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Study of the fruit flies (Diptera: Tephritidae) as biocontrol agents of asteraceus plants in Saqez region (Kurdistan province)

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Abstract

Tephritidae is one of the most important families of the order Diptera. Larvae of this family are often associated with thistle of various plants specially family Asteraceae. The larvae of some species feeding of inedible asteraceus plants to grazing animals, reduce seed amount and cause stable control of them in grasslands. In this study, 13 species belonging to 9 genera of the family Tephritidae from 10 species belonging to 6 genera of the host plants were collected and identified during 2011-2013. Four species, *Onopordum acanthium* (LINNÉ, 1753), *Onopordum illyricum*, *Acroptilon repens* (LINNÉ, 1837) and *Echinops spinosissimus* TURRA, 1765, are recorded as the host plants of these flies for the first time from Iran. *Acanthiophilus helianthi* ROSSI, 1794 from *Onopordum acanthium* and *Acroptilon repens*, *Tephritis postica* LOEW, 1844 and *Terellia gynae-cochroma* HERING, 1937 from *Onopordum illyricum* as well as *Tephritomyia lauta* LOEW, 1869 from *Echinops spinosissimus* were obtained by rearing in the laboratory.

Key words: Iran, Saqez, Asteraceae, Host plant association, Fruit flies.

Zusammenfassung

Die Tephritiden bilden eine der wichtigsten Familien der Ordnung Diptera (Zweiflügler). Die Larven dieser Familie sind oft vergemeinschaftet mit den Samenköpfen verschiedener Pflanzen, hauptsächlich der Familie Asteraceae (Korbblütler). Sofern die Larven sich von Korbblütlern ernähren, welche von grasenden Nutztieren gemieden werden, sorgen sie für eine Reduzierung der Samenmenge dieser Pflanzen und damit für eine andauernde Erhaltung der Grasweide.

Für diese Studie wurden in den Jahren 2011–2013 13 Arten von Tephritiden aus 9 Gattungen dieser Familie gesammelt und identifiziert; diese 13 Arten lebten auf 10 Arten aus 6 Gattungen von Wirtspflanzen. Von diesen Wirtspflanzen wurden 4 Arten erstmals aus dem Iran gemeldet, und zwar *Onopordum acanthium* (LINNÉ, 1753), *Onopordum illyricum*, *Acroptilon repens* (LINNÉ, 1837) sowie *Echinops spinosissimus* TURRA, 1765. Folgende Larvenarten wurden aus Aufzucht im Laboratorium gewonnen: *Acanthiophilus helianthi* ROSSI, 1794 vom *Onopordum acanthium* und vom *Acroptilon repens*; *Tephritis postica* LOEW, 1844 and *Terellia gynaecochroma* HERING, 1937 beide vom *Onopordum illyricum*; *Tephritomyia lauta* LOEW, 1869, vom *Echinops spinosissimus*.

Introduction

The Tephritidae, true fruit flies, with more than 4500 described species is a family of attractive picture-winged flies. The taxonomic diversity of this single family of two-winged flies is far greater than that of mammals (NORRBOM 2004). Fruit flies are distributed throughout the temperate and tropical areas of the world, being absent only from the high arctic and antarctic (THOMPSON 1998). This family consist of small to medium flies in 2–12 mm long, fronto-orbital plate usually bears one or more frontal bristles, antennae with bare or plumose arista, wings usually with a pattern consisting of brown strips and spots, costal vein with two interruptions (WHITE & ELSON-HARRIS 1992). They are almost all phytophagous and include numerous pests of fruit and vegetable crops as well as useful species to the biocontrol of weeds. Most Tephritidae larvae associated with thistle of plants particularly of the family Asteraceae. Family Asteraceae, usually known as Compositae or Sunflower, is one of the biggest families of the Angiosperms and the main features of this family is the type of their thistle flower. A few inflorescences of this family are compound and have environmental-economic importance and found in the most habitats. These plants are distributed in dry or semidry area (DLUSSKII et al. 2004).

Sometimes tephritids act as important biological control agents of asteraceous plants by reducing seed production and operation but some other attack leaves plant and cause leaf miner (KAPOOR et al. 1980; WHITE 1988). Some species like *Urophora stylata* (FABRICIUS) and *Chaetostomella cylindrical* (ROBINEAU-DESVOIDY) are important agents in biological control programs against weeds such as *Cirsium vulgare* (SAVI) (WHITE & ELSON-HARRIS, 1992). Also *Urophora sirunaseva* (HERING) was used to control of some roughage species of Asteraceae (WHITE & ELSON-HARRIS 1992; WOODS et al. 2008).

Recently some studies have been done about identification of the fruit flies and their host plants in Iran (MOHAMMADZADE NAMIN et al. 2010; KARIMPOUR 2011). MOHAMMADZADE NAMIN & NOZARI (2011), introduced *Centaurea behen* LINNÉ as new host plant of *Urophora merzi* from Iran. KARIMPOUR (2011), introduced 13 species of Asteraceae as new host plants of Tephritids in Urmia province. Also the larvae of the species *Aciura afghana* (HERING, 1961) were collected from various species of Lamiaceae plants in Iran (KHAGHANINIA & GHARAJEDAGHI 2013). Before this study, the fruit flies fauna of Saqez region has not been studied. Since most of the tephritid flies are important as biological agents of some of the Asteraceus plants, this research has been done to increasing the knowledge of the tephritid flies fauna and their host plants in the region.

Material and methods

Flower heads of Asteraceus thistles were collected from Saqez region during 2012-2013. The collected host plants were deposited to the greenhouse of Plant Protection Department of Tabriz University. Materials including capitula of asteraceus plants and tephritids larvae preserved in net containers (20-30 C° and 40% humidity). Adult specimens exited of flower heads of the weeds in the greenhouse after 1-3 weeks. In order to identification, the containers filled by CO₂ and the adults were dropping to the alcohol and some of them were pinned for more studies. Tephritidae and asteraceus species were identified by WHITE et al. 1999; WHITE 1988 and FLOUR of GHAHRAMAN & ATTAR 2000.

Results

In this study, 13 species belonging to 9 genera of the family Tephritidae from 10 species belonging to 6 genera of the weed asteraceus host plants were identified in Saqez region which totally are listed in table 1-1 and the new record ones are explained as follow.

Family: T e p h r i t i d a e

Tribe *Tephritini* NEWMAN, 1834

Acanthiophilus helianthi (ROSSI, 1794) (Fig. 1a)

Material examined: (1 ♂): from flower heads of *Onopordum acanthium* (new host plant record) and (52 ♂♂, 43 ♀♀): from flower heads of *Cirsium heterophyllum*, 36°04.134' N, 46°15.221' E, 1639 m. (1 ♂): from flower heads of *Acroptilon repens* (new host plant record) and (1 ♀): from *Senecio vulgaris* and (2 ♀): from *Centaurea solstitialis*, 36°10.471' N, 46°20.291' E, 1603 m.

Host plants in Saqez: From flower heads of some species such as *Acroptilon repens* (LINNÉ, 1837), *Onopordum acanthium* (LINNÉ, 1753), *Cirsium heterophyllum*

(HILL, 1768), *Centaurea solstitialis* and *Senecio vulgaris* were collected. *Acroptilon repens* and *Onopordum acanthium* are first records of the host plants in Iran.

Distribution: Poland, North Africa, Turkey, Spain, Sweden and Afghanistan (RICHTER 1988; NORRBOM et al. 1999); Iran: Tehran, Tabriz and Ilam (MOHAMMAZADE NAMIN et al. 2010).

***Tephritis postica* (LOEW, 1844) (Fig. 1b)**

Material examined: (66 ♂♂, 94 ♀♀): from flower heads of *Onopordum acanthium* and (249 ♂♂, 236 ♀♀): from *Onopordum illyricum* (new host plant record), 36°044.134' N, 46°15.221' E, 1639 m.

Host plants in Saqez: From flower heads of *Onopordum acanthium* and *Onopordum illyricum* were collected. *Onopordum illyricum* is a new host plant record from Iran.

Distribution: France, Okarina, Uzbekistan, South to North Africa and Cent. Europe (RICHTER, 1988; NORRBOM et al. 1999); Iran: Tehran and Tabriz (MOHAMMAZADE NAMIN et al. 2010; GHARAJEDAGHI et al. 2011).

***Tephritomyia lauta* (LOEW, 1869) (Fig. 1c)**

Material examined: (22 ♂♂, 20 ♀♀): from *Echinops spinosissimus* (new host plant record) and (28 ♂♂, 15 ♀♀): from *Echinops viscosus*, 36°10.365' N, 46°04.061' E, 1570 m.

Host plants in Saqez: from flower heads of *Echinops viscosus* and *Echinops spinosissimus* were collected. *Echinops spinosissimus* is first record of the host plant from Iran.

Distribution: Greece, Tunisia, and Egypt (NORRBOM et al. 1999); Iran: Tehran and Ilam (MOHAMMAZADE NAMIN et al. 2010; GHARAJEDAGHI et al. 2011).

Tribe *Terellini* HENDEL, 1927

***Terellia gynaecochochroma* (HERING, 1937) (Figs.1j)**

Material examined: (46 ♂♂, 40 ♀♀): from *Onopordum acanthium* and (46 ♂♂, 64 ♀♀): from *Onopordum illyricum*, 36°10.471' N, 46°20.290' E, 1603 m.

Host plants in Saqez: From flower heads of *Onopordum acanthium* and *Onopordum illyricum* were collected which *Onopordum illyricum* reported as a new host plant from Iran.

Distribution: North Europe, Turkey and Lebanon (NORRBOM et al., 1999; KNIO et al. 2002; KUTUK & VAROL 2006); Iran: Tehran and Tabriz (MOHAMMAZADE NAMIN et al. 2010).

Table 1-1: The list of the studied Tephritidae species and their host plants in Saqez regio

Tribe	Species	Host plant	
Myopitini	<i>Urophora stylata</i> (FABRICIUS 1775)	<i>Cirsium arvens</i> (Fig2.f)	(2♂, 4♀) (Fig1.d)
	<i>Urophora terebrans</i> (LOEW 1850)	<i>Onopordum acanthium</i> (Fig2.g)	(2♂) (Fig1.f)
	<i>Urophora xanthippe</i> (MUNRO 1934)	<i>Acroptilon repens</i> (Fig2.a)	(2♂, 4♀) (Fig1.e)
Xyphosiini	<i>Xyphosia miliaria</i> (SCHRANK 1781)	<i>Cirsium arvens</i>	(2♂, 2♀) (Fig1.g)
Tephritini	<i>Sphenella marginata</i> (FALLEN 1814)	<i>Senecio vulgaris</i> (Fig2.c)	(7♂, 3♀) (Fig1.k)
Terellini	<i>Chaetorellia carthami</i> (STACKELBERG 1929)	<i>Centaurea solstitialis</i> (Fig2.e)	(16♂, 11♀) (Fig1.h)
	<i>Chaetostomella cylindrical</i> ROBINEAU-DESVOIDY 1830	<i>Onopordum</i>	(8♂, 3♀)
		<i>acanthium</i>	(17♂, 13♀)
		<i>O. illyricum</i>	(2♂, 1♀)
		<i>Cirsium arvense</i>	(1♀)
		<i>Cirsium palustre</i> (Fig2.g, b, f, j)	(Fig1. i)
	<i>Terellia quadratula</i> (LOEW 1869)	<i>Echinops viscosus</i> (Fig2.i)	(2♂, 1♀) (Fig1.l)
<i>Terellia ruficauda</i> (FABRICIUS 1794)	<i>Cirsium arvens</i>	(6♂, 3♀) (Fig1.o)	

Discussion

This study showed that the large number of these flies feeding from roughage species of Asteraceae which predicted to be as their biocontrol agents. WHITE (1988), THOMPSON (1998) & NORRBOM et al (1999) introduced roughage species of Asteraceae as host plants of the most tribes of Tephritidae. Also HARRIS (1980) showed that the two species of *Urophora affinis* and *Urophora quadrifasciata* can be used for the biological control of *Centaurea diffusa* and *Centaurea maculosa* in Canada. In this study most of the fruit flies were collected from roughage species such as *Cirsium* and *Onopordum*. However some asteraceus species such as the members of the genus *Acroptilon* are not roughage but because of their toxic secondary products, their control in pastures could be important too. Roughage plants make pastures useless for grazing and as they have high resistance to herbicides, their chemical control is so difficult (HARRIS 1980). Studies on application of these flies for biological control of weeds have been done already in the world but no study has been done in this aspect in Iran so far. Thus it is suggested that use of these flies as biological agents as integrated control programs increase the efficiency and utilization of pasture.

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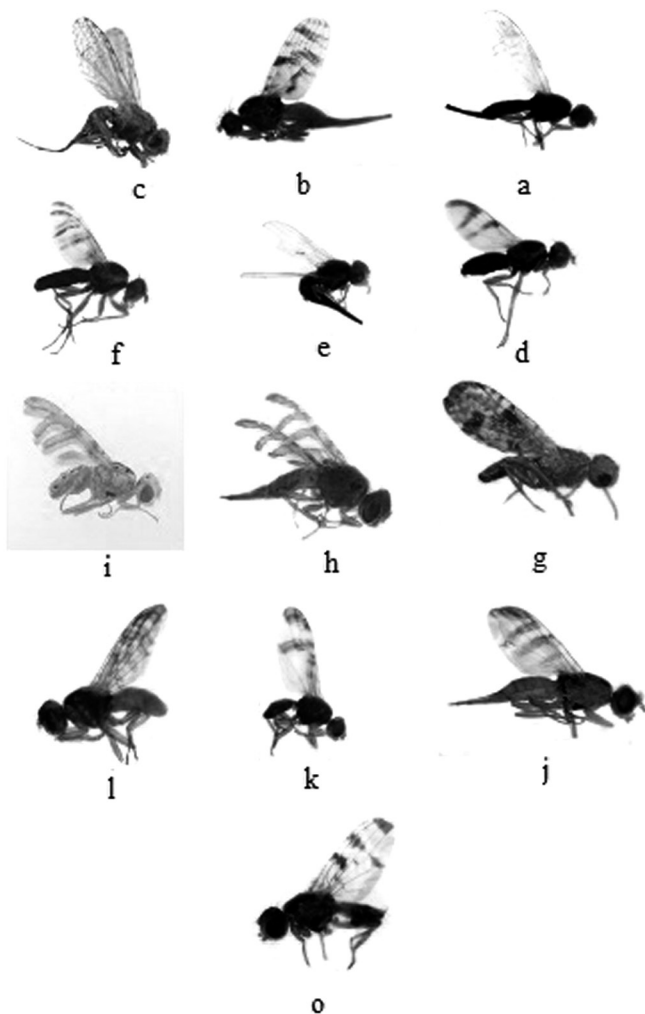
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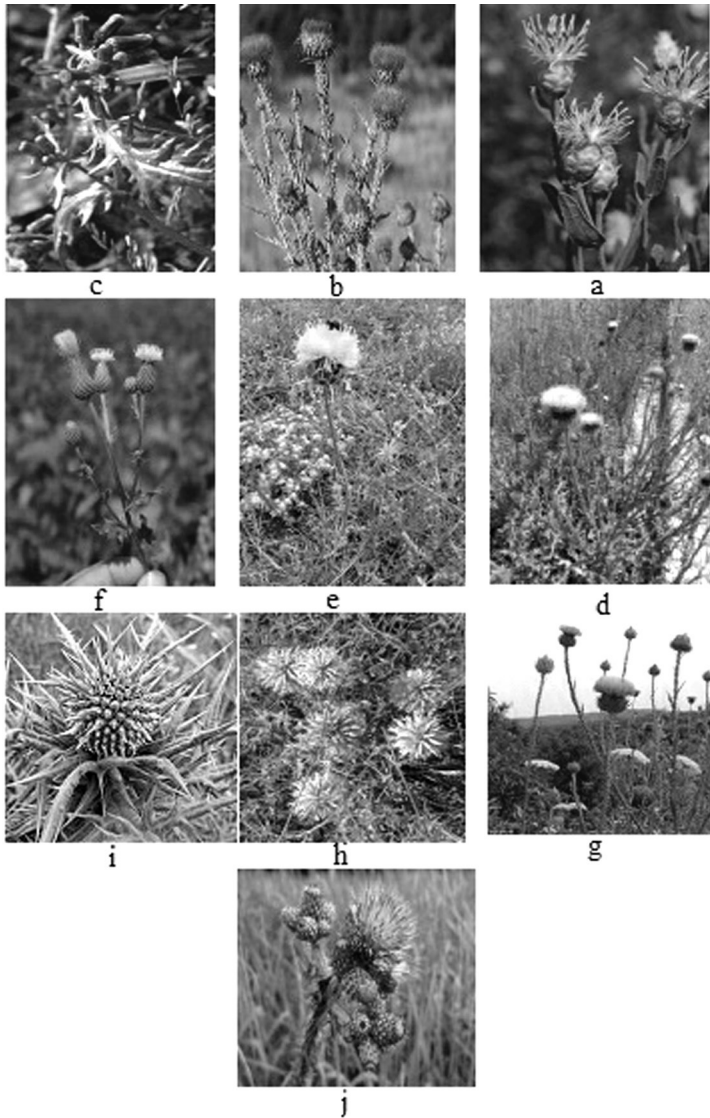
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Figs. 1: Lateral view of (a) *Acanthiophilus helianth*; (b) *Tephritis postica*, (c) *Tephritomyia lauta*; (d) *Urophora stylsta*; (e) *Urophora xanthippe*; (f) *Urophora terebrans*; (g) *Xyphosia mialiaria*, (h) *Chaetorellia carthami*; (i) *Chaetostomella cylindrica*; (j) *Terellia gynacochroma*; (k) *Sphenella marginata*; (l) *Terellia quadratulla*; (o) *Terellia ruficauda* (original).



Figs 2: Flower head of (a) *Acroptilon repens*; (b) *Onopordum Illyricum*; (c) *Senecio vulgaris*; (d) *Cirsium heterophyllum*; (e) *Centaurea solstitialis*; (f) *Cirsium arvens*; (g) *Onopordum acanthium*; (h) *Echinops spinosissimus*; (i) *Echinops viscosus*; (j) *Cirsium palustre* (original).

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