

**SPECIES OF CERANISINAE (HYMENOPTERA: EULOPHIDAE)
AND THEIR THYSANOPTEROUS INSECTS AND
PLANT ASSOCIATIONS IN TURKEY**

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ABSTRACT: From 8 provinces in Turkey, Hatay, Kahramanmaraş, Şanlıurfa, Niğde, Adıyaman, Gaziantep, Diyarbakır, and Bingöl-Muş province border, and from 36 localities, 20 species of Thysanoptera (18 species of Thripidae and 2 species of Phlaeothripidae), and 19 species of Ceranisinae, were collected. In the future, each Ceranisinae species and their thysanopterous associate(s), together with their host plants, should be collected from the localities, cultured under laboratory conditions and their hosts should be identified. In that case, the parasitoids could potentially be used in biological control programmes of the thrips species.

KEY WORDS: Species, Ceranisinae, Eulophidae, Hymenoptera, thysanopterous associate, Turkey

In the last 25 years, several works on species of thrips-attacking genera and of Thysanoptera have been conducted. The genera of Ceranisinae (Eulophidae) are known as thrips-attacking, but there are not many records on specific hosts of the species, such as: *Ceranisus* Walker (hosts of 5 of the nine species are known); *Epomphale* Girault (hosts of one of the ten species are known); *Urfacus* Doğanlar (hosts of the nine species are unknown); *Gaziantepus* Doğanlar & Doğanlar (hosts of the two species are unknown); *Guelsenia* Doğanlar & Doğanlar (hosts of the two species are unknown); and *Sergueicus* Doğanlar & Doğanlar (hosts of one species is unknown); *Entedonomphale* Girault (= *Entedonastichus* Girault) (hosts of 5 of the fourteen species are known); *Goetheana* Girault (hosts of the four species are known); *Thripoctenus* Crawford (= *Thripobius* Ferriere) (hosts of the four species are known), and they have been recorded as larval parasitoids of Thysanoptera worldwide (Boucek, 1976, 1988; Triapitsyn, 1978; Schauff, 1991; Triapitsyn & Headrick, 1995; Gauthier et al., 2000; Triapitsyn, 2005; Triapitsyn & Morse, 2005; Doğanlar, 2003; Doğanlar & Triapitsyn, 2007; Doğanlar et al., 2009, 2010, 2011; Doğanlar & Doğanlar, 2013, 2014; Noyes, 2014).

Most of the phytophagous Thysanoptera have been recorded as important pests on several agricultural plants (Tunç, 1992, 1998; Lodos, 1993; Tunç & Göçmen, 1994; Atakan & Özgür, 1999; Vierbergen, 2001; Doğanlar & Yiğit, 2002; Karsavuran & Gücük, 2003; Kılıç & Yoldaş, 2004; Atakan & Tunç, 2004; Şenkonca et al., 2006; Sertkaya et al., 2006; Kumar et al., 2006; Alavi et al., 2007; Atakan, 2007, 2008a,b; Nas et al., 2007; Diffie et al., 2008; Mound & Azidah, 2009; Doğanlar & Aydın, 2009; Aydın, 2010). However, there are not many works on the parasitoids controlling their populations. Only the following species have been used as biological control agents of several thrips species around the world, namely *Epomphale menes* (Walker) (Murai, 1990; Loomans et al., 1992; Loomans et al., 1995; Tagashira & Hirose, 2001), *Thripoctenus jawae* (= *Thripobius semiluteus*) (Froud et al., 1996; Mineo et al., 1999; Froud & Stevens, 2002) and *Goetheana shakespearei* Girault (Viggiani & Nieves Aldrey, 1993).

The present work was aimed at obtaining the host associations of the thrips-attacking genera from different parts of the South and Southeastern Anatolia, and Central Anatolia Regions of Turkey from 2005 to 2012.

MATERIAL AND METHODS

The study focused on the species of the genera of Ceranisinae (Eulophidae: Hymenoptera) that parasitise young stages of some thrips species belonging to Thripidae and Phlaeothripidae (Thysanoptera) in Turkey. In the period from the beginning of April to the end of June in the years 2005 to 2012 from different parts of south and southeastern Anatolia, and the central Anatolia region, Turkey, specimens were collected by net sweeping plants at collecting sites. All of the swept materials were put directly into jars with 96 % ethanol, including larvae and adults of thrips and adults of Ceranisinae. The plants at the collecting sites were identified. After sorting the materials, individuals were stored in 96% ethanol for DNA extractions to be done in the future works. The specimens were slide-mounted in Canada balsam. The Ceranisinae species were identified by following the keys of several works (Triapitsyn 2005; Doğanlar 2003; Doğanlar & Triapitsyn 2007; Doğanlar et al. 2009; Doğanlar et al. 2010 a; Doğanlar et al. 2011; Doğanlar & Doğanlar 2013; 2014) by the first author; and the thysanopterous species by following the keys of Zur Strassen (2003), with the aid of the CD-ROM of Moritz et al. 2004, by the both authors; and some of the problematic species were identified by Dr. Mound (CSIRO, Australian National Insect Collection, Canberra, Australia).

The examined specimens were deposited in the Insect Museum of the Research Station of Biological Control, Adana, Turkey.

RESULTS AND DISCUSSION

From different parts of Turkey, 19 species of Ceranisinae (Hymenoptera: Eulophidae) were collected but none of them were reared from the host/hosts. They were collected together with some species of Thysanoptera from several habitats.

The genera and their species of Ceranisinae in Turkey, including their primary hosts, associates, plant associates and localities, are listed below:

Ceranisus Walker 1841

Ceranisus antalyacus Tryapitsyn, 2004

Primary host: Thysanoptera: Thripidae: *Thrips major* (Cameron et al., 2004).

Thysanoptera: Aeolothripidae: *Aeolothrips glorious* Bagnall, *Aeolothrips vesicolor* Uzel, *Melanthrips ficulbii* Buffa, *M. pallidior* Priesner, Phlaeothripidae: *Haplothrips andresi* Preisner, *H. reuteri* Karny, *Neoheegeria dalmatica* Schmutz, Thripidae: *Ceratothrips vesicolor* Uzel, *Frankliniella occidentalis* Pergande, *Ioneurothrips australis* Bagnall, *Oxythrips ajugae* Uzel, *Taeniothrips inconsequens* Uzel, *T. meridionalis* Preisner, *Thrips minutissimus* L. (Cameron et al., 2004). in the current study *T. inconsequens*.

Plant associates: Ericaceae: *Arbutus andrachne* Collinson, Rosaceae: *Pyrus communis* L. (Cameron et al., 2004 and in the current study).

Localities: Antalya (Cameron et al., 2004). In the current study: Hatay: Çayır, Altınözü.

Ceranisus onuri O. Doğanlar, 2010

Primary host: Thysanoptera: Thripidae: *T. meridionalis* (Doğanlar et al., 2010).

Associates: none.

Plant associates: *Asphodeline damascena* (Boiss) (Doğanlar et al., 2010).

Localities: Niğde: Ulukışla, Maden (Doğanlar et al., 2010).

Ceraninus pacuvius (Walker, 1841)

Primary host: Thysanoptera: Thripidae: *Kakothrips pisivorus* Westwood (Thompson, 1955), *K. robustus* Uzel (Boucek, 1961; Boucek & Askew, 1968; Triapitsyn, 1978).

Associates: Thysanoptera: Aeolohripidae: *Aelothrips intermedius* Bagnall, Thripidae: *Aptinothrips rufus* Haliday, *Chirothrips hamatus* Trybom, *Frankliniella intonsa* Trybom, *K. robustus*, *Odontothrips meliloti* Preisner (Thuroczy & Jenser, 1996); In the current study *Thrips angusticeps* (Uzel), *Kakothrips priesneri* Pelikan, *K. acantus* Berzosa.

Plant associates: Fabaceae: *Lathyrus tuberosus* L., *Melilotus alba* Medikus (Thuroczy & Jenser, 1996), *Lens culinaris* Medicus, *Medicago sativa* L. (Doğanlar & Triapitsyn, 2007), *Sarothamnus scoparius* (Triapitsyn, 2005). In the current study *L. culinaris*, *M. sativa*, *M. alba*.

Localities: Hatay: Hassa, Saylak, Reyhanlı, Atçana; Şanlıurfa: Birecik, İnnaphı, Arat Mount., Bozova (5 km to Atatürk Barage), Kangörmez, Gaziantep: İslahiye, Nurdağ-Akyokuş passage, from Nizip to Karkamış 15 km; Kahramanmaraş: Pazarcık, Araban, Yukarımülk; Diyarbakır: Silvan, Aslanlı.

Epomphale kocaki Doğanlar & Doğanlar, 2014

Primary host: Unknown.

Associates: Unknown.

Plant associates: Herbaceous plants.

Localities: Bingöl-Muş province border.

Epomphale menes (Walker, 1839)

Primary host: Thysanoptera: Thripidae: *Ceratothripoides claratris* Shumsher (Murai et al., 2000), *F. intonsa* (Murai, 1988; Murai & Loomans, 1995; Tachikawa, 1986; Triapitsyn & Headrick, 1995), *F. occidentalis*, *F. schultzei* Trybom (Goodwin & Steiner, 1996, 1998; Loomans & Murai, 1994; Loomans et al., 1993, 1995; Triapitsyn & Headrick, 1995), *Kakothrips* sp. (Boucek, 1961, 1977), *K. pisivorus* (Thompson, 1955), *K. robustus* (Boucek & Askew 1968; Antsiferova & Timraleev, 1974; Triapitsyn, 1978), *Megalurothrips sjostedti* (Trybom) (Tamò et al., 1993), *M. usitatus* (Bagnall) (Chang, 1990; Tamò et al., 1993; Triapitsyn, 2005), *Microcephalothrips abdominalis* (Crawford), *Thrips flavus* Schrank (Boucek & Askew, 1968; Trjapitzin, 1978), *Pseudodendrothrips mori* Niwa (Shimada, 1998), *Scirtothrips citri* (Moulton), *S. perseae* Nakahara (Triapitsyn & Morse, 1999, 2005; Triapitsyn, 2005), *Taeniothrips* sp. (Boucek, 1961), *Thrips palmi* Karny (Castineiras et al., 1996; Daniel et al., 1988; Hirose, 1991; Hirose et al., 1992, 1993; Suasa-ard & Charernsom, 2000).

Laboratory reared host: Thysanoptera: Thripidae: *F. intonsa* (Tagashira & Hirose, 2001; Triapitsyn, 2005), *F. occidentalis* (Fourez & Impe, 1995; Lacasa et al., 1996; Loomans, 1991, 1997; Loomans & Lenteren, 1995; Loomans & Pakozdi, 1996), *T. palmi* (Tagashira & Hirose, 2001).

Associates: in the current study: Thysanoptera: Thripidae: *K. priesneri*, *F. occidentalis*, *Thrips angusticeps* Uzel, *T. meridionalis* (Priesner), *Thrips tabaci* Lindeman, *Collemboothrips mediterraneus* Preisner, *Oxythrips cannabensis* Knechtel, *Neohydatothrips gracilicornis* Williams, *F. occidentalis*, *Ceratothrips ericae* Haliday.

Plant associates: *Trifolium* sp., *Medicago* sp., *Sinapis arvensis* L.

Localities: Hatay: Serinyol, Üniversite campus, Reyhanlı, Atçana, Adıyaman: Gölbaşı, Gaziantep: İslahiye, Kahramanmaraş: Pazarcık, Yukarımülk.

Epomphale oezdikmeni Doğanlar & Doğanlar, 2014

Primary host: Unknown.

Associates: Thysanoptera: Thripidae: *Limothrips cerealium* (Haliday), *T. meridionalis*.

Plant associates: *S. arvensis*, *Avena* spp., *Astragalus* sp.

Localities: Niğde: Ulukışla- Gümüş.

Gaziantepus hirsutus (Doğanlar & Triapitsyn, 2007)

Primary host: Unknown.

Associates: Thysanoptera: Thripidae: *N. gracilicornis*, *K. acantus*, *K. priesneri*, *L. cerealium*, *F. occidentalis*, *T. angusticeps*, *Thrips dubius* Preisner, *T. meridionalis*, *T. tabaci*, *C. ericae*, *Chirothrips africanus* Preisner, *C. mediterraneus*, *Sericothrips bicornis* Karny, *O. cannabensis*. Thysanoptera: Phlaeothripidae: *Haplothrips tritici* Kurdjumov.

Plant associates: *Triticum vulgare* L., *Astragalus* sp., *Triticum* sp., *Avena* spp., *L. culinaris*, *Trifolium* sp., *Medicago* sp., *S. arvensis*, herbaceous plants.

Localities: Kahramanmaraş, Pazarcık, Centrum, Yukarımülk, Adıyaman: Side of Atatürk Barage, Gaziantep: Islahiye, Oğuzeli -Keçikuyusu, Sekili, Şanlıurfa: Bozova (5 km), Bozova, Kangörmez, Birecik, İnnaplı.

Gaziantepus oguzeliensis O. Doğanlar, 2013

Primary host: Unknown.

Associates: Thysanoptera: Thripidae: *T. angusticeps*, *K. priesneri*, *K. acantus*, Thysanoptera: Phlaeothripidae: *H. tritici*.

Plant associates: *S. arvensis*, *Trifolium* sp., *Medicago* sp., *Triticum* spp., *Avena* spp.

Localities: Gaziantep: Oğuzeli -Keçikuyusu, Sekili.

Goetheana sp.

Primary host: Unknown.

Associates: Thysanoptera: Thripidae: *T. angusticeps*; Thysanoptera: Phlaeothripidae: *H. tritici*.

Plant associates: *Triticum* spp., *Avena* spp., *Trifolium* sp., *Medicago* sp., herbaceous plants.

Localities: Adıyaman: Side of Atatürk Barage.

Guelsenia amanosus (Doğanlar, Gumowsky & Doğanlar, 2009)

Primary host: Unknown.

Associates: Thysanoptera: Thripidae: *T. meridionalis*, *T. angusticeps*, Thysanoptera: Phlaeothripidae: *H. tritici*.

Plant associates: *Trifolium* sp., *Medicago* sp., *S. arvensis*, herbaceous plants.

Localities: Hatay: Belen, Amanos mount. Kômürçukuru road connection.

Thripoctenus jawae (Girault, 1917)

Primary host: Thysanoptera: Thripidae: *Retithrips syriacus* (Mayet).

Associates: none.

Plant associates: *Vitis vinifera* L.

Localities: Hatay: Samandağ, Çevlik.

Urfacus adıyamanensis Doğanlar & Doğanlar, 2013

Primary host: Unknown.

Associates: Thysanoptera: Thripidae: *T. angusticeps*, Thysanoptera: Phlaeothripidae: *H. tritici*.

Plant associates: *Astragalus* sp., *Triticum* spp., *Avena* spp., *Trifolium* sp., *Medicago* sp. and herbaceous plants.

Localities: Adıyaman: Çelikhana, Side of Atatürk Barage.

Urfacus atcanacus Doğanlar & Doğanlar, 2013

Primary host: Unknown.

Associates: Thysanoptera: Thripidae: *C. africanus*, *L. cerealium*, *T. angusticeps*, *T. tabaci*, *T. meridionalis*. Thysanoptera: Phlaeothripidae: *H. tritici*.

Plant associates: *Triticum vulgare* L., *Avena* spp., *S. arvensis*.

Localities: Hatay: Reyhanlı, Atçana, Altınözü, Yanık pınar, Belen, Amanos mount. Kômürçukuru- road connection.

Urfacus bozovaensis Doğanlar, 2005

Primary host: Thysanoptera: Phlaeothripidae: *H. tritici*.

Associates: Thysanoptera: Thripidae: *T. meridionalis*, *T. angusticeps*, *C. ericae*, *C. africanus*, *C. mediterraneus*, *O. cannabensis*, *L. cerealium*, *N. gracilicornis*, *F. occidentalis*.

Plant associates: *T. vulgare*, *Avena* spp., *M. sativa*, *S. arvensis*, *Astragalus* sp.

Localities: Şanlıurfa: Bozova, Kangörmez, Birecik, İnnaplı, Hatay: Hassa, Saylak, Altınözü, Kozkalesi, Yanıkpınar, Reyhanlı, Hacıpaşa, Belen, Amanos mount. Kômürçukuru road connection, Kahramanmaraş: Pazarcık, Yukarımülk, Adıyaman: Gölbaşı, Gaziantep: Oğuzeli -Keçikuyusu, Sekili, Diyarbakır: Silvan-Aslanlı.

Urfacus karacadaği Doğanlar & Doğanlar, 2013**Primary host:** Unknown.**Associates:** Thysanoptera: Phlaeothripidae: *H. tritici*.**Plant associates:** *T. vulgare*, *S. arvensis*, *Avena sativa* L..**Localities:** Diyarbakır: Karacadağ-road connection.***Urfacus karkamisus*** Doğanlar & Doğanlar, 2013**Primary host:** Unknown.**Associates:** Thysanoptera: Thripidae: *T. meridionalis*, *T. angusticeps*, *K. acantus*, *K. priesneri*, Thysanoptera: Phlaeothripidae: *H. tritici*.**Plant associates:** *L. culinaris*, *Triticum* spp., *Avena* spp., *S. arvensis*, *Medicago* sp.**Localities:** Diyarbakır: Siverek, Gaziantep: From Nizip to Kargamış road, Nurdağ-Akyokuş passage, İslahiye, Şanlıurfa: Bozova-Hilvan yolu, Bozova, Kangörmez, Birecik, İnnaplı.***Urfacus komurcukurus*** Doğanlar & Doğanlar, 2013**Primary host:** Unknown.**Associates:** Thysanoptera: Thripidae: *T. angusticeps*, *T. meridionalis*, Thysanoptera: Phlaeothripidae: *H. tritici*.**Plant associates:** *M. sativa*, *S. arvensis*, herbaceous plants.**Localities:** Hatay: Belen, Amanos mount. Kömürçukuru road connection.***Urfacus nizipus*** Doğanlar & Doğanlar, 2013**Primary host:** Unknown.**Associates:** Thysanoptera: Thripidae: *C. aculeatus*, *C. africanus*, *C. mediterraneus*, *F. occidentalis*, *K. acantus*, *K. priesneri*, *L. cerealium*, *N. gracilicornis*, *T. angusticeps*, *T. meridionalis*, *T. tabaci*. Thysanoptera: Phlaeothripidae: *H. tritici*.**Plant associates:** *Astragalus* sp., *Pisum sativum* L., *L. culinaris*, *M. sativa*, *Trifolium* sp., *T. vulgare*, *Avena* spp., *S. arvensis*.**Localities:** Hatay: From Dörtüyl to Erzin 5 km, Yayladağ: Şakşak, Yaloz, Hassa: Saylak, Şanlıurfa: Bozova (5km), Bozova, Kangörmez, Suruç, Adıyaman: Gölbaşı, Gaziantep: Nurdağ-Akyokuş passage, Oğuzeli -Keçikuyusu, Sekili, From Nizip to Kargamış 15 km.***Urfacus sekilinensis*** Doğanlar & Doğanlar, 2013**Primary host:** Unknown.**Associates:** Thysanoptera: Thripidae: *K. priesneri*, *T. angusticeps*, Thysanoptera: Phlaeothripidae: *H. tritici*.**Plant associates:** *S. arvensis*, *Trifolium* sp., *Medicago* sp., *Triticum* spp., *Avena* spp.**Localities:** Gaziantep: Oğuzeli -Keçikuyusu, Sekili.***Urfacus sincanus*** Doğanlar & Doğanlar, 2013**Primary host:** Unknown.**Associates:** Thysanoptera: Thripidae: *C. africanus*, *C. aculeatus*, *C. mediterraneus*, *F. occidentalis*, *K. priesneri*, *L. cerealium*, *T. angusticeps*, *T. meridionalis*, *T. tabaci*. Thysanoptera: Phlaeothripidae: *H. tritici*.**Plant associates:** *T. vulgare*, *Hordeum* spp., *Avena* spp., *Trifolium* sp., *Medicago* sp., *S. arvensis*.**Localities:** Hatay: İskenderun, Sincanköy, Antakya: Serinyol, MKU Campus.

The species of Ceranisinae and their hosts and/or associates collected in the present study are summarized in Table 1. The most abundant Thripidae were *T. angusticeps*, *F. occidentalis*, *K. priesneri*, *T. meridionalis* and *C. africanus*, and of Phlaeothripidae was *H. tritici*, and the abundant parasitoids were *U. bozovaensis*, *G. hirsutus*, *C. onuri* and *E. menes*.

Most of the *Urfacus* spp. are associated with the pests of Graminae, and *C. pacuvius* is associated with thrips species found on Fabaceae spp..

The hosts should be found by conducting the necessary studies for to help explain their usefulness in the biological control of thrips pests, such as *E. menes* against *F. occidentalis*, *F. intonsa* and *T. palmi*; *T. jawae* (= *T. semiluteus*) and *G. shakespearei* against *Heliothrips haemorrhoidalis*.

Table 1. No of the specimens of Thripidae (Thysanoptera) and Ceranisinae spp. (Hymenoptera: Eulophidae) collected from several parts of Turkey.

Thripidae (Thysanoptera)	No of specimens	Ceranisinae spp. (Hymenoptera: Eulophidae)	No of specimens
<i>Rettithrips syriacus</i> (Mayet 1890)	23	<i>Ceranisus antalyacus</i> Tryapitsyn, 2004	22
<i>Neohydatothrips gracilicornis</i> (Williams 1916)	34	<i>Ceranisus omuri</i> O. Doğanlar, 2010	65
<i>Sericothrips staphylinus</i> (Haliday 1836)	2	<i>Ceranisus pacuvius</i> (Walker 1841)	31
<i>Sericothrips bicornis</i> (Karny 1910)	3	<i>Epomphale kocaki</i> Doğ. & Doğ. 2014	11
<i>Chirothrips africanus</i> (Priesner 1932)	95	<i>Epomphale menes</i> (Walker 1839)	45
<i>Chirothrips aculeatus</i> (Bagnall 1927)	1	<i>Epomphale oezdikmeni</i> Doğ. & Doğ. 2014	14
<i>Limothrips cerealeum</i> (Haliday 1836)	15	<i>Gazlantepus hirsutus</i> (Doğ. & Triapitsyn 2007)	78
<i>Limothrips transcaucasicus</i> Sawenko 1844)	5	<i>Gazlantepus oguzeltensis</i> O. Doğanlar 2013	1
<i>Limothrips angulicornis</i> (Jablonowski 1894)	3	<i>Goetheana</i> sp.	1
<i>Kakothrips priesneri</i> Pelikan 1965	136	<i>Guelsenia amanosus</i> (Doğ., Gumowsky & Doğ. 2009)	26
<i>Kakothrips acantus</i> (Berzosa 1994)	60	<i>Thripoctenus jawae</i> (Girault)	8
<i>Frankliniella occidentalis</i> (Pergande 1895)	157	<i>Urfacus adyamanensis</i> Doğ. & Doğ. 2013	2
<i>Frankliniella intonsa</i> (Trybom 1895)	4	<i>Urfacus atcanacus</i> Doğ. & Doğ. 2013	17
<i>Isoneurothrips australis</i> (Bagnall 1915)	32	<i>Urfacus bozovaensis</i> Doğanlar 2005	93
<i>Thrips angusticeps</i> (Uzel 1895)	343	<i>Urfacus karacadagi</i> Doğ. & Doğ. 2013	2
<i>Thrips meridionalis</i> (Priesner 1926)	100	<i>Urfacus karkamisus</i> Doğ. & Doğ. 2013	4
<i>Thrips tabaci</i> Lindeman 1889	76	<i>Urfacus komurcukurus</i> Doğ. & Doğ.	13
<i>Thrips euphorbiae</i> Knechtel 1923	1	<i>Urfacus nizipus</i> Doğ. & Doğ. 2013	21
<i>Thrips funebris</i> Bagnall 1924	13	<i>Urfacus sekillimensis</i> Doğ. & Doğ. 2013	15
<i>Thrips dubius</i> (Priesner 1927)	2	<i>Urfacus stincanus</i> Doğ. & Doğ. 2013	20
<i>Oxythrips ajugae</i> Uzel 1895	33		
<i>Oxythrips cannabensis</i> (Knechtel 1923)	2		
<i>Ceratothrips ericae</i> (Haliday 1836)	22		
<i>Collembolothrips mediterraneanus</i> (Priesner 1935)	48		
<i>Taeniothrips inconsequens</i> (Uzel 1895)	44		
TOTAL	1,254		266

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