

Aphid Parasitoids (Hymenoptera: Braconidae: Aphidiinae) on Weeds from Ankara, Turkey

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Studies were conducted during the years 2001–2003 to determine the parasitoids of Aphidoidea (Homoptera) species on weeds in Ankara province. Six genera and ten species of aphid parasitoids belonging to Braconidae were determined. The tritrophic associations of plant/aphid/parasitoid were analyzed. Forty-four associations of aphidiinae wasps, host aphids and host plants new to the Mediterranean region and 71 new associations for Turkish fauna were reported.

KEY WORDS: Aphid parasitoids; Braconidae; weeds; tritrophic associations; Ankara; Turkey.

INTRODUCTION

Aphids are serious pests of economic crops because of the direct or indirect damages they cause. However, they have a great number of various natural enemies known over the world. Many aphid parasitoids, especially aphidiinae, can be considered as important biological control agents (29). It is necessary to determine the beneficial fauna in order to implement the concept of IPM. The main goal of this study was to investigate the aphid parasitoid species of weeds. Weeds are known to be not only common elements that contribute to the diversity of plant cover in the cultivated areas, but also alternative hosts for both aphid and parasitoid fauna (24).

MATERIALS AND METHODS

Samples of aphid parasitoids were collected from Ankara province, located in central Anatolia of Turkey, from 2001 through 2003. Attention was paid to various weeds. Aphid colonies consisting of both live and mummified aphids were collected together with their host plants.

Each sample was placed in a plastic container and brought to the laboratory for rearing. Samples were examined daily for emerged aphids and parasitoids. Both adult aphids and parasitoids were preserved in 70% ethanol for subsequent identification. Determinations of parasitoids were made by the authors. The following keys were used: Starý (23,25,26), Mescheloff and Rosen (14-18), Kavallieratos *et al.* (11) and Tomanovic *et al.* (32). The complete materials were kept in the collection of the Entomology Laboratory, Faculty of Agriculture, Ankara University.

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RESULTS

Investigations of aphid and aphid parasitoid fauna of different weeds resulted in finding 33 aphid taxons parasitized by ten species of aphid parasitoids. Eighty-one samples yielding 1170 specimens were taken in total. New associations for Turkish and Mediterranean fauna are shown with different symbols. Collection sites, date the material was collected, coordinates for sites, and sex of the species are also given.

- New parasitoid–aphid association for Mediterranean region
- ▲ New parasitoid–aphid association for Turkey
- △ New parasitoid host plant association for Mediterranean region
- △ New parasitoid host plant association for Turkey

Aphidius Nees, 1819

Aphidius colemani Viereck, 1912

Aphis sp.–*Veronica* sp. (Scrophulariaceae), center, 988 m, 11.XI.2002, 8♀♀, 1♂

□△*Hyperomyzus lactucae* (Linnaeus) mixed with *Uroleucon*(*Uroleucon*) *sonchi* (Linnaeus)–*Sonchus* sp. (Compositae), center, 980 m, 27.VI.2002, 1♀

□△ *Rhopalosiphum maidis* (Fitch) mixed with *Myzus* (*Nectarosiphon*) *persicae* (Sulzer) and *Ovatus mentharius* (van der Goot)–*Mentha* sp. (Labiatae), center, 900 m, 11.XI.2002, 46♀♀, 21♂♂

□△ Undetermined aphid species–*Verbena tenuisecta* Imagination (Verbenaceae), center, 900 m, 11.XI.2002, 2♀♀

Distribution in Turkey: Adana, Diyarbakır, Hatay, İçel, İzmir (7,19,35)

Aphidius funebris Mackauer, 1961

Uroleucon (*Uroleucon*) *sonchi* (Linnaeus)–*Sonchus oleraceus* L. (Compositae), Çubuk, 1200 m, 17.X.2001, 1♀

△ *Uroleucon* (*Uroleucon*) *sonchi* (Linnaeus) and *Uroleucon* (*Uromelan*) *jaceae* ssp. *aeneum* (Hille Ris Lambers) mixed with *Brachycaudus* (*Acaudus*) *cardui* (Linnaeus)–*Carduus pycnocephalus* L. (Compositae), Kalecik, 376 m, 11.VII.2002, 1♀

Distribution in Turkey: Ankara, Kahramanmaraş (3,5)

Binodoxys Mackauer, 1960

Binodoxys acalephae (Marshall, 1896)

△*Aphis fabae* Scopoli mixed with *Staegeriella necopinata* (Börner)–*Galium verum* L. (Rubiaceae), Haymana, 1204 m, 27.VI.2001, 2♀♀, 1♂

■▲△ *Aphis galiiscabri* Schrank–*Galium* sp. (Rubiaceae), Nallıhan, 672 m, 20.VI.2001, 1♀

■▲△ *Aphis galiiscabri* Schrank–*Galium* sp. (Rubiaceae), Beypazarı, 1240 m, 21.VI.2001, 22♀♀, 23♂♂

■□▲△ *Anuraphis* sp.–*Echinochloa crus-galli* L.P.B. (Gramineae), center, 987 m, 11.XI.2002, 1♀

Distribution in Turkey: Ankara, Adana, Diyarbakır, Hatay, İçel (5,19,35)

Binodoxys angelicae (Haliday, 1833)

Aphisfabae Scopoli–*Galium aperine* (Rubiaceae), Beypazarı, 1211 m, 21.VI.2001, 1♂, 1♀

▲▲ *Aphis fabae* ssp. *solanella* Theobald–*Solanum nigrum* L. (Solanaceae), center, 987 m, 11.XI.2002, 13♀♀, 9♂♂

Distribution in Turkey: Adana, Antalya, Ankara, Diyarbakır, Hatay, İçel, İzmir, Kahramanmaraş (2,3,5,7,19,21,33,35,36)

***Binodoxys brevicornis* (Haliday, 1833)**

Hyadaphis sp. mixed with *Aphis galiiscabri* Schrank–*Galium* sp. (Rubiaceae), Beypazarı, 1240 m, 21.VI.2001, 1♀

Distribution in Turkey: Ankara (2,5)

***Diaeretiella* Starý, 1960**

***Diaeretiella rapae* (M'Intosh, 1855)**

△ *Aphis fabae* Scopoli mixed with *Hayhurstia atriplicis* (Linnaeus)–*Chenopodium* sp. (Chenopodiaceae), Çubuk, 1215 m, 30.VII.2002, 3♀♀

△ *Aphis fabae* Scopoli mixed with *Hayhurstia atriplicis* (Linnaeus)–*Chenopodium album* (Chenopodiaceae), center, 987 m, 13.XI.2002, 9♀♀, 6♂♂

Aphis sp.–undetermined host plant, Bala, 1158 m, 02.VII.2001, 1♂

△ *Brevicoryne* sp.–*Cardaria draba* (L.) (Cruciferae), center, 829 m, 03.V.2002. 2♀♀, 2♂♂

□ *Brevicoryne brassicae* (Linnaeus)–*Sinapis arvensis* L. (Cruciferae), Güdül, 1050 m, 25.IX.2002, 1♀, 1♂

□ *Brevicoryne brassicae* (Linnaeus)–*Sinapis arvensis* L. (Cruciferae), Akyurt, 1124 m, 25.VI.2001, 27♀♀, 17♂♂

□ *Brevicoryne brassicae* (Linnaeus)–*Sinapis arvensis* L. (Cruciferae), Ayaş, 672 m, 26.VI.2001, 2♀♀

▲▲ *Hayhurstia atriplicis* (Linnaeus)–*Chenopodium album* (Chenopodiaceae), Haymana, 1226 m, 27.VI.2001, 2♀♀

▲▲ *Hayhurstia atriplicis* (Linnaeus)–*Chenopodium* sp. (Chenopodiaceae), Ayaş, 873 m, 18.VII.2002, 1♀

■▲ *Hyadaphis foeniculi* (Passerini)–Cruciferae, Polatlı, 761 m, 31.V.2001, 5♀♀, 5♂♂

■□▲▲ *Hyadaphis coriandri* (Das)–*Diplotaxis* sp. (Cruciferae), center, 830 m, 20.X.2002, 15♀♀, 5♂♂

□△ *Hyadaphis coriandri* (Das) mixed with *Brevicoryne brassicae* (Linnaeus)–*Diplotaxis tenuifolia* (L.) DC (Cruciferae), center, 830 m, 07.XI.2002, 6♀♀, 6♂♂

□△ *Hyperomyzus lactucae* (Linnaeus) mixed with *Uroleucon (Uroleucon) sonchi* (Linnaeus)–*Sonchus* sp. (Compositae), center, 987 m, 27.VI.2002, 1♂

Lipaphis sp.–Cruciferae, Polatlı, 761 m, 31.V.2001, 10♀♀, 19♂♂

Distribution in Turkey: Adana, Ankara, Diyarbakır, Erzurum, İçel, İzmir, Kahramanmaraş, Konya, Tarsus, Tekirdağ (2-7,13,19,21,33,36)

***Lysiphlebus* Foerster, 1862**

***Lysiphlebus confusus* Tremblay and Eady, 1978**

□△ *Aphis craccivora* Koch–*Crepis foetida* L. (Compositae), Haymana, 1220 m, 31.V.2001, 7♀♀

□△ *Aphis euphorbiae* Kaltenbach mixed with *Aphis valleii* Hille Ris Lambers & Stroyan–*Euphorbia* sp. (Euphorbiaceae), Kalecik, 772 m, 14.VI.2001, 1♀

△ *Aphis urticata* Gmelin mixed with *Aphis craccivora* Koch–*Urtica urens* L. (Urticaceae), Kızılcahamam, 1230 m, 19.VI.2001, 2♀♀ ▲△ *Aphis urticata* Gmelin–*Urtica urens* L. (Urticaceae), center, 987 m, 06.VI.2003, 10♀♀

□△ *Aphis vallei* Hille Ris Lambers & Stroyan mixed with *Aphis euphorbiae* Kaltenbach–*Euphorbia* sp. (Euphorbiaceae), Kalecik, 1159 m, 14.VI.2001, 3♀♀

□▲△ *Aphis vallei* Hille Ris Lambers & Stroyan–*Euphorbia* sp. (Euphorbiaceae), Gölbaşı, 1210 m, 26.IV.2002, 2♀♀

Aphis sp.–Labiatae, Kalecik, 772 m, 14.VI.2001, 6♀♀

■□▲△ *Dysaphis crataegi* (Kaltenbach)–*Eryngium campestre* L. (Umbelliferae), Kızılcahamam, 1215 m, 28.IX.2001, 4♀♀, 2♂♂

□△■▲ *Dysaphis foeniculus* (Theobald)–*Eryngium campestre* L. (Umbelliferae), Bala, 1165 m, 12.X.2002, 2♀♀, 1♂

□△ Undetermined aphid species–*Acroptilon repens* (L.) DC. (Compositae), Elmadağ, 741 m, 06.VI.2002, 5♀♀

△ Undetermined aphid species–*Artemisia* sp. (Compositae), Çubuk, 1218 m, 09.X.2002, 7♀♀, 1♂

Distribution in Turkey: Adana, Diyarbakır, Hatay, İçel, Ankara (3,5,19,35)

***Lysiphlebus fabarum* (Marshall, 1896)**

□△ *Aphis craccivora* Koch–*Crepis foetida* L. (Compositae), Kızılcahamam, 1026 m, 19.VI.2001, 10♀♀, 1♂

□△ *Aphis craccivora* Koch–*Crepis foetida* L. (Compositae), Haymana, 1159 m, 31.V.2001, 32♀♀

Aphis craccivora Koch–*Vicia* sp. (Leguminosae), Kızılcahamam, 1026 m, 19.VI.2001, 14♀♀, 2♂♂

Aphis craccivora Koch–undetermined host plant, Kızılcahamam, 1026 m, 19.VI.2001, 33♀♀

Aphis fabae Scopoli–*Rumex* sp. (Polygonaceae), Kızılcahamam, 1013 m, 19.VI.2001, 2♀♀

Aphis galiiscabri Schrank mixed with *Staegeriella necopinata* (Börner)–*Galium* sp. (Rubiaceae), Nallıhan, 990 m, 20.VI.2001, 1♀

Aphis intybi Koch mixed with *Aphis craccivora* Koch–*Cichorium intybus* L. (Compositae), center, 980 m, 12.X.2001, 11♀♀

■□▲△ *Aphis polygonata* (Nevsky)–*Polygonum* sp. (Polygonaceae), Kayaş, 900 m, 07.VIII.2002, 3♀♀, 1♂

▲ *Aphis rumicis* Linnaeus–*Rumex* sp. (Polygonaceae), Nallıhan, 672 m, 20.VI.2001, 4♀♀

■□▲△ *Aphis salviae* Walker–*Salvia* sp. (Labiatae), Kızılcahamam, 1048 m, 30.V.2002, 6♀♀

Aphis fabae ssp. *solanella* Theobald–*Solanum nigrum* L. (Solanaceae), center, 987 m, 11.XI.2002, 20♀♀

△ *Aphis urticata* Gmelin mixed with *Aphis craccivora* Koch–*Urtica urens* L. (Urticaceae), Kızılcahamam, 1230 m, 19.VI.2001, 1♀

▲△ *Aphis urticata* Gmelin–*Urtica urens* (Urticaceae), Çubuk, 1509 m, 12.VII.2001, 5♀♀

▲△ *Aphis verbasci* Schrank–*Verbascum* sp. (Scrophulariaceae), Kızılcahamam, 1100 m, 27.IX.2002, 7♀♀, 1♂

▲△ *Aphis verbasci* Schrank–*Verbascum* sp. (Scrophulariaceae), Kızılcahamam, 1203 m, 30.V.2002, 18♀♀

- ▲▲ *Aphis verbasci* Schrank–*Verbascum* sp. (Scrophulariaceae), Gündül, 1050 m, 13.IX.2001, 18♀♀, 2♂♂
- ▲▲ *Aphis verbasci* Schrank–*Verbascum* sp. (Scrophulariaceae), Beypazarı, 1441 m, 26.VII.2002, 3♀♀
- *Aphis* sp.–*Centaurea solstitialis* L. (Compositae), Kızılcahamam, 1026 m, 19.VI.2001, 3♀♀
- *Aphis* sp.–*Centaurea solstitialis* L. (Compositae), Çubuk, 1200 m, 11.IX.2001, 3♀♀
- Aphis* sp.–Labiatae, Kalecik, 14.VI.2001, Kalecik, 1015 m, 9♀♀
- △ *Aphis* sp.–*Tribulus terrestris* L. (Zygophyllaceae), Kalecik, 1015 m, 12.IX.2001, 4♀♀
- Aphis* sp.–undetermined host plant, Beypazarı, 1245 m, 21.VI.2001, 45♀♀, 2♂♂
- *Dysaphis* (*Dysaphis*) *crataegi* (Kaltenbach) mixed with *Dysaphis foeniculus* (Theobald)–*Eryngium campestre* L. (Umbelliferae), Beypazarı, 1245 m, 28.IX.2001, 3♀♀, 1♂
- △ *Myzus* (*Nectarosiphon*) *persicae* (Sulzer)–*Portulaca oleracea* L. (Portulacaceae), center, 987 m, 31.X.2002, 1♀
- ▲△ *Protaphis terricola* Rondani–*Centaurea iberica* Spreng. (Compositae), Çubuk, 1358 m, 12.VII.2001, 3♀♀
- △ *Uroleucon* (*Uromelan*) *jaceae* (Linnaeus)–*Acroptilon repens* L. DC. (Compositae), Elmadağ, 1035 m, 06.VI.2002, 17♀♀
- △ Undetermined aphid species–*Scabiosa argentata* (Dipsacaceae), Kazan, 1055 m, 30.V.2002, 2♀♀
- Undetermined aphid species–Leguminosae, Haymana, 1047 m, 28.V.2002, 1♂
- Undetermined aphid species–*Mentha* sp. (Labiatae), center, 987 m, 02.XI.2002, 34♀♀
- △ Undetermined aphid species–*Tribulus terrestris* L. (Zygophyllaceae), center, 987 m, 26.VI.2002, 49♀♀
- Distribution in Turkey: Adana, Adıyaman, Ankara, Diyarbakır, Hatay, İçel, İzmir, Kahramanmaraş, Konya, Mardin, Muğla, Şanlıurfa, Şırnak, Tekirdağ (2,3,5-7,9,10,13,19,20, 36)

***Praon* Haliday, 1833**

***Praon dorsale* (Haliday, 1833) auct.**

- ▲△ *Uroleucon* (*Uromelan*) *jaceae* (Linnaeus)–*Acroptilon repens* (L.) DC. (Compositae), center, 987 m, 20.VI.2002, 1♀
- Distribution in Turkey: Ankara (5)

***Praon volucre* (Haliday, 1833)**

- △ *Aphis fabae* ssp. *solanella* Theobald mixed with *Hyperomyzus lactucae* (Linnaeus)–*Solanum nigrum* L. (Solanaceae), center, 987 m, 02.XI.2002, 1♀
- △ *Hyalopterus pruni* (Geoffroy)–*Phragmites communis* Trin. (Gramineae), center, 987 m, 13.VI.2002, 2♀♀, 1♂
- Hyperomyzus lactucae* (Linnaeus)–*Sonchus oleraceus* L. (Compositae), Akyurt, 1124 m, 25.VI.2001, 1♀
- △ *Rhopalosiphum maidis* (Fitch) mixed with *Aphis* sp. and *Myzus* (*Nectarosiphon*) *persicae* (Sulzer)–*Veronica* sp. (Scrophulariaceae), center, 895 m, 13.XI.2002, 1♀, 1♂
- *Uroleucon* (*Uroleucon*) *sonchi* (Linnaeus)–*Sonchus* sp. (Compositae), center, 987 m, 02.XI.2002, 1♀, 1♂
- Undetermined aphid species–*Lactuca* sp. (Compositae), center, 985 m, 10.VI.2003, 1♀

Δ Undetermined aphid species–*Mentha* sp. (Labiatae), center, 987 m, 02.XI.2002, 1♀
Distribution in Turkey: Adana, Ankara, Çanakkale, Diyarbakır, Hatay, İçel, Tekirdağ
(2,5,19,20,35,36)

***Praon* sp.**

Hyperomyzus lactucae (Linnaeus)–*Lactuca scariola* L. (Compositae), center, 987 m,
13.VI.2002, 1♀

Undetermined aphid species–*Lactuca* sp. (Compositae), center, 987 m, 15.VIII.2002, 1♀.

DISCUSSION

Ten aphid parasitoid taxa were found: *Praon volucre* (Haliday), *Praon dorsale* (Haliday) auct., *Lysiphlebus confusus* Tremblay and Eady, *Lysiphlebus fabarum* (Marshall), *Diaeretiella rapae* (M'Intosh), *Aphidius colemani* Viereck, *Aphidius funebris* Mackauer, *Binodoxys angelicae* (Haliday), *Binodoxys acalephae* (Marshall) and *Binodoxys brevicornis* (Haliday). Among these, *L. fabarum* was described as the most common species occurring on weeds. Starý reported that in Czechoslovakia the adults of aphidiids can be observed during all seasons in nature from the beginning of May to about the end of September or beginning of October (23). In the present study, when the occurrence of the parasitoids according to months was examined, the parasitoid population was found to peak in June, with a decrease in July and August. It is believed that the occurrence of parasitoids was in close relation to the requirements of temperature, host aphid life cycle and degree of secondary parasitism (24). Field observations based on collected samples showed that the rate of hyperparasitism increased during the vegetation period and reached its peak in late summer. It has been claimed that aphid parasitoids are more susceptible to chemicals than aphids (8). In the present study the primary parasitoids were found to be more abundant in uncultivated areas than in cultivated ones. We assume that species spectra and relative abundance of parasitoids obtained from cultivated habitats should be influenced by pesticides.

Many studies have considered the importance of weeds as reservoirs of aphid parasitoids (1,12,27,28,30,31,34) because a parasitoid fauna renews itself from those reservoirs during their seasonal migrations between weeds and agro ecosystems. Starý mentioned that monoecious aphids do not change the type of their habitat during the season, so therefore such aphids are parasitized by the same parasitoid species (22). In contrast, dioecious aphids change the type of their habitat during the season because of their migrations from primary to secondary host plants, due to the fact that they are infested by different complexes of parasitoids. The findings of the present study will provide useful information about the habitat interactions of aphid parasitoids. Furthermore, determination of parasitoid fauna of various weeds will enable different approaches to pest management.

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