

**Species inventory, preys and host plants
of Anthocoridae *sensu lato* (Hemiptera: Heteroptera)
in Shiraz and its environs (Iran, Fars province)**

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Abstract. We study the fauna of the Anthocoridae (Heteroptera) in Shiraz and its environs (south Iran, Fars province) and record their local prey and host plants by sampling specimens from different crops and weeds. Twelve species are recorded in this study. An identification key to the species of the Anthocoridae is presented including illustrations of the male genitalia for most species. *Orius niger* (Wolff, 1811) was the most abundant species. *Orius niger* and *Anthocoris minki pistaciae* Wagner, 1957 are recommended as good candidates for further studies of their potential in biological control of insect pests. *Dufouriellus ater* (Dufour, 1833) is recorded for the first time from Iran.

Key words. Anthocoridae, key, prey, biological control, host plants, geographical distribution, Shiraz, Fars province, Iran

Introduction

The family Anthocoridae *sensu lato* is distributed worldwide and includes about 100 genera and 600 species. They are small (1.4–4.5 mm) and occur in a wide variety of habitats. Many are cryptic and found, e.g., in galls, while others live in ant nests and under tree bark; a number of genera feed on thrips, aphids, psyllids, and mites (KERZHNER 1967, LATTIN 1999, PÉRICART 1972). Despite their predaceous habits, several species appear to occur only on a restricted number of plant species (PÉRICART 1972, SLATER & BARANOWSKI 1978). The importance of this family in efficient control of pests is widely recognized as they have many characteristics of ideal biological control agents, i.e., high searching efficiency, ability to increase more rapidly when prey is abundant and ability to aggregate in areas of high prey density (HADGSON &

AVELING 1988). For example, species of the genus *Orius* Wolff, 1811 are generalist predators able to suppress pest populations and some species have been studied in detail because of their efficiency in controlling thrips (Thysanoptera) on different crops (BOSCO & TAVELLA 2008).

The Anthocoridae of Iran were recently catalogued by GHAHARI et al. (2009) including an extensive reference list. The Anthocorid fauna of Guilan was monographed by LINNAVUORI & HOSSEINI (2000), who also provided geographic distribution, host plants and keys for all taxa. LINNAVUORI & MODARRES AWAL (1998) listed 10 species of this family for the Khorasan province. The fauna of the Anthocoridae was studied extensively in the Fars province (MODARRES AWAL 1997; OSTOVAN 1998; OSTOVAN & NIAKAN 2000; ERFAN & OSTOVAN 2002, 2005; OSTOVAN & MIRHELLI 2008). ERFAN & OSTOVAN (2002, 2005) studied the biodiversity of these predators in environs of Shiraz, documented 11 species and mentioned their host plants. Our present research is focused on further species inventory and bionomics of these predators in Shiraz and its environs.

Material and methods

The Anthocorid fauna of different localities in Shiraz and its environs (Fars province) (Fig. 19) was studied during 1998–2000. The Fars province is located in southern Iran between 27°01' and 31°51'N and between 50°27' and 55°45'E, covering an area of 125,000 km². The climate of the province is arid to semiarid.

Specimens were collected on various cultivated plants and weeds and preserved in vials containing 70% ethanol. Coordinate data for sampling sites (Table 1 and Fig. 19) were obtained from GIS group of Agricultural Organization of the Fars province.

Our identifications were based on wing patterns, body structure and male genitalia, which are the most reliable structure for taxonomic identification, especially for the genus *Orius* (PÉRICART 1972, ELOV 1976). Adult males were dissected to extract the genital clasper and identified to species using the keys by PÉRICART (1972) and LINNAVUORI & HOSSEINI (2000). Permanent slide preparations were made to examine and illustrate the genitalia. The terminal abdominal segments were placed in 5% KOH and boiled for 3–5 minutes until the organs became soft and transparent. After the treatment with KOH, the material was dehydrated with 80% to absolute ethanol and xylene and mounted with Canada Balsam on a glass slide (YASUNAGA 1997).

All identifications were confirmed by Rauno E. Linnavuori and Reza Hosseini. All specimens are deposited in the personal collection of the senior author. Prey were determined by Kambiz Minaei & Mahmoud Alich (Plant Protection Department, College of Agriculture, Shiraz University) and host plants were identified by Saeid Eshghi (Horticultural Science Department, College of Agriculture, Shiraz University).

Species new to the Fars province are marked with an asterisk and species new to Iran with two asterisks. In two cases we were not able to identify the specimens to species level.

Table 1. List of sampling sites in the Fars province. Species: 1 – *Temnostethus reduvinus parilis* (Horváth, 1891), 2 – *Anthocoris minki pistaciae* Wagner, 1957, 3 – *Anthocoris* sp., 4 – *Orius albidipennis* (Reuter, 1884), 5 – *O. niger* (Wolff, 1811), 6 – *O. laevigatus laevigatus* (Fieber, 1860), 7 – *O. laticollis discolor* (Reuter, 1884), 8 – *O. horvathi* (Reuter, 1884), 9 – *O. vicinus* (Ribaut, 1923), 10 – *Xylocoris* sp., 11 – *Dufouriellus ater* (Dufour, 1833).

No	Sampling site	Coordinates	Species
1	Akbar abad kavari	52°41'E 29°11'N	5
2	Badjgah	52°32'E 29°36'N	1, 2, 3, 4, 5, 7, 8, 9, 11
3	Beyza	52°24'E 29°58'N	4, 5, 10
4	Dasht-e-arzhan	51°58'E 29°39'N	2, 5, 6, 7, 8
5	Dasht-e-mook	52°38'E 29°08'N	2, 8
6	Dehroud	52°34'E 28°36'N	2, 4, 5, 6, 8
7	Dowlat abad	52°00'E 29°58'N	4, 8
8	Emamzade Shahid	52°19'E 28°35'N	6
9	Fathabad kavari	52°38'E 29°18'N	4, 5, 6
10	Firouzabad	52°34'E 28°49'N	2, 5, 6
11	Kaftarak	52°41'E 29°34'N	2, 4, 5, 7
12	Kavari	52°40'E 29°10'N	2, 4, 5, 6
13	Khaneh zenian	52°10'E 29°42'N	4, 5
14	Koushkak	52°26'E 30°12'N	4, 5, 8, 9
15	Maharlou	52°48'E 29°21'N	5, 7, 8, 9
16	Marvdasht	52°52'E 29°57'N	4, 5, 7
17	Neyriz	54°19'E 29°11'N	4, 5, 7, 9
18	Palayeshgah Shiraz	52°39'E 29°44'N	5, 6
19	Qir	53°01'E 28°29'N	4, 5
20	Sarvestan	53°13'E 29°16'N	2, 4
21	Sepidan	51°59'E 30°15'N	1, 2, 5
22	Shiraz	52°33'E 29°37'N	2, 5, 7, 8, 9
23	Soltan abad	52°32'E 29°32'N	2, 5
24	Tafihan	52°38'E 29°27'N	4
25	Tangab Firouzabad	52°33'E 28°57'N	2, 6, 8
26	Zanjiran	52°38'E 29°07'N	6, 8
27	Zarghan	52°43'E 29°47'N	2, 4

Results

List of species, host plants and prey

Altogether five genera and 12 species were collected during our survey. The precise collection sites for each species are given in Table 1. The lists of host plants and prey are summarized in Tables 2 and 3, respectively.

* *Temnostethus (Ectemnus) reduvinus parilis* (Horváth, 1891) (Fig. 5)

Anthocoris pilosus (Jakovlev, 1877) (Fig. 6)

Anthocoris minki pistaciae Wagner, 1957 (Fig. 7)

Anthocoris sp. (Fig. 8)

Orius (Dimorphella) albidipennis (Reuter, 1884)

Orius (Orius) niger (Wolff, 1811)

Orius (Orius) laevigatus laevigatus (Fieber, 1860)

- * *Orius (Heterorius) laticollis discolor* (Reuter, 1884)
Orius (Heterorius) horvathi (Reuter, 1884)
 * *Orius (Heterorius) vicinus* (Ribaut, 1923)
Xylocoris sp. (Fig. 9)
 ** *Dufouriellus ater* (Dufour, 1833) (Fig. 10). Badjgah, 1810 m a.s.l., under loose bark of *Salix* sp., 23.iii.2000, 3.iii.2000, 17.iii.2000, 1 ♂ 3 ♀♀, Sh. Falamarzi lgt., R. Hosseini det.

Key to genera of Anthocoridae in Shiraz and its vicinity

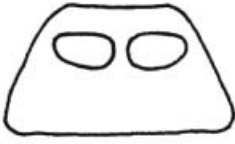
- 1 Antennomeres 3 and 4 approximately as thick as antennomeres 1 and 2, covered with rather short hairs of variable length but not longer than twice the thickness of the antennomere. 2
 - Antennomeres 3 and 4 slender, thinner than antennomeres 1 and 2, covered with long, sparse erect hairs. 4
- 2 Very small species, length 1.2–3 mm. Pronotum with narrow collar. Paramere evenly curved. *Orius* Wolff, 1811
 - Larger species. Pronotum with distinct collar. Apical portion of paramere blade-like. 3
- 3 Apex of metasternum rounded, hind coxae widely separated. Body remarkably flat.
 *Temnostethus* Fieber, 1860
 - Apex of metasternum triangular, hind coxae close to each other.
 *Anthocoris* Fallén, 1814
- 4 Pronotum without median longitudinal groove. Antennomeres 3 and 4 thin. Male fore tibiae strongly expanding apicad. Head, pronotum and apex of abdomen with long macrosetae. *Xylocoris* Dufour, 1831
 - Pronotum with median longitudinal groove (Fig. 10). Antennomeres 3 and 4 thicker. Male fore tibiae slender. Body very flat and shiny black. *Dufouriellus* Kirkaldy, 1906

Key to species of *Orius* Wolff, 1811

- 1 Pronotal calli flat, divided in middle by punctate band (Fig. 1). Paramere as in Fig. 13 (subgenus *Dimorphella*). *O. albidipennis* (Reuter, 1884)
 - Pronotal calli large, continuous. 2
- 2 Lateral angles of pronotum with long erect bristles (Figs. 2 and 3) (subgenus *Orius*). 3
 - Lateral angles of pronotum without long bristles (Fig. 4) (subgenus *Heterorius*). 4
- 3 Fore tibiae pale, middle and hind tibiae blackish. Paramere as in Fig. 14.
 *O. niger* (Wolff, 1811)
 - All tibiae pale. Paramere as in Fig. 15. *O. laevigatus laevigatus* (Fieber, 1860)
- 4 Pronotum with straight, strongly diverging lateral margins in male, lateral margins curved in female. Flagellum of paramere very long, extending far beyond the conical part (Fig. 16). *O. laticollis discolor* (Reuter, 1884)

Figs. 1–10. 1–4: pronotum of subgenera of *Orius* Wolff, 1811: 1 – *Dimorphella* Reuter, 1884; 2–3 – *Orius* s. str.; 4 – *Heterorius* Wagner, 1952. 5–10: habitus of Anthocoridae: 5 – *Temnostethus reduvinus parilis* (Horváth, 1891); 6 – *Anthocoris pilosus* (Jakovlev, 1877); 7 – *Anthocoris minki pistaciae* Wagner, 1957; 8 – *Anthocoris* sp.; 9 – *Xylocoris* sp.; 10 – *Dufouriellus ater* (Dufour, 1833). Scale bars = 1 mm.

1



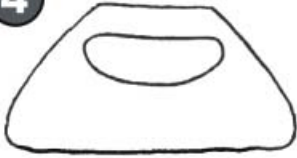
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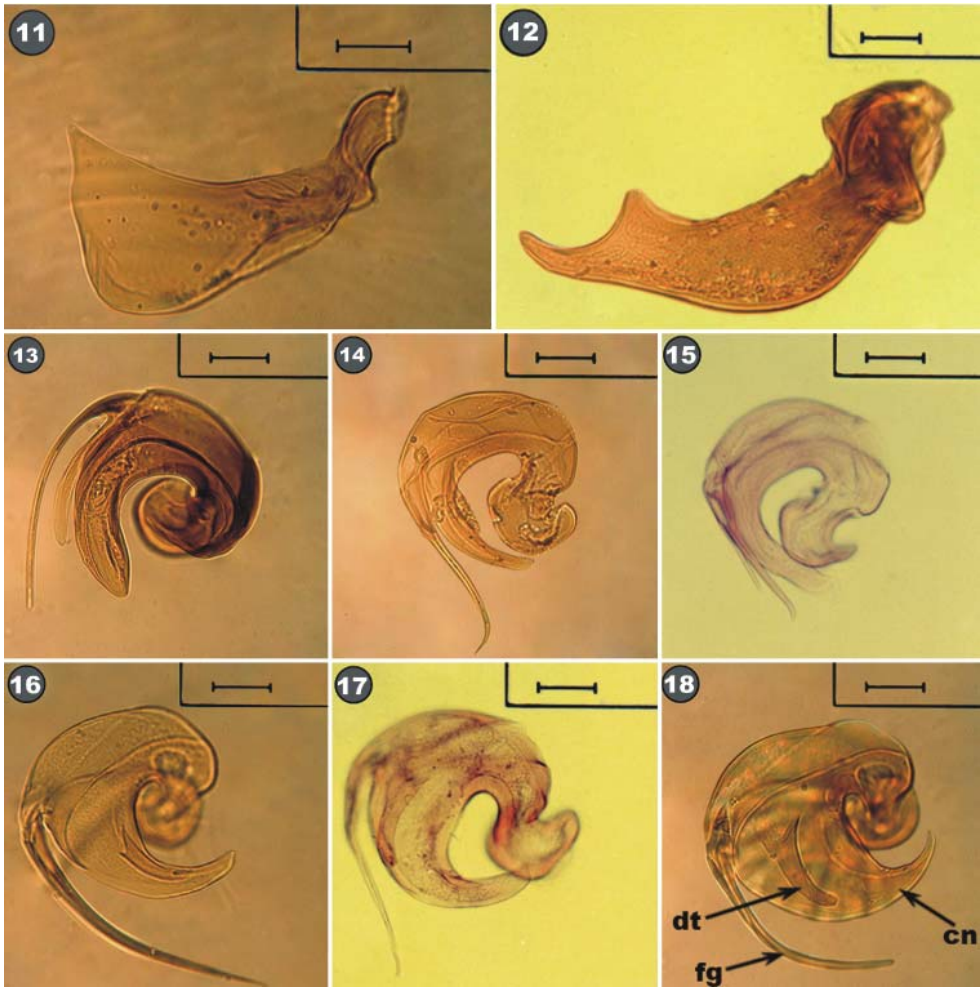


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Figs. 11–18. Parameres of Anthocoridae. 11 – *Temnostethus reduvinus parilis* (Horváth, 1891), 12 – *Anthocoris minki pistaciae* Wagner, 1957, 13 – *Orius albidipennis* (Reuter, 1884), 14 – *O. niger* (Wolff, 1811), 15 – *O. laevigatus laevigatus* (Fieber, 1860), 16 – *O. laticollis discolor* (Reuter, 1884), 17 – *O. horvathi* (Reuter, 1884), 18 – *O. vicinus* (Ribaut, 1923). Abbreviations: cn – cone, dt – denticule, fg – flagellum. Scale bars = 0.05 mm.

- Pronotum not sexually dimorphic. Paramere different. 5
- 5 Lamellate portion of paramere slender, claw-like (Fig. 17).
 *O. horvathi* (Reuter, 1884)
- Lamellate portion of paramere much broader, tooth of paramere distinctly below upper margin of conical portion (Fig. 18). *O. vicinus* (Ribaut, 1923)

Key to species of *Anthocoris* Fallén, 1814

- 1 Body and entire antennae dark. Apical part of corium and cuneus blackish. Dorsal surface covered with long erect hairs (Fig. 6). *A. pilosus* (Jakovlev, 1877)
 – Body including antennomere 1 reddish. Corium and cuneus shiny. Dorsal surface without long erect hairs (Fig. 7). Paramere as in Fig. 12. *A. minki pistaciae* Wagner, 1957

Note. We did not find *Anthocoris pilosus* during this survey but specimens of this species from Shiraz are deposited in the collection of the Plant Protection Department, Shiraz University.

Discussion

Orius niger was found to be the most common species during this study on a wide range of host plants (18 plant species of 13 families). *Orius laticollis discolor* and *O. vicinus* were detected only on trees. The highest diversity of the Anthocoridae was observed on willow trees (*Salix* sp.), which was the host plant of six species we found. *Orius laevigatus* mainly occurred on plants infested by thrips. All *Orius* species except *O. laticollis* prey on Thysanoptera. *Anthocoris minki pistaciae* is probably an important natural enemy of some gall-producing pests of plants, e.g. the jumping louse *Psyllopsis fraxini* on *Fraxinus rotundifolia*,

Table 2. List of observed prey.

Predator	Prey
<i>Anthocoris minki pistaciae</i>	<i>Forda</i> sp. (Hemiptera: Aphidoidea), <i>Hyalopterus pruni</i> (Geoffroy, 1762) (Hemiptera: Aphidoidea), <i>Psyllopsis fraxini</i> (Linnaeus, 1758) (Hemiptera: Psylloidea), <i>Slavum</i> sp. (Hemiptera: Aphidoidea)
<i>Anthocoris</i> sp.	<i>Psyllopsis fraxini</i> (Linnaeus, 1758) (Hemiptera: Psylloidea)
<i>Orius albidipennis</i>	<i>Tetranychus</i> sp. (Acari: Tetranychidae), <i>Haplothrips reuteri</i> (Karny, 1907) (Thysanoptera), <i>Haplothrips tritici</i> (Kurdjumov, 1912) (Thysanoptera), <i>Odontothrips</i> sp. (Thysanoptera), <i>Retithrips syriacus</i> (Mayet, 1890) (Thysanoptera)
<i>Orius horvathi</i>	<i>Hyalopterus pruni</i> (Geoffroy, 1762), <i>Sipha</i> sp. (Hemiptera: Aphidoidea), <i>Therioaphis maculata</i> (Buckton, 1899) (Hemiptera: Aphidoidea), <i>Thrips meridionalis</i> (Priesner, 1926) (Thysanoptera)
<i>Orius laevigatus</i>	<i>Haplothrips reuteri</i> (Karny, 1907), <i>Tenothrips discolor</i> (Karny, 1907) (Thysanoptera), <i>Thrips tabaci</i> Lindeman 1889 (Thysanoptera)
<i>Orius laticollis discolor</i>	<i>Hyalopterus pruni</i> (Geoffroy, 1762), <i>Monosteria inermis</i> Horváth, 1899 (Hemiptera: Heteroptera: Tingidae), <i>Psylla pyricola</i> (Förster, 1848) (Hemiptera: Psylloidea), <i>Sipha</i> sp. (Hemiptera: Aphidoidea)
<i>Orius niger</i>	<i>Agonoscena pistaciae</i> Burckhardt & Lauterer, 1989 (Hemiptera: Psylloidea), <i>Therioaphis maculata</i> (Buckton, 1899) (Hemiptera: Aphidoidea), <i>Haplothrips reuteri</i> (Karny, 1907) (Thysanoptera), <i>Haplothrips tritici</i> (Kurdjumov, 1912) (Thysanoptera), <i>Odontothrips</i> sp. (Thysanoptera), <i>Retithrips syriacus</i> (Mayet, 1890), <i>Tenothrips discolor</i> (Karny, 1907) (Thysanoptera)
<i>Orius vicinus</i>	<i>Hyalopterus pruni</i> (Geoffroy, 1762), <i>Sipha</i> sp. (Hemiptera: Aphidoidea), <i>Aeolothrips</i> sp. (Thysanoptera), <i>Frankliniella tenuicornis</i> (Uzel, 1895) (Thysanoptera),

Table 3. Recorded host plants.

Species	Host plants
<i>Anthocoris minki pistaciae</i>	<i>Pistacia mutica</i> (Anacardiaceae), <i>Fraxinus rotundifolia</i> (Oleaceae), <i>Amygdalus communis</i> (Rosaceae), <i>Amygdalus scoparia</i> (Rosaceae), <i>Prunus persicae</i> (Rosaceae), <i>Prunus</i> sp. (Rosaceae), <i>Populus alba</i> (Salicaceae), <i>Salix</i> sp. (Salicaceae), <i>Ulmus campestris</i> (Ulmaceae)
<i>Anthocoris</i> sp.	<i>Fraxinus rotundifolia</i> (Oleaceae)
<i>Dufouriellus ater</i>	<i>Salix</i> sp. (Salicaceae)
<i>Orius albidipennis</i>	<i>Coriandrum sativum</i> (Apiaceae), <i>Helianthus annuus</i> (Asteraceae), <i>Cardaria draba</i> (Brassicaceae), <i>Convolvulus arvensis</i> (Convolvulaceae), <i>Glycyrrhiza glabra</i> (Fabaceae), <i>Medicago sativa</i> (Fabaceae), <i>Spartium junceum</i> (Fabaceae), <i>Mentha</i> sp. (Lamiaceae), <i>Myrtus communis</i> (Myrtaceae), <i>Plantago</i> sp. (Plantaginaceae), <i>Triticum vulgare</i> (Poaceae) <i>Polygonum aviculare</i> (Polygonaceae), <i>Rosa beggariana</i> (Rosaceae),
<i>Orius horvathi</i>	<i>Nerium oleander</i> (Apocynaceae), <i>Glycyrrhiza glabra</i> (Fabaceae), <i>Medicago sativa</i> (Fabaceae), <i>Plantago</i> sp. (Plantaginaceae), <i>Zea mays</i> (Poaceae), <i>Zizyphus spinachristi</i> (Rhamnaceae), <i>Amygdalus communis</i> (Rosaceae), <i>Crataegus</i> sp. (Rosaceae), <i>Prunus persicae</i> (Rosaceae), <i>Rosa beggariana</i> (Rosaceae), <i>Salix</i> sp. (Salicaceae)
<i>Orius laevigatus</i>	<i>Nerium oleander</i> (Apocynaceae), <i>Convolvulus arvensis</i> (Convolvulaceae), <i>Glycyrrhiza glabra</i> (Fabaceae), <i>Medicago sativa</i> (Fabaceae), <i>Rosa carnica</i> (Rosaceae), <i>Rubus</i> sp. (Rosaceae)
<i>Orius laticollis discolor</i>	<i>Fraxinus rotundifolia</i> (Oleaceae), <i>Amygdalus communis</i> (Rosaceae), <i>Prunus persicae</i> (Rosaceae), <i>Prunus</i> sp. (Rosaceae), <i>Pyrus communis</i> (Rosaceae), <i>Populus alba</i> (Salicaceae), <i>Salix</i> sp. (Salicaceae)
<i>Orius niger</i>	<i>Pistacia vera</i> (Anacardiaceae), <i>Nerium oleander</i> (Apocynaceae), <i>Helianthus annuus</i> (Asteraceae), <i>Lactuca serriola</i> (Asteraceae), <i>Convolvulus arvensis</i> (Convolvulaceae), <i>Caesalpinia gilliesii</i> (Fabaceae), <i>Glycyrrhiza glabra</i> (Fabaceae), <i>Medicago sativa</i> (Fabaceae), <i>Mentha</i> sp. (Lamiaceae), <i>Althaea</i> sp. (Malvaceae), <i>Myrtus communis</i> (Myrtaceae), <i>Plantago</i> sp. (Plantaginaceae), <i>Zea mays</i> (Poaceae), <i>Polygonum aviculare</i> (Polygonaceae), <i>Punica granatum</i> (Punicaceae), <i>Malus</i> sp. (Rosaceae), <i>Mespilus germanica</i> (Rosaceae), <i>Rosa</i> sp. (Rosaceae)
<i>Orius vicinus</i>	<i>Punica granatum</i> (Punicaceae), <i>Amygdalus communis</i> (Rosaceae), <i>Prunus persicae</i> (Rosaceae), <i>Salix</i> sp. (Salicaceae)
<i>Temnostethus redivinus parilis</i>	<i>Fraxinus rotundifolia</i> (Oleaceae), <i>Malus</i> sp. (Rosaceae), <i>Prunus persicae</i> (Rosaceae), <i>Pyrus communis</i> (Rosaceae), <i>Populus alba</i> (Salicaceae), <i>Salix</i> sp. (Salicaceae)
<i>Xylocoris</i> sp.	<i>Convolvulus arvensis</i> (Convolvulaceae)

and aphids *Slavum* sp. and *Forda* sp. on *Pistacia mutica*. *Anthocoris minki pistaciae* was found on 13 examined sampling sites. This species reaches the highest population densities of all *Anthocoris* species. Plants belonging to the family Rosaceae (11 confirmed host plant species) seem to be a preferred habitat of several anthocorid species.

A rich fauna of anthocorids was documented in Badjgah where the Agriculture College of Shiraz University is located (13 km north of Shiraz, 1810 m a.s.l.) where most of the samples were taken. Here we collected nine species found on different plants in orchards, ornamentals, crops, weeds and vegetables. Five species (*Orius vicinus*, *O. laticollis discolor*, *O. horvathi*,

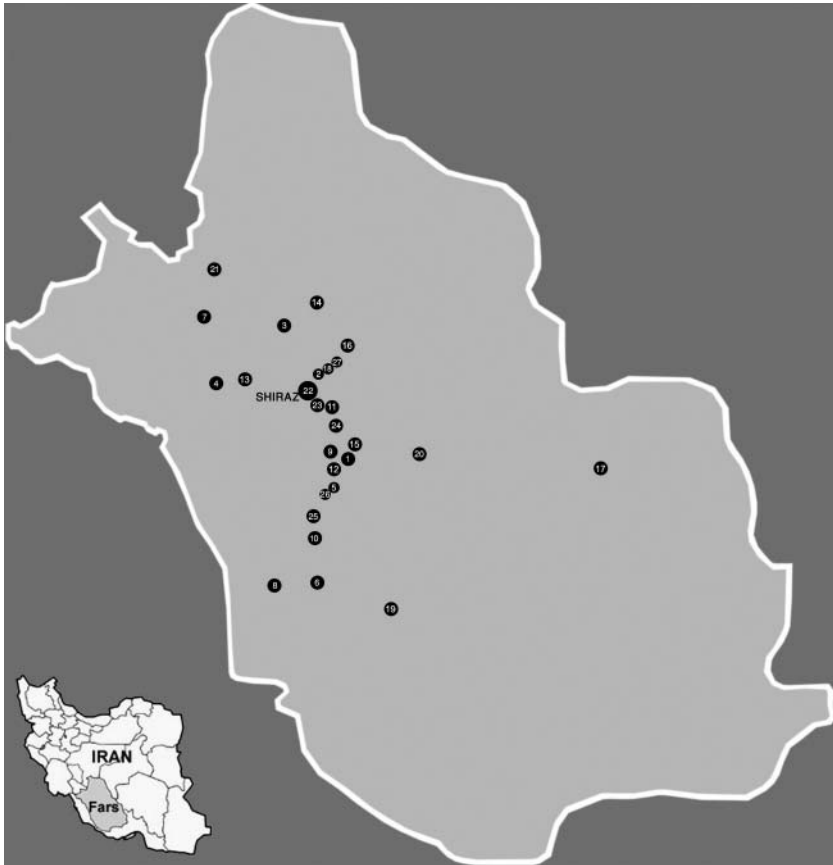


Fig. 19. Map of the Fars Province with the positions of the sampling sites.

Anthocoris minki pistaciae, and *Temnostethus reduvinus parilis*) were found in one sample taken from a single willow tree highly infested by aphids (*Sipha* sp., an important pest of *Salix* sp. in this region). Here we also found *Dufouriellus ater*, which is a new species for fauna of Iran (cf. GHAHARI et al. 2009), under loose bark of the tree.

It seems that *Orius niger* and *O. albidipennis* occur throughout the Fars province, while *Orius laticollis discolor* is present only in areas with colder climate. Some *Orius* species occur mainly on plants with flowers. Because of omnivorous habits of *Orius* species that consume also pollen, neighbouring wild flora may provide additional food for populations of these predators on crops. *Orius niger* and *Anthocoris minki pistaciae* are recommended as good candidates for further studies of their potential for biological control of pests, in particular their behaviour in the field, feeding habits and ecology.

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