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TRIOXYS HALIDAY (HYMENOPTERA: BRACONIDAE: APHIDIINAE) IN SERBIA AND MONTENEGRO

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In this paper we present a review of 11 *Trioxys* species found in Serbia and Montenegro, with their host range pattern. Also, 40 line drawings and a key for the identification of the species are given. All localities are indicated by UTM. *Trioxys pannonicus* Starý is first reported here for the first time in the Serbia and Montenegro.

KEY WORDS: *Trioxys*, Aphidiinae, review, key.

INTRODUCTION

The genus *Trioxys* Haliday is one of the most diverse genera within the subfamily Aphidiinae (MACKAUER, 1960, MACKAUER & STARÝ, 1967, MACKAUER, 1968). *Trioxys* species share the following sinapomorphous characters: small body size, reduced wing venation (only radial vein on forewing distinct (Figs. 18, 35) and paired accessory prongs on the last abdominal sternite (Figs. 2, 8, 14, 19, 24, 32, 38). Paired accessory prongs on the last abdominal sternite represents an adaptation to aphid host oviposition. On the other hand species of the genus *Trioxys* parasitize the most basal lineage of aphid hosts such as Callaphididae, Thelaxidae, Greenideidae and Lachnidae. The current studies of molecular phylogeny show a different position of the genus *Trioxys*, either within the separate tribus – Trioxyni

as sister group of tribus Aphidiini (BELSHAW & QUICKE, 1997), or within the tribus Aphidiini as basal lineage (SMITH *et al*., 1999, KAMBHAMPATI *et al*., 2000, SANCHIS *et al*., 2000).

The faunistic records of Trioxys in Southeastern Europe were given by ATANASSOVA (1997), KOLAROV (1997), TOMANOVIĆ *et al*. (1998), KAVALLIERATOS *et al*. (2001), KAVALLIERATOS *et al*. (2004).

In this paper a review of *Trioxys* species in Serbia and Montenegro, together with their host range pattern and a key for the identification of species are presented.

MATERIAL AND METHODS

Plant samples bearing aphid colonies consisting of both live and mummified aphids, were collected from many localities in Serbia and Montenegro. The plants were pressed herbarized and later identified. Live aphids were preserved in 90% ethyl-alcohol and 75% lactic acid 2:1 (EASTOP & VAN EMDEN, 1972). The remaining parts of the samples were put inside a growth cabinet (22.5 °C, 65% relative humidity, 16:8 L:D photoperiod) till parasitoid emergence. The slides of dissected parasitoid specimens were prepared in Canada balsam for later identification.

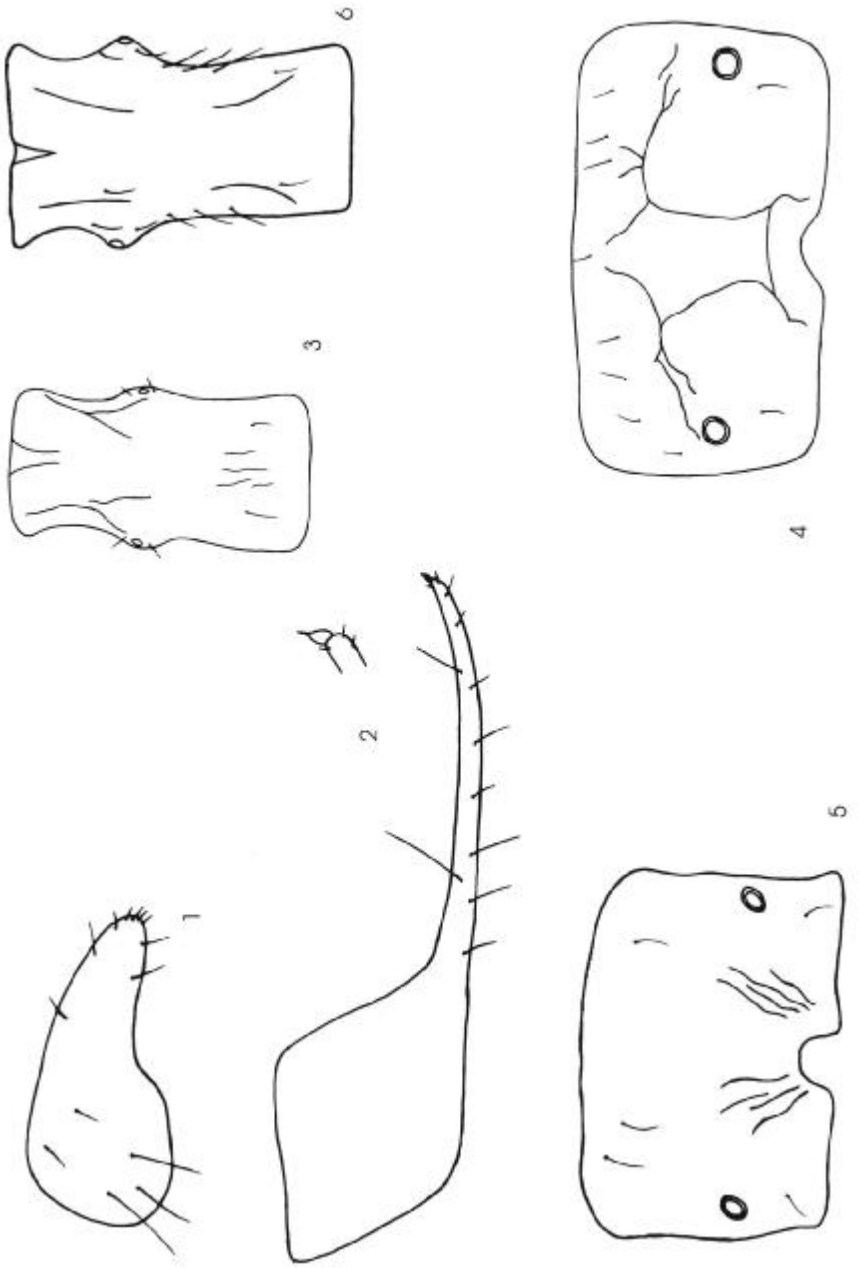
All material was checked by the authors. Nomenclature of aphids is based on REMAUDIÈRE & REMAUDIÈRE (1997) whereas aphid parasitoids nomenclature follows MACKAUER & STARÝ (1967), HUBER & SHARKEY (1993).

All localities are indicated by UTM.

RESULTS

Trioxys betulae (Marshall, 1896)
Figs. 1-4

Callaphis flava Mordvilko: Belgrade-Topčider (UTM=DQ55), 16.05.1998 on *Betula* sp. (3**E**3**G**), leg. ŽT, (SER); ***Eucallipterus tiliae*** (L.): Sićevo gorge (EN99), 2.06.1996 on *Tilia cordata* (12**G**), leg. VŽ (SER); ***Symydobius oblongus*** (von Heyden): Mt Vlasina-Čemernik (FN03), 30.07.1996 on *Betula pendula* (2**E**2**G**), leg. ŽT, (SER).



Figs. 1-6. *T. betulae* – 1. Ovipositor sheath; 2. Prong; 3. Tergite 1; 4. Propodeum; *T. chaetosiphonis* – 5. Propodeum; 6. Tergite 1.

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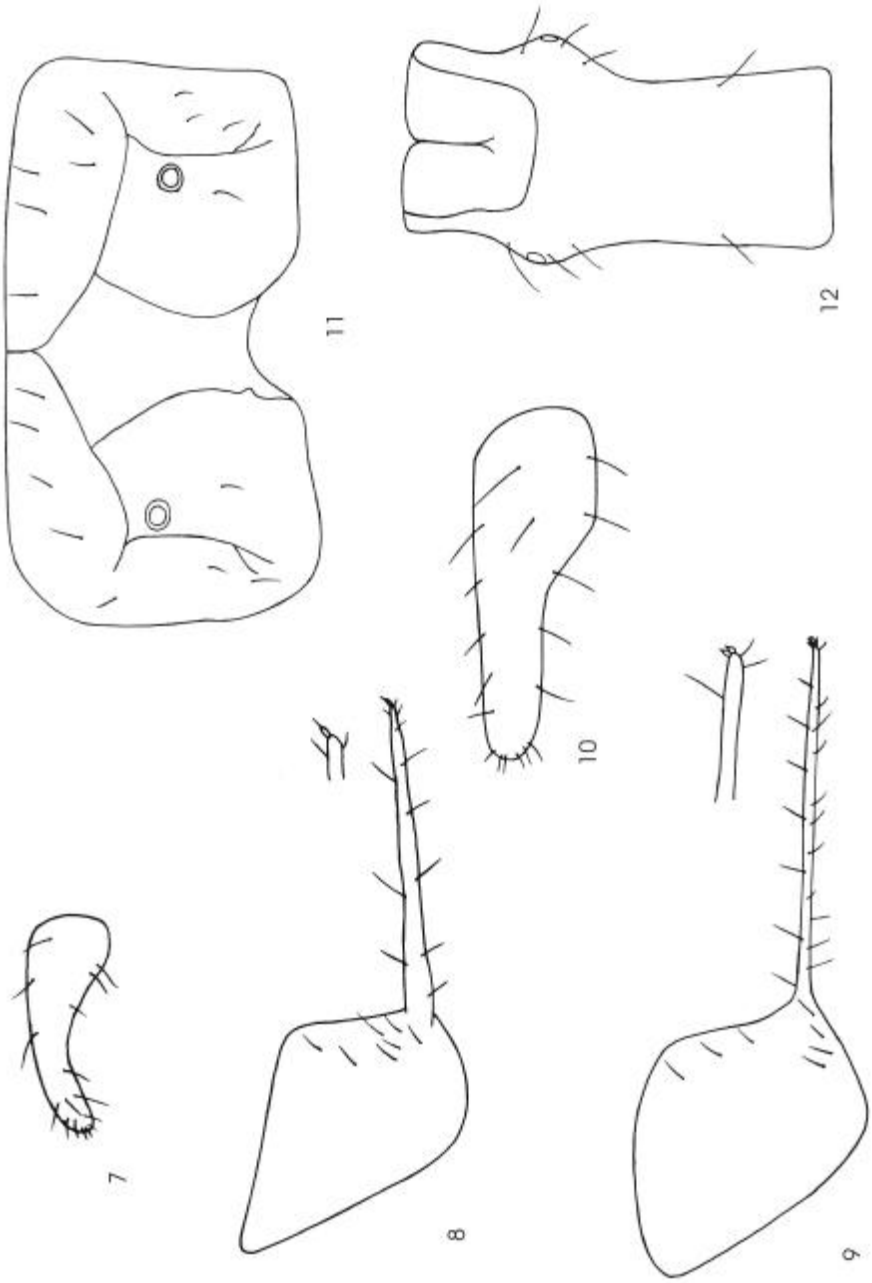
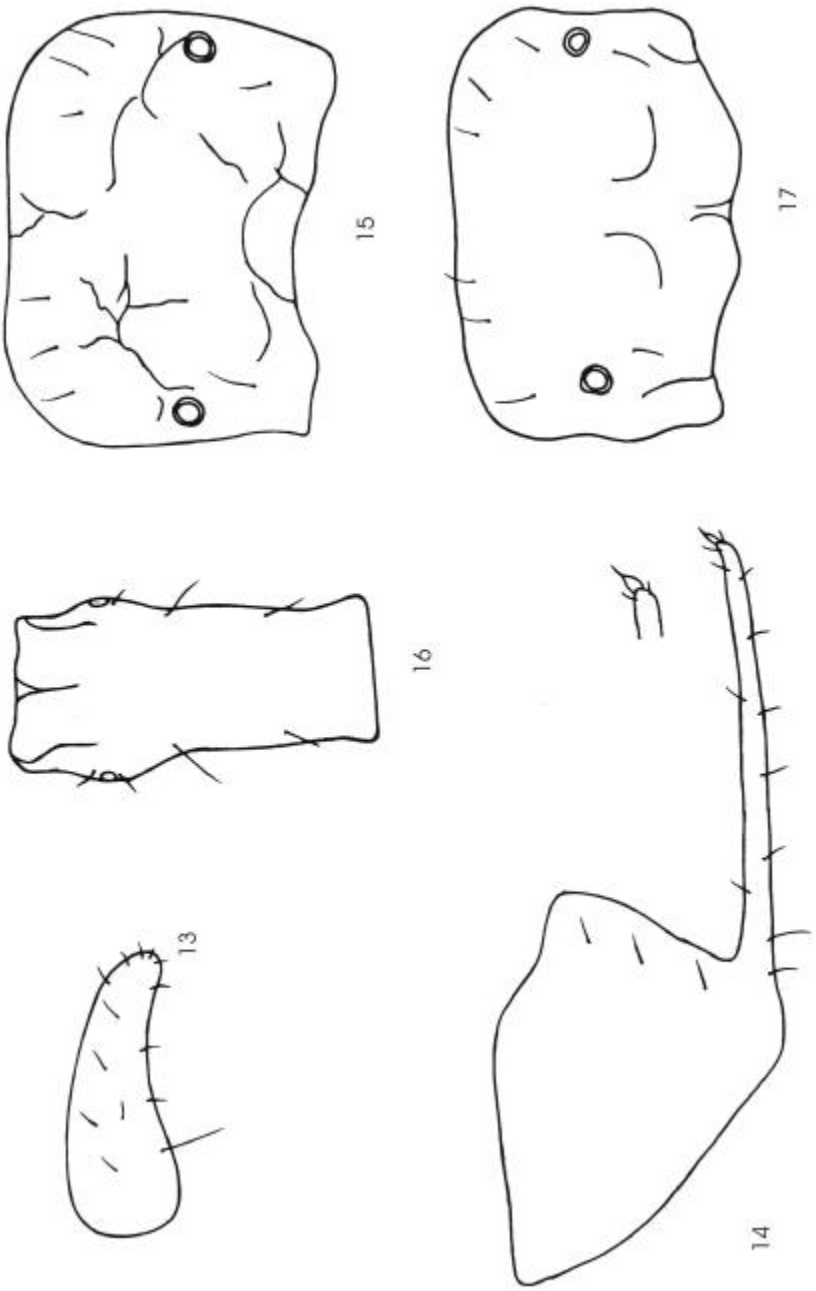


Figs. 7-12. *T. chaetosiphonis* – 7. Ovipositor sheath; 8. Prong; *T. cirsii* – 9. Prong; 10. Ovipositor sheath; 11. Propodeum; 12. Tergite 1.



Figs. 13-17. *T. complanatus* – 13. Ovipositor; 14. Prong; 15. Propodeum; *T. humuli* – 16. Tergite 1; 17. Propodeum.

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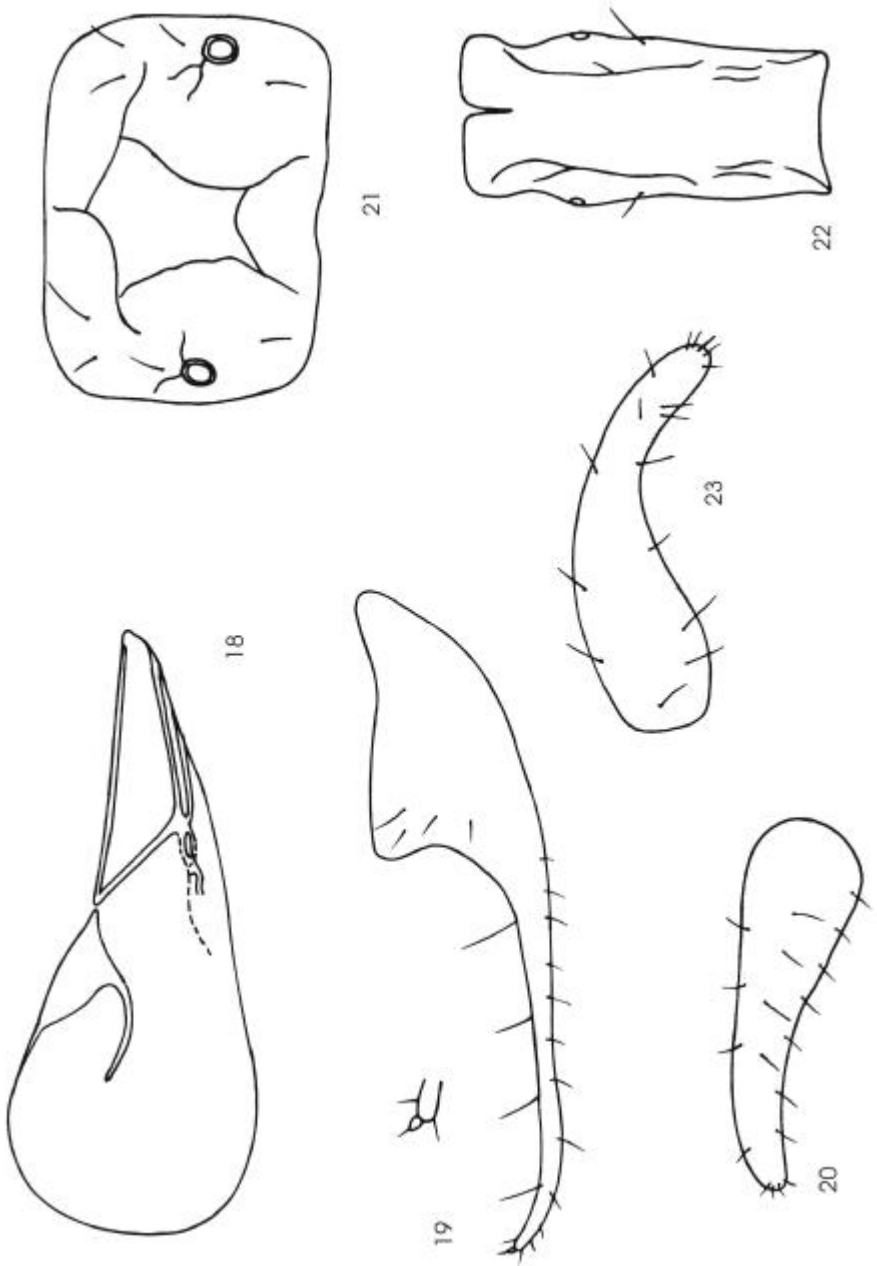
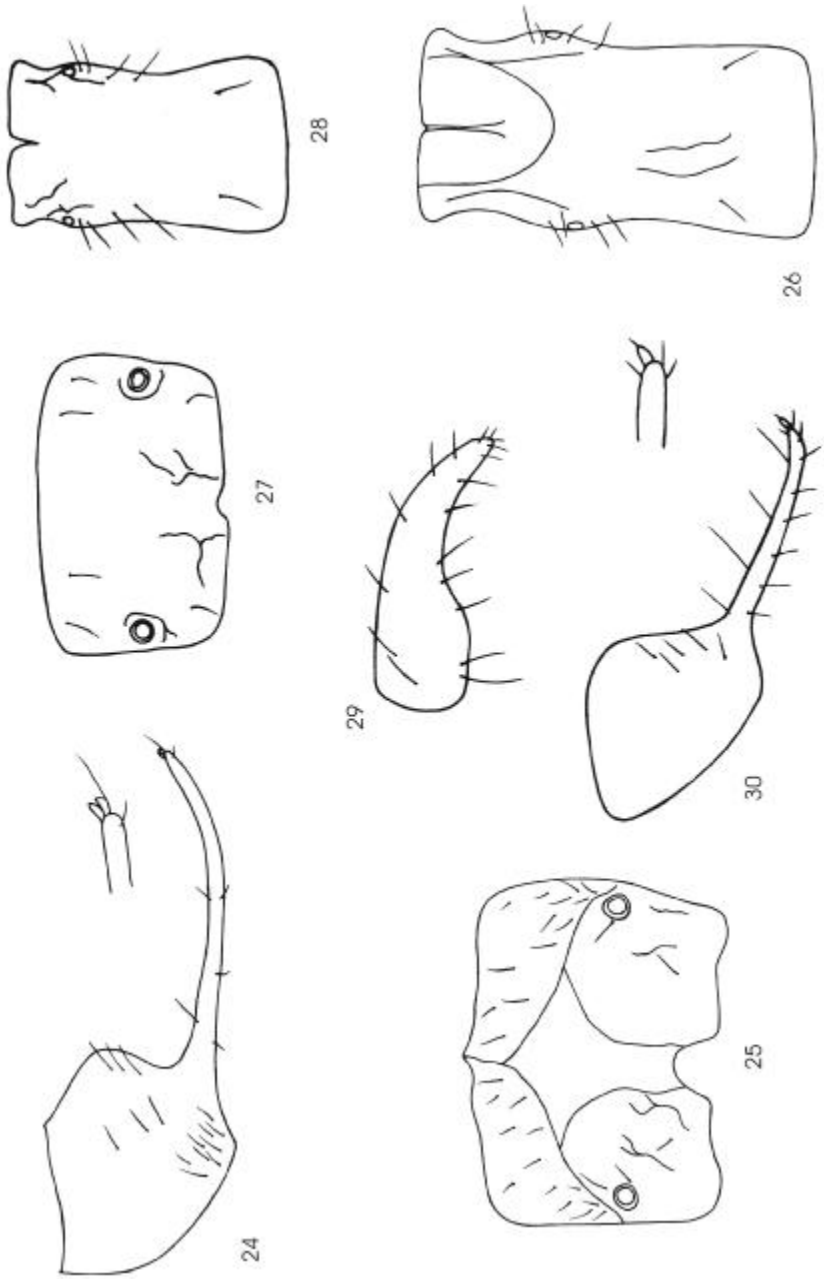


Figs. 18-23. *T. curvicaudus* – 18. Forewing; 19. Prong; 20. Ovipositor sheath; 21. Propodeum; 22. Tergite 1; *T. falcatus* – 23. Ovipositor sheath.



Figs. 24-30. *T. falcatus* – 24. Prong; 25. Propodeum; 26. Tergite 1; *T. galiobii* – 27. Propodeum; 28. Tergite 1; 29. Ovipositor sheath; 30. Prong.

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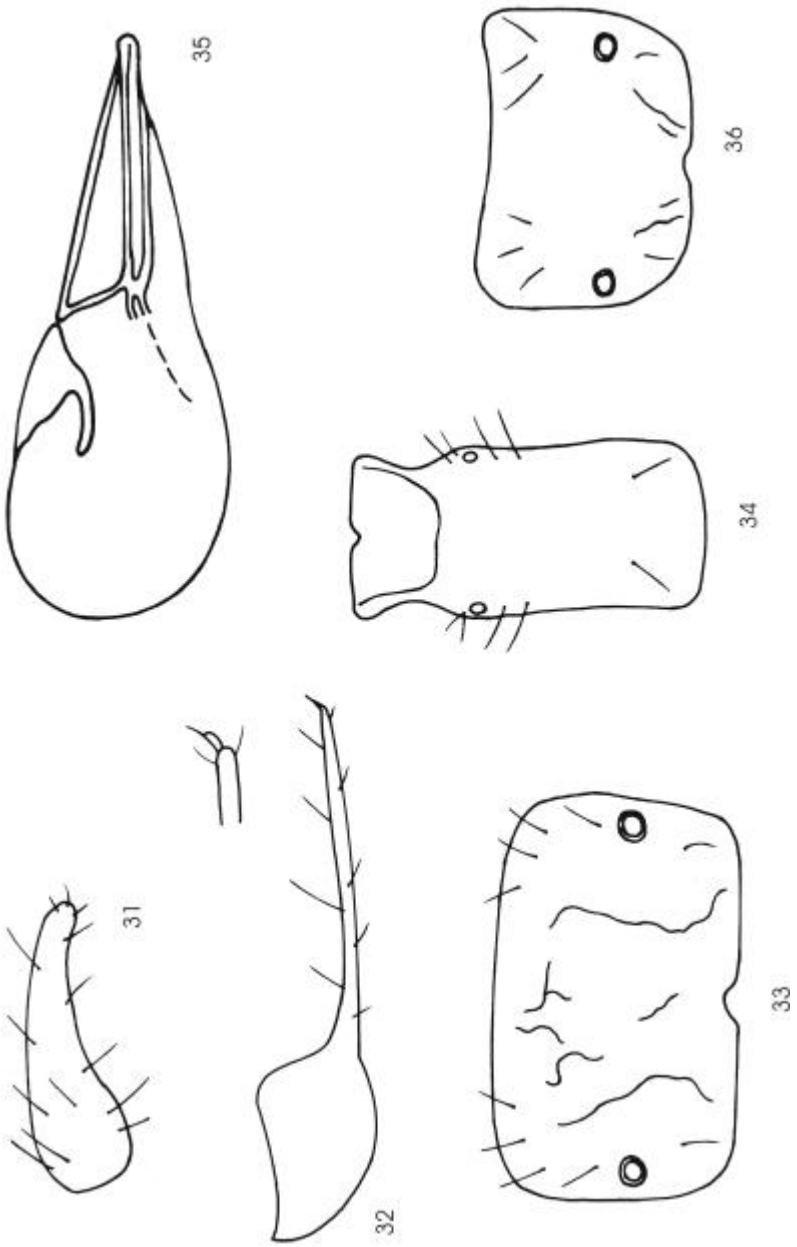
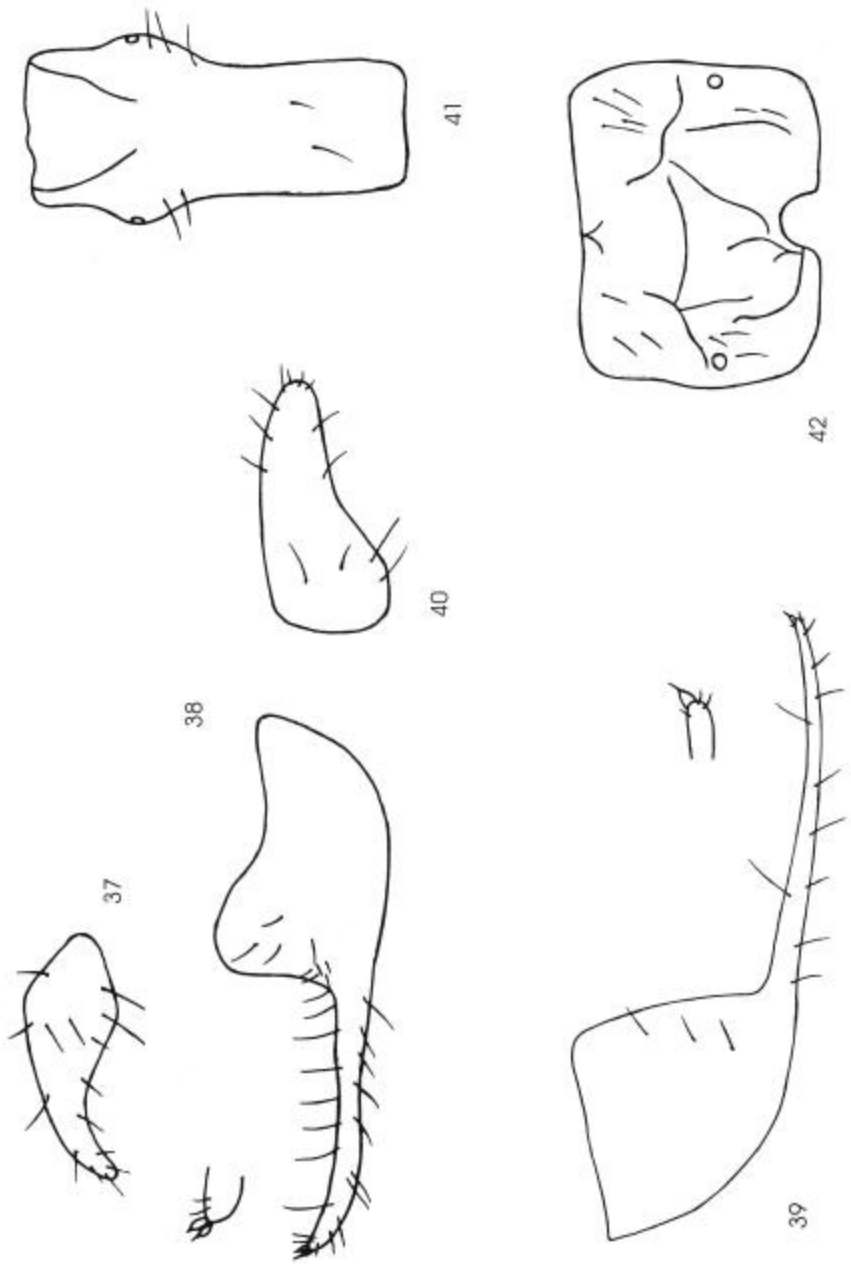


Figs. 31-36. *T. pallidus* – 31. Ovipositor sheath; 32. Prong; 33. Propodeum; 34. Tergite 1; *T. pannonicus* – 35. Forewing; 36. Propodeum.



Figs. 37-42. *T. pannonicus* – 37. Ovipositor sheath; 38. Prong; *T. phyllaphidis* – 39. Prong; 40. Ovipositor sheath; 41. Tergite 1; 42. Propodeum.

Trioxys chaetosiphonis Starý, 1971
Figs. 5-8

Longicaudus trirhodus (Walker): Mt Kopaonik-Samokovska reka (DN88), 8.07.2000 on *Thalictrum aquilegifolium* (2**E**), leg. ŽT, (SER).

Trioxys cirsii (Curtis, 1831)
Figs. 9-12

Drepanosiphum platanoidis Schrank: Belgrade-Botanical Garden (DQ56), 2.05.1998, on *Acer pseudoplatanus* (1**E**1**G**), leg. ŽT, (SER); Belgrade-Topčider (DQ55), 16.05.1998, on *Acer pseudoplatanus* (2**E**), leg. ŽT, (SER).

Trioxys complanatus Quilis, 1931
Figs. 13-15

Therioaphis trifolii (Monell): Kovilovo (DQ46), 15.07.1992, 13.09.1992, 27.09.1992, 5.06.1993, 11.06.1993, 14.09.1993, 10.10.1993 on *Medicago sativa* (32**E**24**G**), leg. ŽT, (SER).

Trioxys curvicaudus Mackauer, 1967
Figs. 18-22

Eucalipterus tiliae (L.): Belgrade-Topčider (DQ55), 16.05.1998 on *Tilia cordata* (3**E**), leg. ŽT, (SER); New Belgrade (45) (DQ45), 12.09.1999, 19.09.1999 on *Tilia sp*. (15**E**8**G**), leg. ŽT, (SER).

Trioxys falcatus Mackauer, 1959
Figs. 23-26

***Peryphillus* sp**.: Belgrade-Crveni krst (DQ65), 18.04.1990 on *Acer platanoides* (3**E**), leg. OP, (SER).

Trioxys galiobii Starý, 1974
Figs. 27-30

Myzus langei Börner: Zlatarsko jezero (DP00), 11.07.1991 on *Galium lucidum* (1**E**), leg. OP, (SER).

Trioxys humuli Mackauer, 1960
Figs. 16-17

Phorodon humuli Schrank: Belgrade-Dušanovac (DQ64), 27.05.1995 on

Table I. Key to *Trioxys* species in the Serbia and Montenegro:

1.	Forewing distal abscissa of R1 (metacarpus) pointlike (Fig. 35); three-segmented maxillary and one-segmented labial palps.	*Trioxys pannonicus* Starý
-	Forewing distal abscissa of R1 (metacarpus) normal developed (Fig. 18); four-segmented maxillary and two-segmented labial palps.	2
2.	Propodeum almost smooth with divergent carinae in lower part (Figs. 5, 17, 27).	3
-	Propodeum areolated (Figs. 5, 15, 21, 25, 33, 42)	5
3.	Propodeum with few divergent carinae in lower part (Figs. 17, 27); tergite I with moderately prominent spiracular tubercles (Figs. 16, 28).	4
-	Propodeum with large numbers divergent carinae in lower part (Fig. 11); tergite I with prominent spiracular tubercles (Fig. 12).	*Trioxys chaetosiphonis* Starý
4.	Tergite I almost square (Fig. 28).	*Trioxys galiobii* Starý
-	Tergite I distinctly longer than wide (Fig. 16).	*Trioxys humuli* Mackauer
5.	Prongs with 2 dilated bristles at apex (Figs. 9, 24).	6
-	Prongs with 1 dilated bristles at apex (Figs. 2, 14, 19, 32, 39).	7
6.	Prongs almost straight with 6-8 setae on dorsal surface (Fig. 9).	*Trioxys cirsii* (Curtis)
-	Prongs distinctly arcuate with 2 setae on dorsal surface (Fig. 24).	*Trioxys falcatus* Mackauer
7.	Propodeal areola clearly defined (Fig. 21).	*Trioxys curvicaudus* Mackauer
-	Propodeal areola is not clearly defined (Figs. 4, 15, 33, 42); propodeum with large number irregular carinae.	8
8.	Prongs almost straight (Figs. 14, 32).	9
-	Prongs moderately arcuate (Figs. 2, 39).	10
9.	Ovipositor sheath broad (Fig. 13).	*Trioxys complanatus* Quilis
-	Ovipositor sheath narrow (Fig. 31).	*Trioxys pallidus* (Haliday)
10.	Tergite I carinated in lower part (Fig. 3).	*Trioxys betulae* (Marshall)
-	Tergite I smooth (Fig. 41).	*Trioxys phyllaphidis* Mackauer

Humulus lupulus (2**E**?1**G**), leg. ŽT, (SER); Belgrade-Galovica (DQ45), 14.05.2000 on *H. lupulus* (1**G**), leg. ŽT, (SER).

Trioxys pallidus (Haliday, 1834)
Figs. 31-34

Chromaphis juglandicola Kaltenbach: Belgrade-Dušanovac (DQ64), 6.06.1993 on *Juglans regia* (2**G**), leg. ŽT, (SER); Palić-Selevenjske pustare (DS00), 7.09.1995 on *J. regia* (2**E**5**G**), leg. ŽT, (SER); Mt Suva planina-Glogovac (EN98), 18.07.1999 on *J. regia* (2**G**), leg. ŽT, (SER); ***Myzocallis carpini*** (Koch): Belgrade-Topčider (DQ55), 24.06.1995 on *Carpinus betulus* (1**G**), leg. ŽT, (SER); ***Panaphis juglandis*** (Goeze): Mt Beljanica-Resava (EP19), 11.07.1998 on *Juglans regia* (1**G**), leg. ŽT, (SER); ***Pterocallis alni*** (de Geer): Mt Durmitor-Đurđevića Tara (CN37), 22.08.1990 on *Alnus glutinosa* (2**G**), leg. OP, (MNG).

Trioxys pannonicus Starý, 1960
Figs. 35-38

***Titanosiphon sp.*:** Ečka (DR51), 24.05.2002 on *Achilea sp*. (1**E**1**G**), leg. ŽT, (SER).

Trioxys phyllaphidis Mackauer, 1961
Figs. 39-42

Phyllaphis fagi (L.): Mt Durmitor-Struga (CN37), 14.07.2000 on *Fagus sylvatica* (2**E**), leg. ŽT, (MNG).

DISCUSSION

We found 11 species of *Trioxys* in Serbia and Montenegro. The majority of them live in forest type habitats: *T. betulae*, *T. cirsii*, *T. chaetosiphonis*, *T. curvicaudus*, *T. falcatus*, *T. galiobii*, *T. pallidus* and *T. phyllaphidis*. Steppe habitats inhabit *T. complanatus*, *T. humuli* and *T. pannonicus*.

T. pannonicus is reported for the first time in Serbia and Montenegro. This species is distributed in steppe areas of Palaearctic. It originated from xerotermic habitats of Central Asia (STARÝ, 1960; TREMBLAY, 1972). *T. pannonicus* has three autapomorphous characters: pointlike of forewing distal abscissa of R1 (metacarpus), three-segmented maxillary and one-segmented labial palps.

T. complanatus is an important natural enemy of the spotted alfalfa aphid, *Terioaphis trifolii* on *Medicago* and *Trifolium* plants. Some European populations of this parasitoid were introduced in Australia (HUGHES *et al*., 1987) and USA (BARNES, 1960) as biocontrol agents of *T. trifolii* on lucerne crops. *T. pallidus* parasitize many species of arboricolous aphids in Europe (STARÝ, 1978). Populations of *T. pallidus* from France were introduced in the USA as biocontrol agents of walnut aphid, *Chromaphis juglandicola* (BOSCH *et al*., 1959, 1962) and filbert aphid, *Myzocallis coryli* Goetze (MESSING & ALINIAZEE, 1989). *T. curvicaudus* parasitize linden aphid, *Eucallipterus tilliae*, which produce honeydew on lindens planted in urban environments. *T. curvicaudus* was introduced and succesfully established as biocontrol agent of *E. tilliae* in California (USA) (ZUPARKO, 1983).

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ВРСТЕ РОДА *TRIOXYS* HALIDAY (HYMENOPTERA: BRACONIDAE: APHIDIINAE) У СРБИЈИ И ЦРНОЈ ГОРИ

Ж. ТОМАНОВИЋ и N. G. KAVALLIERATOS

И з в о д

У фауни Србије и Црне Горе до сада је нађено укупно 11 врста рода *Trioxys*. За сваку врсту су дати основни подаци (датум сакупљања, локалитет, однос полова), као и подаци везани за биљку хранитељку и афидног домаћина. На основу прегледаног материјала, дат је кључ за идентификацију врста рода *Trioxys* у Србији и Црној Гори, илустрован са 40 цртежа. Сви локалитети су представљени у УТМ мрежи. Дискутован је и примењени значај појединих врста.

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