

LACEWINGS (NEUROPTERA: CHRYSOPIDAE & HEMEROBIIDAE) FROM NORTH EASTERN AND EAST PROVINCES OF IRAN

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ABSTRACT: Surveys and collecting of the Iranian Neuroptera fauna over the last 133 years (including this survey) have resulted in a collective list including 51 species of Chrysopidae & Hemerobiidae, covering 25 of the 30 provinces. During 2006-2008, a faunistic survey of Chrysopidae & Hemerobiidae was made in North eastern and East provinces of Iran. As a result, 12 species were recorded, seven of which are new to the study areas, including one (*Hemerobius stigma* Stephens, 1836) new for Iran; three species previously reported in the literature were not encountered in the survey. This brings the total number of Chrysopidae & Hemerobiidae recorded from these provinces to 15. Clearly, more species are to be expected after more intensive collecting.

KEY WORDS: Neuroptera, Chrysopidae, Hemerobiidae, Iran, lacewings, Faunistic survey.

The families Chrysopidae and Hemerobiidae (superfamily Hemerobioidea), known as common lacewings and brown lacewings respectively, are the second and third largest families in the order Neuroptera. The two families are similar in general morphology, and green lacewings are possibly the more familiar to non-specialists. By comparison, Hemerobiidae are brownish instead of green, are generally smaller, with different wing venation and are distinguished by moniliform antennomeres (compared to filiform antennomeres in Chrysopidae).

The larvae of both families and a few adults of common lacewings are predaceous, chiefly on aphids, coccids and the other soft-bodied insects they encounter on plants. For this reason, some species have been reared and successfully used for the biological control of pests. To some degree, this biocontrol association drives research in this superfamily, resting on a platform of taxonomy, faunistics, behavioural biology and ecology.

During the years 2006 to 2008 surveys were made in North, Razavi and South Khorasan provinces, North eastern and East Iran, in cereal, sugarbeet and alfalfa fields, during which Chrysopidae and Hemerobiidae were collected and further studied. This paper is the result of that research and lays the foundation for further detailed analysis of species presence and ecology.

Study area

The study area includes 3 provinces of Iran namely North Khorasan, Razavi Khorasan and South Khorasan located in Northeastern and East Iran (30°24'-38°17'N & 55°17'-61°15' E), with an area approximately of 314000 sq. kilometres. It is bounded on the North by the Republic of Turkmenistan, on the East by

Afghanistan, on the South by the Provinces of Kerman and Sistan & Baluchestan, and on the West by provinces of Yazd and Semnan.

The area is a land of mountains and deserts. Northern mountainous region supports a relatively flourishing agricultural and pastoral economy, while deserts and salt plains, where life is centred around oases, dominate the Southern parts.

The survey was conducted in cereals (mainly wheat, but including barley), alfalfa and sugarbeet in an agro-ecosystem of fields often surrounded by sparse hedgerows of trees including apples, plums, cherries, walnuts, almonds and pistachio nuts. A few specimens from other ecosystems such as municipal green spaces and parks were included in the collecting area.

Reviewing the literature, it became clear that the Neuropteran fauna of Iran is not yet completely understood and would benefit from further detailed study. Field studies have hitherto been conducted in nearly all provinces, with specimen documentation focussed on lists of taxa found in regional assessments. Judging from the species additions to the Khorasan provinces we discuss below, this process is not yet complete. Relatively fewer records were known from the eastern provinces than for the western provinces of Iran and this paper is intended (in part) to address that issue, although it is clear that further work will be needed.

According to Mirmoayedi (2008), so far the list of Iranian Neuroptera is 192 species, of which, 46 and 4 species belongs to Chrysopidae and Hemerobiidae respectively. Among them, only 4 species were recorded from the eastern provinces. To the best of our knowledge there is no previous study of Neuropteran fauna in these provinces.

MATERIALS AND METHODS

During the years 2006-2008, the first two authors collected lacewings in different locations of Khorasan provinces. The majority of specimens were collected with a hand net by sweeping vegetation in a variety of situations from cereals, alfalfa and sugarbeet fields. Sometimes, lacewings were captured at lights or in a light trap. Specimens were killed in a killing jar using sodium cyanide and after 1 or 2 hours were pinned dry preserved in 75% ethanol.

Additional specimens from the collection of College of Agriculture were examined. Data, such as number of lacewings, locations and dates were recorded. Plant (or crop-type) associations for the field crops and surrounding vegetation were noted and compared (Table 1) to known crop associations listed in McEwen, New and Whittington (2001).

Vouchers were identified by the third author and deposited in the National Museums of Scotland, while the remainder of the specimens were deposited in the department of Plant Protection, College of Agriculture, Ferdowsi University of Mashhad, Iran.

RESULTS

A total of 10 species of Chrysopidae and two species of Hemerobiidae were recorded in this study (listed below). *Hemerobius stigma* Stephens, 1836 was new to the fauna of Iran. Both species of Hemerobiidae (*Wesmaelius (Kimminsia) navasi* and *Hemerobius stigma*) and 7 species of Chrysopidae (*Chrysopa pallens*, *Chrysopa walkeri*, *Chrysoperla lucasina*, *Chrysopidia ciliata*, *Cunctochrysa albolineata*, *Dichochrysa prasina*, and *Suarius vartianae*) were new for the study area. This brings the total number of Hemerobioidea recorded from the region to 15 (3 species listed in the literature were not encountered in our survey). The

following list includes records made by the authors supplemented by those reported in the literature prior to 2008 and includes comment on the plant association from which our collected material was taken.

Chrysopidae

Chrysopa dubitans McLachlan, 1887

2 females Mashhad 26 April 2007, S. Farahi; 3 males, 12 females Fariman, 29 April 2008, S. Farahi; 1 male, 2 females Chenaran, 20 June 2007, S. Farahi.

Associations: 11 out of 20 specimens were caught in cereal fields and 9 were caught in alfalfa fields.

Previous provincial records for Iran: Sistan and Baluchistan, Tehran (Hölzel, 1967); Kermanshah, Tehran, Zanjan (Moddarres awal, 1997); Lorestan (Shakarami, 1997); Hormozgan, Kermanshah, Markazi (Mirmoayedi, 1998); Fars (Mirmoayedi, 1999a); Mashhad (Mirmoayedi, 2000).

Chrysopa pallens (Rambur, 1838)

2 females Mashhad, 31 May 2007, S. Farahi; 3 females Toos, 28 April 2008, H. Sadeghi. First record from Khorasan province.

Associations: 3 out of 5 specimens were caught in sugarbeet fields and 2 were caught in cereal fields.

Previous provincial records for Iran: Tehran (Hölzel, 1967); Hormozgan, Ilam, Kermanshah, Khuzestan, Markazi (Mirmoayedi, 1998); Kermanshah (Mirmoayedi, 2008).

Chrysopa walkeri McLachlan, 1893

2 females Toos, 5 May 2007, S. Farahi; 4 females Fariman (surroundings Mashhad), 14 May 2008, S. Farahi. First record from Khorasan provinces.

Associations: 2 out of 6 specimens were caught in alfalfa fields and 4 were caught in cereal fields.

Previous provincial records for Iran: unspecified location (Heidari, 1995).

Chrysoperla carnea (Stephens, 1836)

7 females, Chenaran, 10 May 2007, S. Farahi; 12 males, 20 females Fariman, 15 April 2008, S. Farahi; 5 females, Shirvan, 2 June 2005 M. Saberi; 2 females, Birjand, 21 April 2008 H. Sadeghi.

Associations: 14 out of 46 specimens were caught in sugarbeet fields, 14 were caught in alfalfa fields and 18 from cereal fields.

Previous provincial records for Iran: Tehran (Hölzel, 1967); Azarbijan, Chahr mahal, Golestan, Hamadan, Isfahan, Kerman, Kermanshah, Khuzestan, Kohkeylouye, Kurdistan, Lorestan Markazi, Mazandaran, Tehran, Yazd, Zanjan, (Modarres awal, 1997); Guilan, Hormozgan, Ilam, Kermanshah, Khuzestan, Markazi, Teran (Mirmoayedi, 1998).

Chrysoperla lucasina (Lacroix, 1912)

3 females Mashhad, 27 May 2007, S. Farahi; 2 males Akhengan (Mashhad), 4 May 2008, S. Farahi. First record from Khorasan provinces.

Associations: 2 out of 5 specimens were caught in alfalfa fields, 2 from sugarbeet fields and 1 was caught in a cereal field.

Previous provincial records for Iran: Kermanshah (Mirmoayedi, 2002b). The taxonomy of the species within the “*carnea*-complex” have recently been the focus of detailed research, an overview of which is discussed in detail by Canard & Thierry (2005). As a consequence of previous ambiguous placement of species with the complex and confusion concerning the morphological separation of these species, previous records of this complex may have been confused or combined with *Chrysoperla carnea* (Stephens, 1836). Thus, *Chrysoperla lucasina* may indeed be more common in Iran and in Khorasan provinces than previously been reported, but misplaced in the (then) portmanteau group “*carnea*”. Until any such previous specimens are found and examined, we report this as the first instance that this species has occurred in this part of Iran.

Chrysopidia ciliata (Wesmael, 1841)

1 female Kazemabad (Mashhad), 9 May 2008, S. Farahi; 2 females Parkand abad (Mashhad), 15 May 2007, S. Farahi.

Associations: 1 out of 3 specimens was caught in a sugarbeet field and 2 were caught in cereal fields.

Previous provincial records for Iran: “North Iran” (Heidari, 1995).

***Cunctochrysa albolineata* (Killington, 1935)**

1 female Toos, 25 May 2008, S. Farahi; 2 males Golmakan (Mashhad), 16 May 2007, S. Farahi. First record from Khorasan provinces.

Associations: all 3 specimens were caught in alfalfa fields.

Previous provincial records for Iran: "North Iran" Ari *et al.* (2007).

***Dichochrysa derbendica* (Hölzel, 1967)**

This species, previously recorded in Mashhad (and Kermanshah) by Mirmoayedi (2000) and "North Iran" by Heidari (1995) was not encountered in our survey.

***Dichochrysa prasina* (Burmeister, 1839)**

2 females Mashhad, 23 April 2007 and 1 male, 2 females 29 April 2008, S. Farahi. First record from Khorasan provinces.

Associations: 3 out of 5 specimens were caught in alfalfa fields and 2 were caught in cereal fields.

Previous provincial records for Iran: Guilan, Kermanshah, Markazi (Mirmoayedi, 1998).

***Suaris fedtschenkoii* (McLachlan in Fedchenko, 1875)**

2 females Mashhad, 1 June 2007, S. Farahi; 1 male Soran, 30 May 2007, S. Farahi.

Associations: all 3 specimens were caught in cereal fields.

Previous provincial records for Iran: Lorestan (Shakarami, 1997); Hormozgan, Khuzestan, Markazi (Mirmoayedi, 1998); Fars, Kermanshah (Mirmoayedi, 1999a); Mashhad, Esfraeen Mirmoayedi (2000; as *Chrysopa fedtschenkoii*).

***Suaris mongolica* (Tjeder, 1936)**

This species, previously recorded in Khorasan by Heidari (1987, 1995) was not encountered in our survey.

Previous provincial records for Iran: Golestan, Khorasan, Tehran (Heidari, 1987, 1995)

***Suaris nanus* (McLachlan, 1893)**

This species, previously recorded in Mashhad by Mirmoayedi (1999b) was not encountered in our survey.

Previous provincial records for Iran: Tehran (Hölzel, 1967); Isfahan, Sistan and Baluchistan, Tehran (Modarres awal, 1997); Lorestan (Shahkarami, 1997); Ilam, Kermanshah, (Mirmoayedi, 1998); Fars (Mirmoayedi, 1999a); Kermanshah, Mashhad (Mirmoayedi, 1999b); Khuzestan (Sharifi fard & Mosaddegh, 2006).

***Suaris vartianae* (Hölzel, 1967)**

3 females Parkand abad (Mashhad), 26 May 2008, S. Farahi. First record from Khorasan provinces.

Associations: 1 out of 3 specimens was caught in an alfalfa field and 2 were caught in cereal fields.

Previous provincial records for Iran: Tehran (Hölzel, 1967); Hormozgan, Tehran (Modarres awal, 1997); Kermanshah, (Mirmoayedi, 1998).

Hemerobiidae***Hemerobius stigma* Stephens, 1836**

1 male Akhengan (Mashhad) and 1 female Mashhad, 24 May 2008, S. Farahi.

First records from Iran.

Associations: 1 of the specimens was caught in a sugarbeet field the other was caught in a cereal field.

***Wesmaelius (Kimminsia) navasi* (Andréu, 1911)**

1 male Mashhad, 30 May 2008, S. Farahi. First record from Khorasan provinces.

Associations: the specimen was caught in an alfalfa field.

Previous provincial records for Iran: Kermanshah (Mirmoayedi, 1993); Mazandran (Modarres awal, 1997); Hormozgan, Hormozgan (Mirmoayedi, 1998).

DISCUSSION

The Iranian Chrysopids and hemerobiid fauna was previously represented by 46 and 4 species respectively (Mirmoayedi 2008), covering 25 of the thirty provinces of Iran. Earlier reports of the Iranian Chrysopidae and Hemerobiidae fauna include: Ari, *et al.* (2007), Daniali, *et al.* (1995), Heidari (1965, 1987 and 1995), Hölzel (1967), Mirmoayedi (1993, 1995, 1998, 1999a,b, 2000, 2002a, b and

2008); Mirmoayedi *et al.* (1998), Modarres awal (1997), Shahkarami (1997) and Sharifi fard & Mosaddegh (2006). With this study, we collectively increase the number of species of these two families in Iran to 51 species, by the addition of *Hemerobius stigma* and increase the number of species known in Khorasan provinces from 6 to 15:

Previously recorded:

- *Chrysopa dubitans* McLachlan, 1887
- *Chrysoperla carnea* (Stephens, 1836)
- *Dichochrysa derbendica* (Hölzel, 1967)
- *Suarius fedtschenkoi* (McLachlan in Fedchenko, 1875)
- *Suarius mongolica* (Tjeder, 1936)
- *Suarius nanus* (McLachlan, 1893)

First records from Iran.

- *Hemerobius stigma* Stephens, 1836

First record from Khorasan provinces:

- *Chrysopa pallens* (Rambur, 1838)
- *Chrysopa walkeri* McLachlan, 1893
- *Chrysoperla lucasina* (Lacroix, 1912)
- *Chrysopidia ciliata* (Wesmael, 1841)
- *Cunctochrysa albolineata* (Killington, 1935)
- *Dichochrysa prasina* (Burmeister, 1839)
- *Suarius vartiana* (Hölzel, 1967)
- *Wesmaelius (Kimminsia) navasi* (Andréu, 1911)
- *Hemerobius stigma* Stephens, 1836

The crop associations from which samples were collected in this survey, while not a direct pest association, are helpful in linking the data to crops for later consideration in crop protection. In relation to the broader literature (see McEwen, New and Whittington (2001)) these records are both confirmation of previous associations and include the incorporation of new ones.

The three crop types surveyed yielded a total of 10 species of Chrysopidae and two species of Hemerobiidae in the following associations (Table 1):

- wheat 8 species of Chrysopidae and 1 species of Hemerobiidae
- sugarbeet 4 species of Chrysopidae and 1 species of Hemerobiidae
- alfalfa 7 species of Chrysopidae and 1 species of Hemerobiidae
- only *Chrysoperla carnea* was found on all three crops
- *Cunctochrysa albolineata* and *Wesmaelius (Kimminsia) navasi* were only caught in alfalfa fields
- wheat and sugarbeet yielded: *Chrysopa pallens*, *Chrysopidia ciliata* and *Hemerobius stigma*
- wheat and alfalfa yielded: *Chrysopa dubitans*, *Chrysopa walkeri*, *Dichochrysa prasina* and *Suarius vartiana*
- sugarbeet and alfalfa yielded: *Chrysoperla lucasina*.

Only *Chrysoperla carnea* and *Chrysoperla lucasina* had previous associations with wheat, sugarbeet (in the case of *C. carnea*) and alfalfa mentioned in the literature. Most of the species have in the past been associated with the various

trees surrounding the crop types examined (see Table 1) and at present we cannot rule out the possibility of drift from the surrounding hedgerows into the fields and collecting sites. Even if such drift is found to be the case, it re-confirms the notion that species residing in the vegetation at the crop edges can be valuable in control of pests within the crop (Szentkirályi, 2001a). This, and confirmation of the pest species that the lacewings are preying on will be the focus of further research in the area, along with more widespread (in a geographical sense) collecting.

CONCLUSIONS

The majority of species collected in this study were found in low abundance, with the exception of *Chrysoperla carnea* (46 specimens) and *Chrysopa dubitans* (20 specimens). Consequently there is a need to reinforce these data with on going surveying and additional intensive collecting, which are expected to yield more species, clearer prey-associations and a better understanding of community dynamics and relative abundance. Moreover, we hope to better analyse the lacewing-pest and lacewing-crop associations and understand the relative population densities, proportion of drift and the potential for crop protection. A much wider geographical survey is also clearly required, given that to date the records for Khorasan provinces are sparse.

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