



A new species of *Tephritis* Latreille (Diptera: Tephritidae) with an unusual wing pattern from Iran and its taxonomic implications

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Abstract

Tephritis sahandi new species from Iran (type locality: Sahand chain mountains, East Azerbaijan Province) with an uncommon banded wing pattern is described and shown to be related to *Pangasella volkovitshi* Richter from Tadjikistan. Both species fit the diagnosis of the genus *Tephritis* Latreille 1804, and possess its key characters; as the result, *Pangasella* Richter 1995 (type species: *Pangasella volkovitshi* Richter 1995) is shown to be a new junior synonym of *Tephritis*, and its type species is transferred to the genus as *Tephritis volkovitshi* (Richter 1995) new combination. A key to the Palearctic species of banded-winged *Tephritis* is provided.

Key words: Diptera, Tephritidae, new species, new synonymy, Iran

Introduction

The genus *Tephritis* Latreille 1804 includes near 170 species occurring predominantly in the Holarctics and to the lesser degree in the Oriental, Afrotropical and Australasian Regions (Norrbom *et al.* 1999; Merz 2000). As far as known larvae of *Tephritis* feed in flower heads of a wide range of asteraceous plants of the tribes Cichorieae, Cardueae, Astereae, Senecioneae and Anthemideae, occasionally inducing soft galls in flower heads, shoots and rosettes. They inhabit almost all the climatic zones and altitudes, from dry and hot semideserts to the circumpolar tundra and subnival belt in the mountains. North American, European and Far East Asian *Tephritis* species have been recently revised and keyed (Foote *et al.* 1993; Merz 1994; Korneyev & Ovchinnikova 2004), but the Near East and Central Asian species remain poorly known, with almost 50 undescribed species recognized in entomological collections and no comprehensive keys available (V. Korneyev, unpublished data). The only key to all species of the genus by Hering (1944) does not include many of the most important diagnostic characters and is out of date.

The Middle East species of *Tephritis* were studied in the last ten years by different authors (Korneyev & Dirlbek 2001; Kütük 2005, 2008 a, 2008 b). As a result of these investigations several new species were described and many distributional records of species previously known from this and adjacent areas were provided. Recently, over 10 species were collected in Iran and subsequently described (Mohamadzade Namin *et al.* 2010; Zarghani *et al.* 2010 a, 2010 b). In addition, several apparently undescribed species were discovered. One of them, represented by few small specimens with an unusual banded wing pattern (uncommon in the tribe Tephritini) was collected by SK on the southern foothills of Sahand mountain massif and, simultaneously, by SMN on the northern foothills of it (Iran: East Azerbaijan Province); additional specimens were reared from its host plant in 2011 by SK. It is described below, its generic position is discussed, and some taxonomic implications are proposed.

Material and methods

Label data for all examined specimens are cited literally as they appear on labels, with line breaks marked with the slash character (“/”).

Acronyms for the institutions where specimens are deposited are:

IMUT	Insect Museum of Plant Protection Department, Faculty of Agriculture, University of Tabriz, Iran;
JAZM	Jalal Afashar Zoological Museum, College of Agriculture, University of Tehran, Karaj, Iran;
SIZK	I.I.Schmalhausen Institute of Zoology, National Academy of Sciences of Ukraine, Kiev, Ukraine;
ZISP	Zoological Institute of Russian Academy of Sciences, St. Petersburg, Russia.

Morphological terminology generally follows White *et al.* (2000).

The responsibilities are distributed between the authors as follows: SK, EZ and SMN collected the specimens of the new species, SK and EZ added distributional data, SMN described the species based on the holotype, whereas VAK edited its description and added notes on variability of the paratypes, provided the introduction, a redescription of *T. volkovitshi* V. Richter, the discussion and the references. He also pinned and labeled most paratypes of *T. sahandi* new species, dissected terminalia and prepared all the illustrations. The taxonomic decisions in this paper were the responsibility of VAK.

Results and discussion

Subfamily Tephritinae, tribe Tephritini

Tephritis Latreille

Tephritis Latreille 1804 (type species *Musca arnicae* Linnaeus 1758 by subsequent designation of Cresson 1914)

Acrorellia Wang 1990 (type species *Acrorellia sinica* Wang 1990, by original designation). Synonymized by Merz & Freidberg 1994.

Pangasella Richter 1995 (type species *Pangasella volkovitshi* Richter 1995, by original designation). **New synonymy.**

The genus *Tephritis* belongs to the so-called *Tephritis* group of genera along with *Acanthiophilus* Rondani, *Trupanea* Scrank, and many other genera distributed mainly in the Palaearctic and Afrotropical Regions, with some genera occurring also in other zoogeographic regions (Merz 2000). It can be recognized from a reticulate wing pattern with the hyaline spots on brown or grey background, with 2–3 large hyaline spots in the cell r_1 and a large apical hyaline spot at apex of the cell r_{4+5} separating a pair of dark rays bifurcating towards apices of the veins R_{4+5} and M (see Merz 1994: Figs. 51–53, Merz 2000: Fig. 24.7A, and Korneyev & Ovchinnikova 2004: Figs. 304–306); additional characters important for recognition of this genus from other Tephritini genera, are usually white posterior notopleural seta (black in the type species of the genus, *T. arnicae* (Linnaeus 1758) and a few other species), capitate proboscis, 2 frontal setae, 4 scutellar setae, a poorly sclerotized or entirely membranous glans of the phallus (without tubular structures of acrophallus of spinulose internal structures), and two moderately or strongly elongate spermathecae turned at 25–35° angle to their non-sclerotized ducts and with their apices directed posteriorly.

A few species of *Tephritis* are already known to have the wing pattern without apical fork and with tendency to fusion of hyaline and dark elements forming more or less conspicuous crossbands, e.g., *T. angulatofasciata* Portschinsky 1892, *T. admissa* Hering 1961 and *T. sinica* (Wang 1990), see Wang (1998). The latter species was described in the genus *Acrorellia* Wang, 1990, which has been later synonymized with *Tephritis* by Merz & Freidberg (1994).

***Tephritis sahandi* Mohamadzade, Korneyev & Khaghaninia new species**

(Figs. 1–2, 4–17)

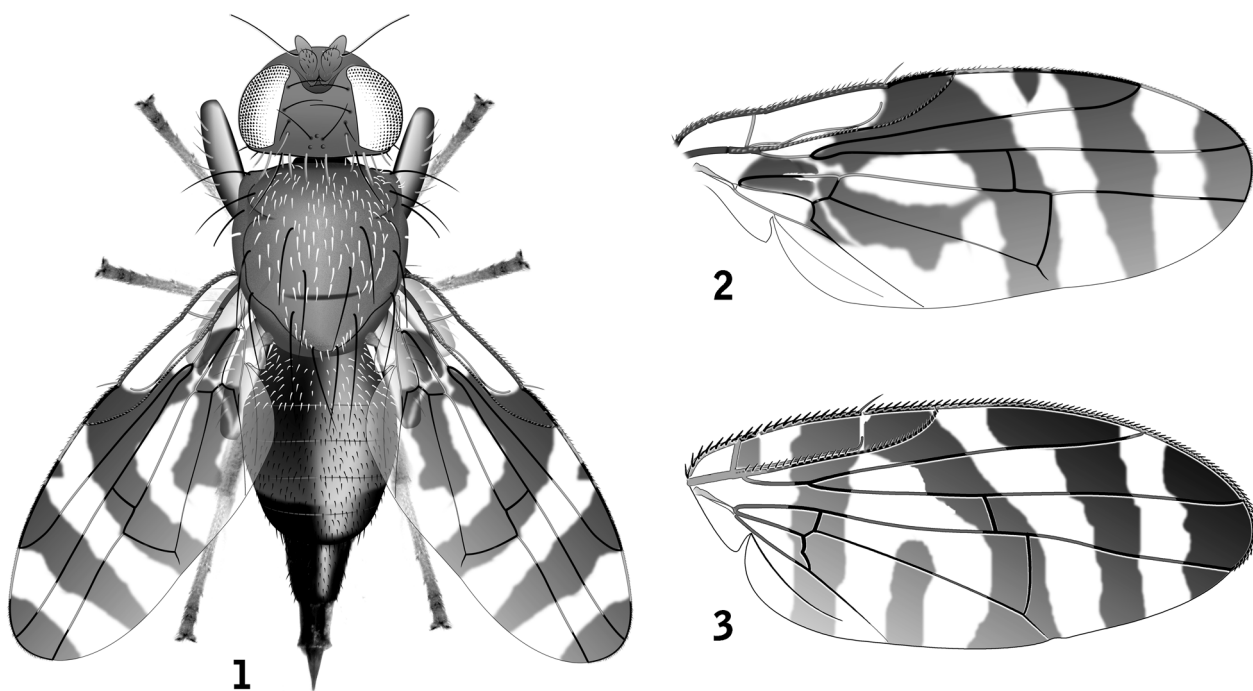
Type material. Holotype. ♀, Iran: East Azerbaijan Province, Sahand ski resort, 30 km of Tabriz, 37°45.850' N 46°30.754' E, 2900 m; swept from *Cirsium* (?) sp., 30.viii.2010 (S. Mohamadzade) (JAZM).

Paratypes. 1 ♂, 2 ♀♀, Iran: East Azerbaijan Province, Kendovan valley [located on the mountainside of Sultan Mount (one of the Sahand's summits)], 34.4 km to Tabriz, 37°46' N 46°15' E, 2341 m, swept from *Galactites* sp., 27.v.2010 and 5.vii.2010, (S. Khaghaninia) (IMUT). 8 ♂♂, 10 ♀♀, Iran: East Azerbaijan Province, Kendovan valley, 37°46.370' N 46°16.323' E, 2401 m, and 37°46.371' N 46°16.325' E, 2338 m, reared ex flower heads of *Achillea clypeolata*, collected 15.vii.2011, exit 23–27.vii.2011, (S. Khaghaninia) (IMUT; SIZK); 1 ♀, Iran: Mazandaran Province, Rineh, southern mountainside of Damavand, 35°52.168' N 52°06.329' E, 2500 m, 3.vi.2011 (S. Mohamadzade); 1 ♂, same collection data as in the holotype, 25.vii.2011 (S. Mohamadzade) (SMN personal collection).

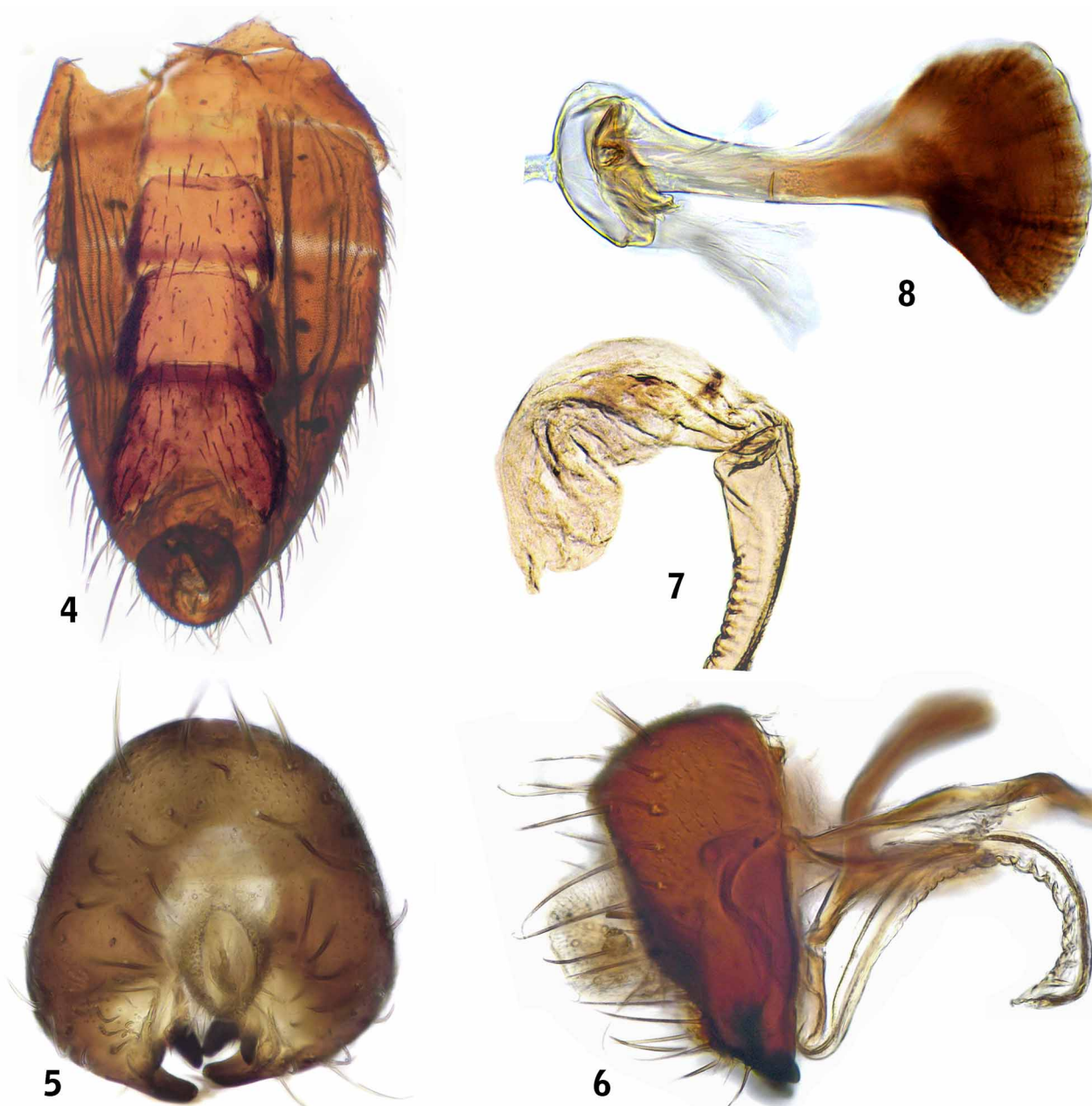
Etymology. Named after Sahand (سهند) mountain massive located in south of East Azerbaijan (آذربایجان شرقی) in northwestern Iran 30 km southwest of Tabriz. It is the highest and largest chain mountains in Azerbaijan Province of Iran, in addition to being an important dormant volcano in the country. It has several summits, of which the highest one is Kamal 3,707 m high.

Diagnosis. This species is similar to *T. volkovitshi* (Richter) from northern Tadjikistan, sharing with it the small size (wing shorter than 4 mm), crossvein r-m situated conspicuously distally of the apex of the vein R_1 and closer to the crossvein dm-cu, and a banded wing pattern with an oblique dark crossband from pterostigma through r-m and dm-cu. It can be readily differentiated from *T. volkovitshi* by the abdominal tergites shining or subshining black (grey microtrichose in *T. volkovitshi*), with the setulae on tergites 3–6 black (white setulose in *T. volkovitshi*) and the pattern in basal half of the wing with entirely brown base of the cell r_{2+3} (with a hyaline spot in the cell r_{2+3} at the level of subcostal vein apex in *T. volkovitshi*), costal cell entirely hyaline and the vein CuA_1 with longitudinal brown vitta along its basal half, but neither a subbasal crossband from anterior to posterior margin, nor short posterior crossband in the cell cua_1 (entire brown crossband from the apical half of the costal cell through radial fork and the veins bm-cu and CuA_2 to posterior margin of the anal lobe and a short posterior crossband from the middle of the vein CuA_1 to apex of the vein CuA_2+A_1 in *T. volkovitshi*).

Description. ♂♀.



FIGURES 1–3. *Tephritis sahandi* sp. nov. (1–2) and *T. volkovitshi* (3): 1. paratype ♀, total view, dorsal. 2–3. Wings.



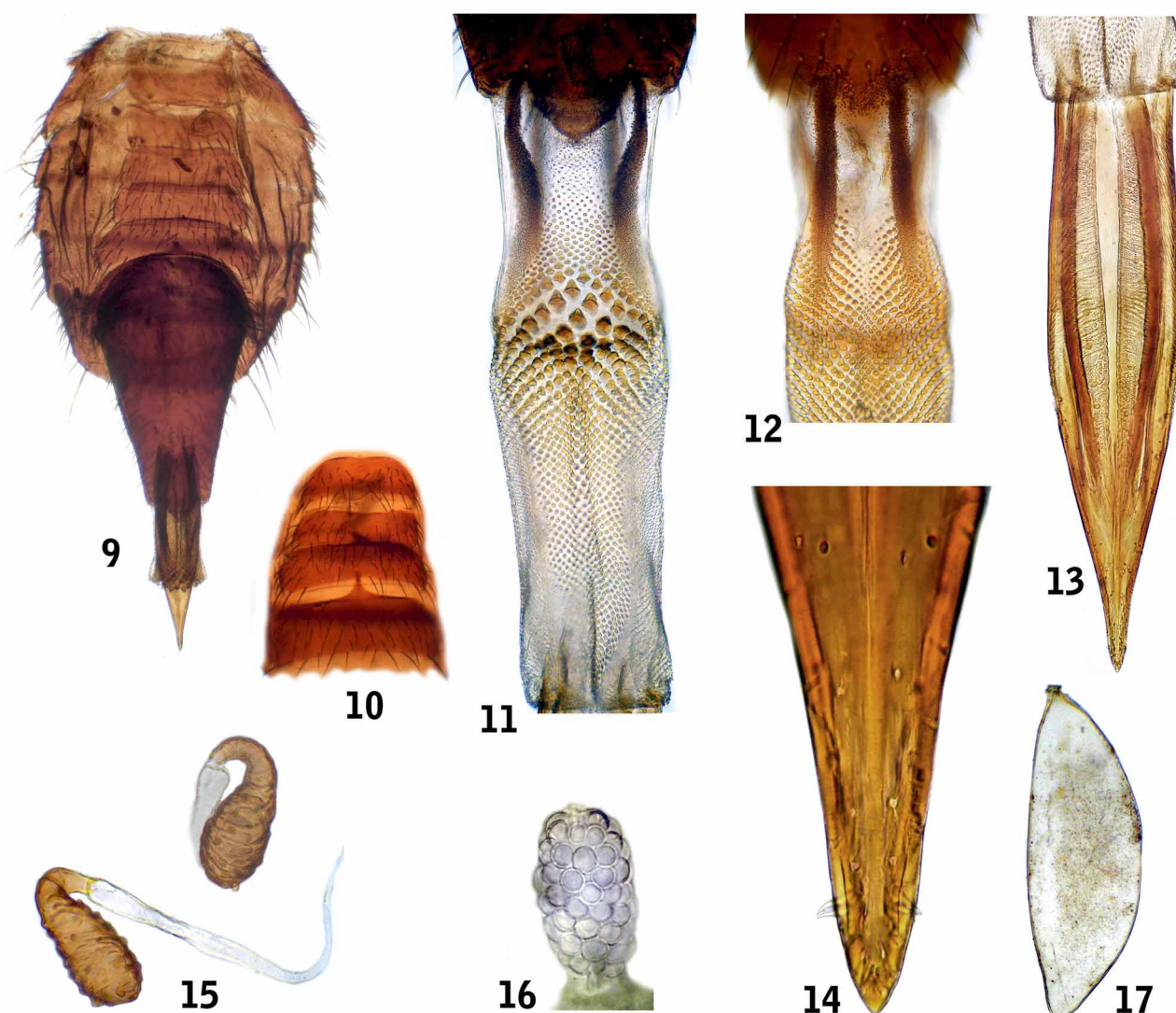
FIGURES 4–8. *Tephritis sahandi* sp. nov., paratype ♂. 4. Abdomen, dissected, ventral view. 5. Epandrium, posterior view. 6. Epandrium and hypandrium, lateral right view. 7. Glans of phallus, lateral. 8. Ejaculatory apodeme.

Head. Mainly yellow. Ocellar spot, upper part of occiput and slender part of arista black, middle part of frons yellow, scape dark brown and first flagellomere of antenna yellow. Frons as wide as eye. Eye 1.2 as high as long. First flagellomere of antennae 1.5 times as long as wide. Gena 0.46 times as high as length of first flagellomere. Ocellar, medial vertical, anterior orbital, frontal and genal setae black; other setae, including posterior orbital and lateral vertical, white to yellowish white. Postocular and genal setulae yellowish and setulae on distal part of palpus and on pedicel black.

Thorax: Ground colour black, sparsely silvery microtrichose; median part of postpronotum, narrow areas on dorsal part of anepisternum, dorsal half of greater ampulla and small adjacent sclerites and postscutellum yellow. Scutellum entirely black, silvery microtrichose and with several whitish setulae. Dorsocentral setae inserted on transverse suture. Most setae black and acuminate; posterior notopleural seta whitish and lanceolate; posterior anepisternal seta and anepimeral seta yellowish. Apical scutellar setae half as long as basals. Calypters white, with whitish fringe; upper one conspicuously lobate, almost as long as wide, lower one narrow. Halter yellow.

Legs. Coxae black, with yellowish brown and white setae. Femora black except knees yellow, sparsely grey microtrichose and black setulose, but forefemur with row of white posterodorsal setae in both sexes and basal half of dorsal row in male with white setae. Fore- and midtibiae yellow, hindtibia with medial two-thirds (in male) or entirely (in female) black. Tarsi yellow.

Wing. Pattern not reticulated, consisting of 3 transverse and 1 longitudinal dark brown bands. Base of wing and costal cell hyaline. Base of cell br, basal half of cell r_{2+3} almost whole cell bm, apex of cell bcu and area along vein CuA_1 in basal halves of cells dm and cua with irregular brown spot, rarely narrowly fused with the remaining dark pattern (as on Fig. 2). Pterostigma (apical portion of subcostal cell) brown without hyaline spots. Oblique brown stigmal crossband crossing wing from pterostigma through r-m and dm-cu to posterior margin and joined with basal spot through basal portions of cells r_1 and r_{2+3} . Subapical band crossing wing from apex of cell r_1 to middle of posterior margin of cell m. Apical band crossing wing between middle of R_{2+3} to R_{4+5} distance to apical quarter of cell m, with proximal margin arcuate or almost straight; one male paratype with two spots on apices of R_{4+5} and M veins separated by hyaline or pale gray area instead of entire band. In addition, cell r_1 with brown triangular indentation at the level of dm-cu as long as or shorter than cell width and proximal of subapical crossband, isolated or partly fused to it. Distance between crossveins r-m and dm-cu as long as r-m.



FIGURES 9–17. *Tephritis sahandi* sp. nov., paratype ♀. 9. Abdomen, dissected, ventral view. 10. Abdominal sternites 3–6, ventral view. 11. Apex of oviscap and eversible membrane, ventral view. 12. Apex of oviscap and basal half of eversible membrane, dorsal view. 13. Aculeus, ventral view. 14. Same, apex. 15. Spermathecae. 16. Ventral receptacle. 17. Egg.

Abdomen. Ground colour black, tergites 1–4 of male and female very sparsely greyish microtrichose, subshining, tergites 5 of male and 5–6 of female shining black. Abdominal tergites black setulose and setose, except syntergite 1+2 entirely white setulose in ♂ and only tergite 1 white setulose in ♀. Sternites (Figs. 4, 9) black, setae and setulae brown and moderately wide. Male sternite 5 posteriorly incised. Female sternite 6 (Figs. 9-10) with antero-medial apodeme. Abdominal pleura matt black or grey.

Genital segments. Male. Epandrium (Figs. 5–6) of oval shape common to other *Tephritis* species. Phallus without spines, glans (Fig. 7) moderately short, mostly membranous. Ejaculatory apodeme as on Fig. 8. Female. Oviscape shining black, entirely black setulose and setose, shorter than 2 last abdominal tergites. Eversible membrane with two pairs of taeniae 0.35–0.4 times as long as membrane itself; membrane with dentate scales, conspicuously larger on medioventral surface (Figs. 11–12). Aculeus moderately short, 0.7 mm long, 4.2 times as long as wide, with evenly acute apex bearing neither steps, nor lateral projections (Figs. 13–14). Two short, papillose spermathecae 2.2–2.3 times as long as wide (Fig. 15). Vagina with morula-like ventral receptacle (Fig. 16). Egg (Fig. 17) broadly oval.

Measurements. Length of wing, 2.7 mm (♂), 2.9 mm (♀); cell c length 0.55 mm. Aculeus length 0.7 mm. Body length, 2.9 mm (♂), 3.0 mm (♀).

Host plant. Larvae feed in flower heads of *Achillea clypeolata* Sibth. et Sm. (Fig. 18).



FIGURE 18. Host plant: *Achillea clypeolata*, host of *Tephritis sahandi*.

Discussion. *T. sahandi* new species fits the diagnosis of *Tephritis* in the following items: frons with 2 frontal and 2 orbital setae (posterior seta white), proboscis capitate, posterior notopleural seta white, scutellum with 2 pairs of setae, phallus glans membranous, without sclerotized structures. It differs from most species by a banded type of wing pattern, which is uncommon in this genus, but not unique, occurring in *Tephritis angulatofasciata*, *T. admissa* and *T. sinica*, and also in some undescribed species of *Tephritis* with partly banded wing pattern recognized in collections (V. Korneyev, unpublished data).

T. sahandi new species infests flower heads of *Achillea*, whereas the larvae of other band-winged *Tephritis* species feed in flower heads of *Alfredia*, *Cirsium*, *Cousinia* and other Cardueae asteraceous host plants (S. V. Korneyev & V. A. Korneyev, unpublished data).

All these species of *Tephritis* differ from *T. sahandi* new species not only by details of wing pattern (middle of wing with straight crossbands), larger size (length of wing 4–7 mm), but also by conspicuously longer spermathecae 4–10 times as long as wide and apparently are not closely related to it. The only species that has similar wing pattern is *Tephritis volkovitshi* (V. Richter 1995) redescribed below.

***Tephritis volkovitshi* (V. Richter 1995), new combination**

(Fig. 3)

Pangasella volkovitshi Richter 1995: 225.

Type material. Holotype ♂, Tadjikistan: Khudjand Region, Ferghana [valley], Pangaz River 10 km above Pangaz village, 1800 m, slope with mountain xerophilic vegetation, 27–28.v.1989 (M. Volkovitsh leg.), “Holotype / Pangasella / volkovitshi / V. Richter” (ZISP). Paratype ♀, same geographic label as in the holotype, and “Paratype / Pangasella / volkovitshi / V. Richter” label (ZISP) (examined by VAK in 1994).

Redescription. ♂♀.

Head. Mostly yellow. Frons 1.2 times as long as wide at anterior margin, as long as wide at posterior margin. Eye 1.5 times as high as long. First flagellomere of antennae 1.5 times as long as wide. Gena 0.3 times as high as eye height and 0.8 times as long as first flagellomere. Ocellar, medial vertical, anterior orbital, frontal and genal setae black; other setae, including posterior orbital and lateral vertical, white. Postocular, genal setulae whitish and setulae on distal part of palpus and on pedicel black.

Thorax: Ground colour black, only postpronotal lobes and apex of scutellum yellow, cuticle coloration hidden by entirely densely grey microtrichosity. Scutellum with several whitish setulae. Dorsocentral setae at transverse suture. Most setae black and acuminate, posterior anepisternal seta brown to black posterior notopleural seta and anepimeral seta whitish and lanceolate. Apical scutellar seta 0.4 times as long as basal. Calypters white, with whitish fringe; upper one conspicuously lobate, almost as long as wide, lower one narrow. Halter yellow.

Legs. Yellow. Femora sparsely microtrichose, mainly black setulose.

Wing. With pattern, consisting of 4 entire and 1 short posterior dark brown crossbands. Base of wing and costal cell pale infuscated on humeral crossvein and at base of cell br. Subbasal crossband straight, reaching from apical half of costal cell through radial fork and basal crossveins to anal lobe at posterior margin; short intermediate crossband reaching from centre of dm cell to posterior wing margin just distal to $CuA_2 + A_1$ apex; pterostigma (apical portion of subcostal cell) without hyaline spots; stigmal crossband oblique arcuate, crossing wing from pterostigma through both r-m and dm-cu crossbands slightly widened to posterior margin. Apical half of cell r_1 widely brown, fused with much narrower subapical band crossing wing from r_1 apex to middle of posterior margin of cell m. Apical band crossing wing between middle of R_{2+3} to R_{4+5} distance to apical quarter of cell m, with proximal margin almost straight. Distance between crossveins r-m and dm-cu as long as r-m or slightly shorter.

Abdomen. Ground colour black, densely grey microtrichose. Abdominal tergites white setulose, male 5th tergite and female 6th tergite with black marginal setae. Female oviscap shining black, partly white setulose on dorsal surface, 1.1 times as long as 2 last abdominal tergites.

Genital segments. Not dissected.

Measurements. Length of wing, 3.5 mm (♂), 3.6 mm (♀); cell c length 0.85 mm. Aculeus not measured. Body length, 3.2 mm (♂), 3.5 mm (♀).

Discussion. This species possesses characters of the genus *Tephritis* as follows: frons with 2 frontal and 2 orbital setae (posterior seta white), proboscis capitate, posterior notopleural seta white, scutellum with 2 pairs of setae. It differs from most species by a banded type of wing pattern, similar to that in *Tephritis sahandi* new species, differing by the details of wing pattern and abdomen setulae and microtrichia as noted in the key.

Identification. In the only existing key to all *Tephritis* species by Hering (1944) as well as in any other keys to local faunas, *T. volkovitshi* and *T. sahandi* new species should be placed in the very beginning as follows. The *angulatofasciata-admissa* group, which includes three described (*T. angulatofasciata* Portschnsky 1892, *T. admissa* Hering 1961 and *T. tatarica* Portschnsky 1892) and several undescribed species, should be revised in a separate paper (S. V. Korneyev, in preparation).

1. Wing apex with one large hyaline spot between veins R_{4+5} and M, dark pattern here represented by 2 rays, forming apical fork joined basally to remaining dark pattern, or as pair of separated dark spots on apices of R_{4+5} and M. . . . Other *Tephritis* species
- Wing apex without hyaline spot between veins R_{4+5} and M (or at most with small hyaline dot), so dark pattern here represented either by mushroom-like apical spot joined basally to remaining dark pattern, or by separated apical crossband covering R_{4+5} and M apices. 2.
2. Wing either with 1–3 irregular dark crossbands with angulate margins separated by hyaline intervals broken into separate hyaline spots or with reticulate pattern and one apical crossband joined to remaining pattern (as „mushroom-like spot on peduncle“) or separated. *angulatofasciata-admissa* group
- Wing with at least three regular dark crossbands with smooth margins separated by entire hyaline intervals not broken into hyaline spots. 3.
3. Wing with 3–4 crossbands: pterostigma and approximated crossveins r-m and dm-cu covered with one oblique and slightly arcuate dark brown crossband. Oviscape black. Smaller flies: wing 2.8–3.5 mm. Middle East. 4.
- Wing with 5 brownish–yellow, more or less parallel-sided crossbands: of them, apical, subapical and stigmal crossbands isolated, straight, crossing wing from anterior to posterior margin, and two crossbands through r-m and dm-cu crossveins fused in dm cell and forming a Y-like mark (Wang, 1998, Figs. 376–377) Oviscape reddish-yellow. Larger flies: wing 5.0–6.1 mm. NE China. *T. sinica*
4. Wing with straight subbasal crossband crossing wing from apical half of costal cell through radial fork and crossveins bm and CuA_2 to anal lobe (Fig. 3). Thorax and abdomen densely grey microtrichose, abdominal tergites 3–5(6) and oviscape white setulose. Tadjikistan. *T. volkovitshi*
- Wing with irregular subbasal spot broadly joined to stigmal crossband but leaving costal cell and anal lobe hyaline (Fig. 2). Thorax and abdominal tergites 1–4 sparsely microtrichose, subshining, tergite 5 of male and tergites 5–6 of female mostly shining, abdominal tergites 3–5(6) and dorsal surface of oviscape black setulose. NW Iran. *T. sahandi* new species

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