A new species of *Aphidius* Nees, 1818 (Hymenoptera, Braconidae, Aphidiinae) attacking *Uroleucon* aphids (Homoptera, Aphididae) from Iran and Iraq

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Abstract
A new endemic aphid parasitoid species, *Aphidius persicus* sp. n., parasitic on *Uroleucon chondrillae* (Nevsky) in Iran and Iraq, is described. The identities of the new species and other co-existing species of *Aphidius* are discussed. In the parasitoid association with *Uroleucon* aphids, *A. persicus* sp. n. probably replaces *Aphidius funebris* Mackauer in the studied area. The latter species is a common member of the parasitoid guild on *Uroleucon* species in the Western Palaearctic and Western Mediterranean.

Keywords: *Aphidiinae*, *Aphidius*, Iran, Iraq, *Uroleucon*

Introduction
All members of the braconid subfamily Aphidiinae are solitary endoparasitoids of aphids (Mackauer and Starý 1967; Starý 1970). Among them, the genus *Aphidius* Nees is the largest (with about 70 species worldwide), attacking many aphid genera and species (Pungerl 1986). Two species of *Aphidius* have been known to attack *Uroleucon* spp. in the Western Palaearctic: *Aphidius funebris* Mackauer and *Aphidius uroleuci* Mescheloff and Rosen (Mescheloff and Rosen 1990; Tomanovic´ et al. 2003b). *Aphidius ohiensis* Smith is a parasitoid of *Uroleucon* spp. in the Nearctic (Pike et al. 2000). *Aphidius funebris* is the only known species from Central Asia parasitic on *Uroleucon* spp. (Starý 1979; Starý et al. 1998, 2000).
A continuous research programme on aphid parasitoids within a broader faunal context and including revisionary taxonomy of individual parasitoid taxa targeting pest aphids in forests, urban agglomerations, cultivated landscapes (fruit trees, crops, and ornamentals), and native ecosystems is being undertaken in Iran.

**Material and methods**

Specimens were collected during 2003–2005 from different localities in three provinces of Iran and also during 1968–1970 in Iraq. Samples of aphid colonies with or without the mummified individuals were collected from plants in the field and transferred to the laboratory. Plants were herbarium-pressed and identified later. Aphids were killed and preserved in 90% ethanol and 75% lactic acid in a ratio of 2:1 (Eastop and van Emden 1972) for identification at a later date. Other samples were maintained alive in the laboratory at room temperature for 1–2 weeks in mesh-covered semi-transparent plastic rearing boxes. Emerged parasitoids were dissected and slide-mounted either in Canada balsam or Hoyers medium. The external morphology of the parasitoid was illustrated using an Olympus BH2 phase-contrast microscope with a drawing tube.

Aphid nomenclature follows Remaudière and Remaudière (1997). The morphological terminology used in the parasitoid species description is based on Sharkey and Wharton (1997) and Kavallieratos et al. (2001).

*Aphidius persicus* Rakhshani and Starý

**Type material**

Holotype: female, Iran, Tehran, Peykanshahr, 1260 m, ex. *Uroleucon chondrillae* (Nevsky) on *Chondrilla juncea* (slide mounted), 29 May 2005, coll. E. Rakhshani. Paratypes: Iran: five females and five males (two females slide mounted), same data as holotype; 13 females, nine males (two females slide mounted), Tehran, 1230 m, ex. *Uroleucon* sp. on *Chondrilla* sp., 28 April 2003, coll. E. Rakhshani; five females, one male, Tehran, 1235 m, ex. *Uroleucon* sp. on *Tragopogon pratensis*, 9 June 2004, coll. E. Rakhshani; five females, five males, Karaj, 1280 m, ex. *Uroleucon chondrillae* (Nevsky), on *Chondrilla juncea*, 16 April 2005, coll. E. Rakhshani; three females, two males, Hamadan, Nobaran, 2770 m, ex. *Uroleucon chondrillae* on *Chondrilla juncea*, 5 May 2005, coll. E. Rakhshani; eight females, three males (two females slide mounted), Tehran, Peykanshahr, 1260 m, 6 May 2005, coll. E. Rakhshani; four females and four males, Zanjan, Zarin-Abad, 1640 m, ex. *Uroleucon chondrillae* on *Chondrilla juncea*, 16 May 2005, coll. E. Rakhshani; one female, Tehran, 6 November 1962, *Uroleucon chondrillae* on *Chondrilla juncea*, coll. G. Remaudière. Iraq: two females and one male, Baghdad, *Uroleucon* sp., on *Taraxacum officinalis*, 1970, coll. Al-Azawi; two females and two males, Baghdad, 26 April 1968, *Uroleucon sonchi* (Geoffr.) on *Sonchus oleraceus*, sample 68/70, coll. P. Starý; one female, Baghdad, Botanical garden, 30 April 1968, *Uroleucon sonchi* on *Sonchus oleraceus*, sample 68/107, coll. P. Starý; two females and one male, Baghdad, garden, 17 April 1968, *Uroleucon sonchi* on *Sonchus oleraceus*, sample 68/8, coll. P. Starý.

The material from Iraq identified as “*Aphidius funebris* Mackauer” in Starý and Kaddou (1971) and Starý (1979) belongs to *Aphidius persicus* sp. n.

The holotype and two paratypes from each sample are deposited in the collection of the Institute of Zoology, Faculty of Biology, University of Belgrade (Serbia); 10 paratypes are
deposited in the collection of P. Starý (České Budějovice); and other paratypes are deposited in Tarbiat Modares University Insect Collection Museum, Tehran, Iran.

The following abbreviations are used: F, flagellomere; T, tergum 1 (=petiole); M, median vein; m-cu: median+cubital vein; Rs, radial sector.

**Diagnosis**

*Aphidius persicus* sp. n. resembles *A. funebris*, but is immediately distinguishable from it in having antennae with 16–17 segments instead of 18–19 in *A. funebris*; F1 slightly longer than F2 (Figure 2), whereas in *A. funebris* F1 is equal in length or slightly shorter than F2; maxillary palpi with three or four segments instead of four in *A. funebris*; labial palpi with two segments (Figure 1) instead of three in *A. funebris*; a higher malar index (0.30–0.40 in *A. persicus* sp. n. instead of about 0.25 in *A. funebris*); a different ratio between length of the stigma and that of the distal abscissa of R1 [1.9–2.4 times as long as the distal abscissa of R1 in *A. persicus* sp. n. (Figure 4) instead of equal in length to R1 in *A. funebris*]; and a lighter colour of the body than in *A. funebris*. *Aphidius persicus* resembles *Aphidius uroleuci* Mescheloff and Rosen, a congeneric species parasitic on *Uroleucon* in geographically neighbouring Israel, but is immediately distinguishable from *A. uroleuci* in having a different flagellomere 1 length-to-width ratio (2.5–3.0 in *A. uroleuci*, 3.0–3.6 in *A. persicus* sp. n.); a higher malar index (0.30–0.40 in *A. persicus* sp. n., 0.25 in *A. uroleuci*); and a different stigma length-to-width ratio (2.8–3.1 in *A. persicus* instead of 3.5–4.5 in *A. uroleuci*).

**Description**

**Female. Head** (Figure 1): eyes medium, oval. Malar space 0.30–0.40 times longitudinal eye diameter. Head transverse, tentorial index 0.6–0.7, ocellar triangle obtuse. Face sparsely setose, bare at middle portion, clypeus oval, with 9–13 long setae in two rows. Mandibles bidentate bearing 12–13 setae on outer surface. Maxillary palpi four-segmented or three-segmented. In the case of four-segmented maxillary palpi, the last segment in one palpus bears a trace of two segments or the last segment is very elongate. Labial palpi two-segmented, the second segment rounded at tip, with sparse setae (Figure 1). Antenna 16–17-segmented, filiform, with semi-erect and adpressed setae which are as long as about half the diameter of the segments. Flagellomere 1 (F1) (Figure 2) slender, 3.0–3.6 times as long as wide, 1.14–1.18 times as long as F2 and 1.45 times as long as preapical segment. F1 with zero to two placodes, F2 with four to six placodes.

**Mesosoma**: mesoscutum (Figure 3) with rows of sparse setae along their length, notaulices effaced dorsally, but observable from the top. Scutellum with 11–12 dorso-lateral sparse setae. Propodeum (Figure 5) areolate, with narrow central pentagonal areola (sometimes incomplete), upper and lower areola with three to five setae and two to three setae, respectively, at each side. Transverse carinae divide propodeum into unequal portions, upper 1.35–1.4 times longer than the lower areola. Fore wing (Figure 4): stigma 2.8–3.1 times as long as wide and 1.9–2.4 times as long as distal abscissa of R1. r-rs vein 1.5–2.1 times as long as 3/Rs. Surface hairs 0.32 times as long as marginal hairs.

**Metasoma**: tergum I (=petiole) (Figure 6), 2.8–3.3 times its width at spiracle with mid-dorsal longitudinal carinae. Anterolateral area with 10–11 costulae and dorso-lateral area of tergum I with 10–12 setae after spiracle (Figure 7). Ovipositor sheath (Figure 8) prominent, elongate, slightly concave dorsally, with three ventral, two to three lateral and two to three...
Figures 1–9. *Aphidius persicus* sp. n. (1–8) Paratype female. (1) Head and mouthparts. (2) First and apical antennal flagellomeres. (3) Mesonotum. (4) Fore wing. (5) Propodeum. (6) Tergum 1, dorsal view. (7) Tergum 1, lateral view. (8) Genitalia. (9) Paratype male: aedeagus.
dorsal setae. Length of ovipositor sheath twice its maximum width and three times at the tip. Second valvulae with a linear dorsal outline.

**Colour:** general colour of body reddish yellow. Eyes and ocelli black, area surrounding the ocelli with grey patches. Dorsal part of scape and pedicel brown with yellow patches at tips. Annellus yellow. F$_1$ yellow at base, following flagellomeres brown. Mouthparts yellow. Apices of mandibles light brown to black. Mesosoma light brown. Mesoscutum with two lateral patches and a medial dark strip. Propodeum and metanotum dark brown. Ventral part of mesopleuron dark brown. Fore legs light brown, middle and hind legs dark brown on outer surface. Wings infumated, venation greyish brown (yellowish in fresh specimens), M+m-cu light-coloured at base (m-cu). Tergum 1 of metasoma yellowish, other terga with dark brown bands after the spiracles. Ovipositor sheath black.

**Length of body:** 2.7–3.2 mm.

**Male.** Antennae 17–18(19)-segmented. Maxillary palpi three to four-segmented (as in the female), second segment thickened. Aedeagus triangular (Figure 9), widening towards the base, with sub-parallel anterolateral margins and relatively long tip. Body darker, sometimes with completely black mesosoma. Face yellow. Mouthparts light brown to yellow. Antennae brown, annellus yellow. Metasoma brown or darker.

**Length of body:** 2.5–3.0 mm.

**Mummy.** Yellow-brown, cornicles, antennae and legs except basal femur and coxa dark brown to black. The emergence hole of the adult parasitoid is situated anteriorly between the cornicles, it is rounded and bears a lid at the lower margin.

**Distribution**

Iran (Tehran, Karaj, Hamadan, Zanjan), Iraq (Baghdad).

**Discussion**

Species of the aphid genus *Uroleucon* are parasitized by rather characteristic parasitoid guilds all over the world. There are four typical guild members in Spain (Tizado and Nuñez 1991), France (Starý et al. 1971), the Czech and Slovak Republics (Starý 1966, 2006), Germany (Völkl and Starý 1988), and Poland (Barczak 1993). They are as follows: *Aphidius funebris* Mackauer, *Binodoxys centaureae* (Haliday), *Ephedrus niger* Gautier, Bonnamour and Gaumont, and *Praon yomenae* Takada (=*P. dorsale* Hal. auct.). All of them are definitely oligophagous on certain *Uroleucon* species, some of them also parasitizing related aphid groups (*Macrosiphoniella*—*B. centaureae, E. niger*). Other guild members, more broadly oligophagous, tend to be occasional (*Praon volucre* Haliday). A similar guild pattern occurs in the Western Mediterranean region as well (Starý 1976).

South-East Europe and Turkey have similar parasitoid guild patterns, but with greater parasitoid species diversity in the genus *Praon* (Tomanović et al. 1998, 2003a, 2003b; Kavallieratos et al. 2004; Uysal et al. 2004). *Praon norveillerti* Tomanović and Kavallieratos and *P. uroleucon* Tomanović and Kavallieratos are recently described species. Both of them are parasitic on *Uroleucon* aphids in the sub-Mediterranean region of Serbia and Montenegro and compose a distinct clade within the “*dorsale-yomenae*” species group (Tomanović et al. 2003b).
In Israel (Mescheloff and Rosen 1988, 1990, 1993), the guild consists of *E. niger* and *P. yomenae*. The species *B. centaureae* has not been recorded in this area so far. Instead of it, two native oligophagous parasitoid species on *Uroleucon*—*Aphidius uroleuci* Mescheloff and Rosen and *Praon unitum* Mescheloff and Rosen—were recorded.

The Central Asian area, namely Iraq (Starý and Kaddou 1971; Starý 1979), Pakistan (Starý et al. 1998), and Iran (Starý et al. 2000), yields *A. funebris*, *E. niger*, and *P. yomenae*, besides some more broadly oligophagous members (*P. volucre*). However, *A. funebris* demands more attention because of the determination of a new *Aphidius* species (*A. persicus* sp. n., an oligophagous parasitoid on *Uroleucon* species) known partially under the name “*A. funebris*” from the area, which is dealt with in the present account. The results of our study indicate that *A. funebris* is a rare species in Iran. It seems that *A. persicus* sp. n. has replaced it in many associations.

*Aphidius* species parasitic on *Uroleucon* in the Palaearctic are a good example of sympatric speciation by adaptive divergence (Tremblay and Pennacchio 1988) to different *Uroleucon* hosts in the Middle East. *Aphidius funebris* is widely distributed in the Palaearctic and is characterized by the following plesiomorphic character states: long distal abscissa 1 (=metacarpus), four maxillary and three labial palps, and short flagellomere 1. On the other hand, *A. uroleuci* and *A. persicus* sp. n. share a short metacarpus and a smaller number of maxillary and labial palps (three or four maxillary and two segmented labial palps in both of them) as synapomorphies. The presence of *A. persicus* sp. n. on *Uroleucon* species in Iran and Iraq represents an endemic parasitoid guild in the Central Asian area.

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