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## AN ANNOTATED CHECKLIST OF CRIOCERINAE (COLEOPTERA: CHRYSOMELIDAE) OF IRAN

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### Abstract

A checklist for Iranian Criocerinae Latreille (Coleoptera: Chrysomelidae) is proposed. Based on a literature review, a total of 13 species within four genera, *Crioceris* Geoffroy (five species), *Lilioceris* Reitter (four species), *Lema* Fabricius (one species) and *Oulema* Des Gozis (three species), are given. Among the listed species, *Lema* (*Lema*) *cyarella* Linnaeus, 1758 is a new record for the fauna of Iran.

KEY WORDS: Fauna, species diversity, catalogue, Criocerinae, Palaearctic, Iran

### Introduction

The subfamily Criocerinae (Coleoptera: Chrysomelidae), known as shining leaf beetles, includes 22 genera and about 1500 described species worldwide, of which more than 200 occur in the Palaearctic region (Schmitt, 2010; Bezděk & Schmitt, 2017). The majority of the taxa inhabit subtropical and tropical habitats and are arranged in five well-known genera; *Crioceris* Müller, 1764, *Lilioceris* Reitter, 1913, *Lema* Fabricius, 1798, *Oulema* Gozis, 1886, and lastly *Neolema* Monrós, 1951, which is known only from the New World (Matsumura *et al.*, 2014). Among these genera, *Lema* constitutes the largest group (about 900 species) with nearly 60% of the subfamily's identified species (Warchałowski, 2011; Vencł & Leschen, 2014).

Members of the subfamily are characterized by their glabrous, shiny appearance with a distinctly narrowed and constricted pronotum (Schmitt, 1988; White, 1993). Body coloration is usually used as an important character at species level. Like most other leaf beetles, Criocerinae have a strong plant association (primarily

monocots, occasionally eudicots) in all their life stages, and are considered to be mono- or oligophagous (Jolivet, 1988; Jolivet & Verma, 2002). Adults are leaf-miners and cause serious damage to the leaf surface, though there are some species that can also eat pollen, flowers and seeds (Jolivet & Hawkeswood, 1995). Several species are important agricultural pests or have been used in biocontrol activities, and over ten species are now distributed outside of their native ranges, e.g. *Oulema melanopus* (Linnaeus), due to long-distance transport of agricultural commodities (Vencel & Leschen, 2014). There are many Criocerinae species that have inadvertently extended their range across natural barriers or have been transported intentionally by human for biological control programs (Beenen, 2006; Noordijk *et al.*, 2016). Their close relation with agricultural and ornamental plants arouses global interest in natural enemies of some crop pests. However, for many taxa there is still a great lack of host-plant information.

Iran, with its large surface area, is one of the most diverse regions of the western Palaearctic. However, its insect fauna is still not fully explored. More comprehensive studies are needed in order to establish exact numbers and the many other unknown taxa. This paper provides a contribution for the current Chrysomelidae knowledge of Iranian fauna, comprising a summary of distributional data for each Criocerinae species as well as host-plant information for some of them.

## Materials and Methods

The published data on distribution of the subfamily Criocerinae (Coleoptera: Chrysomelidae) in Iran are summarized by province. Tribes, genera and species are listed alphabetically. The following data are included for each species: (1) valid name, (2) published Iranian records synthesized by province (classified in alphabetical order of province names) and the relevant references, (3) synthetic information on general distribution on a world scale. Classification, nomenclature and distribution of Criocerinae are mainly based on Schmitt (2010) and the updated list by Bezděk & Schmitt (2017). When accurate data about local distribution in Iran are lacking in a quoted reference, the mention "Iran (no locality cited)" is used. The provinces of Iran are shown in Figure 1.

## Results

In total, 13 species of Criocerinae (Coleoptera: Chrysomelidae) are listed for the fauna of Iran. Among them, *Lema (Lema) cyanella* Linnaeus, 1758 is a new record for the country. The list of species is given below alphabetically with related distributional data.

Family Chrysomelidae Latreille, 1802

Subfamily Criocerinae Latreille, 1804

Tribe Criocerini Latreille, 1804

Genus *Crioceris* Geoffroy, 1762

*Crioceris afghana* Medvedev, 1978

Distribution in Iran: Sistan & Baluchestan (Lopatin, 1985).

General distribution: Afghanistan, Iran.

*Crioceris asparagi* (Linnaeus, 1758)

Distribution in Iran: Golestan (Samin *et al.*, 2014), Mazandaran (Lopatin, 1981; Berti & Rapilly, 1976 as *Crioceris asparagi maculipes* Gebler, 1834).

General distribution: Albania, Armenia, Austria, Azerbaijan, Belgium, Bosnia Herzegovina, Bulgaria, Byelorussia, Croatia, Czech Republic, Denmark, Egypt, France, Great Britain, Georgia, Germany, Greece, Iran, Israel, Italy, Latvia, Lebanon, Liechtenstein, Lithuania, Macedonia, Moldavia, Montenegro, The Netherlands, Poland, Portugal, Romania, Russia, Serbia, Siberia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Syria, Tadjikistan, Turkey, Ukraine. Also introduced in North America (Le Sage *et al.*, 2008).

Plant associations in Iran: *Asparagus filifolius* Bertol. (Asparagaceae) (Berti & Rapilly, 1976).

*Crioceris bicrucata* (Sahlberg, 1823)

Distribution in Iran: Golestan (Samin, 2018).

General distribution: Bulgaria, Caucasus, Greece, Iran, Israel, Jordan, Kazakhstan, Macedonia, Tadjikistan, Turkey, Uzbekistan.

*Crioceris duodecimpunctata* (Linnaeus, 1758)

Distribution in Iran: Mazandaran (Berti & Rapilly, 1976; Lopatin, 1981), northern provinces [Elburz Mountains] (Farahbakhsh, 1961; Abai, 1984; Behdad, 1988; Modarres Awal, 1997; 2012).

General distribution: Albania, Armenia, Austria, Azerbaijan, Belgium, Bosnia Herzegovina, Bulgaria, Byelorussia, Croatia, Czech Republic, Denmark, Estonia, France, Great Britain, Georgia, Germany, Greece, Hungary, Iran, Italy, Kazakhstan, Korea, Kyrgyzstan, Latvia, Lithuania, Macedonia, Moldavia, Mongolia, Montenegro, The Netherlands, Poland, Portugal, Romania, Russia, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Syria, Tajikistan, Turkey, Turkmenistan, Ukraine. Also introduced in North America (LeSage *et al.*, 2008).

Plant associations in Iran: *Asparagus filifolius* Bertol. (Asparagaceae) (Berti & Rapilly, 1976), *Asparagus* sp. (Farahbakhsh, 1961; Modarres Awal, 1997; 2012).

*Crioceris quatuordecimpunctata* (Scopoli, 1763)

Distribution in Iran: Guilan (Aslan & Ghahari, 2017).

General distribution: Albania, Austria, Belgium, Bosnia Herzegovina, Bulgaria, Belarus, Croatia, Czech Republic, France, Germany, Hungary, Iran, Japan, Kazakhstan, North Korea, Moldavia, Poland, Romania, Serbia, Slovakia, Slovenia, Russia, Taiwan, Turkey, Ukraine.

Genus *Lilicercis* Reitter, 1913*Lilicercis antevallata* Jakob, 1954

Distribution in Iran: Chaharmahal & Bakhtiari (Jakob, 1954 – Holotype: Kuhrang), Isfahan (Berti & Rapilly, 1976).

General distribution: Endemic to Iran.

*Liliceris chodjajii* Berti & Rapilly, 1976

Distribution in Iran: Fars, Isfahan (Boroumand, 2000; Modarres Awal, 2012), Mazandaran (Berti & Rapilly, 1976 – Holotype: Bords du Sandabeh, Roud-Vandarbone, Alam-Kuk, Elburz).

General distribution: Endemic to Iran.

*Liliceris faldermanni* (Guérin-Méneville, 1844)

Distribution in Iran: Alborz (Lopatin, 1981; Mirzaei *et al.*, 2015), Ardabil (Padasht Dahkaii & Hagh Ghadam, 2006), East Azarbaijan, West Azarbaijan (Boroumand, 2000; Hagh Ghadam *et al.*, 2006; Modarres Awal, 2012; Samin, 2018), Kermanshah (Boroumand, 2000; Hagh Ghadam *et al.*, 2006; Modarres Awal, 2012), Kuhgiloyeh & Boyerahmad (Modarres Awal, 2012), Guilan (Hagh Ghadam *et al.*, 2006; Padasht Dahkaii & Hagh Ghadam, 2006; Modarres Awal, 2012).

General distribution: Armenia, Azerbaijan, Caucasus, Cyprus, Georgia, Greece, Iran, Iraq, Israel, Jordan, Romania, Russia, Syria, Turkey.

Plant associations in Iran: *Lilium ledebourii* (Liliaceae) (Hagh Ghadam *et al.*, 2006; Modarres Awal, 2012).

*Liliceris lillii lillii* (Scopoli, 1763)

Distribution in Iran: Iran (no locality cited) (Schmitt, 2010; Bezděk & Schmitt, 2017).

General distribution: Albania, Andorra, Armenia, Austria, Azerbaijan, Belgium, Bosnia Herzegovina, Bulgaria, Byelorussia, China, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Great Britain, Greece, Germany, Georgia, Hungary, Iran, Ireland, Israel, Italy, Jilin, Kazakhstan, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Macedonia, Moldavia, Mongolia, Montenegro, Norway, The Netherlands, Poland, Portugal, Romania, Russia, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Syria, Turkey, Ukraine. Also introduced in North America (Majka & LeSage, 2008; Majka & Kirby, 2011).

## Tribe Lemiini Gyllenhal, 1813

Genus *Lema* Fabricius, 1798*Lema (Lema) cyanella* (Linnaeus, 1758)

Material examined: East Azarbaijan province: Kaleybar (Kardujin), 29.05.2002, 1 ♀, 1 ♂, leg. P. Farhadi, on *Carduus* sp. (Asteraceae). New record for Iran.

General distribution: Albania, Austria, Belgium, Bosnia Herzegovina, Bulgaria, Belarus, China, Croatia, Czech Republic, Denmark, Finland, France, Germany, Great Britain, Greece, Hungary, Ireland, Italy, Japan, Kazakhstan, Latvia, Lithuania, Luxembourg, Moldavia, Mongolia, The Netherlands, North Korea, Norway, Poland, Romania, Russia, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Taiwan, Turkey, Ukraine. Also introduced in North America and New Zealand (Winston *et al.*, 2014).

Genus *Oulema* Des Gozis, 1886*Oulema duftschmidi* (Redtenbacher, 1874)

Distribution in Iran: Northern Khorasan (Bezděk & Baselga, 2015), Iran (no locality cited) (Berti, 1989).

General distribution: Afghanistan, Albania, Algeria, Andorra, Armenia, Austria, Azerbaijan, Belgium, Bosnia Herzegovina, Bulgaria, Byelorussia, China, Croatia, Cyprus, Czech Republic, Denmark, Finland, France, Germany, Great Britain, Greece, Hungary, Iran, Israel, Italy, Jordan, Kazakhstan, Kyrgyzstan, Latvia, Lebanon, Liechtenstein, Lithuania, Malta, Macedonia, Montenegro, Morocco, The Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Syria, Tadjikistan, Tunisia, Turkey, Turkmenistan, Ukraine, Uzbekistan.

*Oulema (Oulema) melanopus* (Linnaeus, 1758)

Distribution in Iran: Alborz, Qazvin (Mirzaei *et al.*, 2015), East Azarbaijan, Guilan (Modarres Awal, 2012), Golestan (Nahar-Khoran (in Gorgan), Shahpasand = Azadshahr) (Berti & Rapilly, 1973 as *Lema melanopus*; Boroumand, 2000), Hamadan (Nikbakhtzadeh & Tirgari, 2002), Isfahan (Naeem, 1983; Modarres Awal, 1997; 2012 as *Lema melanopus*), Ilam, Kerman, Kuhgiluyeh & Boyerahmad (Boroumand, 2000 as *Oulema melanopa*), Khuzestan, Razavi Khorasan (Farahbakhsh, 1961; Behdad, 1993; Modarres Awal, 1997; 2012 as *Lema melanopus*; Esmaili *et al.*, 2006 as *Eulema melanopa*; Boroumand, 2000), Mazandaran (Lopatin, 1981; Barari, 2019), Tehran (Farahbakhsh, 1961; Behdad, 1993; Modarres Awal, 1997; 2012 as *Lema melanopus*; Esmaili *et al.*, 2006; Boroumand, 2000; Mirzaei *et al.*, 2015), Iran (no locality cited) (Berti & Rapilly, 1976; Berti, 1989).

General distribution: Albania, Andorra, Armenia, Austria, Azerbaijan, Belgium, Bosnia Herzegovina, Bulgaria, Byelorussia, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Great Britain, Germany, Georgia, Greece, Hungary, Iran, Iraq, Ireland, Israel, Italy, Kazakhstan, Kyrgyzstan, Latvia, Lebanon, Liechtenstein, Lithuania, Luxembourg, Malta, Macedonia, Moldavia, Mongolia, Montenegro, Morocco, The Netherlands, Norway, Poland, Portugal, Romania, Russia, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Syria, Turkey, Ukraine. Also introduced in North America (Haynes & Gage, 1981; LeSage *et al.*, 2007).

Plant associations in Iran: *Avena sativa*, *Hordeum vulgare*, *Phalaris* sp., *Secale cereale*, *Setaria* sp., *Triticum vulgare*, *Zea mays* (Poaceae), *Centaurea* sp., *Cichorium* sp. (Asteraceae), *Convolvulus arvensis* (Convolvulaceae), *Cyperus rotundus* (Cyperaceae), *Glycyrrhiza* sp., *Medicago sativa*, *Trifolium* sp. (Fabaceae) (Farahbakhsh, 1961; Haddad Irani Nejad, 1981; Behdad, 1993; Modarres Awal, 1997; 2012).

*Oulema (Oulema) tristis tristis* (Herbst, 1786)

Distribution in Iran: Golestan (Samin *et al.*, 2018), Guilan (Aslan & Ghahari, 2017).

General distribution: Austria, Belarus, Belgium, Bosnia Herzegovina, Bulgaria, China, Croatia, Czech Republic, France, Germany, Hungary, Iran, Italy, Japan, Kazakhstan, Lithuania, Moldavia, Mongolia, North Korea, Poland, Romania, Russia, Serbia, Slovakia, Slovenia, Spain, Switzerland, Ukraine, Uzbekistan, former Yugoslavia.

## Discussion

To date, a total of 13 species of Criocerinae have been reported from Iran. The Palaearctic fauna includes about 200 species (Bezděk & Schmitt, 2017), with a 6.5% representation in Iran. Iran comprises 31 provinces but Criocerinae are currently recorded from only 21 (Golestan, Guilan and Mazandaran comprise more species with four each) (Fig. 1). Two species, *Lilioceris antevallata* and *Lilioceris chodjajii* are endemic to Iran. Additionally, the exact locality of one species (*Lilioceris lillii lillii* Scopoli, 1763) is unknown. Since Iran is a large country with various geographical regions and climates, a higher diversity is expected for this family in

the different regions. Extensive sampling should result in new findings (new country records, new distributional data and probably new species).

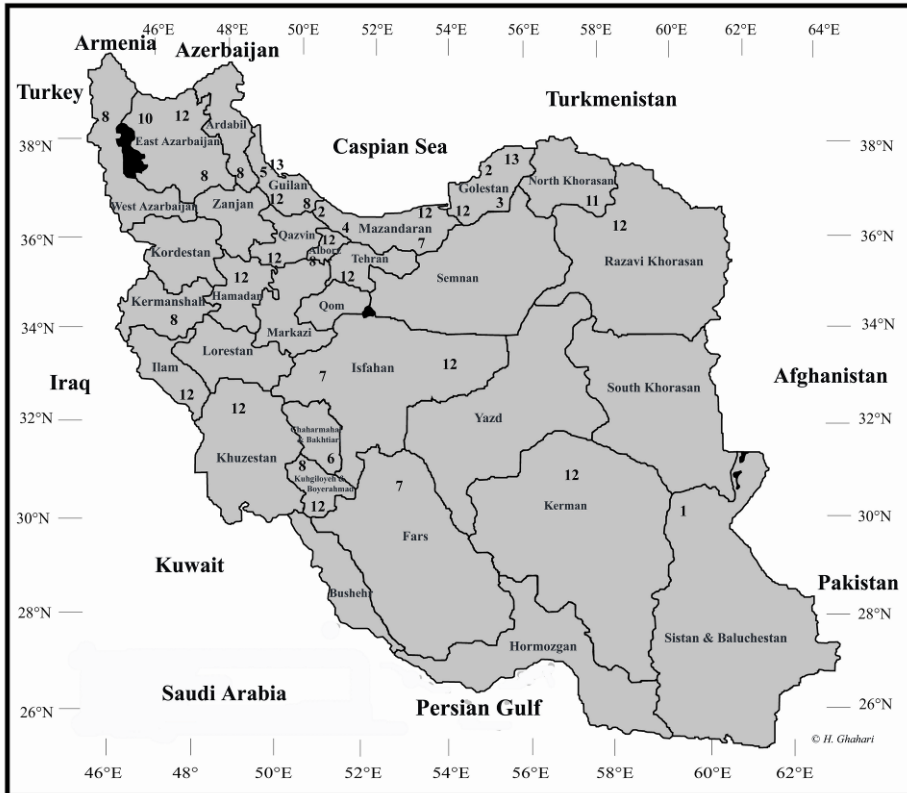


Figure 1. Map of Iran with provincial boundaries and species diversity of Criocerinae by province (numbers refer to species in the text).

Among the adjacent countries, the fauna of Russia, with 26 recorded species (Bezděk & Schmitt, 2017), was well studied followed by Turkey and Iran with 14 and 13 species, respectively (Fig. 2). No species has been recorded from the Arab Emirates, Bahrain and Kuwait so far: there has been no comprehensive study on the Criocerinae of these countries besides the Catalogue of Palaearctic Coleoptera (Bezděk & Schmitt, 2017). Additionally, Turkey shares the highest number of species with Iran, with 9 out of the 14 recorded species (64.2%), followed by Russia (eight species), Armenia and Azerbaijan (six species), Afghanistan, Iraq and Turkmenistan (two species).

Many plant species were reported as the hosts of Iranian Criocerinae. Most of them were listed in the checklists of Modarres Awal (1997; 2012) although some of them are doubtful. For example, reports of *Astragalus* sp. (Fabaceae) as the host plant of *Crioceris duodecimpunctata* (Farahbakhsh, 1961; Modarres Awal, 1997; 2012) are possibly not related to feeding, because *C. duodecimpunctata* is known as a serious pest of *Asparagus* species (Schmitt, 1988). Additionally, host records for *Oulema melanopus*, with the exception of Poaceae, need confirmation. These reports are probably based on observations of accidental

presence or resting on these plants. Representing a plant species as a host needs sufficient scientific evidence. Reliable records of host plants are based on observations of actual feeding by adults or larvae. Also, information can be gained by feeding tests. However, in this paper we apply "Plant associations in Iran" not "Host plants in Iran" in order to avoid these possible mistakes.

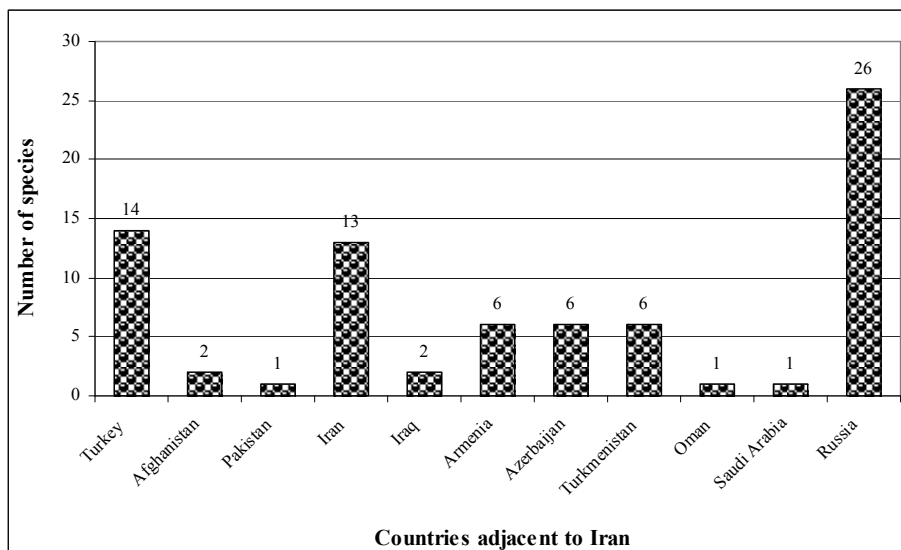


Figure 2. Criocerinae species numbers in Iran and adjacent countries.

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## ПОПИС ВРСТА CRIOCERINAE (COLEOPTERA: CHRYSOMELIDAE) ИРАНА

ЕБРУ ГУЛ АСЛАН И ХАСАН ГАХАРИ

## Извод

Предложен је попис врста Criocerinae Latreille (Coleoptera: Chrysomelidae) за фауну Ирана. На основу прегледа литературе представљено је укупно 13 врста унутар четири рода, *Crioceris* Geoffroy (пет врста), *Liloceris* Reitter (четири врсте), *Lema* Fabricius (једна врста) и *Oulema* Des Gozis (три врсте). Међу пописаним врстама, *Lema* (*Lema*) *cyanella* Linnaeus, 1758 је нови налаз за фауну Ирана.

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