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EPHEDRUS HALIDAY (HYMENOPTERA: BRACONIDAE: APHIDIINAE) IN SERBIA AND MONTENEGRO: TRITROPHIC ASSOCIATIONS AND KEY

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Abstract

Thirteen *Ephedrus* species are reviewed from 105 tritrophic associations collected in Serbia and Montenegro over the period 1982-2007. The *Ephedrus* species were reared from 53 aphid hosts. Fourteen *Ephedrus* parasitoid-host aphid-host plant associations are new for Serbia and Montenegro. *Aphis epilobii* and *Cryptomyzus ribis* are detected for the first time as host aphids for *E. plagiator*. A key for the identification of species is provided.

Key words: Aphids, parasitoids, *Ephedrus*, key, Serbia and Montenegro.

Introduction

The genus *Ephedrus* Haliday (Hymenoptera, Braconidae, Aphidiinae) is comprised of about 30 species worldwide (STARÝ, 1962; GÄRDENFORS, 1986; VAN ACHTERBERG, 2004). There are different opinions about the taxonomic status of some *Ephedrus* populations/species in Europe and the Palaearctic region (KIRIAK, 1977; GÄRDENFORS, 1986). VAN ACHTERBERG (2004) recognized 19 *Ephedrus* species in Europe, while GÄRDENFORS (1986) pointed out 18 valid taxa in the entire Palaearctic region. KAVALLIERATOS *et al*. 2004 reviewed the Aphidiinae from southeastern Europe, including eleven species of *Ephedrus*. Recently two new species of *Ephedrus* from Serbia and Montenegro (TOMIĆ *et al*., 2005; ŽIKIĆ *et al*., 2009) were described.

The genus *Ephedrus* is characterized by morphological and life history characteristics within Aphidiinae as follows: forewing with seven closed cells, eleven antennal segments in both males and females, mummies of parasitized aphids black, emergence hole with a cap in apical portion of the mummy (STARÝ, 1974), several hundred aphid hosts worldwide from Aphididae, Drepanosiphidae, Pemphigidae and Anoeciidae, and lacking any special adaptations for oviposition (VÖLKL & MACKAUER, 2000). Due to many plesiomorphic characters (see GÄRDENFORS, 1986) the genus *Ephedrus* is considered basal within the aphidiine subfamily. This relationship is further supported by comparative molecular findings (BELSHAW & QUICKE, 1997; SANCHIS *et al.* 2000; SHI & CHEN, 2005).

Ephedrus species parasitize many aphid pest species in agroecosystems and some of them are important biocontrol agents both in the open field and glasshouse environments (see ŽIKIĆ *et al*., 2009).

Here we present host aphid associations and a key to thirteen species of *Ephedrus* known from Serbia and Montenegro.

Material and Methods

Collection and deposition of specimens

Plant samples bearing aphid colonies consisting of both live and mummified aphids were collected from many localities in Serbia and Montenegro over the period 1982-2007. Live aphids were preserved in 90% ethyl-alcohol and 75% lactic acid 2:1 (EASTOP & VAN EMDEN, 1972). Mummified aphids of the same species and plant sample were placed in groups in small plastic boxes held in a growth cabinet at 22.5°C, 65% relative humidity, and 16:8 L:D photoperiod (KAVALLIERATOS *et al*., 2001). A circular opening was cut into the lid of each box and covered with muslin for ventilation. Reared parasitoids were dissected and mounted in Canada balsam for later identification.

The terminology used in this paper regarding the diagnostic characters of aphidiines is based on SHARKEY & WHARTON (1997).

Synopsis of characters

The quantitative characters used in the key for the identification of *Ephedrus* species are given as a range of values based on many series of specimens measurements. Characters used in the key include: antennae – shape of antennae, flagellomers (F_1, F_2, etc.), F_1 and F_2 color and length, F_1 length/width (width measured at segment midpoint) and number of longitudinal placodes (Figs. 13-17); forewing venations (length of 3SR and 2SR veins) (Figs. 7-8); petiole – length/width (width measured across spiracles) (Figs. 5, 9) and external

morphology (Figs. 2 & 5); propodeum external morphology (Figs. 1 & 4); and ovipositor sheath (setaceous – Figs. 3 & 6) and length (Figs. 21 & 22).

Successful use of the key is achieved using series of specimens reared from identified aphid host rather than a single individual. Also, evidence on the host aphid and plant association is recommended in keying specimens.

Abbreviations and symbols

Countries: SRB - Serbia, MNE – Montenegro

Collectors: ŽT – Željko Tomanović, OP – Olivera Petrović-Obradović, AP – Andjeljko Petrović, MB – Miloje Brajković, AĆ – Aleksandar Ćetković, ST – Snežana Tomanović

All new associations were marked with an asterisk sign (*).

Results

Key to the females of *Ephedrus* in Serbia and Montenegro

1	Propodeum (Fig. 1) and petiole (Fig. 2) reticulated. Ovipositor sheath densely pubescent (Fig. 3) ..... *Ephedrus validus* Stelfox
-	Propodeum (Fig. 4) and petiole (Fig. 5) are not reticulated. Ovipositor sheath scarcely pubescent (Fig. 6) 2
2	3SR vein shorter than 2SR vein (Fig. 7). Petiole short (Fig. 5) 3
-	3SR vein longer than 2SR vein (Fig. 8). Petiole elongate (Fig. 9) 5
3	Flagellomere 1 (F_1) elongate, 5.00 - 5.30 times as long as wide (Fig. 10). F_1 and half of flagellomere 2 (F_2) yellow ..... *E. lonicerae* Tomanović, Kavallieratos & Starý
-	F_1 shorter, 4.00 - 4.80 times as long as wide (Fig. 11). F_1 brown or basal half yellow. F_2 brown ... 4
4	Antenna thickened at the apex (Fig. 12). F_1 4.50 - 4.80 times as long as wide (Fig. 12). Basal half of F_1 yellow ..... *E. chaitophori* Gärdenfors
-	Antenna slightly thickened at apex (Fig. 11). F_1, 4.00 - 4.50 times as long as wide (Fig. 11). F_1 brown ..... *E. persicae* Froggatt
5	F_1 very long, sometimes 1.5 x F_2 (Fig. 13) ..... *E. lacertosus* (Haliday)
-	F_1 subequal or 1.3 x F_2 6
6	F_1 length 4.00 - 4.80 x width and 1.20 - 1.40 x F_2 (Fig. 14) 7
-	F_1 length 3.00 - 4.00 x width and 1.00 - 1.20 x F_2 (Fig. 15) 9

7 F_1 with 4 - 6 longitudinal placodes and basal constriction in basal third (Fig. 14). F_1 and F_2 brown ..... *E. niger* Gautier, Bonnamour & Gaumont

\- F_1 with 0 - 3 longitudinal placodes and without basal constriction in basal third. F_1 and F_2 yellow or with yellow base of F_1 8

8 F_1 with yellow base and 1 - 2(3) longitudinal placodes (Fig. 16) .... *E. dysaphidis* Tomanović, Kavallieratos & Starý

\- F_1 and F_2 yellow with 0 - 1 longitudinal placode (Fig. 17) ..... *E. cerasicola* Starý

9 F_1 yellow on basal third ..... *E. blattnyi* Starý

\- F_1 brown or with very narrow yellow ring at the base 10

10 Antennae short, reaching propodeum and strongly thickened at apex (Fig. 18) 11

\- Antennae long, reaching first part of metasoma, filiform or slightly thickened at apex (Fig. 19) .. 12

11 F_1 3.50 - 4.00 x width (Fig. 18). F_8 clearly separated from F_9 (Fig. 18) ..... *E. helleni* Mackauer

\- F_1 3.10 - 3.40 x width (Fig. 20). F_8 and F_9 not well separated (Fig. 20) ..... *E. laevicollis* (Thomson)

12 F_1 length 3.00 - 3.50 x width (Fig. 15). Ovipositor sheath short (Fig. 21) ..... *E. nacheri* Quilis

\- F_1 3.70 - 4.00 x width (Fig. 20). Ovipositor sheath elongate (Fig. 22) ..... *E. plagiator* (Nees)

Review of tritrophic relationships (parasitoid – host aphid – host plant)

Ephedrus cerasicola Starý, 1962

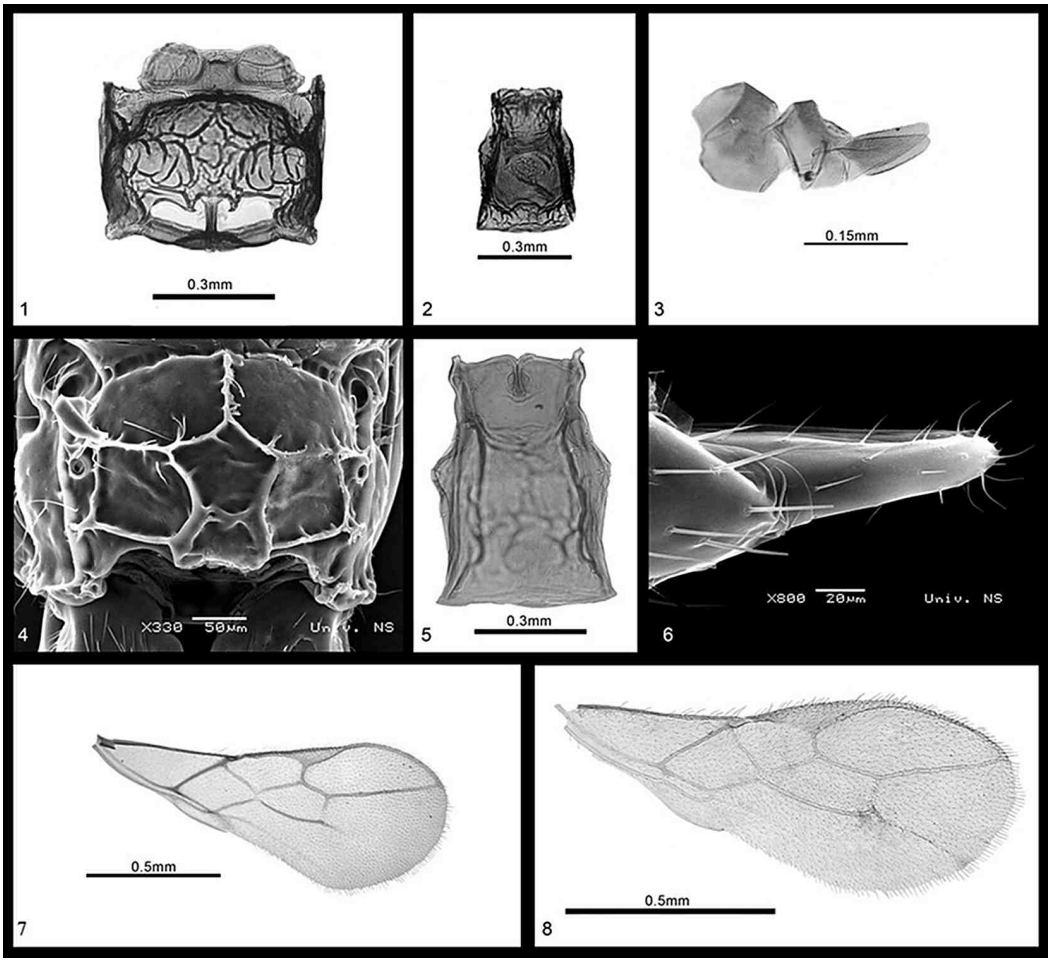
Brachycaudus helichrysi (Kaltenbach): on *Myosotis* sp. (3♀), Kopaonik: Pančićev vrh, 05.07.1997, leg. ŽT, (SRB), Mt. Durmitor: Zminje jezero, 04.08.1982, leg. MB, (MNE); *Myzus cerasi* (Fabricius): on *Prunus cerasus* (4♀), Belgrade: Crveni Krst, 14.06.1997, leg. ŽT, (SRB); *Phorodon humuli* (Schrank): on *Prunus cerasifera* (4♀), Belgrade: Novi Beograd, 17.06.1993, leg. OP (SRB).

Ephedrus dysaphidis Tomanović, Kavallieratos & Starý, 2005

Dysaphis sp.: on *Malus domestica* (3♂, 8♀), Belgrade, 08.05.1995, (1♀), Belgrade: Radmilovac, 22.04.1992, leg. OP, (SRB).

Ephedrus helleni Mackauer, 1968

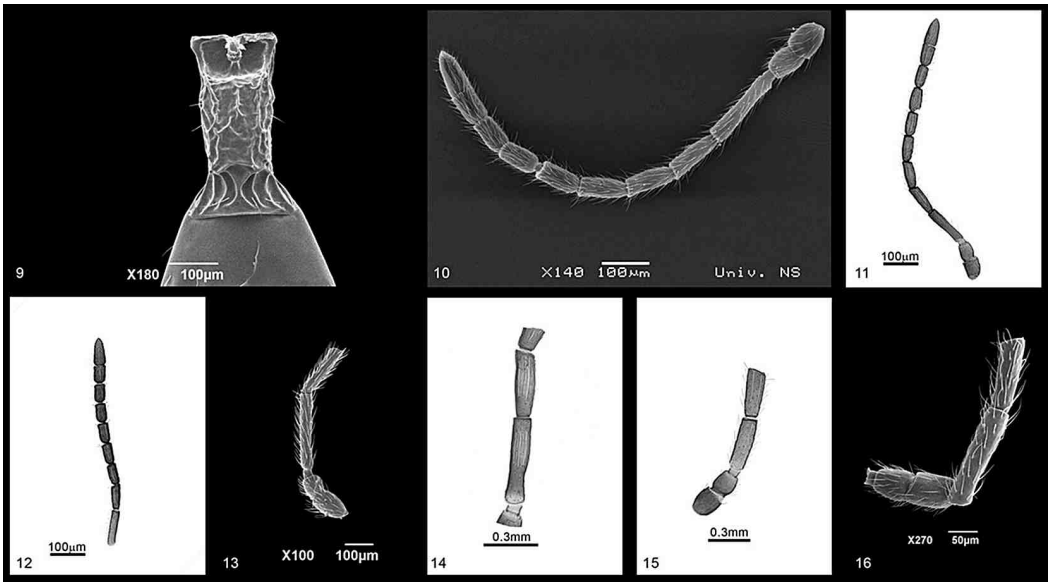
Cavariella aegopodii (Scopoli): on *Salix cinerea* (6♂, 4♀), Debeli lug, 09.06.1990, leg. OP, (SRB); *Pancicia serbica* (1♂), Mt. Durmitor: Bosača, 16.07.2000, leg. ŽT; *Cavariella theobaldi* (Gillette & Bragg) on *Salix caprea* (SRB); **Pastinaca sativa* ssp. *urens* (1♀), Mt. Prokletije: Vizitor, 22.07.2006, leg. ŽT (MNE).



Figures 1-8: *Ephedrus validus*, propodeum, dorsal aspect (1); *E. validus*, petiole, dorsal aspect (2); *E. validus*, ovipositor sheath, lateral aspect (3); *E. lonicerae*, propodeum, dorsal aspect (4); *E. persicae*, petiole, dorsal aspect (5); *E. lonicerae*, ovipositor sheath, lateral aspect (6); *E. persicae*, forewing (7); *E. plagiator*, forewing (8).

Ephedrus lacertosus (Haliday, 1833)

**Acyrthosiphon malvae* (Mosley): on *Geranium coeruleatum* (1♂, 1♀), Mt. Durmitor: Škrka, 22.07.2004, leg. ŽT, (MNE); **Amphorophora rubi* (Kaltenbach): on *Rubus idaeus* (1♂, 1♀), Mt. Prokletije: Vizitor, 22.07.2006, leg. ŽT, (MNE); *Macrosiphum cholodkovskyi* (Mordvilko): on *Filipendula ulmaria* (2♀), Mt. Kopaonik: Marina voda, 08.07.2000, leg. ŽT, (SRB); *Macrosiphum rosae* (L.): on *Rosa canina* (2♀), Belgrade: Bežanija, 15.05.1993, leg. ŽT, Mt. Kopaonik: Markova stena, 13.08.1986, leg. AĆ, (SRB).



Figures 9-16: *Ephedrus plagiator*, petiole, dorsal aspect (9); *E. lonicerae*, antenna, lateral aspect (10); *E. persicae*, antenna, lateral aspect (11); *E. chaitophori*, antenna, lateral aspect (12); *E. lacertosus*, flagellomeres 1 and 2, lateral aspect (13); *E. niger*, flagellomeres 1 and 2, lateral aspect (14); *E. nacheri*, flagellomeres 1 and 2, lateral aspect (15); *E. dysaphidis*, flagellomeres 1 and 2, lateral aspect (16).

Ephedrus chaitophori Gärdenfors, 1986

**Chaitophorus leucomelas* Koch: on *Populus nigra* (1♂, 1♀), Zemun, 09.10.2007, leg. AP, (SRB); *Chaitophorus* sp.: on *Populus nigra* (1♂, 1♀), Belgrade: Novi Beograd (Block 45), 06.06.1999, leg. ŽT, (SRB).

Ephedrus blattnyi Starý, 1973

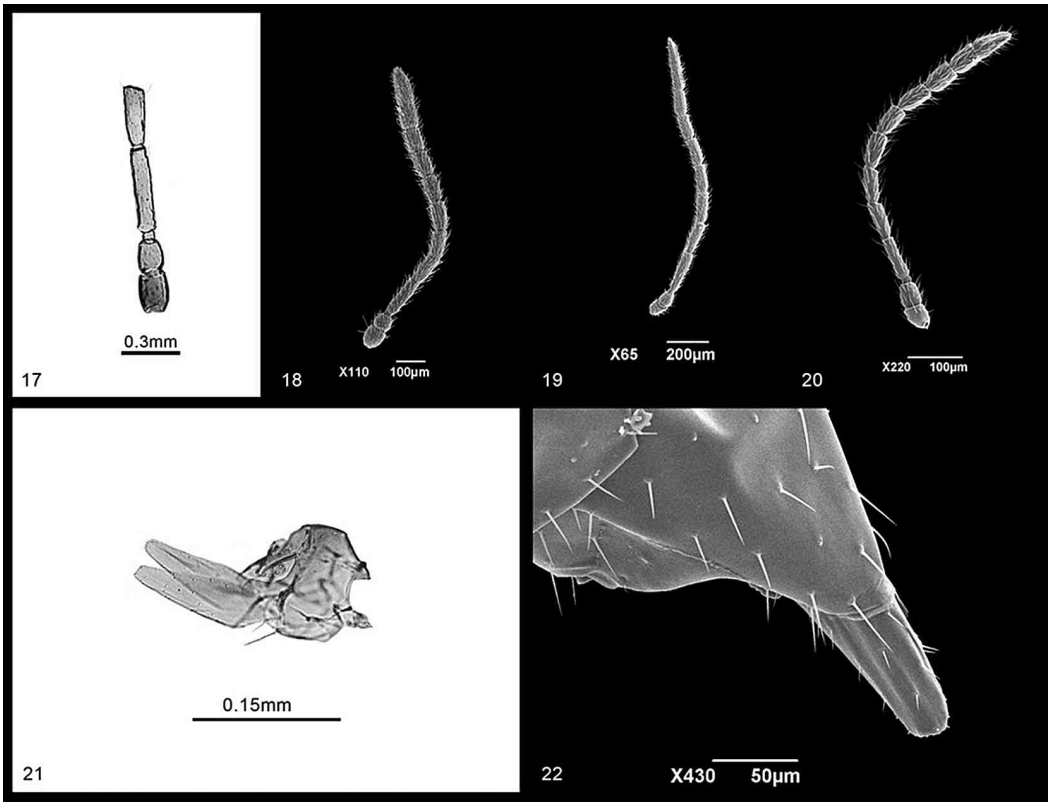
Pterocomma rufipes (Hartig): on *Salix retusa* (1♂, 1♀), Mt. Durmitor: Mali Međed, 14.07. 2000, leg. OP, Mt. Durmitor: Mali Međed, 18.07.2000, leg. ST, (MNE).

Ephedrus laevicolis (Thomson, 1895)

Chaetosiphon tetrarhodum (Walker): on *Rosa* spp. (9♂, 34♀), Belgrade: Crveni Krst, 09.06.1998, 14.06.1998, Užice: Đetinja, 10.06.2000, leg. ŽT, (SRB, MNE); *Longicaudus trirhodus* (Walker): on *Thalictrum minus* ssp. *majus* (3♀), Beljanica: Suvaja, 13.07.1998, leg. ŽT, (SRB), Mt. Durmitor: Donja Ališnica, 19.08.1986, (MNE), Mt. Stara planina: Crnovrška reka, 17.07.1983, Mt. Kopaonik: Gobelja, 15.07.1987, leg. AĆ, (SRB).

Ephedrus lonicerae Tomanović, Kavallieratos & Starý, 2009

Hyadaphis foeniculi (Passerini): on *Lonicera xylosteum* (8♂, 10♀), Mt. Durmitor: Lokvice, 20.07.2004, leg. ŽT, (MNE).



Figures 17-22: *Ephedrus cerasicola*, flagellomeres 1 and 2, lateral aspect (17); *E. helleni*, antenna, lateral aspect (18); *E. plagiator*, antenna, lateral aspect (19); *E. laevicollis*, antenna, lateral aspect (20); *E. nacheri*, ovipositor sheath, lateral aspect (21); *E. plagiator*, ovipositor sheath, lateral aspect (22).

Ephedrus nacheri Quilis, 1934

Hayhurstia atriplicis (L.): on *Chenopodium album* (11♂, 10♀), Zemun, 02.09.1997, Carska bara, 02.07.1996, leg. OP, Banatski Brestovac, 13.06.1996, leg. ŽT, Mt. Kopaonik: Brzeća, 19.08.1998, leg. OP, (SRB).

Ephedrus niger Gautier, Bonnamour & Gaumont, 1929

Megoura viciae (Buckton): on *Lathyrus sativus* (1♀), Mt. Kopaonik: Samokovska reka, 08.07.2000, leg. ŽT, (MNE); *Lathyrus odoratus* (1♂), Mt. Durmitor: Barno jezero, 24.07.2004, leg. ŽT, (MNE); *Uroleucon cichorii* Koch: on *Cichorium intybus* (1♂, 1♀), Opovo, 23.06.1997, leg. ŽT, (SRB); *Uroleucon murale* (Buckton): on *Mycelis muralis* (1♀), Mt. Durmitor, 05.08.1992, leg. OP, (SRB); *Uroleucon* sp.: *Crepis biennis* (2♂), Mt. Durmitor: Crno jezero, 20.07.2004, leg. ŽT, (MNE); **Chondrilla juncea* (2♂, 1♀), Virpazar: Vranjina, 13.05.2006, leg. ŽT, (MNE).

Ephedrus persicae Froggatt, 1904

Aphis pomi de Geer: on *Malus domestica* (1♀), Belgrade: Radmilovac, 22.06.1995, leg. OP, (SRB); **Aphis viticis* Ferrari: on *Vitex agnus castus* (4♂, 6♀), Virpazar: Vranjina, 13.05.2006, leg. ŽT, (MNE); *Aphis* sp.: on *Satureja montana* (3♂, 11♀), Virpazar: Vranjina, 30.04.2001, leg. ŽT, (MNE); *Vitex agnus-castus* (1♂, 1♀), Virpazar: Vranjina, 30.04.2001, leg. ŽT, (MNE); *Salvia officinalis* (3♂), Virpazar: Vranjina, leg. ŽT, (MNE); *Brachycaudus cardui* (L.): on *Prunus domestica* (4♀), Belgrade, 28.04.1995, leg. OP, (SRB); *Brachycaudus helichrysi* (Kaltenbach): on *Achillea abrotanoides* (5♂, 6♀), Mt. Durmitor: Mali Međed, 01.07.2001, leg. ŽT, (MNE); *A. tanacetifolia* (1♂), Biogradska gora: Svatovsko groblje, 22.07.2001, leg. ŽT, (MNE); *Achillea* sp. (1♂, 1♀), Mt. Durmitor: Crna Gora, 03.07.1998, leg. ŽT, (MNE); *Myosotis sylvatica* (1♂), Mt. Kopaonik: Samokovska reka, 05.07.2000, leg. ŽT, (SRB); *Prunus cerasifera* (1♀), Belgrade: Novi Beograd, 04.05.1995, leg. OP, (SRB); *P. domestica* (18♂, 6♀), Belgrade, 28.04.1995, leg. OP, (SRB); *Sedum anopetalum* (1♂), Mt. Durmitor: Crno jezero, 27.08.1990, leg. OP, (MNE); *Brachycaudus prunicola* (Kaltenbach): on *Prunus cerasifera* (1♀), Belgrade, 07.05.1995, leg. OP, (SRB); *Dysaphis plantaginea* (Passerini): on *Malus domestica* (4♀), Belgrade: Radmilovac, 13.05.1998, leg. OP, (SRB); *Dysaphis pyri* (Boyer de Fonscolombe): on *Pyrus communis* (1♂), Belgrade: Radmilovac, 13.05.1998, leg. OP, (SRB); *Dysaphis reaumuri* (Mordvilko): on *Pyrus communis* (2♀), Belgrade: Radmilovac, 13.05.1998, leg. OP, (SRB); *Dysaphis* sp.: on *Pyrus communis* (5♂, 7♀), Avala, 26.05.1993, leg. ŽT, (SRB); *Melanaphis pyraria* (Passerini): on *Pyrus communis* (3♂, 1♀), Lugavčina, 20.04.1995, leg. OP, (SRB); *Myzus cerasi* (Fabricius): on *Prunus avium* (1♂, 3♀), Belgrade, 28.04.1995, leg. OP, (SRB); *Prunus cerasus* (10♂, 18♀), Belgrade, 28.04.1995, 07.05.1995, leg. OP, (SRB); *Myzus persicae* Sulzer: on *Prunus cerasifera* (3♀), Belgrade, 21.04.1995, leg. OP, (SRB); *P. persica* (1♀), Belgrade, 28.04.1995, leg. OP, (SRB); *Phorodon humuli* (Schrank): on *Prunus cerasifera* (3♂, 3♀), Belgrade: Dušanovac, 29.05.1993, leg. ŽT, Mt. Rudnik, 18.05.1990, Belgrade, 07.05.1995, leg. OP, (SRB); *P. cerasus* (3♂, 1♀), Belgrade, 07.05.1995, leg. OP, (SRB); *P. domestica* (2♂), Belgrade: Novi Beograd, 25.04.1995, leg. OP, (SRB); *P. spinosa* (1♂, 1♀), Belgrade, 07.05.1995, leg. OP, (SRB); *Rhopalosiphum nymphaeae* L.: on *Prunus* sp. (1♂), Belgrade: Novi Beograd, 25.04.1995, leg. OP, (SRB); *Uroleucon solidaginis* (Fabricius): on *Solidago virgaurea* (2♀), Mt. Kopaonik: Marine vode, 04.07.2000, leg. ŽT, (SRB).

Ephedrus plagiator (Nees, 1811)

Acyrthosiphon pisum (Harris): on *Medicago sativa* (1♂), Kovilovo, 15.07.1992, leg. ŽT, (SRB); **Acyrthosiphon* sp.: on *Chamaecytisus ciliatus* (1♂), Mt. Durmitor: Crno jezero, 20.07.2004, leg. ŽT, (MNE); **Aphis epilobii* Kaltenbach: on *Epilobium angustifolium* (1♂, 12♀), Mt. Prokletije: Hridsko jezero, 20.07.2006, leg. ŽT, (MNE); *Aphis fabae* Scopoli: on *Cephalanthera rubra* (3♂), Mt. Suva planina: Devojački grob, 13.07.1999, leg. ŽT, (SRB); *Evonymus europaeus* (3♂, 7♀), Belgrade: Topčider, 03.05.1997, 26.04.1998; (3♂, 2♀), Belgrade: Botanical Garden, 5.05.2006, leg. ŽT, (SRB); *Impatiens noli-tangere* (3♀), Mt. Beljanica: Suvaja, 13.07.1998, leg. ŽT, (SRB); *Gentiana asclepiadea* (1♀), Mt. Durmitor: Zminičko jezero, 21.08.1990, leg. OP, (MNE); (6♂, 4♀), Mt. Durmitor: Zminičko jezero, 20.07.2004, leg. ŽT, (MNE); *Ranunculus acris* (3♂, 3♀), Mt. Durmitor: Zabojsko jezero, 16.07.2006, leg. ŽT, (MNE); *Aphis idaei* Van der Goot: on *Rubus* sp. (1♂, 1♀), Čačak: Zdravljak, 12.05.2000, leg. ŽT, (SRB); *R. idaeus* (1♂), Vrujci: Berkovac, 30.04.2000, leg. ŽT, (SRB); *Aphis salicariae* Koch: on *Epilobium angustifolium* (3♀), Mt. Kopaonik: Samokovska reka, 06.08.2000, leg. ŽT, (SRB); *Aphis schneideri* (Börner): on *Ribes rubrum* (1♂, 1♀), Užice, 09.07.1996, leg. ŽT, (SRB); *Aphis spiraephaga* Müller: on *Spiraea media* (1♂, 1♀), Belgrade: Novi Beograd (62), 05.05.2000, Belgrade: Topčider, 26.05.2000, (1♂, 1♀), 14.05.2006, leg. ŽT, (SRB); *Brachycaudus helichrysi* (Kaltenbach): on *Hieracium* sp. (1♀), Mt. Kopaonik: Ledenica, 03.07.2000, leg. ŽT, (SRB); *Melampyrum cristatum* (1♀), Mt. Šara, 26.07.1990, leg. OP; (SRB); *Solidago virgaurea* (1♂, 1♀), Mt. Kopaonik: Marine vode, 04.07.2000, leg. ŽT, (SRB); *Stenactis annua* (1♀), Slanci, 08.05.2007, leg. ŽT, (SRB); *Capitophorus*

sp.: on *Polygonum persicaria* (3♂), Vlasinsko jezero, 21.07.1990, leg. OP; (SRB); *Corylobium avellanae* (Schrank): on *Corylus avellana* (9♀6♂), Belgrade, 11.05.1997, Belgrade: Botanical Garden, 13.05.1997, Belgrade: Crveni Krst, 09.05.1998, leg. ŽT, (SRB); **Cryptomyzus ribis* (L.): on *Ribes nigrum* (6♂, 9♀), Belgrade: Botanical Garden, 05.05.2006, leg. ŽT, (SRB); *Dysaphis pyri* (Boyer de Fonscolombe): on *Pyrus communis* (3♀), Belgrade: Radmilovac, 22.04.1992, leg. OP, (SRB); *Dysaphis* sp.: on *Malus domestica* (3♂, 7♀), Belgrade, 08.05.1995, leg. OP, (SRB); **Hyadaphis foeniculi* (Passerini): on *Lonicera xylosteum* (6♂, 3♀), Mt. Durmitor: Lokvice, 20.07.2004, leg. ŽT, (MNE); **Hyadaphis* sp.: on **Galium lucidum* (2♂, 1♀), Mt. Durmitor: Crno jezero, 20.07.2004, leg. ŽT, (MNE); **Sanicula europea* (5♂), Mt. Durmitor: Sušica, 22.07.2004, leg. ŽT, (MNE); *Hyalopterus pruni* (Geoffroy): on *Prunus spinosa* (1♀), Užice: Trešnjica, 01.06.1998, leg. ŽT, (SRB); *Macrosiphum cholodkovskyi* (Mordvilko): on *Filipendula ulmaria* (1♂, 1♀), Mt. Kopaonik: Marine vode, 08.07.2000, leg. ŽT; (SRB); **Macrosiphum euphorbiae* (Thomas): on *Euphorbia amygdaloides* (1♂, 1♀), Mt. Durmitor: Zminje jezero, 25.07.2004, leg. ŽT, (MNE); **Macrosiphum prenanthidis* Börner: on *Prenanthes purpurea* (1♂, 1♀), Mt. Durmitor: Zminje jezero, 25.07.2004, leg. ŽT, (MNE); *Macrosiphum rosae* (L.): on *Rosa* sp. (1♂, 1♀), Belgrade: Studentski grad, 16.05.1995, (SRB), Mt. Durmitor: Zminičko jezero, 04.07.1998, leg. ŽT, (MNE); *Macrosiphum* sp.: on *Linum capitatum* (1♂, 1♀), Mt. Durmitor: Mlinski potok, 03.07.2002, leg. ŽT, (MNE); *Metopolophium dirhodum* Walker: on *Avena sativa* (1♂, 1♀), Zemun, 05.06.1989, 13.06.1989, leg. OP, (SRB); *Hordeum vulgare* (1♂, 1♀), Surčin, 27.05.1989, 07.06.1989, leg. OP, (SRB); *Triticum aestivum* (4♂, 3♀), Zemun, 28.05.1989, Zemun, 28.05.1989, 13.06.1989, Kovilovo, 16.06.1989, 31.05.1990, Ražanj, 11.06.1990, Požarevac, 28.05.1990, Surčin, 28.05.1998, leg. OP, (SRB); *Myzus cerasi* (Fabricius): on *Prunus avium*, (1♂, 1♀), Belgrade: Dušanovac, 06.06.1995, leg. ŽT, (SRB); *P. cerasus* (1♂), Belgrade, 28.04.1995, leg. OP, (SRB); *M. ligustri* (Mosley): on *Ligustrum vulgare* (2♂), Surčin, 19.04.1990, leg. OP; (SRB), (2♂, 2♀), Surčin, 6.05.2006, leg. ŽT, (SRB); *Phorodon humuli* (Schrank): on *Prunus cerasus* (1♂), Belgrade, 07.05.1995, leg. OP, (SRB); *P. spinosa* (2♀), Lugavčina, 01.05.1990, leg. OP, (SRB); *Rhopalomyzus lonicerae* Siebold: on *Lonicera tatarica* (1♀), Belgrade: Novi Beograd, 05.04.1990, leg. OP, (SRB); *Schizaphis graminum* (Rondani): on *Hordeum vulgare* (1♂, 1♀), Belgrade: Radmilovac, 18.06.1999, leg. ŽT, (SRB); *Sitobion avenae* (Fabricius): on *Avena sativa* (1♀), Zemun, 25.06.1989, leg. OP, (SRB); *Dactilis glomerata* (5♂, 3♀), Debeli lug, 09.06.1990, leg. OP, (SRB); *Secale* sp. (1♀), Zemun, 30.05.1989, leg. OP, (SRB); *Triticum aestivum* (12♂, 15♀), Surčin, 29.05.1990, 15.06.1990, Obrenovac, 01.06.1990, Kovilovo, 31.05.1990, 12.06.1990, Lugavčina, 18.06.1990, Obrenovac, 24.05.1990, 21.06.1990, Debeli lug, 09.06.1990, Nova Pazova, 24.05.1998, leg. OP, (SRB); *Phloeum michelli* (3♂, 1♀), Mt. Durmitor: Škrka, 7.08. 2005, leg. ŽT; *Sitobion fragariae* (Walker): on *Dactilis glomerata* (2♀), Debeli lug, 09.06.1990, leg. OP, (SRB); *Poa sp.* (2♂), Mt. Durmitor: Zabojsko jezero, 16.07.2006, leg. ŽT, (MNE).

Ephedrus validus (Haliday, 1833)

Root aphid parasitoid (unknown): Mt Durmitor-Kovačka dolina, 20.08.1982, leg. MB (MNE).

Discussion

105 aphid – host plant associations of thirteen species of *Ephedrus* species from Serbia and Montenegro are summarized. Fourteen of the relationships are newly discovered, i.e.:

E. helleni / Cavariella theobaldi / Pastinaca sativa; *E. lacertosus / Acyrthosiphon malvae / Geranium coeruleatum*; *E. lacertosus / Amphorophora rubi / Rubus idaeus*; *E. chaitophori / Chaitophorus leucomelas / Populus nigra*; *E. niger / Uroleucon* sp. */ Chondrilla juncea*; *E. persicae / A. viticis / Vitex agnus castus*; *E. plagiator / Acyrthosiphon* sp./ *Chamaecytisus ciliatus*; *E. plagiator / Aphis epilobii / Epilobium angustifolium*;

E. plagiator / Cryptomyzus ribis / Ribes nigrum; *E. plagiator / Hyadaphis foeniculi / Lonicera xylosteum*; *E. plagiator / Hyadaphis* sp. */ Galium lucidum*; *E. plagiator / Hyadaphis* sp. */ Sanicula europea*; *E. plagiator / M. euphorbiae / Euphorbia amygdaloides*; *E. plagiator / M. prenanthidis / Prenanthes purpurea*. Generally, *A. epilobii* and *C. ribis* represent new host aphids for *E. plagiator* not previously reported.

Furthermore, 53 aphid hosts parasitized by *Ephedrus* species have been detected. *Ephedrus plagiator* and *E. persicae* parasitize the most diverse aphid hosts with 30 and 16 host aphid species, respectively. The remaining 11 *Ephedrus* species exhibited a higher host specialization and parasitize up to four aphid hosts, among which *E. lonicerae*, *E. dysaphidis*, *E. blattnyi* and *E. nacheri* have only a single known aphid host.

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Appendix 1. Review of parasitoid – aphid hosts associations

Ephedrus blattnyi
- *Pterocomma rufipes*

Ephedrus cerasicola
- *Brachycaudus helichrysi*
- *Myzus cerasi*
- *Phorodon humuli*

Ephedrus chaitophori
- *Chaitophorus leucomelas*
- *Chaitophorus* sp.

Ephedrus dysaphidis
- *Dysaphis* sp.

Ephedrus helleni
- *Cavariella aegopodii*
- *Cavariella theobaldi*

Ephedrus lacertosus
- *Acyrthosiphon malvae*
- *Amphorophora rubi*
- *Macrosiphum cholodkovskyi*
- *Macrosiphum rosae*

Ephedrus laevicolis
- *Chaetosiphon tetrarhodum*
- *Longicaudus trirhodus*

Ephedrus lonicerae
- *Hyadaphis foeniculi*

Ephedrus nacheri
- *Hayhurstia atriplicis*

Ephedrus niger
- *Megoura viciae*
- *Uroleucon cichorii*
- *Uroleucon murale*
- *Uroleucon* sp.

Ephedrus persicae
- *Aphis pomi*
- *Aphis viticis*
- *Aphis* sp.
- *Brachycaudus cardui*
- *Brachycaudus helichrysi*
- *Brachycaudus prunicola*
- *Dysaphis plantaginea*
- *Dysaphis pyri*
- *Dysaphis reamuri*
- *Dysaphis* sp.
- *Melanaphis pyraria*
- *Myzus cerasi*
- *Myzus persicae*
- *Phorodon humuli*
- *Rhopalosiphum nymphaeae*
- *Uroleucon solidaginis*

Ephedrus plagiator
- *Acyrthosiphon pisum*
- *Acyrthosiphon* sp.
- *Aphis epilobii*
- *Aphis fabae*
- *Aphis idaei*
- *Aphis salicariae*
- *Aphis schneideri*
- *Aphis spiraephaga*
- *Brachycaudus helichrysi*
- *Capitophorus* sp.
- *Corylobium avellanae*
- *Cryptomyzus ribis*
- *Dysaphis pyri*
- *Dysaphis* sp.
- *Hyadaphis foeniculi*
- *Hyadaphis* sp.
- *Hyalopterus pruni*
- *Macrosiphum cholodkovskyi*
- *Macrosiphum euphorbiae*
- *Macrosiphum prenanthidis*
- *Macrosiphum rosae*
- *Macrosiphum* sp.
- *Metopolophium dirhodum*
- *Myzus cerasi*
- *Myzus ligustri*
- *Phorodon humuli*
- *Rhopalomyzus lonicerae*
- *Schizaphis graminum*
- *Sitobion avenae*
- *Sitobion fragariae*

Ephedrus validus
- Root aphid parasitoid

Appendix 2. Review of host aphid – parasitoid associations

Acyrthosiphon pisum
Ephedrus plagiator

Acyrthosiphon sp.
Ephedrus plagiator

Amphorophora rubi
Ephedrus lacertosus

Aphis epilobii
Ephedrus plagiator

Aphis fabae
Ephedrus plagiator

Aphis idaei
Ephedrus plagiator

Aphis pomi
Ephedrus persicae

Aphis salicariae
Ephedrus plagiator

Aphis schneideri
Ephedrus plagiator

Aphis viticis
Ephedrus persicae

Aphis spiraephaga
Ephedrus plagiator

Aphis sp.
Ephedrus persicae

Brachycaudus cardui
Ephedrus persicae

Brachycaudus helichrysi
Ephedrus cerasicola
Ephedrus persicae
Ephedrus plagiator

Brachycaudus prunicola
Ephedrus persicae

Capitophorus sp.
Ephedrus plagiator

Cavariella aegopodii
Ephedrus helleni

Cavariella theobaldi
Ephedrus helleni

Chaetosiphon tetrarhodum
Ephedrus laevicolis

Chaitophorus leucomelas
Ephedrus chaitophori

Chaitophorus sp.
Ephedrus chaitophori

Corylobium avellanae
Ephedrus plagiator

Cryptomyzus ribis
Ephedrus plagiator

Dysaphis plantaginea
Ephedrus persicae

Dysaphis pyri
Ephedrus persicae
Ephedrus plagiator

Dysaphis reamuri
Ephedrus persicae

Dysaphis sp.
Ephedrus persicae
Ephedrus plagiator
Ephedrus dysaphidis

Hayhurstia atriplicis
Ephedrus nacheri

Hyadaphis foeniculi
Ephedrus lonicerae
Ephedrus plagiator

Hyadaphis sp.
Ephedrus plagiator

Hyalopterus pruni
Ephedrus plagiator

Longicaudus trirhodus
Ephedrus laevicolis

Macrosiphum cholodkovskyi
Ephedrus lacertosus
Ephedrus plagiator

Macrosiphum prenanthidis
Ephedrus plagiator

Macrosiphum rosae
Ephedrus lacertosus
Ephedrus plagiator

Macrosiphum euphorbiae
Ephedrus plagiator

Macrosiphum sp.
Ephedrus plagiator

Megoura viciae
Ephedrus niger

Melanaphis pyraria
Ephedrus persicae

Metopolophium dirhodum
Ephedrus plagiator

Myzus cerasi
Ephedrus cerasicola
Ephedrus persicae
Ephedrus plagiator

Myzus ligustri
Ephedrus plagiator

Myzus persicae
Ephedrus persicae

Phorodon humuli
Ephedrus cerasicola
Ephedrus persicae
Ephedrus plagiator

Pterocomma rufipes
Ephedrus blattnyi

Rhopalomyzus lonicerae
Ephedrus plagiator

Rhopalosiphum nymphaeae
Ephedrus persicae

Schizaphis graminum
Ephedrus plagiator

Sitobion avenae
Ephedrus plagiator

Sitobion fragariae
Ephedrus plagiator

Uroleucon cichorii
Ephedrus niger

Uroleucon murale
Ephedrus niger

Uroleucon solidaginis
Ephedrus persicae

Root aphid parasitoid (unknown)
Ephedrus validus

EPHEDRUS HALIDAY (HYMENOPTERA: BRACONIDAE: APHIDIINAE) У СРБИЈИ И ЦРНОЈ ГОРИ: ТРИТРОФИЧКЕ АСОЦИЈАЦИЈЕ И КЉУЧ

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Извод

У раду је дат преглед 13 врста рода *Ephedrus* са око 100 тритрофичких асоцијација у Србији и Црној Гори сакупљане у периоду 1982-2007. *Ephedrus* врсте су одгајене са 53 афидна домаћина. Четрнаест тритрофичких *Ephedrus* асоцијација су нове за Србију и Црну Гору. *Aphis epilobii* и *Cryptomyzus ribis* су први пут детектовани као домаћини за врсту *Ephedrus plagiator*. Дат је оригинални кључ за идентификацију женки врста рода *Ephedrus*.

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