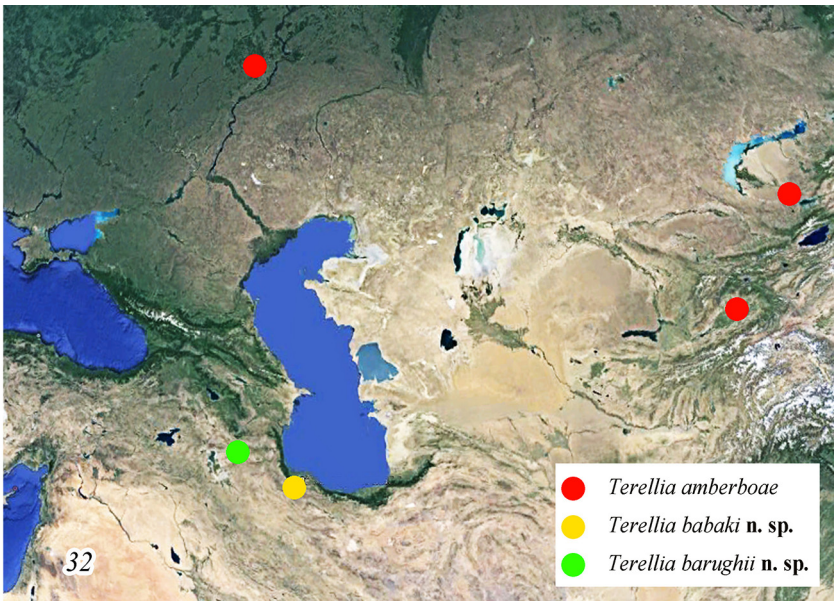
Conclusion

The species of *amberboae* group are widespread geographically (Fig. 32), but very rare in collections. The main reason is apparently that their host plants occur locally, flowering in the spring (April–May, rarely June) mainly in semi-desert localities; a time and place where collecting is uncommon.

Host plants are morphologically similar, especially as dry remains, having middle-sized flower heads with non-spinulose bracts, yellow, rarely purple florets, and flowering in May or June, depending on the height a.s.l. and temperature. *Amberboa bucharica* Iljin and the closely related *A. turanica* Iljin (Fig. 31) occur in sandy and clay deserts of Middle Asia, lower belt of bordering mountains of West Tien-Shan in the East, including Ferghana Valley, and up to Middle Volga River flood plain in the South East of European Russia. In Iran, six species have been recorded so far; of them *A. bucharica* and *A. turanica* occur mainly in Khorasan Razavi Province, whereas *A. sosnovskyi* Iljin is the most common species in the area where the two new *Terellia* species were collected, including Azerbaijan Sharghi (Eastern Azerbaijan), Zanjan and Ghazvin Provinces (Ranjbar & Negaresh, 2013).

Responsibilities. The responsibilities are distributed between the authors as follows: EZ discovered and collected the type series of *T. barughii* **new species** and prepared its illustrated description under a supervision of SK, then edited, completed and corrected by SMN; VAK collected the specimens of *T. amberboae* and *T. babaki*

new species, described them, dissected terminalia and prepared the final versions of figures for all the species. The present version of the paper is completed by VAK, with equal contribution of all the authors into its final cut. The taxonomic decisions in this paper were the responsibility of EZ and VAK.



FIGURES 31–32. *Terellia amberboae* group of species: 31, *Amberboa turanica*, possible host plant of *T. amberboae*, Uzbekistan (courtesy of T. Tullaev); 32, distribution of species.

Acknowledgments

This paper is a part of Ebrahim Zarghani's PhD project under the supervision of Dr. Samad Khaganinia supported by the Tabriz University. The last author (VAK) thanks Bernhard Merz (Andeer, Switzerland) and Dr. Babak Ghrali for their assistance during collecting trips in Uzbekistan and Iran (with the support of the Research Center for Agriculture and Natural Resources, Ghazvin, Iran) and to Dmitry Evstigneev (Ulyanovsk, Russia), who kindly provided him with the picture of the only specimen of *T. amberboae* collected in Russia. VAK also thanks Bernhard Schurian (Naturkunde Museum Berlin) for his assistance in taking pictures of flies at his laboratory. Tulkin Tillaev (Toshkent, Uzbekistan), kindly granted permission to use his photograph of *Amberboa turanica*.

References

Freidberg, A. & Kugler, J. (1989) Fauna Palaestina, Insecta IV. Diptera: Tephritidae. *The Israel Academy of Sciences and Humanities, Jerusalem*, [vi] + 212 pp. [8 pls., 1 map.]

Hadley, A. (2007) CombineZP. [Open source image processing software package for creating extended depth of field images]. Avaliable from: http://www.hadleyweb.pwp.blueyonder.co.uk/ (Accessed 21 Mar. 2016)

Korneyev, V. A. (1985) Fruit flies of the tribe Terelliini Hendel 1927 (Diptera, Tephritidae) of the fauna of the USSR. *Entomologicheskoe Obozrenie,* 64 (3), 626–644.

Korneyev, V.A. (1999) Phylogeny of the subfamily Tephritinae: relationships of the tribes and subtribes. *In*: Aluja, M. and Norrbom, A.L. (Eds.), *Fruit flies (Tephritidae): Phylogeny and evolution of behavior*. CRC Press, Boca Raton, pp. 549–580. [[16] +944 pp.]
https://doi.org/10.1201/9781420074468.sec6

Korneyev, V.A. (2003) New and little-known Tephritidae (Diptera, Cyclorrhapha) from Europe. *Vestnik Zoologii*, 37 (3), 3–12.

Korneyev, V.A. (2006) A revision of the *quadratula* group of the genus *Terellia* Robineau-Desvoidy (Diptera: Tephritidae). *In*: Freidberg, A., (Ed.), Biotaxonomy of Tephritoidea. *Israel Journal of Entomology*, pp. 35–36, 341–366.

Korneyev, V.A. & Evstigneev, D.A. (2007) The first record of *Terellia amberboae* (Diptera, Tephritidae) from Russia and Europe. *Vestnik Zoologii*, 41 (1), 1–70.

Korneyev, V.A., Evstigneev, D.A., Karimpour, Y., Kütük, M., Mohamadzade Namin, S., Ömür Koyuncu, M. & Yaran, M. (2013) Revision of the Terellia virens group (Diptera, Tephritidae) with description of three new species. *Vestnik Zoologii*, 47 (1), 3–25.
https://doi.org/10.2478/vzoo-2013-0001

Korneyev, V.A. & Merz, B. (1996) A new species of the genus *Terellia* (Diptera: Tephritidae) from Central Asia. *Journal of Ukrainian Entomological Society*, (1994–1995), 2 (2), 57–62.

Mohamadzade Namin, S., Nozari, J. & Najarpoor, A. (2011) A new species of *Terellia* (Diptera: Tephritidae) from Iran with a key to the species of the *tarbinskiorum* group. *Zootaxa*, 2750, 65–68.

Norrbom, A.L., Carroll, L.E., Thompson, F.C., White, I.M. & Freidberg, A. (1999) Systematic database of names. *In*: Thompson, F. C. (Ed.), Fruit fly expert identification system and systematic information database. *Backhuis Publishers, Leiden*, pp. 65–299.

Ranjbar, M. & Negaresh, K. (2013) A contribution to the genus *Amberboa* (Asteraceae, Cardueae, Centaureinae) from Iran. *Willdenowia*, 43 (2), 271–277.
https://doi.org/10.3372/wi.43.43206

White I. M. (1989) A new species of *Terellia* Robineau-Desvoidy associated with *Centaurea solstitialis* L. and a revision of the *Terellia virens* (Loew) species group (Diptera: Tephritidae). *Entomologist's Monthly Magazine,* 125, 53–61.

White, I.M., Headrick, D.H., Norrbom, A.L. & Carroll, L.E. (1999) Glossary. *In*: Aluja, M. & Norrbom, A.L. (Eds.), Fruit Flies (Tephritidae): *Phylogeny and evolution of behavior.* CRC Press, Boca Raton, pp. 881–924.
https://doi.org/10.1201/9781420074468.sec8