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Three new records of the genera *Leiophron* and *Euphorus* (Hym.: Braconidae: Euphorinae) from Iran

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Abstract

The parasitoid wasps of the genera *Leiophron* Nees and *Euphorus* Nees were studied in northern Iran (Guilan, Mazandaran and Alborz provinces). The specimens were collected using Malaise traps from different habitats during 2010-2011. Four species of both genera were collected and identified, of which three species, *Euphorus pallidistigma* (Curtis), *E. similis* (Curtis) and *Leiophron fascipennis* (Ruthe) are newly recorded from Iran. An identification key for these four species together with comments on diagnostic characters and geographical distribution of each species are presented.

Key words: Braconidae, Euphorinae, *Leiophron*, *Euphorus*, new record, Northern Iran

چکیده

سه گزارش جدید از جنس‌های *Leiophron* و *Euphorus* از ایران (Hym.: Braconidae: Euphorinae)

سمیرا فراهانی، علی اصغر طالبی، کیز فن آختربرگ و احسان رخشانی

زنبورهای پارازیتویید جنس‌های *Leiophron* Nees و *Euphorus* Nees در شمال ایران (استان‌های گیلان، مازندران و البرز) مورد بررسی قرار گرفت. نمونه‌ها به‌وسیله‌ی تله‌ی مالیز از زیستگاه‌های مختلف در طی سال‌های ۱۳۹۰-۱۳۸۹ جمع‌آوری شدند. چهار گونه از این دو جنس جمع‌آوری و شناسایی گردید که از بین آن‌ها سه گونه‌ی *Euphorus pallidistigma* (Curtis)، *E. similis* (Curtis) و *Leiophron fascipennis* (Ruthe) گزارش جدید برای ایران محسوب می‌شوند. کلید شناسایی این چهار گونه به‌همراه توضیحاتی در مورد صفات تشخیصی و انتشار جغرافیایی گونه‌ها ارائه شده است.

واژگان کلیدی: Braconidae، Euphorinae، *Leiophron*، *Euphorus*، گزارش جدید، شمال ایران

Introduction

The subfamily Euphorinae with a worldwide distribution, is one of the largest subfamilies of Braconidae and contains 53 genera and 1198 described species (Yu *et al.*, 2012). This subfamily includes small, medium-sized and large braconids. Species of Euphorinae have a diverse biology, containing solitary or gregarious endoparasitoids of adults and larvae of other insects, such as Lepidoptera, Coleoptera, Hemiptera, Psocoptera and Hymenoptera (van Achterberg, 1976; Shaw & Huddleston, 1991).

The species of the genus *Leiophron* Nees are parasitoids of nymphs and adults of the leaf bugs (Hem.: Miridae) and seed bugs (Hem.: Lygaeidae). *Euphorus* Nees are parasitoids of barklice or booklice (Insecta: Psocoptera) (Chen & van Achterberg, 1997). Both genera can be distinguished by extremely short marginal cell of fore wing (less than 0.5 times the maximum width of pterostigma), small or absent subbasal cell of hind wing, and frons without median carina. In *Euphorus*, the occipital carina is separated from the hypostomal carina (Chen & van Achterberg, 1997).

The genera *Leiophron* and *Euphorus* have few described species and little information is available on their taxonomy. The taxonomy of both genera has recently been studied by different authors (Loan, 1974; Shaw, 1985; Chen & van Achterberg, 1997; Simbolotti *et al.*, 2002; Goulet & Mason, 2006). Loan (1974) listed 11 species of *Leiophron* in Europe and Simbolotti *et al.* (2002) presented a provisional key for Western Palaearctic species. Three species of the genus *Leiophron*, viz. *L. pseudomitis* (Hedwig), *L. deficiens* (Ruthe) and *L. heterocordyli* Richards), have hitherto been reported from Iran (Hedwig, 1957; Ghahari & Fischer, 2011).

The objective of this research was (1) to study the occurrence of the genera *Leiophorn* and *Euphorus*, and (2) to determine the species that are distributed in the northern provinces of Iran. This would be a first step for biological control of some important species of true bugs.

Materials and methods

Adult specimens were collected from different habitats at the northern provinces (Guilan, Mazandaran and Alborz provinces) of Iran during 2010 to 2011 using Malaise traps. The specimens were removed from the traps and sorted weekly. They were identified using the key by Loan (1974) and an unpublished key by van Achterberg. Images were captured using an Olympus AX70 microscope and Olympus SZX9 stereomicroscope equipped with a Sony CCD digital camera. Terminology of the morphological characters follows that of van Achterberg (1976). The accepted name of the species follows that of Yu *et al.* (2012). The specimens are deposited in the insect collection of the Department of Entomology, Tarbiat Modares University, Tehran, Iran.

Results

A total of four species belonging to the genera *Leiophron* and *Euphorus* were collected and identified as follows: *Euphorus pallidistigma* (Curtis), *E. similis* (Curtis), *Leiophron fascipennis* (Ruthe) and *L. deficiens*. Among them, the first three species are new records to Iran.

Key to the species of the genera *Leiophron* and *Euphorus* in Iran

1. Occipital carina straight ventrally and remaining separated from hypostomal carina (genus *Euphorus*).... 2

- Occipital carina curved towards and joined hypostomal carina or at least connected to it by a branch (genus *Leiophron*)..... 3

2- Notauli absent; flagellum pale yellow..... ..... ***E. pallidistigma***

- Notauli present and very well indicated; flagellum reddish yellow ..... ***E. similis***

3- Subbasal cell of hind wing closed (fig. 3, C); fore wing venation reduced, basal cell with less than 20 setae (fig. 2, C), discal and subdiscal cells without a brownish pigmented band; length of first metasomal tergite about 2.0 as long as its apical width (fig. 5, C)... ..... ***L. deficiens***

- Subbasal cell of hind wing open (fig. 3, B); fore wing venation complete, basal cell with more than 20 setae, discal and subdiscal cells with a well developed brownish pigmented band; length of first metasomal tergite at least 3.0 times as long as its apical width (fig. 5, D); ..... ***L. fascipennis***

- *Euphorus pallidistigma* (Curtis, 1833)

(Figs. 1-5, A)

Material examined – IRAN, Guilan province: Roodsar, Ziaz, 36°52'27.18" N, 50°13'24.78" E, 490 m.a.s.l., 7.vi.2010 (1 ♀), 13.vi.2010 (1 ♀); Roodsar, Orkom, 36°45'44.34" N, 50°18'11.88" E, 1201 m.a.s.l., 30.v.2010 (1 ♀), 6.vi.2010 (1 ♂), 27.vi.2010 (1 ♂); Mazandaran province: Noor, Tangeh-Vaz, 36°18'51.42" N, 52°07'48.00" E, 702 m.a.s.l., 21.vi.2011 (1 ♀), 27.vi.2011 (1 ♀); all specimens collected by M. Khayrandish.

Diagnosis – Female. Antenna with 14 flagellomeres (fig. 4, A); fore wing venation complete and pale yellow in colour, vein 1-SR+M present, first submarginal, discal and subdiscal cells distinct, basal cell with more than 30-40 setae, pterostigma 2.1 times as long as its width (fig. 2, A); vein cu-a of hind wing absent (fig. 3, A); mesoscutum without notauli; first metasomal tergite weakly reticulate, about twice as long as its apical width (fig. 5, A).

Male. Ventral face of parameres of genitalia with median and apical hooks, deeply sclerotised and large.

Colouration – Body generally blackish brown; antennae and legs pale yellow; head and mesosoma black; sides of pronotum brown (fig. 1, A).

Distribution – Azerbaijan, former Czechoslovakia, France, Germany, Hungary, Ireland, Kazakhstan, Korea, Netherlands, Poland, Russia, Ukraine, United Kingdom, Uzbekistan (Yu *et al.*, 2012) and new record from Iran.

Hosts – Hemiptera: Miridae: *Orthotylus adenocarpi* (Perris), *O. virescens* (Douglas & Scott), *O. concolor* (Kirschbaum), *Asciodema obsoletum* (Fieber) and *Pachylops bicolor* (Douglas & Scott) (Waloff, 1967).

- *Euphorus similis* (Curtis, 1833)

(Figs. 1-5, B)

Material examined – IRAN, Guilan province: Roodsar, Ziaz, 36°52'34.44" N, 50°13'17.40" E, 537 m.a.s.l., 6.vi.2010 (1 ♀), leg. A. Nadimi.

Diagnosis – Female. Antenna with 14 flagellomeres (apical half of antenna darker than basal half) (fig. 4, B); fore wing venation complete, vein 1-SR+M present, first submarginal, discal and subdiscal cells distinct, basal cell with more than 40 to 50 setae, pterostigma about 2.3 times as long as its width (fig. 2, B); vein cu-a of hind wing absent (fig. 3, B); mesoscutum with distinct notauli; first metasomal tergite weakly reticulate, about twice as long as its apical width (fig. 5, B).

Colouration – Body generally blackish brown; antennae light brown; legs pale yellow; head and mesosoma blackish brown (fig. 1, B).

Distribution – Belgium, Croatia, former Czechoslovakia, Finland, France, Germany, Hungary, Ireland, Italy, Kazakhstan, Netherlands, Norway, Poland, Sweden, Switzerland, United Kingdom, former Yugoslavia (Yu *et al.*, 2012) and new record from Iran.

Hosts – Coleoptera: Chrysomelidae: *Longitarsus longipennis* Kutschera, *L. pellucidus* (Foudras), *Phyllotreta nigripes* Fabricius, *P. undulata* (Kutscher) and *Psylliodes attenuatus* (Koch); Psopcoptera: Caeciliusidae: *Caecilius flavidus* Stephens (Yu *et al.*, 2012).

- *Leiophron deficiens* (Ruthe, 1856)

(Figs. 1-5, C)

Material examined – IRAN, Alborz province: Karaj, 35°46'20.16" N, 50°56'44.94" E, 1278 m.a.s.l., 14.vi.2010 (2 ♀♀); Shahriar, 35°40'08.01" N, 50°56'56.64" E, 1168 m.a.s.l., 17.v.2010 (1 ♀), 24.v.2010 (1 ♀), 31.v.2010 (1 ♀), 21.vi.2010 (1 ♀), 18.x.2010 (2 ♀♀); all specimens collected by A. Nadimi.

Diagnosis – Female. Antenna with 13 flagellomeres (fig. 4, C); fore wing venation incomplete, vein 1-SR+M absent, first submarginal, discal and subdiscal cells effaced, basal cell less than 20 setae and clearly less setose than first discal cell, pterostigma 2.1 times as long as width (fig. 2, C); vein cu-a of hind wing present, subbasal cell narrow (fig. 3, C); first metasomal tergite weakly striate, about twice as long as its apical width (fig. 5, C).

Colouration – Body generally reddish brown; head, sides of pronotum and legs yellow; base of pterostigma paler than brownish apical half (fig. 1, C).

Distribution – Finland, Germany, Greece, Hungary, Kazakhstan, Korea, Moldova, Poland, Russia (Krasnodar Kray, Primor'ye Kray, Yakutskaya Respublika), Sweden, Turkey, Ukraine (Yu *et al.*, 2012) and Iran (Ghahari & Fischer, 2011).

Hosts – Hemiptera: Miridae: *Polymerus cognatus* (Fieber), *Creontiades pallidus* (Rambur), *Campylomma diversicornis* Reuter (Yu *et al.*, 2012).

- *Leiophron fascipennis* (Ruthe, 1856)

(Figs. 1-5, D)

Material examined – IRAN, Guilan province: Roodsar, Ziaz, 36°52'34.44" N, 50°13'17.40" E, 537 m.a.s.l., 6.vi.2010 (1 ♂), leg. M. Khayrandish.

Diagnosis – Male. Antenna with 15 flagellomeres (fig. 4, D); fore wing venation complete, vein 1-SR+M present, first submarginal, discal and subdiscal cells distinct, basal cell with more than 30 setae and clearly less setose than first discal cell, pterostigma 2.3 times as long as width, brownish pigmented band distinct (fig. 2, D); vein cu-a of hind wing absent (fig. 3, D); mesoscutum without trace of notauli; first metasomal tergite reticulate, longer than 3 times its apical width (fig. 5, D); ventral face of parameres in genitalia without median and apical hooks.

Colouration – Body generally yellow; head yellow; legs pale yellow; base of pterostigma paler than brownish apical half (fig. 1, D).

Distribution – Former Czechoslovakia, France, Germany, Hungary, Korea, Russia, Switzerland, United Kingdom (Yu *et al.*, 2012) and new record from Iran.

Hosts – Unknown.

Discussion

According to our research and previous studies, six species of *Leiophron* and *Euphorus* are present in Iran. *Leiophron heterocordyli* and *L. deficiens* have been reported from Guilan and Mazandaran provinces, respectively (Ghahari & Fischer, 2011). In the current study, *L. deficiens* is recorded from Alborz province. The specimens were collected using Malaise traps, therefore the biology of the recorded species is unknown. According to the literature, *Leiophron* and *Peristenus* Förster, are endoparasitoids of *Lygus* spp. in Europe (Loan & Shaw, 1987; Haye, 2004). Female wasps of the most species of *Leiophron* tend to oviposit in the second and third instar nymphs of Miridae (Loan & Shaw 1987); however, *Leiophron* (*Mama*) *reclinator* (Ruthe) is an adult parasitoid of *Lygocoris pabulinus* (L.) and *Liocoris tripustulatus* (Fabricius). Three species of the genus *Leiophron* (i.e. *L. australis* Goulet & Mason, *L. lygivorus* (Loan) and *L. simony* Goulet & Mason) have successfully been reared from *Lygus lineolaris* (Palisot de Beauvois). *Leiophron uniformis* (Gahan) has been reared from several mirid hosts, such as *Lygus elisus* Van Duzee, *L. lineolaris*, *Halticus bractatus* (Say), *Adelphocoris lineolatus* (Goeze), *Trigonotylus caelestialium* (Kirkaldy), *T. tenuis* Reuter, and *Pseudatomoscelis seriatus* (Reuter) in North America (Goulet & Mason, 2006). Parasitism levels of *L. uniformis* can reach up to 100% on *Lygus hesperus* (Knight), indicating the potential of this parasitoid for biological control of leaf bugs (Norton *et al*., 1992). Furthermore, *Leiophron argentinensis* Shaw readily parasitize *L. lineolaris* and *L. hesperus* (Williams *et al.*, 2003). In Turkey, *L. deficiens* was found to be a parasitoid of the mirid species, *C. diversicornis* (Efil *et al*., 2009).

The species of *Leiophron* have a cosmopolitan distribution (Chen & van Achterberg, 1997) and it is likely that other species of this genus occur in Iran. Therefore, more research is needed to be carried out to assess their potential as biological control agents against Hemipteran pests in Iran. Its application in biological control programs may suppress pest population levels below the economic thresholds.

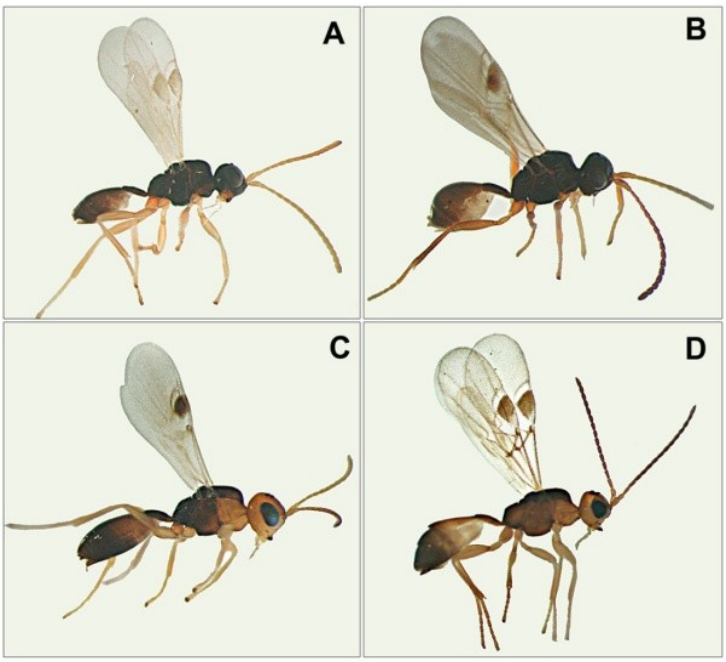

Fig. 1. *Euphorus* and *Leiophron* species; lateral habitus: (A) *Euphorus pallidistigma*, (B) *E. similis*, (C) *Leiophron deficiens*, (D) *L. fascipennis*.

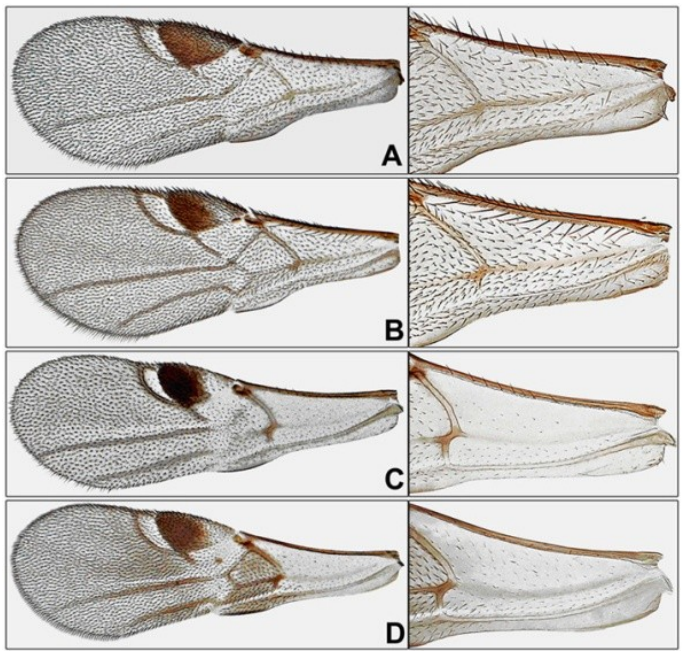

Fig. 2. Fore wing (left) and its subbasal cell (right) in *Euphorus* and *Leiophron* species: (A) *Euphorus pallidistigma*, (B) *E. similis*, (C) *Leiophron deficiens*, (D) *L. fascipennis*.

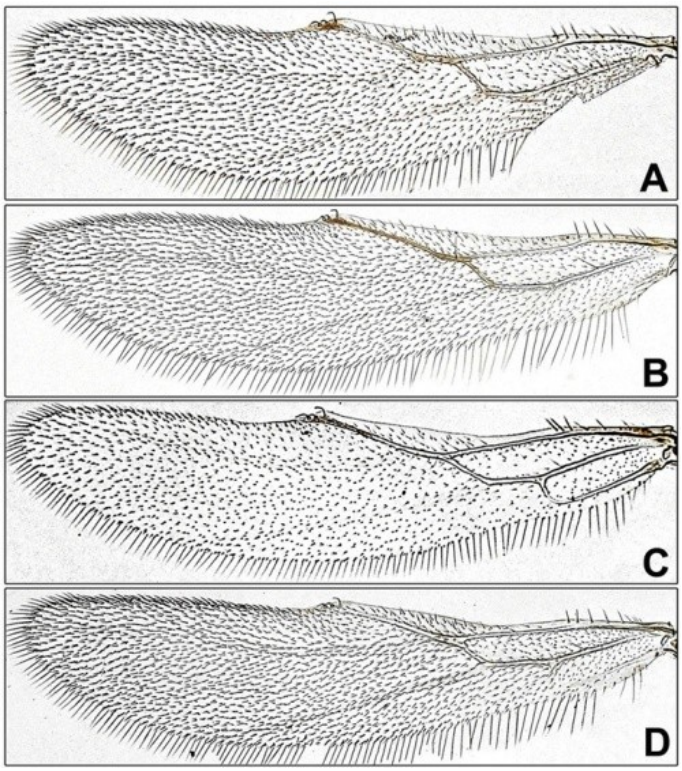

Fig. 3. Hind wing in *Euphorus* and *Leiophron* species: (A) *Euphorus pallidistigma*, (B) *E. similis*, (C) *Leiophron deficiens*, (D) *L. fascipennis*.

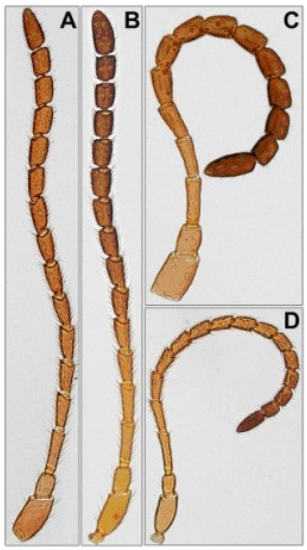

Fig. 4. Antenna in *Euphorus* and *Leiophron* species: (A) *Euphorus pallidistigma*, (B) *E. similis*, (C) *Leiophron deficiens*, (D) *L. fascipennis*.

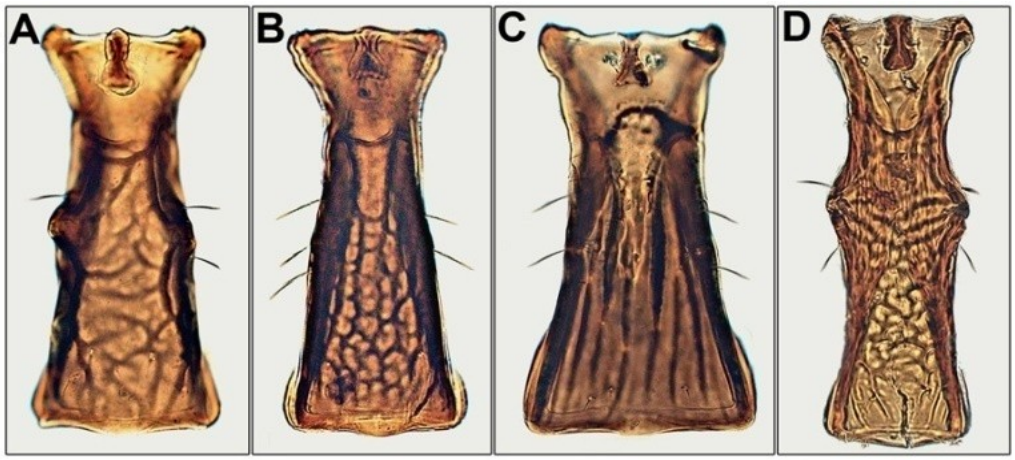

Fig. 5. First metasomal tergite in *Euphorus* and *Leiophron* species: (A) *Euphorus pallidistigma*, (B) *E. similis*, (C) *Leiophron deficiens*, (D) *L. fascipennis*.

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