



Two new species of aphid parasitoids (Hymenoptera, Braconidae, Aphidiinae) from the Balkan Peninsula

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Abstract

Two new species of aphid parasitoids from the Balkan Peninsula are described. *Aphidius chaetosiphonis* sp. n. was reared from *Chaetosiphon* sp./ *Potentilla clusiana*, while *Aphidius balcanicus* sp. n. was reared from *Acyrtosiphon malvae* / *Geranium* spp. associations. The taxonomic position of both species has been discussed.

Key words: *Aphidius chaetosiphonis* sp. n., *Aphidius balcanicus* sp. n., tritrophic associations, high mountains

Introduction

The Balkan Peninsula is one of the six biodiversity hotspots in Europe (Horvat *et al.* 1974; Kryštufek & Reed 2004) which are characterized by very diverse ecosystems, combined with a high percentage of plant endemism (Turrill 1929; Horvat *et al.* 1974). These factors could lead to species diversity patterns of aphids and parasitoids (Dolphin & Quicke, 2001). In the last two decades intensive research on aphid parasitoid diversity in this area has resulted in the description of a large number of new and endemic species of aphid parasitoids belonging to the subfamily Aphidiinae (Starý *et al.* 1998; Kavallieratos & Lykouressis 2000; Kavallieratos *et al.* 2001; Tomanović & Starý 2001; Tomanović & Kavallieratos 2002; Tomanović *et al.* 2002; Kavallieratos *et al.* 2003; Tomanović *et al.* 2003b; 2003c; Petrović *et al.* 2009; Tomanović *et al.* 2009, Žikić *et al.* 2009), as well as many new tritrophic interactions (plants–aphids–parasitoids) (Tomanović *et al.* 1998; Kavallieratos *et al.* 2004). Four out of 13 recently described species from the Balkans belong to the genus *Aphidius* Nees (Kavallieratos *et al.* 2001; Tomanović & Starý 2001; Tomanović & Kavallieratos 2002; Petrović *et al.* 2009). *Aphidius*, with over 100 species described worldwide is the most diverse (Starý 1973; Achterberg 2010) and also taxonomically the most problematic genus within the subfamily (Eady 1969; Punglerl 1986; Tomanović *et al.* 2003a; 2007; Rakhshani *et al.* 2008). Within *Aphidius* we can recognize several species complexes which suggest cryptic species as follows: *ervi* complex (Pennacchio & Tremblay, 1986; Hufbauer *et al.* 2004), *urticae* complex (Starý 1972; Petrović *et al.* 2009), *uzbekistanicus-rhopalosiphii* complex (Starý 1981; Höller 1991). As well, the taxonomic and phylogenetic status of several closely related genera (e.g. *Lysaphidus* Smith, *Diaeretellus* Starý, *Diaeretiella* Starý, *Euaphidius* Mackauer, *Remaudiereia* Starý) with *Aphidius* is still unclear (Tomanović *et al.* 2007; Kambhampati *et al.* 2000; Sanchis *et al.* 2000; Achterberg 2010).

In this paper we describe two new *Aphidius* species from the Balkan Peninsula and discuss their biology and taxonomic position within the genus.

Material and methods

Specimens used in this study were collected in the last 12 years from high mountains of the Balkan Peninsula. Plant samples bearing both live and mummified aphids were collected. Samples of live aphids were preserved in 90% ethanol and 75% lactic acid at a ratio of 2:1 (Eastop & van Emden 1972) for later identification. The remaining aphids were maintained in the laboratory until parasitoid emergence. Mummies, each attached to a small leaf piece, were placed separately in small plastic boxes with a circular opening covered with muslin on the lid and put inside a growth cabinet (22.5°C, relative humidity 65%, 16L:8D) (Kavallieratos et al. 2001). The external structure of emerged parasitoids was studied using a ZEISS Discovery V8 stereomicroscope. One female paratype specimen (from both species) was sputter coated with gold and examined using a Jeol JSM – 6460LV scanning electron microscope.

Morphological terminology follows Sharkey and Wharton (1997).

Results

Aphidius chaetosiphonis Tomanović and Petrović sp. n.

Diagnosis. According to wing venation and the number of antennal segments, *Aphidius chaetosiphonis* sp. n. is related to *Aphidius salicis* Haliday. Both species have a low number of antennal segments in females (*Aphidius chaetosiphonis* sp. n. has 12–13-segmented antennae and *A. salicis* has (12)13-segmented antennae), while male *A. chaetosiphonis* has a lower number of antennal segments (14-segmented) compared to the 16–17-segmented antennae in male *A. salicis*. *Aphidius chaetosiphonis* sp. n. can also be distinguished from the latter by their labial palps with two palpomeres (*A. salicis* have labial palps with three palpomeres), shorter F1 (*A. chaetosiphonis* sp. n. has F1 length/width ratio of 2.15, vs. 2.45–3.2 in *A. salicis*), shorter petiole (*A. chaetosiphonis* sp. n. has about a 2.45 petiole length/width ratio vs. 2.5–3.0 in *A. salicis*). *Aphidius chaetosiphonis* parasitize *Chaetosiphon* aphid hosts, while *A. salicis* mainly parasitize *Cavariella* aphids.

Description. Female. **Head:** Eyes oval (Fig 1.a). Malar space equal to 0.35 of longitudinal eye diameter. Clypeus oval with 13 long setae. Tentorial index about 0.5. Antenna 12–13-segmented, filiform, moderately thickened at apex with semierect setae shorter than the diameter of the segment (Fig 1.b). Flagellomere 1 (F1) about 2.15 times as long as the median width, without longitudinal placodes. Flagellomere 2 (F2) twice as long as the median width, with 2 longitudinal placodes. F1 subequal to F2. F8 about 1.6 times as long the median width, with 5 longitudinal placodes. Maxillary palps with four palpomeres, labial palps with two palpomeres.

Mesosoma: Mesonotum with notaulices distinct in the fore part, with irregularly distributed setae (Fig 1.c). Propodeum areolated with narrow pentagonal central areola (Fig 1.d). Each upper lateral areola with 1–3 setae and lower lateral areola with 1–2 setae.

Forewing: Stigma about 3.8 times longer than wide and about 1.6 times longer than the distal abscissa of R1; r–rs vein about 1.1 times as long as 3/RS vein; R1 vein 2.5–3.0 times longer than stigma width (Fig 1.e).

Metasoma: Petiole about 2.45 times longer than wide at spiracles with 7 costulae on its anterolateral area and with weakly prominent mediodorsal carina. Ovipositor sheath slightly concave on its dorsal margin (Fig 1.f).

Colour: Head black. Mouthparts brown. Scape and pedicel dark brown, remainder of antenna brown. Petiole light brown to brown, remaining part of metasoma black. Legs brown with yellow joints. Rest of the body black.

Body length about 2 mm.

Male. Antenna 14-segmented, F1 with 4 longitudinal placodes. Stigma 3.4 times longer than wide and about 1.5 times longer than the distal abscissa of R1; R1 vein 2.25 times longer than stigma width. Petiole with 8 costulae on its anterolateral area. Body generally darker than female body.

Type material. Holotype female. Montenegro, Mt. Durmitor-Škrka lakes (alt. 1700 m), 02.08.2009, reared from *Chaetosiphon* sp. on *Potentilla clusiana* Jacq., coll. Ž. Tomanović & A. Petrović. Holotype slide mounted and deposited in the collection of the Institute of Zoology, Faculty of Biology, University of Belgrade.

Paratypes. 1♀1♂, Montenegro, Mt. Durmitor-Škrka lakes, 02.08.2009, reared from *Chaetosiphon* sp. on *Potentilla clusiana* Jacq., coll. Ž. Tomanović & A. Petrović. Paratypes slide mounted and deposited in the collection of the Institute of Zoology, Faculty of Biology, University of Belgrade.

Etymology. The name of the new species is derived from its aphid host.

Host aphid. *Aphidius chaetosiphonis* is a parasitoid of an unidentified *Chaetosiphon* (*Pentatrichophus*) sp., which probably represents a new aphid species for science.

Distribution. *Aphidius chaetosiphonis* is currently distributed in Montenegro.

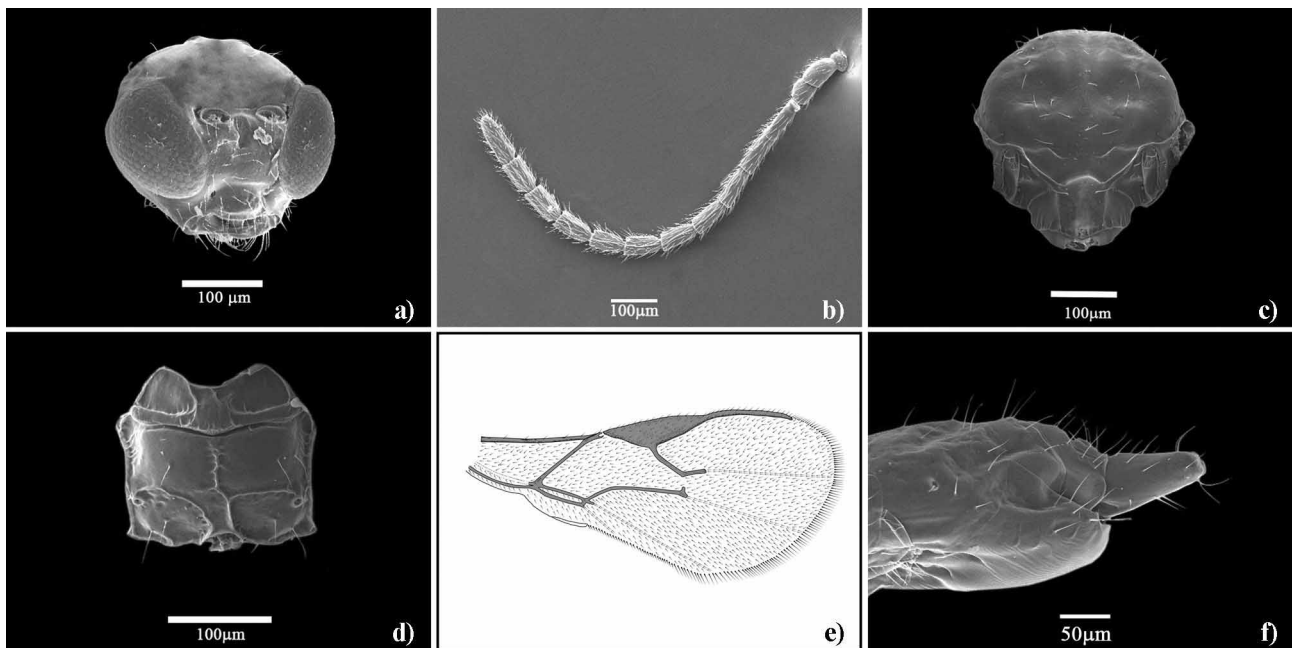


FIGURE 1. *Aphidius chaetosiphonis* sp. n.; a) head; b) antenna; c) mesoscutum; d) propodeum, dorsal aspect; e) forewing; f) ovipositor sheath, lateral aspect.

Aphidius balcanicus Tomanović and Petrović sp. n.

Diagnosis. On the basis of the host range pattern and number of antennal segments, *Aphidius balcanicus* sp. n. is close to *A. pelargonii* Starý and Carver, a species described from Australia. The female of *A. balcanicus* sp. n. differs from the Australian species by having more elongate flagellomere (F1 length/width ratio = 2.9–3.6 and F2 length/width ratio = 2.3–3 in *A. balcanicus* sp. n. vs. F1 length/width ratio = 2.5, F2 length/width ratio = 2 in *A. pelargonii*), wider stigma (length/width ratio 3.1–3.8 in *A. balcanicus* sp. n. vs. length/width ratio about 4.0 in *A. pelargonii*). The new species is close to the *A. urticae* group in the shape of the petiole, and partly in wing venation, but it differs from *A. urticae* in the number of antennal segments (16–17 in *A. balcanicus* sp. n. and 18–20 in *A. urticae*).

Description. Female. **Head:** Eyes oval (Fig 2.a). Malar space equal to 0.41 (from 0.38 to 0.50) of longitudinal eye diameter. Clypeus oval with about 14 (11–18) long setae. Tentorial index 0.40–0.55. Antenna 16–17-segmented, filiform, moderately thickened at apex with semierect setae shorter than diameter of the segment. F1 about 2.9–3.6 times longer than wide, without longitudinal placodes. F2 about 2.3–3 times longer than wide, with (1)2–3(4) longitudinal placodes (Fig 2b.). F8 about 1.65–1.85 times longer than wide, with 4–5 longitudinal placodes. F1 subequal to F2. Maxillary palps with four palpomeres, labial palps with three palpomeres.

Mesosoma: Mesonotum with notaulices distinct in the fore part, with setae distributed in two rows (Fig 2.c). Propodeum areolate with very narrow pentagonal central areola (Fig 2.d). Each upper lateral areola with 4 setae and lower lateral areola with 3 setae.

Forewing: Stigma about 3.1–3.8 times longer than wide and about 1.4–2 times longer than the distal abscissa of R1; r-rs vein about 1.2–1.35 times as long as 3/RS vein; R1 vein about 1.9–2.9 times longer than stigma width (Fig 2.e).

Metasoma: Petiole about 2.8–3.2 times longer than wide at spiracles (Fig 2.f) with 6–9 costulae on its anterolateral area (Fig 2.g), with moderately prominent mediodorsal carina. Ovipositor sheath with almost straight dorsal margin (Fig 2.h).

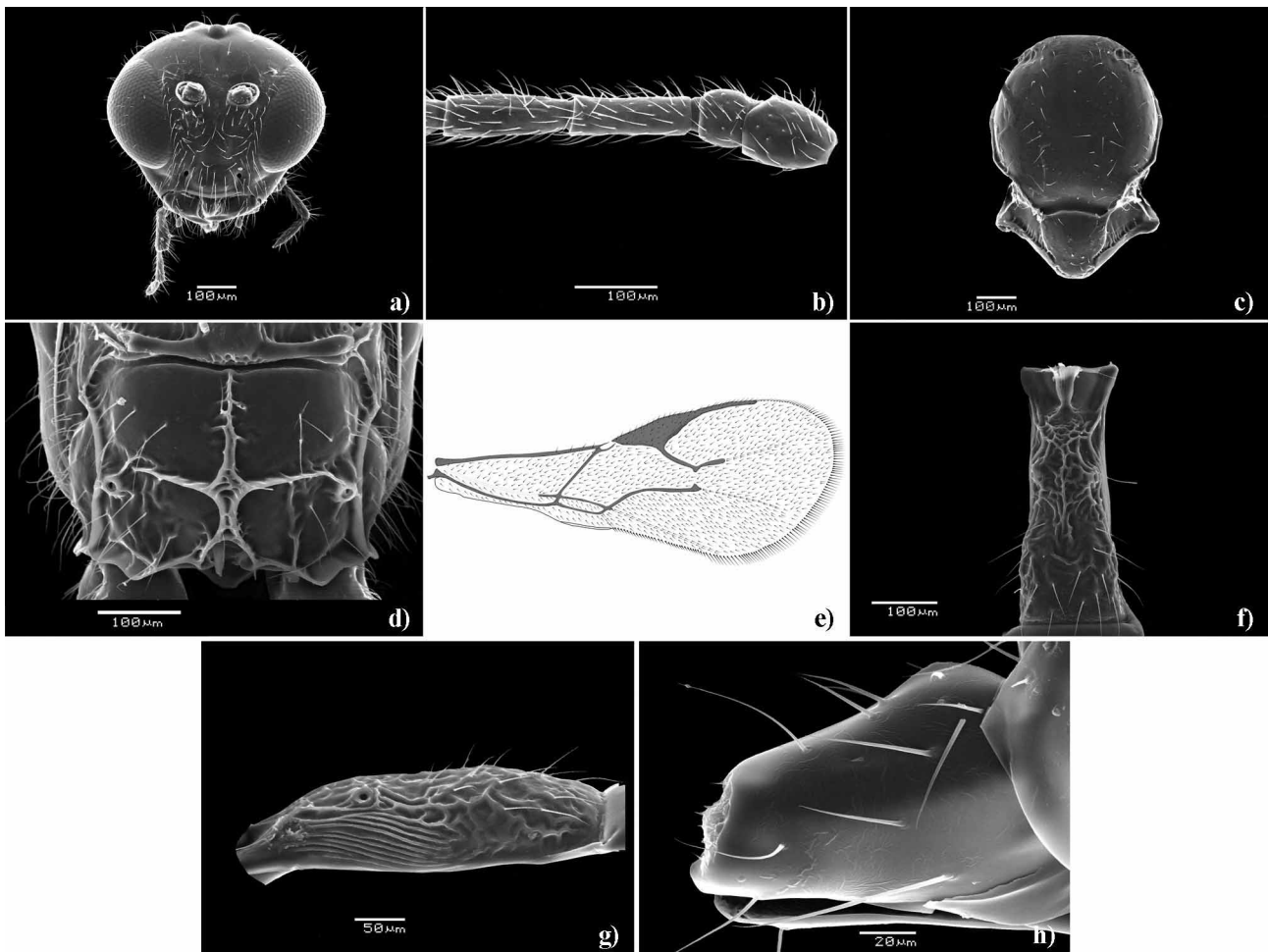


FIGURE 2. *Aphidius balcanicus* sp. n.; a) head; b) flagellomeres F1 and F2; c) mesoscutum; d) propodeum, dorsal aspect; e) forewing; f) petiole, dorsal aspect, g) petiole, lateral aspect h) ovipositor sheath, lateral aspect.

Colour: Head dark brown. Mouthparts yellow to light brown. Scape and pedicel light brown, F1 with yellow ring at the base, remainder of antenna brown. Petiole yellow to light brown, remaining part of metasoma dark brown. Legs yellow to brownish. Rest of the body brown.

Body length about 2.5 mm.

Male. Antenna 19–20-segmented. Stigma 3.5–4.2 times longer than wide and about 1.5–1.9 times longer than the distal abscissa of R1; R1 vein 2.3–2.6 times longer than stigma width. Petiole, 3.0–3.6 times longer than wide at spiracles with 6–9 costulae on its anterolateral area. Body generally darker than female body.

Type material. Holotype female. Serbia, Mt. Zlatibor–Bela Zemlja, 28.06.1999, reared from *Acyrtosiphon malvae* on *Geranium pyrenaicum*, coll. Ž. Tomanović. Holotype slide mounted and deposited in the collection of the Institute of Zoology, Faculty of Biology, University of Belgrade.

Paratypes. 18♀22♂, Serbia, Mt. Zlatibor–Bela Zemlja, 02.08.2009, reared from *Acyrtosiphon malvae* on *Geranium pyrenaicum*, coll. Ž. Tomanović. Paratypes slide mounted and deposited in the collection of the Institute of Zoology, Faculty of Biology, University of Belgrade.

Additional material. 1♀1♂ Serbia, Mt. Kopaonik–Marina voda, 06.07.2000, reared from *Acyrtosiphon malvae* on *Geranium* sp., coll. Ž. Tomanović 6♀8♂ Montenegro, Mt. Durmitor–Mlinski potok, 13.07.2000, reared from *A. malvae* on *Geranium* sp., coll. Ž. Tomanović; 1♀5♂ Montenegro, Mt. Durmitor–Zminje jezero, 13.07.2000, reared from *A. malvae* on *Geranium* sp., coll. Ž. Tomanović; 2♀2♂ Montenegro, Mt. Durmitor – Mali Medjed, 14.07.2000, reared from *A. malvae* on *Geranium coeruleatum*, coll. Ž. Tomanović; 10♀6♂ Montenegro, Mt. Durmitor–Bosača, 16.07.2000, reared from *A. malvae* on *Geranium* sp., coll. Ž. Tomanović; 2♀ Montenegro, Mt. Durmitor–Mali Medjed, 18.07.2000, reared from *A. malvae* on *Geranium coeruleatum*, coll. Ž. Tomanović;

2♂, Montenegro, Mt. Durmitor–Škrka, 02.08.2009, reared from *A. malvae* on *Geranium coeruleatum*, coll. Ž. Tomanović & A. Petrović.

Etymology. The name of the new species is derived from its current distribution.

Host aphid. It is a parasitoid of *Acyrtosiphon malvae* on *Geranium* spp.

Distribution. It is distributed on the high Balkan mountains of Serbia and Montenegro.

Discussion

Over 62 aphid species were recorded as feeding on species from the genus *Potentilla* (Blackman & Eastop 2006). There are only five parasitoid species which parasitize aphids on *Potentilla* spp. in Europe: *Paralipsis enervis* (Nees), *Ephedrus plagiator* (Nees), *Aphidius rosae* Hal., *A. urticae* Hal., and *Lysiphlebus fabarum* (Marsh.) (Kavallieratos *et al.* 2004; Starý 2006). *Potentilla clusiana* is an element of central European mountain flora with an insular type of distribution on high mountains (Kurtto 2009). The association of *Aphidius chaetosiphonis* **sp. n.** /*Chaetosiphon* sp. is the first record of aphid and parasitoid on this plant species. The *Chaetosiphon* aphid host represents most probably a new species, so it seems that the whole aphid-parasitoid association is new for science and subendemic for high montane areas of southeastern Europe. In southeastern Europe only *Aphidius eglanteriae* Haliday 1834 and *Ephedrus laevicollis* (Thomson 1895) are recorded as parasitoids of *Chaetosiphon* aphids on *Rosa* spp. (Kavallieratos *et al.* 2004). *Aphidius chaetosiphonis* and *A. salicis* represent *Aphidius* species with the lowest number of antennal segments in the Palearctic (Starý 1973; Tomanović *et al.* 2003a). Besides aphid and parasitoid species on *P. clusiana*, we recorded several unidentified hyperparasitoid species.

Aphidius balcanicus **sp. n.** was reported from the Balkans from 2003 as *Aphidius* cf. *pelargonii* (Tomanović *et al.* 2003a; Tomanović *et al.* 2004; Petrović *et al.* 2009). However, detailed morphological examination revealed that the newly described species is close to the *A. urticae* group and different from *A. pelargonii*, representing a new species, and supported by morphological and molecular data (Petrović *et al.* unpublished data). *Aphidius balcanicus* **sp. n.** is a new member of the parasitoid guild associated with *A. malvae* on *Geranium* spp. Prior to this finding four parasitoids were reported from the *A. malvae* /*Geranium* spp. association: *Aphidius avenae* Haliday 1834, *Aphidius geranii* Tomanović & Kavallieratos 2009, *Ephedrus lacertosus* (Haliday 1833) and *Praon volucre* (Haliday 1833) (Kavallieratos *et al.* 2004).

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