SYNOPSIS OF THE GENUS *TEPHRITIS* LATREILLE (DIPTERA: TEPHRITIDAE) IN IRAN

Ebrahim Zarghani*, Samad Khaghaninia*, Reza Farshbaf Pour Abad* and Babak Gharali**

* Dept. of Plant Protection, Faculty of Agriculture, University of Tabriz, IRAN. E-mail: khsz.zarghani@gmai.com
** Dept. of Plant Protection, Ghazvin Research Station for Agriculture and Natural, IRAN.

[Zarghani, E., Khaghaninia, S., Pour Abad, R. F. & Gharali, B. 2010. Synopsis of the genus *Tephritis* Latreille (Diptera: Tephritidae) in Iran. Munis Entomology & Zoology, 5, suppl.: 1176-1181**]**

ABSTRACT: Based on specimens collected from Iran during years 2008-2009, ten species of *Tephritis* were recognized. Identification key to the species was prepared. The locality, host plants and figures of wing pattern of each species are given.

KEY WORDS: Tephritidae, Fruit flies, Tephritinae, *Tephritis*, Iran.

Tephritidae (true fruit flies) is a large family of the order Diptera with more than 4400 described species over the world. Considering their damage on fruit plantations, they are important insects from the agricultural point of view as well as forest entomology (Merz, 2001).

Tephritis Latreille, with about 170 species is the sixth largest genus of Tephritidae and third largest genus in the Tephritinae, (Norrbom et al., 1999; Korneyev & Dirlbek, 2000). The majority of the species (about 120) occur in Palaearctic and a few are known from other zoogeographic regions. Except the old comprehensive but outdated, key to species of Hering (1944), other studies treated the genus in areas as small as countries (White, 1988 for Great Britain; Freidberg & Kugler 1989 for Israel and nearby areas; Merz, 1994 for North and Central Europe; Wang, 1996 for China and Kutuk, 2003 for Turkey).

Tephritis is distinguished from the other genera in subfamily Tephritinae by a combination of following characters (only the major characters are listed; more complete lists of characters can be found in Freidberg & Kugler (1989) and Merz (1994)): 2 orbital setae, anterior setae acuminate and dark (brown or blackish), posterior setae usually lanceolate and pale (whitish or yellowish; in 2 species brown or black); 2 dark frontal setae; dorsocentral setae situated on or slightly posterior to transverse suture; scutellum flat, with 2 pairs of setae, apical setae about 0.5- 0.6 times as long as basal setae; wing pattern highly variable among the species, usually reticulate with well developed apical fork, sometimes stellate [as in *T. cometa* (Loew)], or even banded [as in *T. postica* (Loew)]; oviscape somewhat flattened dorsoventrally.

Biologically, most species of *Tephritis* infest the flowerheads and in a few case stems of Asteraceae hosts that may induce formation of galls (Freidberg, 1984).

MATERIAL AND METHODS

Adult specimens were swept on flowers head of Asteraceae plants from several provinces of Iran during 2008 and 2009.

The voucher specimens were deposited at Insect Museum of Tabriz University. Figures of the wings were prepared by photos of a digital camera installed microscope eyepiece. For identification, Hering (1944), Freidberg & Kugler

(1989), and Merz (1994) were consulted. Terminology follows primarily White et al. (2000), Merz (1994), Freidberg & Mathis (1986), and Freidberg & Kugler (1989).

RESULTS

Ten species (*Tephritis bardanea, T. cometa, T. dioscurea, T. formosa, T. hurvitzi, T. hyoscyami, T. maccus, T. postica, T. praecox T. urelliosomima*) infest Asteraceae plants in Iran.

Key to species of *Tephritis* in Iran

1. Apical fork of wing absent; only isolated brown spots present at end of veins R_{4+5} and M (Figures 1, 4, 6, 8)..... 2
- Apical fork of wing present (Figures 2, 3, 5, 7, 9, 10)..... 4

2. Wing with enlarged hyaline area, brown spots small (Figure 1) .....***bardanae*** (Schrank)
- Hyaline areas on wing normal, brown spots large (Figure 4) .....***formosa*** (Loew)

3. Pterostigma hyaline on tip; 5-6 round hyaline areas in cells r_{4+5} and br. (Figure 6)..... ***hyoscyami*** (Linneaus)
- Pterostigma completely dark brown; only 1- 2 hyaline areas in cells r_{4+5} and br. (Figure 15) ..... ***postica*** (Loew)

4. Branches of apical fork uniformly narrow along their entire length (Figures 2, 5, 7)..... 5
- Branches of apical fork widen distinctly towards wing margin (Figures 3, 9, 10) 9

5. One hyaline area in cell r_1 (Figure 7) .....***maccus*** (Hering)
- Two hyaline areas in cell r_1 (Figures 3, 5, 9) 6

6. Wing without brown or black areas or with a few small spots in cell cua_1 (Figures 1, 2).. 7
- Brown or black pattern distinctly present in cell cua_1 (Figures 5, 6, 8)..... 8

7. Frons about 1.8 times as wide as eyes; length of third antennal segment about 1.7 width; wing with 2 or more hyaline areas in cell m (Figure 2).....***cometa*** (Loew)
- Frons equal to eyes wide.....9

8. Hyaline base of wing without small gray or blackish markings; dark preapical ray in cell dm usually reaching hind margin of wing even if interrupted in middle (Figure 5); mesonotum with indistinct striation..... ***hurvitzi*** Freidberg
- Hyaline base, including entire costal cell and cells bm and bcu; apical portion widely blakish-brown, with few hyaline spots and indentations..... ***urelliosomima*** Korneyev & Dirlbek

9. 2 large hyaline spots present in cell d Pterostigma with hyaline spots (Figure 9)..... ***praecox*** (Loew)
- Six hyaline spots present in cell r_{4+5}; the biggest hyaline spot not reaching vein R_{4+5} (Figure 3)..... ***dioscurea***(Loew)

Genus *Tephritis* Latreille, 1804

Nouv. Dict. Hist. nat., 24 (Sec. 3): 196.
Type species: *Musca arnicae* Linnaeus, 1758: Syst. Nat. Ed., 10, 1: 600.
Remark: Extensive synonymy and bibliography in Thompson (1998).

Tephritis bardanae (Schrank, 1803)
Material examined: Tehran: Damâvand, 2070 m., 14.VII.1976, (Lavallee), 4♂♂,1♀: Chichekli: 38°35' N, 46°14' E, 1223 m, 21-JUL-2009; 1♀: Jonbar: 37°43' N, 46°05' E, 2203 m, 23-JUL-2009; 1♀: Arasbaran: 38°53' N, 47°12' E, 1368 m, 01-JUL-2009 (Khaghaninia).
Diagnosis: Subcosta at least with indistinct transparent spot, wing with oblique brown band and large brown subapical spot with several hyaline spots (Figure 1); basal segment of ovipositor red, with darkened base and apex, length equal to two terminal tergites of abdomen combined.
Host plants: *Arctium lapa* and *A. tomentosum*.
Distribution: Northwest, South, Crimea, Caucasus, Kazakhstan, Western Europe and Iran (Gilasian and Merz, 2008).

Tephritis cometa (Loew, 1840)
Material examined: 125♂♂, 99♀♀, 5 km North East Abali, , 35°50' N, 51°58' E, 2360 m, 08.08.2008; 1♀: Araz and Sarand: 38°39' N, 46°15' E, 1272 m, 02-JUN-2009; 1♂, 1♀: Jonbar: 37°43' N, 46°05' E, 2203 m, 23-JUL-2009; 1♀: Znozakh: 37°55' N, 46°41' E, 1893 m, 04-AUG-2009 (Khaghaninia).
Diagnosis: Basal half of wing mainly hyaline; cell r_1 with small subapical hyaline spot; branches of apical fork uniformly narrow along their entire length; hyaline spot of cell r_{2+3} continuous with basal indentation of cell r_1, (Figure 2).
Host plants: *Circium gaillardotii, C. vulgare, C. arvense, and C. palustre* (Giray, 1979; White, 1988; Freidberg and Kugler, 1989; Merz, 1994).
Distribution: West and Middle Asia, Israel, Afghanistan, Russia, Estonia, Latvia, Lithuania, Ukraine, Moldova, Azerbaijan, Georgia, Armenia, Kazakhstan, Uzbek, Tajikistan, Kirghis, Turkomanas, Switzerland, England, Germany and Turkey (Foote, 1984; White, 1988; Freidberg and Kugler, 1989; Merz, 1994; Kutuk and Ozgur, 2003), and Iran (Mohamadzade Namin et al. 2010).

Tephritis dioscurea (Loew, 1856)
Material examined: 1♂: Uskuli; 38°51' N 46°59' E, 1367 m, 1 Jul. 2009; 1♀: Jonbar: 37°43' N, 46°05' E, 2203 m, 23-JUL-2009 (Khaghaninia).
Diagnosis: Inner margine of brown septum between two large hyaline spot of anterior wing. r always beyond midpoint of section occupied by spots (closer to apex of wings); brown pattern of wings less developed; narrow brown spot along M_{3+4} not crossing backward through longitudinal fold of P_3 (Posteromarginal wing cell), brown spots on vein A (anal) isolated (Figure 3).
Host plants: *Achillea millefolium, Artemisia absinthium, A. crithmifolia* and *Chrysenthemum corymbosum* (Asteraceae) (Hendel, 1927; Merz, 1994).
Distribution: Sweden, France, Hungary, Austria, Germany, Switzerland, Russia, Estonia, Latvia, Lithuania, Ukraine, Moldova, Azerbaijan, Armenia, Georgia, Kazakhstan, and Turkey (Foote, 1984; Merz, 1994; Thompson, 1998; Kutuk, 2005). Recorded by Zarghani et al. (2010) from Iran.

Tephritis formosa (Loew, 1844)
Material examined: 1♂: Nazarabad, Tankaman, 22.07.2008; Taleghan 1, 1900 m, 36°9.941 N, 50°42.785 E, 19.06.2008 (Mohamadzade); 1♀: Araz and Sarand: 38°39' N, 46°15' E, 1272 m, 02-JUN-2009; 1♀: Chichekli: 38°35' N, 46°14' E, 1223 m, 21-JUL-2009; 1♀: Arasbaran: 38°53' N, 47°12' E, 1368 m, 01-JUL-2009 (Khaghaninia).
Diagnosis: Brown spots large on wing; hyaline areas are small, Apical fork absent; only isolated brown spots at end of veins R_{4+5} and M.
Host plants: *Sonchus oleraceus, S. aspera, S. arvensis, Hypochaeris radicata*, and *Crepis virens* (White, 1988; Freidberg and Kugler, 1989; Merz, 1994).
Distribution: Europe, except Scandinavia, to Israel and Iran (Norrbom et al., 1999).

Tephritis hurvitzi Freidberg, 1981
Material examined: 1 ♂, Haraz Road, 2000 m, 36°36' N, 52°15' E, 14.06.2008 (Mohamadzade); 2♂♂: Znozakh: 37°55' N, 46°41' E, 1893 m, 04-AUG-2009; 1♀: Horand:

38°56' N, 47°27' E, 1439 m, 31-MAY-2009; 5♀♀: Jonbar: 37°43' N, 46°05' E, 2203 m, 23-JUL-2009 (Khaghaninia).
Diagnosis: Basal half of wing mainly hyaline; apex of cell r_1 without subapical hyaline spot; brown ray to costa in cell r_{2+3} narrow, at most as wide as hyaline spot at end of vein R_{2+3}; reticulate brown area from middle of cell dm to end of cell bcu continuous (Figure 5).
Host plants: *Scorzonera syrica* and *Tragopogon longirostris* (Freidberg and Kugler, 1989).
Distribution: Europe, Middle Asia, Israel, Syria, Jordan, Lebanon, Iraq and Iran (Norrbom et al., 1999; Korneyev, Dirlbek, 2000, and Mohammadzade naming et al. 2010).

Tephritis hyoscyami (Linneaus, 1758)
Material examined: 1♀: Qaradervish; 38°56' N 47°27' E, 1439 m, 31 May. 2009 (Khaghaninia).
Host plants: *Carduus crispus, C. defloratus, C. personata and C. aconthoides* (Merz, 1994).
Distribution: North and Middle Europe, Russia, Estonia, Latvia, Ukraine, Lithuania, Moldova, Azerbaijan, Georgia, Armenia, China, Switzerland and Turkey (Foote, 1984; Thompson, 1998; Merz, 1994; Kutuk and Ozgur, 2003). Recorded by Zarghani et al. (2010) from Iran.

Tephritis maccus Hering, 1937
Material examined: Tehran: Evin, 23.VIII.1973, light trap (Gilasian and Merz, 2008), 1♀, 5 km North East Abali, 2360 m, 35°50.304 N, 51°58.980 E, 29.08.2008 (Mohamadzade).
Diagnosis: Medium-sized *Tephritis* with the wing pattern strongly resembling that of *Capitites ramulosa* Loew, differing from the latter by the structura of phallic glands, shape of the aculeus and by the head.
Host plants: Unknown. Some specimens were swept from stands of *Chondrilla, Picris* and *Scarriola*.
Distribution: Spain, Kyrgyzstan, Iran, Afghanistan, India. (Korneyev and Dirlbek, 2000, Gilasian and Merz, 2008).

Tephritis postica Loew, 1844
Material examined: 2♂♂, 2♀♀: 3 km West Bomehen, from flower heads of *Onopordon acanthium,* 03.06.2008, exit 21.06.2008; 2♂♂, 3♀♀: Damavand, reared from *O. heteracanthum*, 04.06.2009, exit 14.06.2009 (Mohamadzade); 1♂: Jonbar: 37°43' N, 46°05' E, 2203 m, 23-JUL-2009; 1♀: Jonbar: 37°43' N, 46°05' E, 2203 m, 23-JUL-2009 (Khaghaninia).
Diagnosis: Only two large hyaline spots in cell r_{2+3}, both distal of r-m crossvein (Figure, 8).
Host plants: *Onopordum cynarocephalum* and *O. acanthium* (Freidberg and Kugler, 1989; Merz, 1994).
Distribution: North Europe, West Asia, Iran, Italy, Spain, Israel, France, Switzerland, Germany and Turkey (Giray, 1979; Foote, 1984; Merz, 1994; Kutuk and Ozgur, 2003; Ozgur and Kutuk, 2003).

Tephritis praecox (Loew, 1844)
Material examined: 1♀: Zidasht, Taleghan, 36°99' N, 50°42' E, 1900m, 14.06.2009; 1♂, 1♀: Horand: 38°56' N, 47°27' E, 1439 m, 31-MAY-2009; 2♂♂: Chichekli: 38°35' N, 46°14' E, 1223 m, 21-JUL-2009; 1♀: Arasbaran: 38°53' N, 47°12' E, 1368 m, 01-JUL-2009; 1♀: Horand: 38°56' N, 47°27' E, 1439 m, 31-MAY-2009 (Khaghaninia).
Diagnosis: Only two large hyaline spots in cell r_{2+3}, both distal of r-m crossvein (Figure 9)
Host plants: *Calendula arvensis* (Merz, 1994).
Distribution: South Europe, North Africa, Israel, Syria, Iraq and Uzbekistan and Iran (Norrbom et al., 1999; Korneyev and Dirlbek, 2000, and Mohammadzade namin et al., 2010).

Tephritis urelliosomima Korneyev and Dirlbek, 2000
Material examined: Fars: Bamu, 1700 m., 24.IX.1996, Tehran: Evin, 16.V.1996, light trap.
Diagnosis: Medium-sized *Tephritis* with wing pattern somewath similar to that of *Trupanea guimari* (Becker, 1908) [syn. *Urelliosoma guimari* (Becker, 1908)], and differing from the latter by the head and body chaetotaxy typical for *Tephritis*.

Host plants: Unknown.
Distribution: Spain, Syria, Jordan, Middle Asia, Afghanestan and Iran (Korneyev and Dirlbek, 2000, Gilasian and Merz, 2008).

LITERATURE CITED

Foote, R. H. 1984. Family Tephritidae, In: A. Soos and L. Papp eds., Catalogue of Palaearctic Diptera (ed., R. C. Foote). Budapest and Elsevier Science Publishers, Amsterdam, 9: 66-149.

Fridberg, A. 1984. Gall Tephritidae (Diptera), In: Biology of Gall Insects (ed., T.N. Ananthakrishnan), Oxford and IBH Publishing Co., New Delphi, pp. 129-167.

Freidberg, A. & Mathis, W. N. 1986. Studies of Terelliinae (Diptera:Tephritidae): A revision of the genus Neaspilota Osten. Sacken. Smithsonian Institution Press, Washington, No. 439.

Freidberg, A. & Kugler, J. 1989. Fauna Palaestina. Insecta IV. Diptera: Tephritidae. Israel Academy of Sciences and Humanities, Jerusalem.

Gilasian, E. & Merz, B. 2008. The first report of three genera and fifteen species of Tephritidae (Diptera) from Iran. Journal of Entomological Society of Iran, 27: 11- 14.

Giray, H. 1979. Turkiye Trypetidae (Diptera) faunasına ait ilk liste. Türkiye Bitki Koruma Dergisi, 3: 35-46.

Hendel, F. 1927. 49. Trypetidae. In: Die Fliegen der Palaearktischen Region. (Ed. E. Lindner) SchweitzerbartÕschen Verlagsbuchhandlung, Stuttgart, Vol. 5. E.

Hering, M. 1944. Bestimmungtabelle der Gattung *Tephritis* Latreille, 1804. Siruna Seva, 5: 17-31.

Korneyev, V. A. & Dirlbek, J. 2000. The fruit flies (Diptera: Tephritidae) of Syria, Jordan and Iraq. Studia Dipterologica, 7: 463-482.

Kutuk, M. 2005. Two New Records of *Tephritis* Latreille, 1804 (Diptera: Tephritidae) from Turkey. Turkish Journal of Zoology, 29: 167-170.

Kutuk, M. 2006. The Fauna and Systematics of the Genus *Tephritis* Latreille, 1804 (Diptera: Tephritidae) with a Key to the Species of *Tephritis* in Turkey. Turkish Journal of Zoology, 30: 345-356.

Kutuk, M. & Ozgur, A. F. 2003. Faunistical and Systematical Studies on the Genus *Tephritis* Latreille, 1804 (Diptera: Tephritidae) in the South West of Turkey Along with new Records. Turkish Entomology Dergisi, 27: 243-252.

Merz, B. 1994. Diptera, Tephritidae. Insecta Helvetica Fauna, Vol: 10, Geneve.

Merz, B. 2001. Faunistics of the Tephritidae (Diptera) of the Iberian Peninsula and the Baleares. Bulletin de la Societe Entomologique Suisse, 74: 91- 98.

Mohammadzade Namin, S., Nozari, J. & Rasolian, G. H. 2010. The fruit flies (Diptera, Tephritidae) in Tehran province, with new records for Iranian fauna. Vestnik zoologii, 44 (1): 20-31.

Norrbom, A. L., Carroll, L. E., Thompson, F. C. White, I. M. & Freidberg, A. 1999. Systematic Database of Names. In: Fruit Fly Expert Identification System and Systematic Information Database. (Ed. F.C. Thompson) Backhuys Publishers, Myia 9. Leiden.

Ozgur, A. F. & Kutuk, M. 2003. Adana Üli Meyve Sinekleri (Tephritidae: Diptera) Faunasõnõn Tespiti Çukurova Üniversitesi Ziraat Fakültesi Dergisi, 18: 35-44.

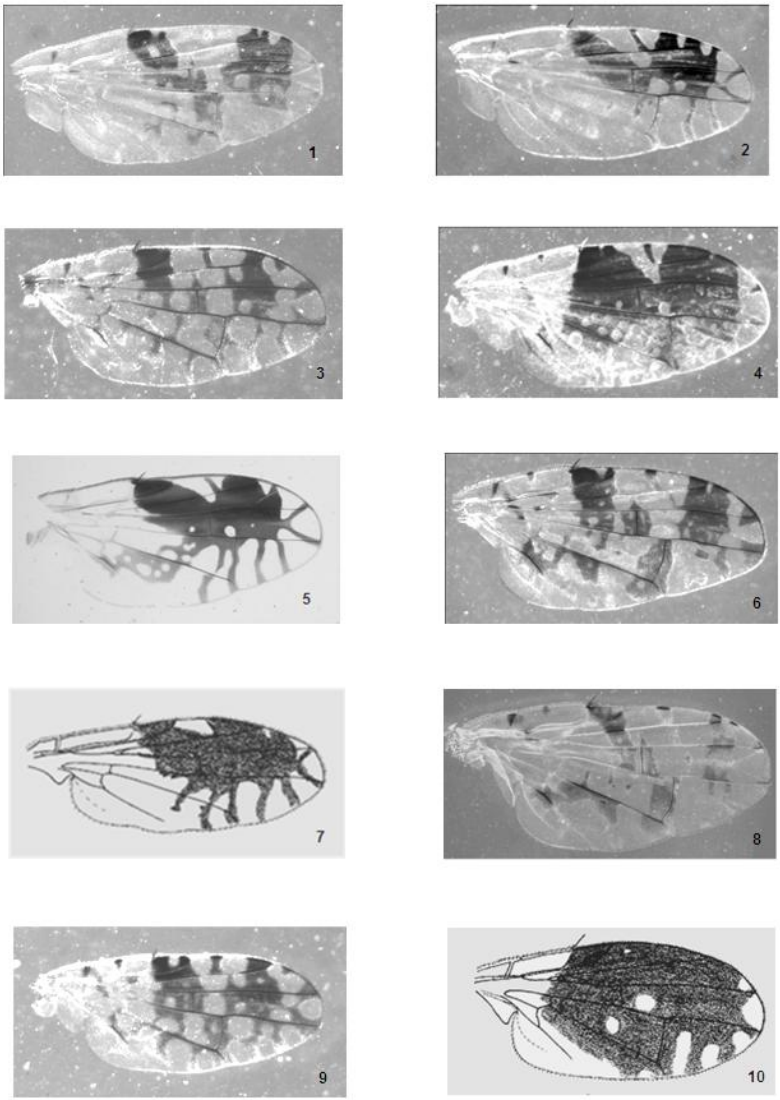
Thompson, F. C. 1998. Fruit Fly Expert Identification System and Systematic Information Database. North American DipteristsÕ Society, Backhuys Publishers, Leiden, the Netherlands.

Wang, X. 1996. The Fruit Flies (Diptera: Tephritidae) of the East Asian Region. Acta Zootaxonomica Sinica 21. Supplement.

White, I. M. 1988. Tephritid Flies (Diptera: Tephritidae). Handbooks for the Identification of British Insects 10 (5a).

White, I. M., Headrick, D. H., Norrbom, A. L. & Carroll, L. E. 2000. 33 Glossary. In: Fruit Flies (Tephritidae): Phylogeny and Evolution of Behavior (eds., Aluja, M. and Norrbom, A. L.). CRC, Boca Raton, Washington, pp. 881-924.

Zarghani, E., Khaghaninia, S., Farshbaf Pour Abad, R. & Gharali, B. 2010. Two genera and five species as new records for fruit flies fauna of Iran from East Azarbaijan Province. Munis Entomology and Zoology, Vol. 5: 823-824.



Figures. Wings of *Tephritis*: 1- *Tephritis bardanea*; 2- *T. cometa*; 3- *T. dioscurea*; 4- *T. Formosa;* 5- *T. hurvitz*; 6- *T. hyoscyami*; 7- *T. maccus*; 8- *T. postica*; 9- *T. praecox*; 10- *T. urelliosomima* (All the photos are original except 8 and 10 which from Korneyev, 2000).