

***MONOCTONUS* HALIDAY, *FALCICONUS* MACKAUER AND
HARKERIA CAMERON (HYMENOPTERA, BRACONIDAE,
APHIDIINAE) IN SERBIA AND MONTENEGRO:
TRITROPHIC ASSOCIATIONS AND KEY**

¹Ž. TOMANOVIĆ, ²A. PETROVIĆ, ³P. STARÝ AND ⁴N.G. KAVALLIERATOS

¹Institute of Zoology, Faculty of Biology, University of Belgrade,
Studentski trg 16, 11 000 Belgrade, Serbia

²Department of Plant Pests, Institute for Plant Protection and Environment,
Banatska 33, 11080 Zemun, Serbia

³Institute of Entomology, Academy of Sciences of the Czech Republic,
Branišovská 31, 37005 České Budejovicé, Czech Republic

⁴Laboratory of Agricultural Entomology, Department of Entomology and Agricultural Zoology,
Benaki Phytopathological Institute, 8 Stefanou Delta str., 145 61 Kifissia, Attica, Greece

ABSTRACT. A review of species in the genera *Monoctonus*, *Falciconus* and *Harkeria* of the subtribus Monoctonina in Serbia and Montenegro is presented. Eight described species are keyed and illustrated with scanning electron micrographs and line drawings. The species presented in this work have been identified from 10 aphid species occurring on 13 plant taxa. Furthermore, 18 original parasitoid - aphid - plant associations of the species mentioned in the key are presented. The taxonomic status of the genera *Monoctonus*, *Falciconus* and *Harkeria* is also discussed.

KEY WORDS: Review, taxonomy, key, *Monoctonus*, *Harkeria*, *Falciconus*, taxonomic status

INTRODUCTION

The genera *Monoctonus*, *Falciconus* and *Harkeria* belong to the subtribe Monoctonina Mackauer (MACKAUER, 1961a) which together with the subtribe Trioxina Ashmead consist the tribe Trioxini as it was supported by molecular phylogenetic analysis by SMITH et al. (1999) and SANCHIS et al. (2000). MACKAUER (1961b) erected *Falciconus* as a subgenus. Also, STARÝ (1959) treated *Falciconus* as a subgenus of *Monoctonus*. *Falciconus* was mainly considered as a separate genus

(STARÝ 1970; ACHTERBERG, 2004). The taxonomic position of the genus *Harkeria* and the close related genus *Paramonoctonus* was also problematic. Both genera were treated as subgenera of the genus *Monoctonus* (STARÝ, 1959; STARÝ & SMITH, 1976). ACHTERBERG (1989) synonymized *Paramonoctonus* with *Harkeria*. Although the subtribe Monoctonina and the genus *Monoctonus* were revised (STARÝ, 1959; VAN ACHTERBERG, 1989) the taxonomic status of the genera *Falciconus* and *Harkeria* are still unresolved and even the host range pattern related to their phylogenetic positions need to be further supplemented and considered.

The females of Monoctonina species are clearly recognized by the membranous ventral part of the ovipositor sheath which is curved down-wards and more “externed” than mesosoma. These character states are clearly apomorphic. Oviposition behaviour in Monoctonina is recognized as one of the ancient within Aphidiinae regarding the long duration of oviposition (VÖLKL & MACKAUER, 2000). The host range of Monoctonina includes Aphidinae, Thelaxinae and Drepanosiphinae aphids (MACKAUER & STARÝ, 1967).

This paper aims to a further diversity and taxonomical study of Aphidiinae in Serbia and Montenegro. We present the trophic associations existing in Monoctonina genera in Serbia and Montenegro. A key for the identification of species is provided and the taxonomic relationships of *Harkeria*, *Falciconus* and *Monoctonus* are discussed.

MATERIAL AND METHODS

Collection and deposition of specimens

The analyzed specimens were collected during 1982-2006 from many localities in Serbia and Montenegro. Samples from various host plants bearing aphid colonies consisting of both live and mummified aphids were collected. Plants were pressed, herbarized and later identified. Live aphids were preserved in 90% ethanol and 75% lactic acid in a ratio 2:1 (EASTOP & VAN EMDEN 1972) for identification at a later date. The remaining aphid colonies were maintained in the laboratory until parasitoid emergence. Mummies, each attached to a small leaf piece, were placed separately in small plastic boxes and put inside a growth cabinet. On the lid of each box there was a circular opening covered with muslin for ventilation in order to maintain inside the boxes conditions similar to those in the growth cabinet (22.5 °C, relative humidity 65%, 16L:8D) (KAVALLIERATOS et al. 2001, 2004). Slides were made in Canada balsam with dissected parasitoid specimens for later identification. The external structure of the emerged parasitoids was studied using Olympus SZX9 stereomicroscope. Specimens of *Monoctonus crepidis* and *Harkeria angustivalva* were gold coated with a sputter coater and examined using a Cambridge S 150 scanning electron microscope.

The material examined in this study is deposited in the collection of the Belgrade Natural History Museum and the Institute of Zoology, Faculty of Biology, University of Belgrade. The terminology used in this paper for the diagnostic characters of the aphidiines follows SHARKEY & WHARTON (1997) and KAVALLIERATOS et al. (2001).

Diagnostic characters. In the key for the identification of the species of the genera *Monoctonus*, *Falciconus* and *Harkeria* we used mainly meristic (number of antennal flagellomere and number of labial palps) and qualitative characters (ovipositor shape, carination/areolation of propodeum, developed Radial + Median forewing cell, colour). The proportion between flagellomere 1 and 2 was the only quantitative character used for the distinction between *Monoctonus ligustri* and *M. mali*.

RESULTS

Tritrophic (parasitoid-host aphid-plant) relationships

***Monoctonus crepidis* (Haliday 1834)**

Hyperomyzus hieracii (Börner): on *Hieracium* sp. (1 ♀), Durmitor-Zminje jezero, 13.7.2000, *Nasonovia ribisnigri* Mosley: on *Hieracium pilosella* (3 ♀ 2 ♂), Vlasina-Luinci, 24.7.1997, *Nasonovia* sp.: on *Cichorium intybus* (8 ♀ 2 ♂), Durmitor-building NP, 18.7.2000; on *C. alpina* (12 ♀ 9 ♂), Kopaonik-Ledenica, 3.7.2000; on *Lapsana communis* (2 ♀ 4 ♂), Suva planina-Korube, 17.7.1997; on *Hieracium murorum* (52 ♀ 39 ♂), Durmitor-Ivan do, 30.6.2002; on *Hieracium pilosella* (3 ♀ 2 ♂), Vlasina-Luinci, 24.7.1997; on *Hieracium* sp. (433 ♀ 206 ♂), Durmitor-Crno jezero 1.7.1998, 30.6.2001, 20.7.2004, Durmitor-Mali Meded, 3.8.1982, 22.7.2004, Durmitor-Mioč poljana, 14.7.2000, Durmitor-Mlinski potok, 13.7.2000, Durmitor-Ražana Glava, 4.7.1998, Durmitor-Sušica, 2.7.2000, Durmitor-Zminje jezero, 2.7.1998, Durmitor-Zminje jezero, 13.7.2000, Kopaonik, 14.7.1988, Kopaonik-Ledenica, 3.7.2000, Kopaonik-Lisičje stene, 5.7.2000, Kopaonik-Marina voda, 3.7.2000, Kopaonik-Markov kamen, 5.7.2000, Kopaonik-Samokovska reka, 5.7.2000, 8.7.2000, 9.7.2000, Stara panina-Babin Zub, 20.7.1983, Vlasina-Čemernik, 29.7.1996, Vlasina-Čemernik, 31.7.1996, Vlasina-brana, 28.7.1996, Mt Durmitor-Sušica, 2.7.2002; Mt Durmitor-Komarnica, 21.7.2004; Mt Durmitor-Škrka, 23.7.2004.

***Monoctonus leclanti* Tomanović & Starý 2002**

Delphinobium junackianum Karsch: on *Aconitum toxicum* ssp. *bosniacum* (7 ♀ 1 ♂), Durmitor-Crno jezero, 15.8.1997, 19.7.2000, Mt Durmitor-Sušica, 2.7.2002; Mt Kopaonik-Metode, 18.8.1998, 20.7.1999; *A. pentheri* (4 ♀), Mt Kopaonik-Samokovka, 4.7.2000, Mt Kopaonik-Metode, 7.8.2000.

***Monoctonus mali* van Achterberg 1989**

Dysaphis reamuri (Mordvilko) on *Pyrus communis* (2 ♂), Beograd-Radmilovac, 13.5.1998. *Dysaphis* sp. on *Malus domestica* (1 ♀), Šara-Brezovica, 20.7.1995. *Rhopalosiphum insertum* Walker on *M. domestica* (2 ♀), Beograd, 8.5.1995.

***Monoctonus nervosus* (Haliday 1833)**

Acyrtosiphon malvae (Mosley) on *Salix retusa* (3 ♀ 4 ♂), Mt Durmitor-Mali Meded, 6.7.1998, 14.7. 2000, 18.7.2000, Mt Durmitor-Ledena pećina, 17.7.2000, Mt Durmitor-Struga, 14.7. 2000.

***Monoctonus ligustri* van Achterberg 1989**

Myzus ligustri (Mosley) on *Ligustrum vulgare* (6 ♀ 3 ♂), Surčin 6.5.2006.

***Harkeria angustivalva* (Starý 1959)**

Nasonovia sp.: on *Hieracium* sp. (4 ♀ 2 ♂), Kopaonik, 2.7.2000, Kopaonik-Samokovska reka, 5.7.2000.

***Falciconus pseudoplatani* (Marshall 1896)**

Drepanosiphum platanoides (Marshall) on *Acer* sp., (2 ♂), Suvaja, 14.7.1998; Mt Durmitor-Komarnica, 21.7.2004.

Key for the identification of the species of the genera *Monoctonus*, *Falciconus* and *Harkeria* based on adult females

1.	Propodeum without central areola, just with two divergent carinae at the base (Fig. 1); ovipositor sheath needle shaped (Fig. 2).	<i>Harkeria angustivalva</i>
-	Propodeum areolated (Fig. 3); ovipositor sheath plough-share shaped (Fig. 4) or only gradually widened ventrally (Fig. 5).	2
2.	Ovipositor sheath only gradually widened ventrally.	3
	Ovipositor sheath plough-share shaped.	4
3.	Antennae 15-16-segmented; labial palps 2-segmented; body brown to dark coloured.	<i>Falciconus pseudoplatani</i>
-	Antennae 16-17-segmented (Fig. 6); labial palps 3-segmented; body light brown to yellow coloured.	<i>Monoctonus leclanti</i>
4.	Radial + Median forewing cell closed (Fig. 7).	5
-	Radial + Median forewing cell opened and r-m and m-cu veins completely absent (Fig. 8).	6
5.	Antennae 13-14-segmented.	<i>Monoctonus crepidis</i>
-	Antennae 15-16-segmented.	<i>Monoctonus nervosus</i>
6.	Forewing 2-1A vein not sclerotized (Fig. 8); flagellomere 1 elongate, about 1.5 times longer than flagellomere 2 (Fig. 9).	<i>Monoctonus ligustri</i>
-	Forewing 2-1A vein sclerotized (Fig. 10); flagellomere 1, 1.1-1.2 times longer than flagellomere 2 (Fig. 11).	<i>Monoctonus mali</i>

DISCUSSION

The taxonomical status of the genera *Monoctonus*, *Falciconus* and *Harkeria* is still unresolved. On the basis of morphological characters there is no clear distinction among them. *Falciconus* and *Harkeria* share a narrow and elongate ovipositor sheath as well as 2-segmented labial palps as synapomorphies. Although, *Harkeria* species are separated from *Monoctonus* by the needle shaped ovipositor sheath, two divergent carinae at the base of propodeum and 2-segmented labial palps, some newly discovered *Monoctonus* species (*M. leclanti* and *M. allisoni*) possess narrow ovipositor sheath (TOMANOVIĆ et al., 2002, PIKE et al., 2003). Also, *Monoctonus hispanicus* described by TIZADO (1992) has two divergent carinae at the base of propodeum. Our unpublished molecular data (28SDNA gene) suggest the transitional position of *M. leclanti* between the *Harkeria* and *Monoctonus* species.

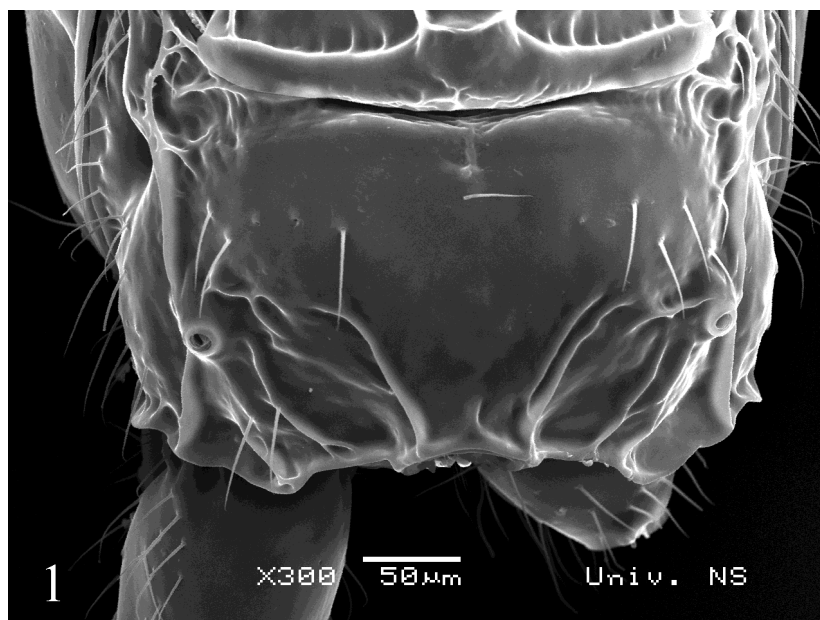


Fig. 1. *Harkeria angustivalva*, propodeum, dorsal aspect.

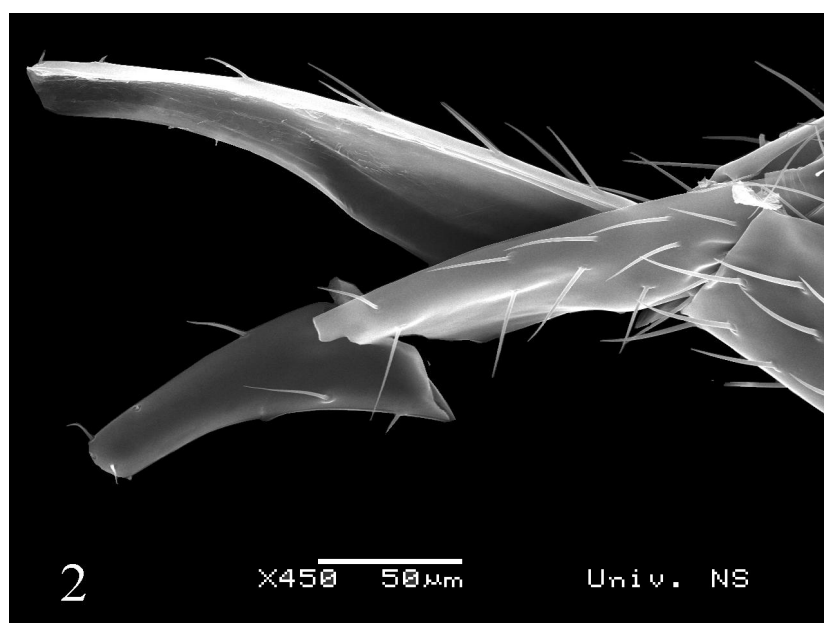


Fig. 2. *Harkeria angustivalva*, ovipositor sheath, lateral aspect.

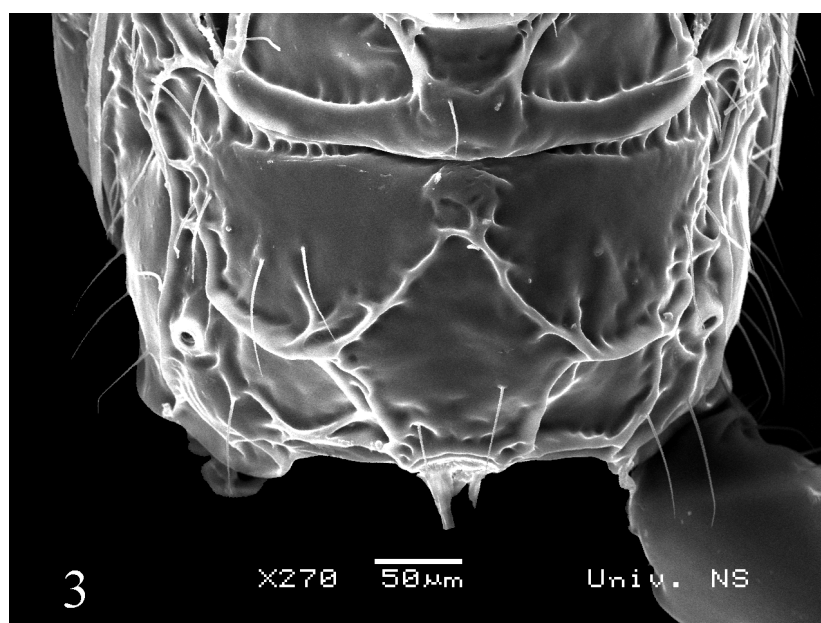


Fig. 3. *Monoctonus crepidis*, propodeum, dorsal aspect

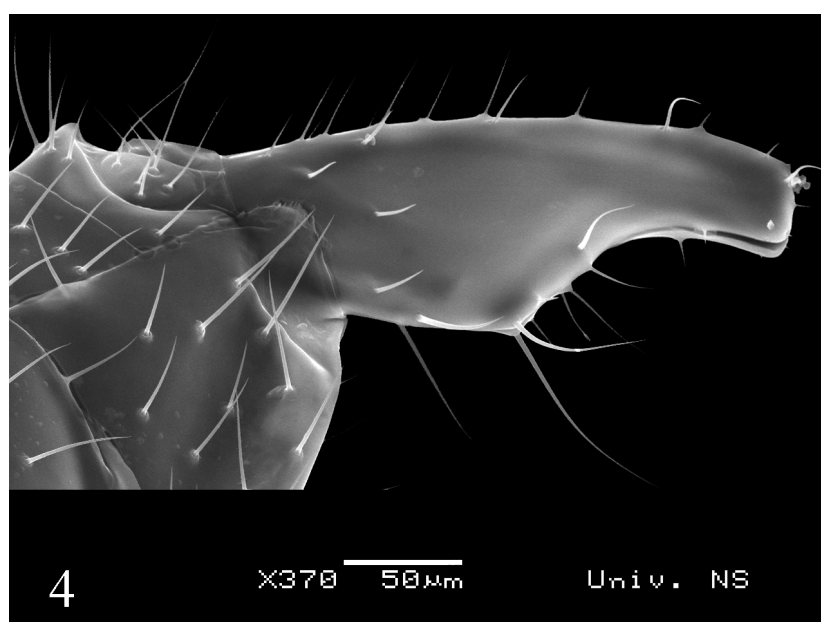


Fig. 4. *Monoctonus crepidis*, ovipositor sheath, lateral aspect.

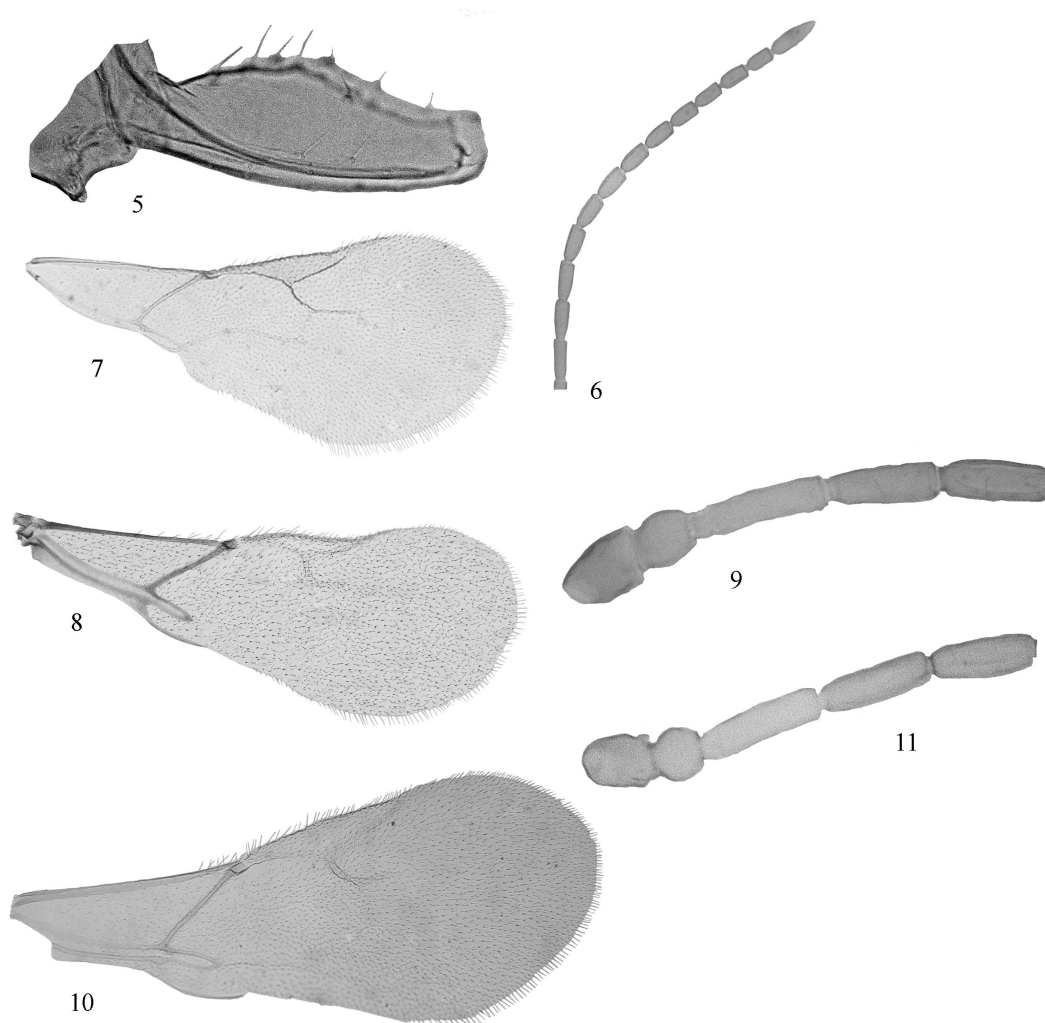


Fig. 5. *Monoctonus leclanti*, ovipositor sheath, lateral aspect.

Fig. 6. *Monoctonus leclanti*, antennae, lateral aspect.

Fig. 7. *Monoctonus crepidis*, forewing.

Fig. 8. *Monoctonus ligustri*, forewing.

Fig. 9. *Monoctonus ligustri*, flagellomeres 1 and 2.

Fig. 10. *Monoctonus mali*, forewing.

Fig. 11. *Monoctonus mali*, flagellomeres 1 and 2.

A more detailed analysis of the morphological characters within the subtribe Monoctonina supported by molecular phylogenetic studies will help us to understand the relationships and taxonomic status among Monoctonina genera. Also, the evolutionary position of some morphological characters and the relationship with host aphid should be resolved.

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***MONOCTONUS* HALIDAY, *FALCICONUS* MACKAUER И *HARKERIA*
CAMERON (HYMENOPTERA, BRACONIDAE, APHIDINAE) У
СРБИЈИ И ЦРНОЈ ГОРИ: ТРИТРОФИЧКЕ АСОЦИЈАЦИЈЕ И КЉУЧ**

Ж. ТОМАНОВИЋ, А. ПЕТРОВИЋ, П. СТАРИ И Н. Г. КАВАЛИЕРАТОС

ИЗВОД

У раду је дат преглед укупно осам врста родова *Monoctonus*, *Falciconus* и *Harkeria* у Србији и Црној Гори, међу којима су *Falciconus* и *Harkeria* представљене са по једном врстом. Укупно је идентификовано десет афидних домаћина на 13 биљних таксона, односно 18 оригиналних тритрофичких асоцијација. Таксономски статус родова *Monoctonus*, *Falciconus* и *Harkeria* је дискутован, а такође је дат и оригинални кључ за идентификацију врста наведених родова са 11 илустрација.

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