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Potential candidates for biological control of the black bean aphid *Aphis fabae* in Serbia

Saša S. Stanković*, Marijana Ilić Milošević, Vladimir Žikić

University of Niš, Faculty of Sciences and Mathematics, Department of Biology and Ecology, Višegradska 33, 18000 Niš, Serbia

** E-mail: sasasta@gmail.com*

***Abstract*:**

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The black bean aphid is widely spread aphid species in the Palaearctic, known to attack over 1150 plant species. Because some of the host plants are of great agricultural interest, *Aphis fabae* represent a very important pest. We assembled all data concerning the presence of this pest and connected it in tritrophic associations. In the period of 24 years investigation on the territory of Serbia it has been recorded in 107 trophic associations. In total there are 145 findings of *A. fabae* parasitized by 19 taxa of Aphidiinae (Brackonidae) from seven genera. The most suitable biocontrol agents for the black bean aphid are *Lysiphlebus fabarum*, *Binodoxys angelicae*, *Lipolesis gracilis* and the introduced species *Lysiphlebus testaceipes*.

Key words: *Aphis fabae*, parasitoids, Aphidiinae, tritrophic associations

***Apstrakt*:**

Stanković, S.S., Ilić Milošević, M., Žikić, V.: Potencijalni kandidati za biološku kontrolu crne repine vaši *Aphis fabae* u Srbiji. *Biologica Nyssana, 6 (1), Septembar 2015: 49-54.*

Crna repina vaš je rasprostranjena širom palearktika. Ova biljna vaš je zabeležena na preko 1150 vrsta biljaka. S obzirom na to da su mnoge biljke domaćini veoma bitne sa agrikulturnog stanovišta, *Aphis fabae* predstavlja veoma vašnu štetočinu u zasadima gajenih biljaka. Prikupljeni su podaci o prisustvu crne repine vaši u periodu od 24 godine na teritoriji Srbije, a rezultati su predstavljeni u vidu tritrofičkih asocijacija. Tokom istaraživanog perioda zabeleženo je 107 asocijacija. Ukupno je registrovano 145 nalaza *A. fabae* koju je parazitiralo ukupno 19 taksona potfamilije Aphidiinae (Braconidae) iz sedam rodova. Najpogodnije vrste za biološku kontrolu crne repine vaši su *Lysiphlebus fabarum*, *Binodoxys angelicae*, *Lipolesis gracilis*, a takođe i introdukovana vrsta *Lysiphlebus testaceipes*.

Key words: *Aphis fabae*, parasitoidi, Aphidiinae, tritrofičke asocijacije

Introduction

The black bean aphid, *Aphis fabae* Scopoli 1763 (Aphididae) is one of the most common aphid in Europe. It is notorious for attacking many crops, especially broad bean *Vicia faba* (Fabaceae) and beet *Beta vulgaris* (Amaranthaceae), but also many other host plants which are of agricultural importance. According to Holman (2008) *A. fabae* has been reported on over 1150 host plants. This species has almost global distribution; it is especially common in temperate regions (Blackman & Eastop, 2008). Regarding its wide plant host range it is very difficult to comprehend biology and ecology of this particular group. Therefore *A. fabae* (*sensu lato*) has long been

considered as a species complex and there were many attempts to resolve this problem (Müller & Steiner, 1986; Thieme & Dixon, 1996; Raymond et al., 2001). Today there are five recognized taxa of the *A. fabae* complex, three of them considered on a subspecies level: *A. fabae fabae* Scopoli 1763, *A. fabae cirsiiacanthoidis* Scopoli 1763, *A. fabae mordvilkoi* Börner & Janisch 1922; while *A. evonymi* Fabricius 1775 and *A. solanella* Theobald 1914 have the species status (Van Emden & Harrington, 2007).

Beside direct damages inflicted by probing and sucking plant juices, *A. fabae* is an important vector of many plant viruses among other aphid species. One of the most important viruses is BYV (beet yellows virus) which causes a yellowing disease in *Beta vulgaris* and some other plants, but also BMV (brome mosaic virus) which primarily infects plants from Poaceae family and cause damages to wheat plants.

Traditionally, aphids are treated chemically to prevent damages on agricultural plants; however, nowadays the biological control concept is of the highest importance. Biologically, aphid number is controlled by predators, such are coccinellids, some hoverfly larvae; parasites, such are entomopathogenic nematodes, fungi and bacteria; and also by parasitoids, where the most important are wasps from the family Braconidae, precisely the subfamily Aphidiinae which are exclusive parasitoids of aphids. Many Aphidiinae species are economically very important as biological control agents in agroecosystems, therefore it is of great importance to know their taxonomy, biology and ecology for their successful usage against aphids (Hågvar & Hofsvang, 1991; Völkl & Mackauer, 2000).

One of the most common parasitoid of *A. fabae* is an aphidiine wasp *Lysiphlebus fabarum* (Marshall 1896) which has been frequently reared from *A. fabae* feeding on crops and other plants (Völkl & Stechmann, 1998). Beside *L. fabarum*, the black bean aphid is attacked by many other aphidiines such are *Ephedrus plagiator* (Nees 1811), *Binodoxys angelicae* (Haliday 1833), *Praon abjectum* (Haliday 1833) and others (Starý, 1970). Along native and common parasitoid wasps, *A. fabae* is very frequently parasitized by *Lysiphlebus testaceipes* (Cresson 1880) which is now rather invasive species previously introduced into the Mediterranean area for biological control of citrus aphids (Starý et al., 1988; Žikić et al., 2015). Research on *A. fabae* on the territory of Serbia has been conducted since 1952 (Miletić, 1952a, 1952b), also aphid parasitoids were studied intensively in Serbia (Vukasović, 1928; Tomanović & Brajković, 2001; Tomanović et al., 1998; Kavallieratos et al., 2004, 2010; Petrović et al., 2009). One of the recent surveys of aphidiine parasitoids in Serbia was done three years ago where several parasitoids were recorded to attack *A. fabae* (Žikić et al., 2012).

Having in mind the economic importance of *A. fabae* in crop productions, as well as its natural enemies such is wasps from the family Aphidiinae, the authors strived to present tritrophic associations of the black bean aphid and its aphidiine parasitoids, but as well the host plant species on which aphids were found. Also, we think this paper will serve as a good starting point toward practical usage of afidiinae parasitoids for biological control of *A. fabae* in Serbia and beyond.

Material and methods

The material was collected in a period of 24 years (1990-2014) research and collecting throughout the territory of Serbia. Most of the material was collected during 2000s, although some of the samples date from 1990s (Table 1). Infested plants were cut and placed into plastic cups along with aphids, a muslin cloth were put on the top of the cups to prevent the exit of insects but allowing ventilation. Such prepared plastic cups were kept in laboratory condition with the constant temperature of 23 °C, relative humidity of 65%, and the photoperiod (L:D) 16:8h. Each plant was prepared and photographed for later identification following Josifović (1972) and Sarić & Diklić (1986). Live aphids were preserved in 90% ethyl-alcohol and identified, following nomenclature Remaudière & Remaudière (1997). Parasitoid wasps were preserved as dry material but most of them were put in plastic tubes with 90% ethyl-alcohol. Morphological terminology of parasitoids follows Sharkey & Wharton (1997). Some of the wasp specimens were dissected and mounted onto microscopic slides in order to facilitate identification on the species level.

Results

Here we present 145 findings of *A. fabae* on 50 plant taxa. Eight plant specimens were identified to the generic level, while for one plant specimen we have data only to the family level (**Tab. 1**). In total, *A. fabae* was parasitized by 19 Aphidiinae taxa from seven genera; *Aphidius*, *Binodoxys*, *Ephedrus*, *Lipolexis*, *Lysiphlebus*, *Praon* and *Trioxys*. Twelve taxa were identified to the species level, and the remaining seven taxa were identified to the generic

Table 1. The list of *Aphis fabae* findings with its host plants and parasitoids. Legend: ♂– male; ♀ – female; (+) – over the presented number; XX – no data about number of specimens. Legator abbreviations: AP – Anđeljko Petrović, MĐ – Maja Đorđević, MM – Majda Mehanović, SS – Saša Stanković, VŽ – Vladimir Žikić, ZK – Zorana Kojičić, ŽT – Željko Tomanović, X – no data about legator.

Plant	Parasitoid	No of spec.	Locality, date, legator initials
Aegopodium podagraria	*Praon* sp.	2♂ 3♀	Niš, Trošarina; 11.06.2014; VŽ
	Lysiphlebus testaceipes	4♂	Niš, Trošarina; 11.06.2014; VŽ
Amaranthus retroflexus	*Lipolexis gracilis*	1♀	Lebane, Konjino; 06.07.2010; SS
	Lysiphlebus fabarum	17♀ 20♂	Lebane, Konjino; 06.07.2010; SS
Anthriscus sylvestris	*Lysiphlebus fabarum*	50+♀	Tara, Perućac; 25.06.2014; SS
Apiaceae	*Lipolexis gracilis*	3♀ 2♂	Brzeće; 29.07.2010; VŽ
Arctium lappa	*Binodoxys angelicae*	50+♀	Sićevačka klisura, Ostrovica; 28.05.2013; MĐ
	Lipolexis gracilis	2♀	Sićevačka klisura, Ostrovica; 28.05.2013; MĐ
	Lysiphlebus cardui	100+♀♂	Sićevačka klisura, Ostrovica; 28.05.2013; MĐ
	Lysiphlebus cardui	2♀ 6♂	Sićevačka klisura; 23.06.2012; SS
	Lysiphlebus fabarum	50+♀ 1♂	Sićevačka klisura; 23.06.2012; SS
	Lysiphlebus cardui	1♂	Tara, Mitrovac; 25.06.2013; VŽ
Beta vulgaris	*Lysiphlebus fabarum*	13♀ 7♂	Zemun; 27.09.1990; X
Bifora radians	*Lysiphlebus testaceipes*	6♀ 5♂	Niš, Trošarina; 22.05.2013; MĐ
Calendula officinalis	*Binodoxys angelicae*	1♀ 2♂	Kruševac; 18.06.2013; ZK
Capsella bursa pastoris	*Lysiphlebus fabarum*	3♂	Vlasina, Čemernik; 04.08.2011; VŽ
Carduus acanthoides	*Lysiphlebus fabarum*	13♀	Slankamen; 24.06.2011; X
Carduus sp.	*Lysiphlebus fabarum*	1♀	Petnica; 12.06.2011; AP
	Lysiphlebus fabarum	22♀	Kragujevac, Ilićevo; 06.06.2011; X
Centaurea cyanus	*Lysiphlebus fabarum*	13♀ 7♂	Lebane, Konjino; 31.05.2014; SS
Chenopodium album	*Aphidius matricariae*	1♀	Niš, Popovac; 22.05.2010; VŽ
	Binodoxys acalephae	23♀ 14♂	Niš, Popovac; 22.05.2010; VŽ
	Ephedrus plagiator	1♂	Niš, Popovac; 22.05.2010; VŽ
	Lipolexis gracilis	11♀	Niš, Popovac; 22.05.2010; VŽ
	Lysiphlebus fabarum	1♀	Niš, Popovac; 22.05.2010; VŽ
	Lysiphlebus fabarum	18♀ 4♂	Sićevačka klisura; 04.06.2011; VŽ
	Binodoxys angelicae	1♀	Sićevačka klisura; 04.06.2011; VŽ
	Lysiphlebus cardui	18♀ 3♂	Sićevačka klisura, Sićevo; 17.07.2013; SS
	Binodoxys angelicae	1♂	Sićevačka klisura, Sićevo; 17.07.2013; SS
	Binodoxys angelicae	11♀	Niš, Popovac; 25.06.2010; VŽ
	Lipolexis gracilis	9♀ 3♂	Niš, Popovac; 24.07.2010; VŽ
	Lysiphlebus cardui	23♀ 11♂	Sićevačka klisura, Sićevo; 23.06.2012; VŽ
	Lipolexis gracilis	2♀ 5♂	Sićevačka klisura, Sićevo; 23.06.2012; VŽ
	Lysiphlebus fabarum	2♀ 3♂	Sićevačka klisura; 06.06.2013; VŽ
	Binodoxys angelicae	2♀ 8♂	Sićevačka klisura; 06.06.2013; VŽ
	Lysiphlebus orientalis	4♀	Slankamen; 24.06.2011; X
	Praon volucre	1♀ 1♂	Slankamen; 24.06.2011; X
	Lysiphlebus fabarum	3♀	Lebane; 01.06.2013; SS
	Lysiphlebus fabarum	21♀ 1♂	Sićevačka klisura, Sićevo; 17.07.2013; SS
	Binodoxys sp.	1♂	Sićevačka klisura, Sićevo; 17.07.2013; SS
	Lysiphlebus fabarum	2♀	Surčin; 15.06.2010; AP
	Lysiphlebus fabarum	20♀	Zemun; 17.10.1991; X
	Lysiphlebus fabarum	14♀	Zemun; 15.06.2011; AP
	Lysiphlebus orientalis	28♀	Zemun, Galenika; 07.06.2011; AP
	Binodoxys angelicae	1♀	Zemun, Galenika; 07.06.2011; AP
	Lysiphlebus testaceipes	21♀ 26♂	Niš; 03.06.2014; SS
	Lysiphlebus fabarum	1♀	Prokuplje, Bresničić; 15.06.2014; SS
Cichorium sp.	*Lipolexis gracilis*	12♀ 2♂	Sićevačka klisura; 04.06.2011; SS
	Binodoxys angelicae	2♀	Sićevačka klisura; 04.06.2011; SS
Cirsium arvense	*Lysiphlebus fabarum*	116♀ 37♂	Vlasina; 03.08.2011; SS
	Lysiphlebus fabarum	83♀ 85♂	Vlasina; 03.08.2011; SS
	Lysiphlebus fabarum	15♀ 4♂	Vlasina, Čemernik; 07.08.2010; SS
	Lysiphlebus fabarum	1♀ 14♂	Brzeće; 29.07.2010; SS
	Lipolexis gracilis	6♀ 4♂	Brzeće; 29.07.2010; SS
	Lysiphlebus fabarum	1♀ 2♂	Merošina, Oblačinsko jezero; 15.06.2014; SS
	Lysiphlebus fabarum	22♀ 1♂	Ostružnica; 06.07.2011; X
	Lysiphlebus testaceipes	8♂ 9♀	Niš; 25.05.2014; SS
	Lysiphlebus confusus	7♂ 2♀	Niš; 25.05.2014; SS

Cirsium arvense	*Lysiphlebus fabarum*	8♀ 4♂	Vlasina; 21.07.2013; SS
	Lysiphlebus fabarum	15♀ 3♂	Vlasina, Čemernik; 07.08.2010; SS
	Lysiphlebus fabarum	2♀	Vlasina; 15.06.2013; SS
	Lysiphlebus cardui	66♀ 16♂	Suva planina, Bojanine vode; 11.07.2010; VŽ
	Lysiphlebus fabarum	7♀ 1♂	Vlasina; 11.08.2006; VŽ
	Lysiphlebus fabarum	62♂	Vlasina; 28.06.2012; VŽ
	Lysiphlebus fabarum	27♀ 15♂	Vlasina; 06.08.2010; VŽ
	Binodoxys acalephae	3♀	Zlatibor; 26.06.2013; SS
Cirsium eriophorum	*Lipolexis gracilis*	4♀ 2♂	Dukat; 07.08.2011; SS
Cirsium palustre	*Lysiphlebus fabarum*	9♀ 24♂	Goč; 13.07.2011; X
Cirsium sp.	*Lysiphlebus fabarum*	12♀ 21♂	Kopaonik; 17.07.2013; SS
Coreopsis verticillata	*Lysiphlebus fabarum*	XX	Zemun; 17.10.1991; ŽT
Coronilla varia	*Lysiphlebus testaceipes*	2♀	Niš, Pantelej; 10.07.2014; VŽ
Digitalis ambigua	*Lysiphlebus fabarum*	12♀	Tara, Derventa; 03.07.2012; VŽ
	Lysiphlebus cardui	8♀	Tara, Derventa; 03.07.2012; VŽ
Eryngium campestre	*Lipolexis gracilis*	7♀ 5♂	Jerma canyon; 19.07.2013; VŽ
Euonymus japonicus	*Lysiphlebus fabarum*	11♀ 12♂	Lebane, Konjino; 31.05.2014; SS
Euonymus europaeus	*Trioxys* sp.	XX	Beograd, Radmilovac; 21.04.1995; X
	Binodoxys angelicae	5♂	Obedska bara; 01.04.2001; X
Galium aparine	*Lysiphlebus testaceipes*	1♂ 2♀	Niš, Gornji Matejevac; 25.05.2014; VŽ
	Lysiphlebus fabarum	37♀ 9♂	Niš, Tvrdjava; 05.06.2013; MĐ
	Ephedrus sp.	30♀	Sićevačka klisura, Ravni do; 29.05.2014; VŽ
	Lipolexis sp.	7♀ 4♂	Sićevačka klisura, Ravni do; 29.05.2014; VŽ
	Lysiphlebus cardui	10♂	Vlasina; 05.08.2011; VŽ
	Binodoxys sp.	2♀ 1♂	Niš, Bubanj; 28.05.2014; SS
Lactuca serriola	*Lysiphlebus cardui*	89♂	Vlasina; 05.08.2011; SS
Levisticum officinale	*Lysiphlebus fabarum*	7♀	Užice; 14.08.1999; ŽT
Matricaria chamomilla	*Lipolexis* sp.	2♀ 4♂	Grdelička klisura; 05.06.2014; SS
	Lysiphlebus fabarum	4♀ 1♂	Grdelička klisura; 05.06.2014; SS
	Lysiphlebus cardui	3♀	Sićevačka klisura, Ostrovica; 28.05.2013; MĐ
	Binodoxys angelicae	3♀ 1♂	Lebane; 01.06.2013; SS
	Praon volucre	3♀ 1♂	Lebane; 01.06.2013; SS
	Lysiphlebus fabarum	6♀ 2♂	Lebane; 01.06.2013; SS
	Lysiphlebus testaceipes	4♀ 10♂	Lebane; 01.06.2013; SS
	Lysiphlebus testacepies	50+♀	Lebane, Konjino; 31.05.2014; SS
	Lysiphlebus fabarum	50+♀	Lebane, Konjino; 31.05.2014; SS
	Lysiphlebus confusus	50+♀	Lebane, Konjino; 31.05.2014; SS
Matricaria perforata	*Lysiphlebus fabarum*	88♀ 60♂	Vlasina; 05.08.2011; SS
Musa sapientum	*Lysiphlebus fabarum*	21♀ 4♂	Kruševac; 21.06.2012; ZK
Oenanthe stenoloba	*Lysiphlebus fabarum*	75♀ 31♂	Vlasina; 05.08.2011; SS
Onopordum acanthium	*Lysiphlebus fabarum*	2♀	Niš, Lalinac; 08.06.2013; SS
Orlaya grandiflora	*Lysiphlebus testaceipes*	4♀	Niš, Gornji Matejevac; 25.05.2014; VŽ
Papaver dubium	*Praon* sp.	1♀	Niš, Gornji Matejevac; 25.05.2014; VŽ
Papaver rhoeas	*Binodoxys angelicae*	1♀ 1♂	Niš, Tvrdjava; 05.06.2013; MĐ
	Lysiphlebus fabarum	3♂	Niš, Tvrdjava; 05.06.2013; MĐ
	Lysiphlebus orientalis	1♀ 2♂	Niš, Tvrdjava; 05.06.2013; MĐ
	Praon volucre	1♀	Niš, Tvrdjava; 05.06.2013; MĐ
	Lysiphlebus testaceipes	2♀ 3♂	Niš, Tvrdjava; 05.06.2013; MĐ
	Lysiphlebus testaceipes	3♀ 1♂	Niš, Gornji Matejevac; 25.05.2014; VŽ
Papaver sp.	*Binodoxys angelicae*	3♀	Beograd, Botanička bašta; 06.12.2013; X
	Lysiphlebus orientalis	4♀	Beograd, Botanička bašta; 06.12.2013; X
	Praon abjectum	3♀ 2♂	Beograd, Botanička bašta; 06.12.2013; X
Pastinaca sativa	*Lysiphlebus fabarum*	3♀ 1♂	Beograd, Radmilovac; 22.08.1996; X
	Binodoxys angelicae	1♀	Vlasina; 03.08.2011; SS
Pastinaca sp.	*Binodoxys angelicae*	1♀	Nova Varoš, Suljova česma; 07.07.2013; X
	Praon sp.	3♀	Nova Varoš, Suljova česma; 07.07.2013; X
Philadelphus coronarius	*Aphidius matricariae*	1♂	Niš; 05.05.2009; VŽ
	Aphidius sp.	2♂	Niš; 07.05.2014; SS
	Praon sp.	2♂ 2♀	Niš; 07.05.2014; SS
	Binodoxys sp.	3♀ 5♂	Niš; 07.05.2014; SS
	Lysiphlebus testaceipes	1♀ 1♂	Niš; 07.05.2014; SS
	Lysiphlebus sp.	1♂	Niš; 25.05.2014; SS
	Aphidius sp.	1♂	Niš; 25.05.2014; SS
	Praon sp.	2♂ 2♀	Niš; 25.05.2014; SS
	Lysiphlebus testaceipes	1♂ 1♀	Niš; 20.05.2014; SS

Philadelphus coronarius	*Binodoxys* sp.	1♀	SRB, Niš; 20.05.2014; SS
Plantago lanceolata	*Lysiphlebus fabarum*	9♀ 19♂	Vlasina; 05.08.2011; SS
Polygonum aviculare	*Lysiphlebus fabarum*	42♀ 23♂	Zemun; 06.10.2012; SS
Ranunculus sp.	*Binodoxys angelicae*	10♀ 5♂	Sićevačka klisura, Ostrovica; 28.05.2013; MĐ
	Lysiphlebus cardui	1♀	Sićevačka klisura, Ostrovica; 28.05.2013; MĐ
Rumex sp.	*Lysiphlebus fabarum*	40♀	Padinska skela; 06.04.2009; X
	Lysiphlebus testaceipes	1♀	Lebane, Konjino; 31.05.2014; SS
	Lysiphlebus confusus	2♂	Lebane, Konjino; 31.05.2014; SS
	Lysiphlebus fabarum	4♂	Niš, Trošarina; 22.05.2013; MĐ
	Lysiphlebus fabarum	10♀	Tara, Derventa; 03.07.2012; SS
	Lysiphlebus cardui	6♀	Tara, Derventa; 03.07.2012; SS
Solanum nigrum	*Binodoxys angelicae*	29♀ 16♂	Niš; 08.10.2010; VŽ
	Lysiphlebus fabarum	1♀	Niš; 08.10.2010; VŽ
	Lysiphlebus fabarum	2♀	Obedska bara; 15.06.1996; ŽT
Tamarix sp.	*Lysiphlebus testaceipes*	30+♀	Niš, Niška banja; 29.05.2014; VŽ
Torilis microcarpa	*Ephedrus plagiator*	1♀	Dukat; 07.08.2011; SS
Urtica dioica	*Lysiphlebus fabarum*	7♀ 2♂	Smederevo; 27.05.2011; X
Valeriana officinalis	*Lysiphlebus fabarum*	2♀ 5♂	Vlasina; 21.07.2013; SS
	Lysiphlebus testaceipes	1♀ 5♂	Vlasina; 21.07.2013; SS
Yucca filamentosa	*Lysiphlebus testaceipes*	7♀ 2♂	Niš; 02.07.2014; MM
Zea mays	*Lysiphlebus fabarum*	2♀ 1♂	Beljanica, Resavska pećina; 30.07.1996; X
	Lysiphlebus cardui	10♀ 10♂	Lebane, Konjino; 24.07.2012; SS

level (**Tab. 1**). In this survey we found 107 tritrophic associations; plant/aphid/parasitoid. The results of this research are given in a table form where all listed plants were infested by *A. fabae*, and the very same species was parasitized by the listed Aphidiinae taxa (**Tab. 1**).

Although the fauna of Aphidiinae parasitoids has been relatively well investigated in Serbia, we want to highlight the three new associations of *A. fabae* and its parasitoids since the last checklist of Aphidiinae in Serbia (Žikić et al., 2012). *Aphidius matricariae* Haliday 1834 is now newly recorded to parasitize *A. fabae* in Serbia, two specimens, one male and one female were found on *Chenopodium album* (Chenopodiaceae) and *Philadelphus coronarius* (Hydrangiaceae) (**Tab. 1**). Also, two invasive species from the genus *Lysiphlebus* are reported to attack black bean aphid. *Lysiphlebus orientalis* Stary & Rakhshani 2010, which was originally described from the northeast China as a specialized parasitoid of the soybean aphid (*Aphis glycines* Matsumura 1917) was recently recorded on the territory of Serbia where as a host, among other aphid species, was *A. fabae* (Petrović et al., 2013). Also, *Lysiphlebus testaceipes*, known to attack many aphids primarily in the Mediterranean area, in some recent researches was recognized as a very competitive introduced species in the European mainland as well as in Serbia (Žikić et al., 2015). Sublimating the results of this investigation we found that the most suitable biological control agent of *A. fabae* is *Lysiphlebus fabarum*, but also *Binodoxys angelicae*, *Lipolesis gracilis* Foerster 1862 and the previously mentioned introduced species *L. testaceipes*.

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