Review of the tribe Chilocorini Mulsant from Iran (Coleoptera, Coccinellidae)

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Abstract

The Iranian checklist of the tribe Chilocorini Mulsant, 1846 (Coleoptera: Coccinellidae) is updated. In total, 13 species belonging to four genera (Brumoides Chapin, 1965, Chilocorus Leach, 1815, Exochomus Redtenbacher, 1843, and Parexochomus Barovsky, 1922) are listed from Iran. An identification key to all genera and species currently known from Iran is presented along with illustrations of adult specimens and male genitalia.

Keywords

checklist, Chilocorini, Coccinelloidea, Iran, review
Introduction

The family Coccinellidae, with nearly 6000 species and 360 genera, belongs currently to the superfamily Coccinelloidea (Coleoptera: Polyphaga) (Robertson et al. 2015, Tomaszewska and Szawaryn 2016). It is divided into two subfamilies: Microweiseinae and Coccinellinae. The subfamily Microweiseinae includes three tribes: Carinodulini, Microweiseini (including Sukunahikonini) and Serangiini (Escalona and Ślipiński 2012); the remaining taxa belong to the subfamily Coccinellinae (Seago et al. 2011, Robertson et al. 2015, Szawaryn et al. 2015, Escalona et al. 2017).

The tribe Chilocorini Mulsant, 1846 contains approximately 250 species belonging to 27 genera (Łączyński and Tomaszewska 2012, Li et al. 2017), of which nine genera have hitherto been recorded from Palaeartic region including: Brumoides Chapin, 1965, Chilocorus Leach, 1815, Chuiochilus Sasaji, 2005, Exochomus Redtenbacher, 1843, Parexochomus Barovsky, 1922, Phaenochilus Weise, 1895, Priscibrurus Kovár, 1995, Simmondsius Ahmad & Ghani, 1966 and Xanthocorus Miyatake, 1970) (Kovář 2007).

Although most members of Chilocorini are coccidophagous (Giorgi et al. 2009, Escalona et al. 2017), aphidophagy is also present in some species (Ślipiński and Giorgi 2006); so, the members of this tribe have the potential to be effective biological control agents of coccids and aphids (Drea and Gordon 1990, Ponsonby and Copland 1997).

In the last classification of the former subfamily Chilocorinae by Kovář (2007), the species of the genus Brumus Mulsant, 1850 were transferred to Exochomus Redtenbacher and the subgenus Parexochomus of Exochomus was considered as a valid genus, under the name of Parexochomus Barovsky, 1922. This classification was followed by Nedvěd and Kovář (2012). Moreover, according to Ślipiński (2007), the subfamily Chilocorinae Mulsant was dissolved and all tribes were lumped into the subfamily Coccinellinae. This classification was confirmed by subsequent morphological and molecular studies (Seago et al. 2011, Robertson et al. 2015). The number of genera and species of this tribe is continuously increasing (Ślipiński and Giorgi 2006, Łączyński and Tomaszewska 2009, Wang and Ren 2010, Łączyński and Tomaszewska 2012, Li et al. 2015, Li et al. 2017) and it is expected that this trend will be continuing.

Although a large number of species of this tribe have hitherto been reported from Iran (Duverger 1983, Kovář 2007, Moddaries-Awal 2012), there is no complete and comprehensive information on the Iranian Chilocorini. The checklist by Abdolahi Mesbah et al. (2016) differs from our view and does not include identification key, diagnosis, and synonymy. Our paper corrects the previous studies on the species of this tribe in Iran, in order to update the information about Iranian Chilocorini.

Materials and methods

This study was mainly based on review of the literature along with the samples collected by the first author. The samples were collected by hand, aspirator, or sweep net in the fields, orchards, and pastures of various provinces of Iran. The specimens were
examined under Olympus stereomicroscope (SZ-ST). The specimens were first boiled in 10% KOH for a maximum of 20 min depending on the darkness of the body color/ sclerotization in order to dissect the genitalia. The dissected genitalia were then transferred into distilled water for a maximum of 10 min to rinse off the KOH. Finally, the slides were prepared using Canada balsam. The slides were examined under a microscope (Olympus CX21) and images were taken using a digital camera and edited in Photoshop software (Adobe Photoshop CS5.1). The specimens were identified to species using available keys and resources (Mader 1955, Fürsch 1961, Bielawski 1984, Kovář 1995, Raimundo and van Harten 2000, Raimundo et al. 2008).

Although the higher classification of Seago et al. (2011) was followed in this study, taxonomy at the species level is based on Kovář (2007). Morphological terminology follows that of Ślipiński (2007). All of the specimens collected and examined during this study are deposited in Plant Protection Department, Lorestan University, Agricultural Faculty, Khorramabad, Iran.

Results and discussion

The Iranian coccinellid species list of the tribe Chilocorini is updated, which includes 13 species belonging to four genera (Brumoides, Chilocorus, Exochomus, and Parexochomus).

Although there are some records of Exochomus flavipes Thunberg, 1781 from Iran (Ansari pour and Shakarami 2011, Tavakol et al. 2014), re-examination of the voucher specimens of this species showed that these reports are misidentifications and these samples are actually Parexochomus nigromaculatus (Goeze, 1777). Parexochomus flavipes is morphologically similar to P. nigromaculatus but is distinguished from it by the male genitalia, and P. flavipes has not hitherto been reported from Palaearctic region (Kovář 2007). It is distributed in the northern states of USA (Gordon 1985) and south and west of Africa (Fürsch 1961).

Mahghari and Ostovan (2006) reported two ladybird species, Brumus undecempunctata L. and Chilocorus stigma (Say, 1835), from the northern provinces of Iran (Gilan and Mazandaran province) as natural enemies of whiteflies. In coccinellid taxonomy, there is no known species under the name of Brumus undecempunctata, while Chilocorus stigma has not been reported so far from Palaearctic region (Kovář 2007). According to our knowledge, the presence of these species in Iran is doubtful and not confirmed.

Barovsky (1922) reported Exochomus kiritschenkoi Barovsky, 1922 from Iran (Shahrood, H. Christoph leg.). There are also specimens in Zoologichesky Institut (Akademii Nauk SSSR) in St. Petersburg, labeled as E. kiritschenkoi which had been collected from Iran (Shahrood, H. Christoph leg). Kovář (1995) however identified these specimens as E. gebleri Weise.

Data on the presence of E. bifasciatus in Iran are based on Kovář (2007). Since we do not have any information (particularly morphological) about this species, it is excluded from the identification key of Iranian species of Chilocorini.
Subfamily Coccinellinae Latreille, 1807

Tribe Chilocorini Mulsant, 1846

**Diagnosis.** Body size small to medium (2.0–8.0 mm), with downward directed head inserted into prothorax to some extent; dorsum usually without obvious pubescence. Head wider than long, flattened ventrally; clypeus variously expanded laterally and wholly concealing antennal insertions. Mandibles triangular, strong with an apical tooth and heavily developed molar teeth; maxillary palps relatively long, terminal palpomere parallel sided to weakly enlarged apically; labial palp clearly separated basally, inserted on ventral side of prementum. Antenna composed of 7–10 antennomeres, markedly short with a fusiform club composed of three terminal antennomeres. Prosternum fairly elongate in front of coxae; prosternal process narrow, parallel sided without carinae. Hind wings with large anal lobe. Elytra irregularly punctate, with epipleuron wide and complete to apex, frequently with foveae for receiving apices of femora. Abdomen with five or six ventrites; postcoxal lines at abdominal ventrite 1 variable, without associated pits and pores. Male genitalia with symmetrical tegmen, penis guide sometimes asymmetrical; parameres well developed, apically setose; penis a simple, single sclerite with sizeable basal capsule. Coxites triangular and faintly sclerotized, usually without styli; bursa copulatrix with infundibulum or fleshy lobe, with sperm duct composed of two parts of different diameter; spermatheca bean-shaped, sclerotised without well differentiated nodulus or ramus, with large accessory gland (after Ślipiński 2007).

**Key to the Iranian species and genera of Chilocorini**

1 Fronto-clypeal plate emarginate anteriorly (Fig. 14). Postcoxal line on abdominal ventrite 1 merging with posterior margin of ventrite or running very close to it (Fig. 15). All tibiae with tooth at outer side; tibial spurs absent (Fig. 16). Elytron brown or reddish brown with 3 small orange discal spots in transverse row, usually partially fused (Fig. 2). Male genitalia with penis guide as long as parameres (Figs 17, 18), penis as in Figs 19, 20. (Body circular, strongly convex, 3.5–4.5 mm long) ................. *Chilocorus bipustulatus* Linnaeus

- Fronto-clypeal plate not emarginate. Postcoxal line on abdominal ventrite 1 distant from posterior margin of ventrite (Figs 21, 22). Mid-and hind tibiae smoothly arcuate; with 2 apical spurs (Fig. 23) ..............................................

2 Antenna composed of 8 antennomeres (Fig. 24). Body yellow with two small black spots on each elytron, one behind the other (Fig. 1). Male genitalia with parameres slightly longer than penis guide (Fig. 25); penis as in Fig. 26. (Body broadly oval, 2.0–2.5 mm long) ..................... *Brumoides adenensis* Fürsch

- Antenna composed of 10 antennomeres (Figs 27, 28)..............................

3 Elytra black with red spots or red-brown with or without black spots. Body size 2.8–5.0 mm ............................................. *Exochomus* Redtenbacher

- Elytra completely black. Body size 2.2–4.5 mm ....... *Parexochomus* Barovsky

10
Elytra black; each elytron with two small or medium sized, separated red spots.................................................................

– Elytra orange to red-brown, with or without black spots, or elytra black with large pale maculae of irregular shape ...................................................

Each elytron with two similar and equally-sized rounded spots (Fig. 6). Male genitalia with penis guide approximately as long as parameres (Figs 29, 31); penis as in Fig. 30. Body oval, 3.5–4.5 mm long ..............

– Each elytron with two differently sized and shaped spots (Figs 7, 8). Male genitalia with penis guide clearly shorter than parameres (Figs 32, 33); penis as in Fig. 34. Body subcircular, 3.5–4.0 mm long.......... E. quadripustulatus Linnaeus

Background of elytra black; elytral maculae large and of irregular shape, brown or orange .................................................................

– Background of elytra orange to red-brown; with or without contrasting markings.................................................................

Humeral part with brown macula (Fig. 9); male genitalia with penis guide longer than parameres (Fig. 35); penis as in Fig. 36. Form oblong, body length 4.3–5.0 mm .............................................. E. undulatus Weise

– Humeral part with orange macula surrounding a black round spot (Fig. 3). Body form oblong, 3.0–5.0 mm long)............................ E. ericae Crotch

Elytra brown without markings; (Body subcircular, 3.5–4.0 mm long)........ E. quadripustulatus Linnaeus

– Each elytron with 4 nearly equally sized, small, black spots similarly distributed .................................................................

Pronotum reddish orange, with a medio basal ungulate black spot (Fig. 5). Tarsal claw simple (Fig. 37). Male genitalia with penis guide as long as parameres (Fig. 38); penis as in Fig. 39. Body nearly of spindle form, 2.8–4.5 mm long ................................................................. E. octosignatus Gebler

– Pronotum entirely black except for dark bordering of lateral and anterior margins (Fig. 4). Tarsal claw with small basal tooth (Fig. 40). Male genitalia with penis guide distinctly shorter than parameres (Figs 41, 42); penis as in Fig. 43. Body broadly oval, 4.0–5.0 mm long .............. E. gebleri Weise

Body pubescent ........................................................................

– Body glabrous ........................................................................

Body covered with dense, moderately long setae (Fig. 13). Male genitalia with penis guide shorter than parameres (Figs 44, 45); penis as in Figs 46, 47. Body short oval to nearly circular, 2.8–2.9 mm long .............. P. pubescens Küster

– Body apparently glabrous, but actually with minute sparse setae particularly at pronotum (Fig. 10). Form oblong, 2.2–2.7 mm long.................... P. melanocephalus Zubkov

Pronotum yellow (Fig. 11). Male genitalia as in Figs 48, 49, 50. Body oval and highly convex, 3.8–4.2 mm long.................... P. nigripennis Erichson

– Pronotum black with yellow lateral margins (Fig. 12). Male genitalia as in Figs 51–55. Body broadly oval, moderately convex, 3.1–4.5 mm long........ P. nigromaculatus Goeze
Updated checklist of the Iranian species of Chilocorini

**Brumoides Chapin, 1965**

*Brumoides* Chapin, 1965: 237. Type species: *Coccinella suturalis* Fabricius, 1798, by original designation.

**Diagnosis.** Body length 2.0–3.5 mm. Dorsum glabrous; yellowish or brown, elytra with dark markings. Eye distinctly emarginate. Antenna composed of 8 antennomeres; terminal antennomere small, partly embedded in penultimate one. Clypeus short; labrum exposed. Pronotal base bordered; prosternal process extremely narrow, without carinae; without hypomeral fovea. Fore tibia narrow, simple; middle and hind tibiae with two apical spurs; tarsal claws appendiculate or weakly thickened basally. Abdominal ventrite 6 visible in males; abdominal postcoxal lines separated medially, each arcuately recurving apically and reaching or nearly reaching midpoint of lateral line (after Ślipiński 2007).

**Ecology.** Various species of *Brumoides* have been associated with mealybugs (Ślipiński 2007), namely *Coccidohystrix insolita* (Hemiptera: Pseudococcidae), *Dactylopis confusus* (Hemiptera: Dactylopiidae), *Ferrisia virgata* (Hemiptera: Pseudococcidae), and *Phenacoccus solenopsis* (Hemiptera: Pseudococcidae) (Gordon 1985, Gautam 1990, Hodek and Honěk 2009, Arif et al. 2012, Giorgi et al. 2014). Some species of this genus, such as *Brumoides suturalis* (F.) feed on some whitefly species, such as *Aleurolobus barodensis* (Maskell) (Inayatullah 1984, Hodek and Honěk 2009) in addition to feeding on some coccids, such as *F. virgata* (better for development) and *Planococcus pacificus* (better for oviposition) (Gautam 1990).

**Brumoides adenensis** Fürsch, 1987

Figs 1, 21, 24–26

*Brumoides adenensis* Fürsch, 1987: 44.

**General distribution.** Middle East (that includes Iran, Saudi Arabia, United Arab Emirates, Yemen) (Kovář 2007), Southern Africa (Łączyński and Tomaszewska 2012). **Distribution in Iran.** Iran (Kovář 2007) – no specific distribution known.

**Remarks.** The species descriptions and photographs by Fürsch (1987) and Ramirez et al. (2008) were used with some modifications.

**Chilocorus Leach, 1815**

*Chilocorus* Leach, 1815: 116. Type species: *Coccinella cacti* Linnaeus, 1767, by monotypy.

**Diagnosis.** Body length 2.5–4.8 mm. Dorsal body glabrous; elytra black or brown with white or orange markings; eye clearly emarginate. Antennae short, composed of
Figures 1–9. Dorsal habitus of Chilocorini species. 1 Brumoides adenensis Fürsch 2 Chilocorus bipustulatus Linnaeus 3 E. ericae Crotch 4 E. gebleri Weise 5 E. octosignatus Gebler 6 E. quadriguttatus Fleischer 7, 8 E. quadripustulatus Linnaeus 9 E. undulatus Weise.

8 antennomeres; with scape symmetrical; 8th antennomere either as long as or markedly longer than antennomere 7. Clypeus long; labrum partly exposed. Pronotal base unbordered; prosternal process narrow without carinae; hypomeral fovea absent. All tibiae flattened and angulate externally, without apical spurs; tarsal claws strongly appendiculate. Elytral margin not reflexed with indistinct bead; epipleural foveae weak. Abdominal ventrite 6 visible in males; abdominal postcoxal lines separated medially, each running parallel to hind margin of ventrite (after Ślipiński 2007).

Ecology. Although various scale insects are primary hosts of Chilocorus (Escalona et al. 2017), some species at least accept aphids as prey (Gordon 1985, Drea and Gordon 1990, Ślipiński 2007, Hodek and Honěk 2009). Nonetheless, there are some reports about some species of this genus, such as Chilocorus stigma (Say) which feed on some whitefly species, such as Aleurocanthus woglumi Ashby (Dowell and Cherry 1981, Hodek and Honěk 2009).
**Chilocorus bipustulatus** (Linnaeus, 1758)

Figs 2, 16, 15–20

*Coccinella bipustulata* Linnaeus, 1758: 367.
*Coccinella fasciata* Müller, 1776: 68.
*Coccinella transversoguttata* Börner, 1776: 250.
*Coccinella frontalis* Thunberg, 1792: 105. [Homonym]
*Coccinella testudo* Florencourt Chassot, 1796: 214.
*Coccinella strigata* Fabricius, 1798: 79. [Homonym]
*Chilocorus olivetorum* Costa, 1839: 104.
*Chilocorus minor* Sahlberg, 1903: 86.

**Material examined.** 8♂, 3♀: Iran, Lorestan province, V.2013, lgt. Amir Biranvand, det. Biranvand. 2♂, 1♀: Iran, Semnan province, V.2015, lgt. Mino Toozandejani, det. Biranvand.

**General distribution.** Afrotropical region, Nearctic region, Palaearctic region (Mader 1955, Gordon 1985, Kovář 2007, Canepari 2011) and Oriental region (Poorani 2002).

**Distribution in Iran.** Widely distributed (Duverger 1983, Moddarres-Awal 2012).

**Ecology.** This species feeds on a wide range of Hemiptera species: *Agonoscena pistaciae* (Psyllidae), *Aonidiella orientalis* (Diaspididae), *Bemisia tabaci* (Aleyrodidae), *Chrysomphalus dictyospermi* (Diaspididae), *Eulecanium prunastri* (Coccidae), *Euphylleta olivina* (Psyllidae), *Salicola kermanshensis* (Diaspididae), *Lepidosaphes malicola* (Diaspididae), *Leucaspis pusilla* (Diaspididae), *Maconellicoccus hirsutus* (Pseudococcidae), *Ommatissus binotatus lybicus* (Tropiduchidae), *Parlatoria blanchardi* (Diaspididae), *Parlatoria oleae* (Diaspididae), *Phloeomyzus passerinii* (Aphididae), *Planococcus citri* (Pseudococcidae), *Pseudaulacaspis pentagona* (Diaspididae), *Psylla pyricola* (Psyllidae) (Moddarres-Awal 2012) and other coccids, particularly armoured scales (Hodek 1973, Stansly 1984).

**Exochomus Redtenbacher, 1843**

*Exochomus* Redtenbacher, 1843:11. Type species: *Coccinella quadripustulata* Linnaeus, 1758, by subsequent designation of Thomson, 1859.

**Diagnosis.** Body length 2.8–5.5 mm. Dorsal body glabrous; elytra black, brown, or yellow, often with contrasting red or yellow markings; sometimes (in lighter coloured species) with black stripes along lateral margins of elytra. Antenna composed of 10 antennomeres, minute terminal antennomere embedded in penultimate one; pronotal basal margin completely bordered with submarginal line; prosternal process narrow, truncate apically, without carinae; elytral epipleura clearly narrowing, without foveae; abdominal postcoxal lines complete or nearly so, semicircular, reaching to inner end of lateral line; meso- and metatibiae each with two apical spurs; tarsal claws with or without basal tooth (after Li et al. 2015).
Ecology. Most species of this genus are aphidophagous and coccidophagous (Gordon 1985, Kovář 1995, Magro et al. 2010). Nonetheless, there are some reports about some species of the genus feeding on aleyrodids e.g., *Exochomus bimaculatus* Mulsant which feeds on *Bemisia tabaci* (Gennadius) (Yigit 1992, Leite et al. 2003, Hodek and Honěk 2009).

*Exochomus bifasciatus* Barovsky, 1927

*Exochomus bifasciatus* Barovsky, 1927: 200.

General distribution. China, Iran, Kazakhstan (Kovář 2007).

Distribution in Iran. Iran (Kovář 2007) – no specific distribution provided.
Exochomus ericae Crotch, 1874
Fig. 3

Exochomus ericae Crotch, 1874: 193.
Chilocorus nigropictus Fairmaire, 1876: 94.
Chilocorus picturatus Fairmaire, 1876: 94.
Exochomus anchorifer Allard, 1870: 9.

General distribution. Algeria, Iran, Morocco, Tunisia (Mader 1955, Duverger 1983, Kovář 2007).

Distribution in Iran. Dasht Arzhanregion, Kerman, Nowshahr region (Duverger 1983).

Remarks. We used the species descriptions and photographs of Mader (1955) with some modifications.

Exochomus gebleri Weise, 1885
Figs 4, 40–43

Exochomus gebleri Weise, 1885: 55.

Material examined. 5♂, 2♀: Iran, Yazd province, spring and summer 2013, lgt. Mehdi Zare Khormizi, det. Biranvand.

General distribution. Afghanistan, Iran, Turkey (Kovář 2007).

Distribution in Iran. Golestan, Semnan (Kovář 1995), Lorestan (Jafari and Kamali 2007), Fars (Moddarres-Awal 2012), Yazd (current study).

Exochomus octosignatus (Gebler, 1830)
Figs 5, 37–39

Coccinella octosignata Gebler, 1830: 225.
Coccinella deserta Motschulsky, 1840: 175.
Coccinella desertorum Gebler, 1841: 376.
Brumus lasioides Weise, 1879: 135.
Brumus conjunctus Fleischer, 1900: 118.

General distribution. Afghanistan, Armenia, Azerbaijan, France, Iran, Iraq, Italy, Kazakhstan, Kyrgyzstan, Mongolia, Russia, Tajikistan, Turkmenistan, Turkey, Uzbekistan (Kovář 2007).

Distribution in Iran. Khameshorkn region (Duverger 1983), Khorasan (Moodi and Mossadegh 1995, Yaghmaei and Kharrazi Pakdel 1995), Chaharmahal and Bakhtiari (Bagheri and Mossadegh 1996), East Azerbaijan, Gilan, Isfahan, Kerman, Qom, Tehran, Sistan and Baluchestan (Moddarres-Awal 2012).
Ecology. This species feeds on the mealybugs *Phenacoccus aceris* and *Planococcus citri* (Pseudococcidae) (Moddarres-Awal 2012).

**Exochomus quadriguttatus** Fleischer, 1900

Figs 6, 29–31

*Exochomus quadriguttatus* Fleischer, 1900: 118.
*Exochomus cordiformis* Roubal, 1926: 245.
*Exochomus illaesicollis* Roubal, 1927: 135.

**Material examined.** 3♂, 8♀: Iran, Semnan province, VII.2015, lgt. Mino Toozandejani, det. Biranvand.
General distribution. Caucasus, Iran, Lebanon, Syria (Duverger 1983), Armenia, Turkey (Kovář 2007).

Distribution in Iran. Sagdar region (Duverger 1983), Kerman (Moddarres-Awal 2012), Semnan (current study).

**Exochomus quadripustulatus** (Linnaeus, 1758)
Figs 7–8, 32–34

*Coccinella quadripustulata* Linnaeus, 1758: 367.
*Coccinella lunulata* Gmelin, 1790: 1662.
*Coccinella quadriverrucata* Fabricius, 1792: 288.
*Coccinella cassidoides* Donovan, 1798: 74.
*Coccinella varia* Schrank, 1798: 444.
*Coccinella distincta* Brullé, 1832: 273
*Coccinella iberica* Motschulsky, 1837: 422.
*Coccinella floralis* Motschulsky, 1837: 423.
*Exochomus haematideus* Costa, 1849: 62.
*Exochomus unicolor* Schaufuss, 1862: 50
*Exochomus sexpustulatus* Kraatz, 1873:192
*Exochomus bilunulatus* Weise, 1879: 133.
*Exochomus koltzei* Weise, 1879: 134.
*Exochomus reitteri* Schneider, 1881: 16
*Exochomus vittatus* Fuente, 1910: 444

Material examined. 60♂, 75♀: Iran, Lorestan province, in all seasons, 2013, 2014, 2015, 2016, 2017, lgt. Amir Biranvand, det. Biranvand. 3♂, 3♀: Iran, Semnan province, V.2015, lgt. Mino Toozandejani, det. Biranvand.

General distribution. Palaearctic Region, Oriental region, Australian region, Nearctic region (USA: California) (Canepari 2011, Li et al. 2015).

Distribution in Iran. Widely distributed (Duverger 1983, Moddarres-Awal 2012).

Ecology. This species feeds on various species of Hemiptera, namely: *Aonidiella orientalis* (Diaspididae), *Aphis fabae* (Aphididae), *Callaphis juglandis* (Aphididae), *Chromaphis juglandicola* (Aphididae), *Eriosoma lanigerum* (Aphididae), *Eulecanium prunastri* (Coccidae), *Euphyllea olivina* (Psyllidae), *Maconellicoccus hirsutus* (Pseudococcidae), *Parlatoria oleae* (Diaspididae), *Psylla pyricola* (Psyllidae), *Saissetia oleae* (Coccidae) (Moddarres-Awal 2012), and other aphids and Coccidae (Uygun 1981, Ülgentürk and Toros 2001, Kaydan et al. 2006, Kaydan et al. 2012).
Review of the tribe Chilocorini Mulsant from Iran (Coleoptera, Coccinellidae)

Exochomus undulatus Weise, 1878
Figs 9, 27, 35–36

Exochomus undulatus Weise, 1878: 93

Material examined. 10♂, 16♀: Iran, Lorestan province, in all seasons, 2013, 2015, 2016, lgt. Amir Biranvand, det. Biranvand.
**General distribution.** Palestine (Mader 1955), Caucasus (Duverger 1983), Afghanistan, Azerbaijan, Egypt, Georgia, Iraq, Iran, Lebanon, Syria, Tajikistan (Kovář 2007).

**Distribution in Iran.** Lorestan (Jafari and Kamali 2007), Chaharmahal and Bakhhtiari, Fars, Isfahan, Kerman, Khorasan, Kohgiluyeh and Boyer-Ahmad, Qazvin (Moddarres-Awal 2012), Tehran (Ghanbari et al. 2012), Markazi (Ahmadi et al. 2012), Yazd (Zare Khormizi et al. 2016).

**Ecology.** This species feeds usually on *Euphyllura olivina* (Hemiptera: Psyllidae) (Moddarres-Awal 2012).

**Parexochomus Barovsky, 1922**

*Exochomus* (*Parexochomus*) Barovsky, 1922: 293. Type species: *Exochomus pubescens* Küster, 1848, by subsequent designation of Chapin 1965.

*Parexochomus*: Kovář 2007: 595.

**Diagnosis.** Body length 3.0–3.5 mm. Dorsal body glabrous or pubescent, dark brown or black with lateral margins of pronotum or at least anterior angles yellow or red. Antenna composed of 10 antennomeres, minute terminal antennomere embedded in penultimate one; terminal maxillary palpomeres stout, nearly parallel-sided; pronotal basal margin entirely bordered with submarginal line; prosternal process narrow, rounded apically, without carinae; elytral epipleura clearly narrowing towards apex, without foveae; abdominal postcoxal lines complete and semicircular, reaching to middle of lateral line; meso- and metatibiae each with two apical spurs; tarsal claws with basal tooth (after Li et al. 2015).

**Ecology.** The species of *Parexochomus* are aphidophagous or coccidophagous (Moddarres-Awal 2012).

**Parexochomus melanocephalus** (Zubkov, 1833)

Fig. 10

*Coccinella melanocephala* Zubkov, 1833: 339.

*Exochomus russicollis* Mulsant, 1850: 1033.

**General distribution.** Southern Russia, Caucasus (Mader 1955), Azerbaijan, Armenia, Bulgaria, Georgia, Iran, Kazakhstan, Tajikistan, Turkmenistan, Turkey, Uzbekistan (Kovář 2007).

**Distribution in Iran.** Razavi Khorasan (Yaghmaei and Kharrazi Pakdel 1995), Lorestan (Jafari and Kamali 2007), Chaharmahal and Bakhhtiari, Khorasan (Moddarres-Awal 2012), Kerman (Salehi et al. 2011), Hormozgan (Fallahzadeh et al. 2013).
Review of the tribe Chilocorini Mulsant from Iran (Coleoptera, Coccinellidae)

Figures 32–39. Morphological details and male genitalia of Chilocorini species 32–34 *E. quadripustulatus*: 32, 33 Tegmen in ventral and lateral view 34 Penis apex 35–36 *E. undulatus*: 35 Tegmen, ventral view 36 Penis apex 37–39 *E. octosignatus*: 37 Tarsal claw 38 Tegmen, ventral view 39 Penis apex.

*Parexochomus nigripennis* (Erichson, 1843)
Figs 11, 23, 28, 48–50

*Chilocorus nigripennis* Erichson, 1843: 267.
*Exochomus xanthoderus* Fairmaire, 1864: 648.

**Material examined.** 10♂, 16♀: Iran, Lorestan province, VII.2014, lgt. Amir Biravan, det. Biravan.

**General distribution.** Oriental region (Poorani 2002), Afrotropical region, Mediterranean region, Middle East (Kovář 2007).
**Distribution in Iran.** Golestan (Montazeri and Mossadegh1995), Lorestan (Jafari and Kamali 2007), Gilan (Hajizadeh et al. 2003), Fars, Kerman, Khorasan, Khuzestan, Sistan, and Baluchestan (Moddarres-Awal 2012), Lorestan (current study).

**Ecology.** This species feeds usually on the following hemipterans: *Acanthococcus abaii* (Eriococcidae), *Agonoscena pistaciae* (Psyllidae), *Bemisia tabaci* (Aleyrodidae) (Moddarres-Awal 2012).

**Figures 40–47.** Morphological details and male genitalia of Chilocorini species. 40–43 *E. gebleri*: 40 Tarsal claw 41, 42 Tegmen in ventral and lateral view 43 Penis apex 44–45 *P. pubescens*: 44–45 Tegmen in ventral and lateral view 46 Tip of penis 47 Penis.
**Figures 48–55.** Morphological details and male genitalia of Chilocorini species. 48–50 *P. nigripennis:* 48 Tegmen, ventral view 49 Penis apex 50 Penis 51–55 *P. nigromaculatus:* 51–53 Tegmen, ventral and lateral view 54 Penis 55 Penis apex.

**Parexochomus nigromaculatus (Goeze, 1777)**
Figs 12, 51–55

*Coccinella nigromaculata* Goeze, 1777: 248. *Coccinella testudinare* Geoffroy in Fourcroy, 1785: 151. *Coccinella aurita* Scriba, 1791: 101. *Coccinella humerale* Townson, 1800: 167.

*Chilocorus rufipes* Stephens, 1832: 375. *Exochomus collaris* Küster, 1849: 100. *Exochomus pyrenaicus* Kraatz, 1873: 194.
Material examined. 75♂, 90♀: Iran, Lorestan province, spring and summer 2013, 2014, 2015, 2016, 2017, lgt. Amir Biranvand, det. Biranvand. 3♂, 1♀: Iran, Semnan province, VI.2015, lgt. Mino Toozandejani, det. Biranvand.

General distribution. Palaearctic region (Duverger 1983, Kovář 2007).

Distribution in Iran. Widely distributed (Duverger 1983, Moddarres-Awal 2012).

Ecology. This species feeds usually on the following species of Hemiptera: Agonoscena pistaciae (Psyllidae), Aonidiella orientalis (Diaspididae), Bemisia tabaci (Aleyrodidae), Diuraphis noxia (Aphidae), Eulecanium prunastri (Coccidae), Euphyllura olivina (Psyllidae), Maconellicoccus hirsutus (Pseudococcidae), Therioaphis maculata (Aphididae) (Moddarres-Awal 2012) and other aphids and Coccidae (Uygun 1981, Athıhan and Öztökçe 2002, Kaydan et al. 2012).

Parexochomus pubescens (Küster, 1848)

Figs 13, 22, 44–47

Exochomus pubescens Küster, 1848: 94
Exochomus apicatus Fairmaire, 1884: 59.
Exochomus circumcinctus Sahlberg, 1903: 36.
Platynaspis flavidabris Motschulsky, 1849: 155.
Platynaspis flavidabris Mulsant, 1850b: 947. [Homonym]
Exochomus gestroi Fairmaire, 1875: 540.
Exochomus lugubrivestis Mulsant, 1853: 194.
Exochomus saharae Sicard, 1929: 60

Material examined. 3♂, 5♀: Iran, Lorestan province, VII.2014, lgt. Amir Biranvand, det. Biranvand.

General distribution. Oriental region, Palestine, Syria (Poorani 2002), Afghanistan, Algeria, Egypt, France, Greece, Iran, Israel, Italy, Libya, Morocco, Saudi Arabia, Spain, Tunisia (Kovář 2007).

Distribution in Iran. Angohran region, Hormozgan, Tehran (Karaj), Khuzestan (Susangerd), Ramine region, Daran region, Sagdan region (Duverger 1983), Lorestan (Jafari and Kamali 2007), Fars, Kerman, Khorasan, Khuzestan, Sistan, and Baluchestan (Moddarres-Awal 2012).

Ecology. This species feeds on Bemisia tabaci (Hemiptera: Aleyrodidae) and Tetranychus turkestani (Acari) (Moddarres-Awal 2012).

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