

Hymenopterous parasitoids of Coccoidea (Hemiptera) in Turkey

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Abstract: In this study, a list of parasitoids attacking scale insects recorded in Turkey up to 2007 is presented. The number of parasitoid species attacking scale insects is 161, belonging to 9 families and 67 genera. The most numerous families are the Encyrtidae with 86 species and Aphelinidae with 53 species. The remaining families have 1 to 8 species each. Some of these parasitoids are considered to be effective in decreasing scale insect populations. Recently, further new parasitoid species of scale insects have been found in non-cultivated areas. These new records are discussed with regard to their use as potential biocontrol agents in Turkey.

Key words: Hymenoptera, parasitoids, scale insect, Turkey, biological control.

Introduction

In Turkey, 266 scale insect species belonging to 187 genera in 12 families are known in the Superfamily Coccoidea. These species mainly have a Palearctic zoogeographic distribution and include 60 cosmopolitan and 12 endemic species. The Diaspididae has 96 species in 40 genera; the Coccidae has 48 species in 25 genera and the Pseudococcidae has 73 species in 26 genera (Kaydan *et al.*, 2007). The number of researchers on scale insects and their natural enemies has been increasing during ten years in Turkey (Ülgentürk & Toros, 1996; Şengonca *et al.*, 1998; Erol & Yaşar, 1999; Ülgentürk & Toros, 1999; Çalmaşur *et al.*, 2000; Erler & Tunç, 2001; Ülgentürk, 2001; Ülgentürk *et al.*, 2001; Japoshvili & Karaca, 2002, 2004; Demirözen *et al.*, 2004; Kumral *et al.*, 2004; Japoshvili & Noyes, 2005; Kaydan *et al.*, 2006; Bolu & Özgen, 2007). Earlier records of natural enemies of scale insects were represented by Öncüer (1991) and Uygun *et al.* (1999). Ülgentürk *et al.* (2004) found 45 chalcidoid parasitoid species of scale insects in Ankara, Afyon, Burdur and Isparta provinces. Chalcidoid parasitoid of *Kermes palestiensis* Balachowsky (Hemiptera: Kermesidae) were reported by Japoshvili *et al.* (2004) and Kaydan *et al.* (2006) reported 22 parasitoid species mealybugs in Ankara.

These studies have improved our knowledge on the hymenopterous parasitoids of the Coccoidea. The list below is based on collections made by the authors and on other records for the years 1930-2007. One hundred and sixty-one species Hymenopteran parasitoids of scale insects belonging to 9 families are known to-date from Turkey (Tables 1, 2, 3). The most speciose families were: Encyrtidae with 78 species and Aphelinidae with 56 species. The remaining families each contain between 1 and 10 species. The Tables below give the host scale insects and the distribution of the parasitoids, the host plants of scale insect and references. The distribution of each species is given in the list by numbers as follows: present in 1 = Aegean Region, 2 = in Black Sea, 3 = in Central Anatolia, 4 = in East Anatolia, 5 = in Marmara, 6 = in Mediterranean and 7 = in Southeast Anatolia. Those species known to be hyperparasitoids are marked with asteriks.

The Tables include 3 introduced species *Encarsia perniciosi* (Tower), *E. berlesei* (Huw.) (Hymenoptera: Aphelinidae) and *Leptomastix dactylopii* Howard (Hymenoptera: Encyrtidae). *L. dactylopii* and the coccinellid beetle *Cryptoleamus mountrouzieri* Mulstant have been mass produced and used together for the biological control of citrus mealybug in citrus orchards in Mediterranean region of Turkey.

Studies of the Coccoidea have been intensified in the Aegean, Central Anatolia and Mediterranean regions of Turkey but have not been yet completed in the Black Sea, Marmara, South Eastern and Eastern regions. We expect, therefore, that more species of Coccoidea and their natural enemies will be found in Turkey in the future. We hope this will help in the development of biological control techniques of scale insects in Turkey and elsewhere.

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Table 1. Aphelinid parasitoids of Coccoidea in Turkey.

Aphelinidae	Host Scale	Host plant	Loc	References
1. <i>Ablertus atomon</i>	<i>Leucaspis loewi</i> Colvée	<i>Pinus</i>	6	Japoshvili & Karaca 2002
2. <i>A. celsus</i> (Walker)	<i>Melanaspis inopinata</i> Leonardi, <i>Diaspidiotus perniciosus</i> Comstock, <i>D. ostreaformis</i> (Curtis)	<i>Populus nigra</i> , walnut, apple	6	Erler & Tunç 2001 Japoshvili & Karaca 2002
3. <i>A. perspicuosus</i> Girault	<i>Salicicola pistaciae</i> Balachowky	<i>Pistacia</i> sp.	6	Erler & Tunç 2001
4. <i>Abrelus</i> sp.	<i>Leucaspis pusilla</i> Loew	<i>Pinus nigra</i>	3	Ülgentürk <i>et al.</i> 2004
5. <i>Aphytis abnormis</i> Howard	<i>Chionaspis salicis</i> Linnaeus	<i>Salix</i> sp.	4	Öncüer 1991
6. <i>A. aonidiæ</i> (Mercet)	<i>Aonidiella citrina</i> (Coquillett), <i>Aspidiotus nerii</i> Bouché, <i>D. perniciosus</i>	<i>Citrus</i> spp., <i>Laurus nobilis</i> , <i>Prunus persicae</i>	1	Öncüer 1991
7. <i>A. chilensis</i> Howard	<i>A. nerii</i>	<i>Nerium oleander</i> , <i>Pistacia</i>	1	Öncüer 1991
8. <i>A. chrysomphali</i> (Mercet)	<i>Chrysomphalus dictyospermi</i> (Morgan), <i>A. aurantii</i> , <i>A. citrina</i>	<i>Citrus limon</i>	1	Şengonca <i>et al.</i> 1998, Erler & Tunç 2001, Öncüer 1991
9. <i>A. diaspidis</i> (Howard)	<i>Pseudaulacaspis pentagona</i> (Targioni-Tozzetti)	<i>Citrus</i> sp.	6, 2	Öncüer 1991
10. <i>A. hispanicus</i> (Mercet)	<i>Parlatoria pergandii</i> Comstock	<i>Populus</i> sp.	5	Öncüer 1991
11. <i>A. lepidosaphes</i> (Compere)	<i>Lepidosaphes beckii</i> (Newman)	<i>Citrus sinensis</i>	6	Erler & Tunç 2001, Öncüer 1991
12. <i>A. libanicus</i> Traboulsi	<i>Lepidosaphes malicola</i> Borchsenius	<i>C. deliciosa</i>	1	Öncüer 1991
13. <i>A. maculicornis</i> (Masi)	<i>A. aurantii</i> , <i>Parlatoria oleae</i> (Colvée), <i>P. pergandii</i>	<i>Rosa</i> sp.	6	Öncüer 1991, Japoshvili & Karaca 2002
14. <i>A. melinus</i> De Bach	<i>A. aurantii</i> , <i>A. citrina</i> , <i>A. nerii</i> , <i>C. dictyospermi</i>	<i>Citrus</i> , <i>M. communis</i> , <i>P. persica</i>	5, 6	Erler & Tunç 2001, Öncüer 1991
15. <i>Aphytis mytilaspis</i> (Le Baron)	<i>L. ulmi</i> , <i>L. malicola</i> , <i>Carulaspis caruelii</i> (Targioni-Tozzetti), <i>C. salicis</i> , <i>D. perniciosus</i> , <i>D. ostreaformis</i> , <i>P. oleae</i> , <i>Salicicola kermanensis</i> (Lindinger)	<i>Citrus</i> sp., <i>L. nobilis</i> , <i>Pistacia</i> sp	1, 6	Öncüer 1991
16. <i>A. proclia</i> (Walker)	<i>L. beckii</i> , <i>D. lenticularis</i> (Lindinger), <i>D. perniciosus</i> , <i>Diaspidiotus prunorum</i>	Pome fruit trees	6	Erler & Tunç 2001, Japoshvili & Karaca 2002, Ülgentürk <i>et al.</i> 2004
17. <i>Aphytis</i> sp.nr. <i>phoenicus</i>	<i>Acanthomytilus cedricola</i> Balachowsky et Alkan, <i>L. newsteadi</i> (Sulc)	<i>Citrus</i> , cherry, apple, walnut	1, 5	Erler & Tunç 2001, Japoshvili & Karaca 2002
18. <i>Aspidiotiphagus citrinus</i> (Craw)	<i>A. aurantii</i> , <i>A. citrina</i> , <i>A. nerii</i> , <i>C. dictyospermi</i> , <i>P. pentagona</i> , <i>L. ulmi</i> , <i>P. oleae</i> , <i>Swisssetia oleae</i> (Olivier)	<i>Cedrus</i> sp.	2, 4, 5, 6	Öncüer 1991, Erler & Tunç 2001, Erol & Yaşar 1996, Demirözen <i>et al.</i> 2004
		<i>Citrus</i> sp., <i>Yucca</i> sp., <i>Sophora japonica</i> , <i>Catalpa</i> sp., <i>Morus</i> sp., pome fruits	6	Japoshvili & Karaca 2002
			2, 5,	Öncüer 1991, Ülgentürk & Toros 1996

19. <i>A. leitrinus</i> (Craw)	<i>Parlatoria oleae</i>	Pome fruit trees	1	Öncüler 1991
20. <i>A. lounsburyi</i> (B. and P)	<i>Aonidiella</i> spp.	<i>Citrus</i> sp.	6	Öncüler 1991
21. <i>Apyitis</i> sp.	<i>D. lenticularis</i> Lind.	Cherry	6	Demirözen <i>et al.</i> 2004
22. <i>Azotus celsus</i> (Walker)	<i>P. pentagona</i> , <i>L. ulmi</i>	<i>Malus communis</i>	7	Öncüler 1991
23. <i>A. perniciosus</i> (Girault)	<i>P. pentagona</i>	<i>P. persicae</i>	6	Öncüler 1991
24. <i>Coccobius</i> sp.	<i>L. ciliciae</i>	<i>Cupressus</i> sp.	6	Şengonca <i>et al.</i> 1998
25. <i>C. testaceus</i> Hayat	<i>L. malicola</i> , <i>L. ciliciae</i> , <i>M. inopinata</i>	<i>Prunus</i> sp., <i>Thuja</i> sp.	6	Erler & Tuuç 2001, Şengonca <i>et al.</i> 1998
26. <i>Coccophagoides</i> spp	<i>L. pusilla</i>	<i>Pinus nigra</i>	3	Ülgentürk & Toros 1996
27. <i>C. comperi</i> Girault	<i>Parthenolecanium persicae</i> (Fabricius)	<i>P. amygdalus</i>	4	Bolu & Özgen 2007
28. <i>C. moeris</i> (Walker)	<i>A. aurantii</i> , <i>M. inopinata</i>	<i>Citrus</i> sp., <i>P. nigra</i>	6	Erler & Tuuç 2001
29. <i>C. similis</i>	<i>D. ostreaformis</i> , <i>S. kermanensis</i>	Plane trees, <i>Populus</i> sp.	6	Japoshvili & Karaca 2002
30. <i>Coccophagus</i> sp.	<i>C. hesperidum</i> Linnaeus, <i>C. pseudomagnoliarum</i> (Kuwana), <i>Planococcus vovae</i> (Nasonov)	<i>Prunus</i> sp., <i>Juniperus</i> sp.	3, 6	Ülgentürk <i>et al.</i> 2004, Kaydan <i>et al.</i> 2006
31. <i>C. aterrimus</i> Vikberg	<i>Eulecanium ciliatum</i> (Douglas)	<i>Acer</i> sp., <i>Crataegus</i> sp., <i>Cydonia</i> sp.	3	Ülgentürk & Toros 1999
32. <i>C. lycimnia</i> (Walker)	<i>A. aurantii</i> , <i>C. rusci</i> , <i>C. floridensis</i> Comst., <i>Ficus carica</i> , <i>Citrus</i> spp., <i>C. hesperidum</i> , <i>C. pseudomagnoliarum</i>	<i>Ficus carica</i> , <i>Citrus</i> spp., <i>Prunus</i> spp., <i>Quercus</i> spp., <i>Pistacia</i> spp., <i>Ulmus campestris</i>	1, 3, 6	Öncüler 1991, Demirözen <i>et al.</i> 2004, Ülgentürk <i>et al.</i> 2004
33. <i>C. differens</i> Jasnosh	<i>Parthenolecanium corni</i> (Bouché), <i>P. rufulum</i> (Cockerell), <i>Pultinaria betulae</i> L., <i>Sphaerolecanium prunastri</i>			
34. <i>C. insidiator</i> Dalman	Fonscolombe, <i>Anapultinaria pistaciae</i> (Bodenheimer), <i>Gossyparia spuria</i> (Modeer)	<i>Prunus domestica</i> , <i>P. cerasifera</i>	3	Ülgentürk 2001
35. <i>C. palaeolecanii</i> Jasnosh	<i>S. prunastri</i>	<i>Picea pungens</i> , <i>P. excelsa</i>	1, 3,	Ülgentürk 2001
	<i>Physokermes piceae</i> (Schrank)	<i>Olea europaea</i> ,	4	Öncüler 1991, Erol & Yaşar 1999,
	<i>Filippia follicularis</i> (Targioni-Tozzetti)	<i>Fraxinus</i> sp. <i>P. domestica</i>		Ülgentürk 2001
	<i>Palaeolecanium bituberculatum</i> (Targioni-Tozzetti), <i>S. prunastri</i>	<i>P. cerasifera</i>		
36. <i>C. piceae</i> Erdös	<i>P. piceae</i>	<i>P. excelsa</i> , <i>P. pungens</i> , <i>P. orientalis</i>	3	Ülgentürk 2001
37. <i>C. proximus</i> Jasnosh	<i>S. prunastri</i>	<i>Prunus domestica</i> , <i>P. cerasifera</i>	3	Ülgentürk 2001

38. <i>C. proximus spartanus</i>	<i>P. corni</i> , <i>P. persicae</i> , <i>S. prunasstri</i>	<i>Prunus</i> sp.	6	Demirözen <i>et al.</i> 2004
39. <i>Coccophagus scutellaris</i> (Dalman)	<i>C. floridensis</i> , <i>C. hesperidum</i> C. pseudomagnoliarum, <i>F. follicularis</i> , <i>S. oleae</i>	<i>Citrus</i> , <i>O. europaea</i>	1, 6	Öncüer 1991
40. <i>Encarsia berleseae</i> (Howard)	<i>P. pentagona</i> , <i>D. perniciosus</i>	<i>P. persica</i> , <i>Malus</i> spp., <i>Morus alba</i>	2, 3, 5	Öncüer 1991, Erler & Tunç 2001, Ülgentürk <i>et al.</i> 2004
41. <i>E. citrinus</i> (Craw)	<i>A. nerii</i> , <i>L. ulmi</i> , <i>L. loewi</i>	<i>Pinus</i> sp. <i>Malus</i> sp.		Öncüer 1991, Japoshvili & Karaca 2002
42. <i>E. leucaspidis</i> (Mercet)	<i>L. pusilla</i> , <i>P. pentagona</i> , <i>D. perniciosus</i> , <i>L. nevsteadi</i>	<i>P. nigra</i> , <i>Sophora japonica</i> , <i>Morus</i> sp	3, 6	Ülgentürk & Toros 1996, Ülgentürk <i>et al.</i> 2004
43. <i>E. perniciosi</i> (Tower)	<i>D. perniciosus</i>	Unknown		Öncüer 1991
44. <i>Marietta picta</i> (André)	<i>P. vocae</i> , <i>Peltiococcopsis caucasicus</i> (Borchsenius), <i>Puto pilosellae</i> (Sulc)	<i>Juniperus</i> sp., <i>Cynodon dactylon</i> , <i>Saiguisorba minor</i> , <i>Agonoscenta succincta</i>	3	Kaydan <i>et al.</i> 2006
45. <i>M. javensis</i> (Howard)	<i>C. pseudomagnoliarum</i>	<i>Citrus</i> sp.	3	Öncüer 1991
46. <i>Marietta</i> sp.	<i>E. festucae</i> (Fonscolombe)	<i>Festuca</i> sp.	3	Ülgentürk <i>et al.</i> 2004
47. <i>Phanerotoma flavitestacea</i> Fischer	<i>P. citri</i> (Risso)	Unknown	3	Öncüer 1991
48. <i>Physcus</i> sp.	<i>L. beckii</i> , <i>Carulaspis juniperi</i> (Bouché)	<i>Citrus</i> spp., <i>Juniperus sabina</i> vt. <i>tamarictfolia</i>	3,6	Ülgentürk & Toros 1996
49. <i>P. lauri</i> (Mercet)	<i>Aonidia lauri</i> (Bouché)	<i>Laurus nobilis</i>	6	Erler & Tunç 2001
50. <i>P. testaceus</i> (Masi)	<i>C. salicis</i> , <i>L. ulmi</i>	<i>Salix</i> sp., <i>M. communis</i>	7	Öncüer 1991
51. <i>Pteroptrix bicolor</i> Howard	<i>S. kermanensis</i>	<i>Populus</i> sp.	6	Japoshvili & Karaca 2002
52. <i>P. lauri</i> (Mercet)	<i>S. kermanensis</i>	<i>Populus</i> sp.	6	Japoshvili & Karaca 2002
53. <i>P. longicornis</i> (Nikol)	<i>S. kermanensis</i>	<i>Populus</i> sp	6	Ülgentürk <i>et al.</i> 2004

Table 2. Encyrtid parasitoids of Coccoidea in Turkey.

Encyrtidae	Host Scale	Host Plants	Loc	References
1. <i>Achalcerimys lindus</i> (Mercet)	<i>Trionymus aberrans</i> Goux	<i>Triticum</i> , <i>Cymodon dactylon</i>	3	Japosvili & Noyes 2005
2. <i>Adelencyrtus aulascapidis</i> (Brethes)	<i>C. salicis</i>	<i>Salix</i> sp.	7	Öncüer 1991, Çalmaşur et al. 2000
3. <i>Aminellus niger</i> (Masi)	<i>Planococcus</i> sp.	Unknown	6	Öncüer 1991
4. <i>Anabrolepis zetterstedtii</i> (Westwood)	<i>L. ulmi</i>	<i>Corylus avellana</i>	2	Öncüer 1991
5. <i>Anagyrsus</i> sp.	<i>Lineaspis striata</i> (Newstead)	<i>Cupressus sempervirens</i>	6	Erler & Tunç 2001
6. <i>Anagyrsus aligarhensis</i> Agarwal & Alam	<i>Phenacoccus pumilus</i> Kiritshenko	<i>Eryngium campestre</i>	3	Kaydan et al. 2006
7. <i>A. aranzadii</i> (Mercet)	<i>P. vovae</i>	<i>Cupressus</i> sp.	6	Ülgentürk et al. 2004
8. <i>A. pseudococci</i> (Girault)	<i>P. citri</i> , <i>P. ficus</i> (Signoret)	<i>Citrus</i> sp., <i>Nerium oleander</i> , <i>Vitis vinifera</i> , <i>Juniperus</i> sp., <i>Fraxinus</i> sp.	1, 3, 6	Öncüer 1991, Kaydan et al. 2006
9. <i>A. schoenherri</i> Westwood	<i>P. aceris</i>	<i>A. pseudoplatanus</i> , <i>A. negundo</i> , <i>Fraxinus</i> sp.	3	Ülgentürk et al. 2004, Kaydan et al. 2006
10. <i>Aphycoides clacellatus</i> (Dalman)	<i>P. piceae</i>	<i>P. excelsa</i> , <i>P. pungens</i> , <i>P. orientalis</i>	3	Ülgentürk 2001
11. <i>Anthemus funicularis</i> (Bakkendorf)	<i>Leucaspis</i> sp.	<i>Pinus</i> sp.	3	Japosvili & Noyes 2005
12. <i>Aptychus</i> sp.	<i>Kermes</i> sp.	<i>Ficus carica</i>	1	Öncüer 1991
13. <i>Aptencyrtus lambinus</i> (Walker)	<i>L. ulmi</i> , <i>Diaspidiotus</i> sp.	<i>Populus alba</i>	7	Öncüer 1991
14. <i>A. microphagus</i> Mayr.	<i>L. ulmi</i>	Unknown	3	Öncüer 1991
15. <i>Blastothrix</i> sp.	<i>Kermes</i> sp.	<i>Quercus</i> sp.	3	Ülgentürk et al. 2004
16. <i>Blastothrix confusa</i> Erdös	<i>Parthenolecanium prunosum</i> (Coquillett)	<i>P. armeniaca</i>	1	Öncüer 1991
17. <i>B. gurselae</i> Japosvili & Karaca	<i>Kermes palestensis</i> Balachowsky	<i>Q. coccifera</i>	6	Japosvili & Karaca 2004
18. <i>B. hungarica</i> Erdös	<i>F. follicularis</i> , <i>P. rufulum</i>	<i>F. americana</i> , <i>F. excelsa</i>	3	Ülgentürk 2001
19. <i>B. longipennis</i> Dalman	<i>S. prunastri</i> , <i>E. tiliae</i> (L.), <i>P. rufulum</i>	<i>P. domestica</i> , <i>P. cerasifera</i> , <i>Malus communis</i> , <i>Quercus</i> sp.	3, 6	Ülgentürk et al. 2004
20. <i>B. sericea</i> Dalman	<i>Kermes</i> sp.	<i>Ficus carica</i> L.	1	Öncüer 1991
21. <i>Baryscapus sugonjaevi</i> (Kustuyukov)	<i>C. salicis</i> L., <i>P. percicae</i>	<i>Populus</i> sp., <i>P. amygdalus</i>	7	Çalmaşur et al. 2000, Bolu & Özgen 2007

22. *Ceropterocerus mirabilis*
Westwood
23. *Cheilonerus* sp.
24. *Cheliloneurus claviger* Thomson
25. *C. maculata* Hoffer
26. *C. paralia* (Walker)
27. *C. quercus* Mayr
28. *Coccidoxenoides perminutus*
Girault
29. *C. percarinus* Timberlake
30. *Choeria* sp.
31. *Comperiella* sp.
32. *Comperiella bifasciata* (How.)
33. *Discodes aeneus* (Dalman)
34. *Discodes coccophagus* Ratz
35. *Epitetracnemus intersextus*
(Fonscolombe)
36. *E. zetterstedtii* (Westwood)
37. *Ericydnus robustior* Mercet
38. *Encyrtus albatarsus* Zett.
39. *E. infelix* (Embleton)
40. *E. infidus* Rossi
41. *E. lecaniorum* (Mayr)
42. *E. scutellata* (Swed)
43. *Epitetracnemus intersextus*
(Fonscolombe)
44. *Ericydnus* sp.
45. *Habrolepis* sp.
46. *Homalotylus quaylei* Timberlake
C. pseudomagnoliarum, *P. pruniosum*, *P. corni*, *S. prunastri*
C. pseudomagnoliarum,
Peliocopsis caucasicus (Borchsenius),
Phenacoccus bicarinus Borchsenius
S. oleae, *F. follicularis*, *Kermes* sp.
Eriopeltis sp.
E. ciliatum
K. palastinensis
P. vovae
P. vovae
E. festucae
L. striata
A. aurantii, *C. dictyospermi*, *L. beckii*
Coccus sp., *S. prunastri*
Coccus sp., *S. prunastri*
L. ulmi
L. ulmi (L.)
Mirococcus inermis (Hall), *P. caucasicus*
E. ciliatum
C. rusci
Kermes sp., *E. ciliatum*, *E. tiliae*, *P. corni*
C. rusci, *C. sinensis* (Del Guercio.), *C. hesperidum*, *C. pseudomagnoliarum*,
Kermes sp.
Eulecanium sp.
L. ulmi
Mirococcus inermis (Hall)
Parthenolcanium sp.
P. vovae
Citrus sp., *P. domestica*, *P. 1, 3*,
cerasifera 6 Ülgentürk et al. 2004
Citrus sp. 3 Öncüer 1991, Kaydan et al. 2006
Cynodon dactylon (L.)
O. europea, *Citrus* spp. 1,3 Öncüer 1991
Quercus sp. Ülgentürk et al. 2004
Poaceae 3 Japosvili & Noyes 2005
P. amygdalus 6 Ülgentürk et al. 2004
Quercus sp. 6 Japoshvili et al. 2004
Juniperus sp., *Thuja* sp. 3 Kaydan et al. 2006
Cupressus sp. 6 Şengonca et al. 1998
Poa sp. 3 Ülgentürk et al. 2004
Cupressus sempervirens 6 Erler & Tunç 1996
Citrus sp. 6 Öncüer 1991
P. domestica 1 Öncüer 1991
P. domestica, *P. cerasifera*, 3 Öncüer 1991
Prunus sp. 6 Ülgentürk 2001,
Malus sp. 6 Japosvili & Noyes 2005
Nerium oleander 6 Erler & Tunç 2001
Chenopodium, *C. dactylon* 3 Kaydan et al. 2006
Acer sp. *Crataegus* sp. 3 Ülgentürk & Toros 1999
F. carica 1 Öncüer 1991
F. carica, *Acer* sp., 1, 3, Öncüer 1991, Ülgentürk & Toros
Crataegus sp., *Corylus* sp. 6 1999, Ülgentürk et al. 2004
Citrus sp., *F. carica*, 1, 6 Öncüer 1991
Citrus sp., *Quercus* sp.
Pistacia vera 7 Öncüer 1991
Malus sp. 6 Ülgentürk et al. 2004
Unknown 6 Ülgentürk et al. 2004
Quercus sp. 6 Ülgentürk et al. 2004
Juniperus sp. 3 Japosvili & Noyes 2005

47. <i>Leptomastidea abnormis</i> (Girault)	<i>P. citri</i>				6	Öncüer 1991
48. <i>Leptomastidea matritensis</i> Mercet	<i>P. ficus</i> , <i>P. vocae</i>				3	Kaydan <i>et al.</i> 2006
49. <i>Leptomastix</i> sp.	<i>P. aceris</i>				3	Ülgentürk <i>et al.</i> 2004
50. <i>L. dactylopii</i> (Howard)	<i>P. citri</i>				3	Öncüer 1991
51. <i>L. flava</i> Mercet	<i>Phenacoccus pumilus</i> Kiritshenko, <i>Trionymus multitorus</i> (Kiritshenko)				3	Kaydan <i>et al.</i> 2006
52. <i>Mayridia formosula</i> Mercet	<i>Trionymus aberrans</i> Goux, <i>P. bicerarius</i>				3	Kaydan <i>et al.</i> 2006
53. <i>M. pulchra</i> Mercet	<i>Asterodiaspis bella</i> (Russell)				6	Ülgentürk <i>et al.</i> 2004
54. <i>Metaphycus asterolecanii</i> (Mercet)	<i>F. follicularis</i> , <i>E. ciliatum</i> , <i>S. prunastri</i> , <i>C. rusci</i>				3, 6	Ülgentürk <i>et al.</i> 2004, Ülgentürk & Toros 1999, Öncüer 1991
55. <i>Metaphycus dispar</i> Mercet	<i>C. dictyospermi</i> , <i>Coccus</i> sp., <i>C. hesperidum</i> , <i>C. pseudomagnoliarum</i> , <i>S. oleae</i>				1, 6	Öncüer 1991
56. <i>M. flavus</i> (Howard)	<i>C. pseudomagnoliarum</i> , <i>S. oleae</i>				6	Öncüer 1991
57. <i>M. helvolicus</i> (Comp.)	<i>S. prunastri</i>				1	Öncüer 1991
58. <i>M. incidiosus</i> Mercet	<i>S. prunastri</i> , <i>E. filiae</i> , <i>Rhizopulvinaria artemisiae</i> (Signoret), <i>E. ciliatum</i>				3, 6	Ülgentürk 2001, Öncüer 1991, Ülgentürk <i>et al.</i> 2004
59. <i>M. silvestri</i> Sugonjaev	<i>Coccus</i> sp., <i>P. corni</i> , <i>S. prunastri</i>				6	Ülgentürk 2001, Ülgentürk <i>et al.</i> 2004
60. <i>Microterys</i> sp.	<i>P. rufulum</i> , <i>Eriococcus spuria</i> (Modeer)				1, 3	Ülgentürk <i>et al.</i> 2004
61. <i>M. bellae</i> Trygitzin	<i>Kermes</i> sp.				3	Ülgentürk <i>et al.</i> 2004
62. <i>M. ferrugineus</i> (Nees)	<i>Pulvinaria floccifera</i> West.				2	Öncüer 1991
63. <i>Microterys flavus</i> Howard	<i>E. ciliatum</i> , <i>S. prunastri</i>				1, 3	Ülgentürk & Toros 1999, Japovili & Noyes 2005
64. <i>M. hortulans</i> Erdös	<i>Coccus</i> sp., <i>P. corni</i> , <i>S. oleae</i> , <i>S. prunastri</i>				1, 3	Öncüer 1991, Demirözer <i>et al.</i> 2004
65. <i>M. lunatus</i> (Dalman)	<i>F. follicularis</i>				1, 6	Öncüer 1991
66. <i>M. masii</i> (Silvestri)	<i>C. floridensis</i>				6	Şengonca <i>et al.</i> 1998
67. <i>M. nietneri</i> Motschulsky	<i>C. hesperidum</i> , <i>C. pseudomagnoliarum</i> , <i>E. filiae</i>				1, 6	Öncüer 1991, Ülgentürk <i>et al.</i> 2004

68. <i>M. tricoloricornis</i> (Rest)	<i>E. douglasi</i>	<i>Prunus</i> sp	6	Japovvili & Noyes 2005
69. <i>M. sylvius</i> (Dalman)	<i>C. rusci</i>	<i>F. carica</i>	1, 6	Öncüer 1991
70. <i>Paraceroprocerus italicus</i> (Masi)	<i>T. multicoorus, Atrococcus</i> sp.	<i>Verbascum</i> sp.	3	Kaydan <i>et al.</i> 2006
71. <i>Parascula tripartitizin</i> Hoffer	<i>L. newsteadi</i>	Unknown	6	Japovvili & Karaca 2002
72. <i>Prochilonurus holcari</i> Mercet	<i>L. newsteadi</i>	Unknown	5	Japovvili & Noyes 2005
73. <i>Pseudorhopus testarcanus</i> (Ratzeburg)	<i>K. palastiniensis</i>	<i>Quercus coccifera</i>	3, 6	Japovvili <i>et al.</i> 2004
74. <i>Psilophrys bela</i> Japovvili	<i>K. palastiniensis</i>	<i>Q. coccifera</i>	6	Japovvili & Noyes 2007
75. <i>P. ghilarovi</i> Japovvilli	<i>K. palastiniensis</i>	<i>Q. coccifera</i>	6	Japovvili 2005
76. <i>Pseudococcobius obenbergeri</i> (Novicky)	<i>K. palastiniensis</i>	<i>Q. coccifera</i>	6	Japovvili <i>et al.</i> 2004
77. <i>Psilophrys tenuicornis</i> Graham	<i>Eriococcus deoniensis</i> (Green)	<i>Achiella</i> sp. <i>C. dactylon</i>	3	Japovvili & Noyes 2005, Kaydan <i>et al.</i> 2006
78. <i>Rhopus</i> sp. nr. <i>acaetes</i> (Walker)	<i>Peliococcopsis caucasicus</i> (Borchsenius)	<i>C. dactylon</i>	3	Japovvili & Noyes 2005
79. <i>Rhopus flavoidus</i> (Mercet)	<i>Pseudococcus</i> sp.	Labiatae	3	Kaydan <i>et al.</i> 2006
80. <i>Stenatosteres</i> sp.	<i>Atrococcus achillae</i> (Kiritchenko)	<i>C. dactylon</i>	3	Kaydan <i>et al.</i> 2006
81. <i>Tetracnemenioidea</i> sp.	<i>P. caucasicus, P. bicerarius, Phenacoccus ferulae</i>			
82. <i>Tomsonisca amathus</i> Walker	<i>P. piceae</i> (Schrank), <i>Paralecanopsis turcica</i>	<i>P. excelsa P. pungens, P. orientalis, Cynedon</i> sp.	3	Ügentürk <i>et al.</i> 2004
83. <i>Trichomasthus</i> sp.	Bodenheimer	<i>Salix</i> sp.		
	<i>C. salicis</i>	<i>Citrus</i> sp., <i>Cynedon</i> sp.	1	Çalmaşur <i>et al.</i> 2000
	<i>C. hesperidum, C. pseudomagnoliarum, P. turcica, P. rufulum, P. piceae</i>			Ügentürk 2001, Ügentürk <i>et al.</i> 2004
84. <i>T. albinianus</i> (Thomas)	<i>C. salicis</i> L.	<i>Populus</i> sp.	4	Çalmaşur <i>et al.</i> 2000
85. <i>T. cyanneus</i> (Dalman)	<i>E. festucae</i>	<i>Festuca</i> sp.	3	Ügentürk <i>et al.</i> 2004
86. <i>Zaomma lambinus</i> Ashmead	<i>C. floridensis, L. ulmi</i>	<i>Citrus</i> spp., <i>Malus</i> sp.	6	Şengonca <i>et al.</i> 1998, Ügentürk <i>et al.</i> 2004

Table 3. Eulophid, Ichneumonid, Mymarid, Pteromalid, Platygastriid and Signiphorid parasitoids of Coccoidea in Turkey.

Eulophidae	Host scale	Host plant	Loc	References
1. <i>Aprostocetus pachyneuros</i> Ratzeburg	Kermes sp.	<i>Quercus</i> sp.	6	Ülgentürk <i>et al.</i> 2004
2. <i>A. toddaliae</i> (Risbec)	<i>S. prunastri</i>	<i>Prunus</i> sp.	1	Ülgentürk <i>et al.</i> 2004
3. <i>A. tryapitzini</i> (Kosjukov)	<i>C. rusci</i> , <i>C. sinensis</i> , <i>S. prunastri</i> , <i>E. ciliatum</i>	<i>Citrus</i> spp., <i>F. carica</i> , <i>P. domestica</i> , <i>P. cerasifera</i>	1, 3, 6	Öncüer 1991, Ülgentürk <i>et al.</i> 2004
4. <i>Aprostocetus</i> sp.	<i>C. rusci</i> , <i>Ceroplastes</i> sp., <i>E. ciliatum</i>	<i>Citrus</i> sp., <i>F. carica</i> , <i>Prunus</i> sp.	1, 3	Öncüer 1991, Ülgentürk <i>et al.</i> 2004
5. <i>Tetrastichus</i> sp.	<i>S. prunastri</i>	<i>Prunus</i> sp.	1	Ülgentürk <i>et al.</i> 2004
6. <i>T. ceroplastae</i> (Sirault)	<i>Rhizaspidiotus donacis</i> (Leonardi)	<i>Phragmites australis</i>		Şengonca <i>et al.</i> 1998
7. <i>T. ceroplastophilus</i> (Domenichini)	<i>C. rusci</i>	<i>Citrus</i> sp., <i>F. carica</i>		Öncüer 1991
8. <i>T. neglectus</i> Domenichini	<i>L. pusilla</i> , <i>S. prunastri</i>	<i>Pinus</i> sp., <i>Prunus</i> sp.	3, 6	Ülgentürk & Toros 1999, Ülgentürk <i>et al.</i> 2004
Ichneumonidae				
1. <i>Grasscriteles ciliator</i> (Aubert)	<i>A. aurantii</i>	<i>Citrus</i> sp.		Öncüer 1991
Mymaridae				
1. <i>Anaphes</i> sp.	<i>L. pusilla</i>	<i>Pinus</i> sp.	3	Ülgentürk & Toros 1996
2. <i>C. subaeneus</i>	<i>E. ciliatum</i>	<i>Prunus</i> sp.	3	Ülgentürk <i>et al.</i> 2004
3. <i>Thysanus ater</i> (Walker)	<i>L. ulmi</i>	<i>C. avellana</i>	2	Öncüer 1991
Pteromalidae				
1. <i>Dinarmus acutus</i> (Thomsan)	<i>C. rusci</i> (Linnaeus)	<i>Ficus</i> sp.	4	Öncüer 1991
2. <i>Eunotus areolatus</i> (Ratzeburg)	<i>E. ciliatum</i> (Douglas)	<i>Acer</i> sp., <i>Crataegus</i> sp.	3	Ülgentürk & Toros 1999
3. <i>E. acutus</i> Kurdjumov	<i>P. turanicus</i>	Graminae	3	Kaydan <i>et al.</i> 2006
4. <i>Gastrancistrus glabellus</i> (Nees)	<i>Planococcus citri</i>	<i>Citrus</i> sp.	6	Öncüer 1991
5. <i>Gonidanichium atrum</i> (Boucek)	<i>Planococcus citri</i>	<i>Citrus</i> sp.	6	Öncüer 1991
6. <i>Pachyneuron concolor</i> Förster*	<i>Coccus</i> sp., <i>Didesmicoccus</i> sp. <i>F. follicularis</i> , <i>S. oleae</i> , <i>Sph. prunastri</i> , <i>P. aceris</i> (Signoret)	<i>A. negundo</i> , <i>A. hippocastaneum</i> , <i>F. excelsior</i> , <i>O. europea</i>	3, 4, 7	Öncüer 1991, Kaydan <i>et al.</i> 2006
7. <i>P. muscarum</i> L. *	<i>F. follicularis</i> , <i>P. piceae</i> , <i>S. prunastri</i> , <i>E. ciliatum</i>	<i>M. alba</i> , <i>Prunus</i> sp., <i>Chenopodium album</i> , <i>F. americana</i> , <i>F. excelsa</i> , <i>P. excelsa</i> , <i>P. pungens</i> , <i>P. orientalis</i> , <i>P. domestica</i> <i>P. cerasifera</i> , <i>Pyrus</i> sp.	3, 6	Ülgentürk 2001, Ülgentürk <i>et al.</i> 2004, Japoshvili <i>et al.</i> 2004

8. <i>Scutellista cyanea</i> (Motschulsky)	<i>C. floridensis</i> , <i>C. rusci</i> , <i>S. oleae</i>	<i>Citrus</i> sp., <i>Ficus carica</i> , <i>Olea</i> sp.	1, 5, 6	Öncüer 1991, Kumral, & Kovancı 2004
Platygastridae				
1. <i>Allotropa mecirida</i> (Walker)	<i>Phenacoccus aceris</i> (Signoret)	<i>A. pseudoplatanus</i> F. <i>excelsior</i>	3	Ülgentürk <i>et al.</i> 2004 Kaydan <i>et al.</i> 2006
Sigalphoridae				
1. <i>Chartocerus kurajumovi</i> (Nikol'skaya)*	<i>Heterococcus tritici</i> (Kiritshenko), <i>P. caucasicus</i> , <i>T. aberrans</i>	<i>C. dactylon</i> , <i>Festuca</i> sp.	3	Kaydan <i>et al.</i> 2006
2. <i>C. subaeneus</i>	<i>E. ciliatum</i> (Douglas)	<i>Prunus</i> sp.	3	Ülgentürk <i>et al.</i> 2004, Öncüer 1991
3. <i>Thysanus ater</i> (Walker)	Coccidae, Encyrtidae <i>L. ulmi</i> (L.)	<i>C. avellana</i>	2	Öncüer 1991