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The first record of *Aphidius ervi* Haliday in Slovenia

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ABSTRACT

In 2008, a lucerne aphid parasitoid *Aphidius ervi* Haliday was first recorded in Slovenia. This oligophagous parasitoid is used as biological control agent against bigger aphid species. By sampling aphid mummies on different locations in Slovenia in 2008, we found parasitoid *Aphidius ervi* on nine host plants (corn, pea, alfalfa, red clover, winter wheat, oat, onion, potato and winter barley). Among 1812 primary parasitoids found in Slovenia in 2008, there were 46 individuals of *Aphidius ervi*; 21 male and 25 female parasitoids. In the present paper description of the species, its geographic distribution and host plant-aphid-parasitoid associations are given.

Keywords: *Aphidius ervi*, parasitoid, first record, biological control, Slovenia

IZVLEČEK

PRVA NAJDBA PARAZITOIDA *Aphidius ervi* Haliday V SLOVENIJI

V letu 2008 smo v Sloveniji prvič ugotovili zastopanost parazitoida *Aphidius ervi* Haliday, ki parazitira zlasti listne uši na metuljnicah (Fabaceae). Ta oligofagni parazitoid se uporablja kot biotični agens večjih vrst listnih uši. Parazitoida *Aphidius ervi* smo v letu 2008 našli na 9 gostiteljskih rastlinah (koruza, grah, lucerna, črna detelja, ozimna pšenica, oves, čebula, krompir in ozimni ječmen) v Sloveniji, in sicer med vzorčenjem ušjih mumij. V letu 2008 smo nabrali 1812 primarnih parazitoidov, med njimi je bilo 46 osebkov vrste *Aphidius ervi*; 21 je bilo samcev in 25 samic. V prispevku je opisana vrsta, njena geografska razširjenost in povezava med gostiteljsko rastlino, ušjo ter parazitoidom.

Ključne besede: *Aphidius ervi*, parazitoid, prva najdba, biotično varstvo rastlin, Slovenija

1 INTRODUCTION

Aphidius ervi Haliday is a Palaearctic oligophagous parasitoid species associated in its region of origin mainly with Macrosiphinae aphids, such as *Acyrthosiphon pisum* Harris on legumes and to a lower degree with *Macrosiphum euphorbiae* Thomas and *Aulacorthum solanii* (Kaltenbach) on other food plants (Takada & Tada, 2000; Takada, 2002). Although *Sitobion avenae* (Fabricious) on cereals in a suitable host for *Aphidius ervi*, this parasitoid has a minor relevance as an aphid biological control agent on the cereal agro-ecosystems in Europe (Cameron, 1984).

Aphidius ervi was already found in Australia, East Palaearctic, Nearctic region and in North Africa (Fauna europaea, 2007). In Europe *Aphidius ervi* is present in some areas of former Yugoslavia (Serbia, Kosovo,

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Montenegro), in the Netherlands, Spain, Slovakia, Republic of Moldova, Italy, Ireland, Hungary, Greece, Germany, France, Finland, Czech Republic, Bulgaria, Great Britain and in Andorra (Fauna europaea, 2007).

Females of the *Aphidius ervi* are from 2.8 to 4.1 mm long. It has clypeus with 10-18 long hairs and antennae 18-19 (17,20)-segmented, reaching to the middle of abdomen. Antennal F1 is equal to F2, 3 times as long as wide, with apical portion not thickened. Central areola on propodeum is relatively narrow, upper areola has 5-10 and lower 3-6 hairs. Pterostigma on wing is 4-5 times as long as wide, with metacarpus about 1/3 shorter than pterostigma. Radial abscissa 2 is usually only somewhat shorter than abscissa 1. Tergite 1 is 3.5 times as long as wide at spiracles. *Aphidius ervi* is easily distinguishable from the other congeners by the rugose anterolateral area of tergit 1. The coloration of female head is black brown, with lower part of genae, clypeus and mouthparts yellowish and apices of mandibles dark. Antennae apex of pedicellus and the basal part of F1 is yellowish and the remaining antennomeres from dark-brown to black. Legs are yellow with apices of tarsi and coxae dark brown. Male of *Aphidius ervi* has antennae 20-21(22)-segmented and tergite 1 clearly stouter than in female. The coloration in male is much darker than in female. Head is entirely black brown with clypeus and lower portion of genae more of less yellowish. Antennae are black brown with basal ring of F1 yellowish. Thorax is entirely brown, legs are more or less brown yellowish and abdomen is dark brown (Starý, 1973; Pennacchio, 1989).

Aphidius ervi is the most common on legume aphids, such as *Acyrthosiphon pisum* and *Acyrthosiphon* Mordvilko sp. on different host plants: *Medicago sativa* Linnaeus, *Lathyrus clymenum* Linnaeus, *Lens culinaris* Medikus, *Melilotus alba* Medikus, *Pisum sativum* Linnaeus, *Trifolium nigrescens* Viviani, *Trifolium pretense* Linnaeus, *Vicia faba* Linnaeus, *Vicia sativa* Linnaeus and other. *Aphidius ervi* is also parasitoid of other aphids: *Aulacorthum solani* on *Malva neglecta* Wallr. and *Pedicularis brachyodonta* Schloss. et Vukotin.; *Diuraphis noxia* (Kurdjumov) on *Hordeum vulgare* Linnaeus; *Hyperomyzus lactucae* Linnaeus on *Sonchus* Linnaeus sp.; *Macrosiphum cholodkovskyi* (Mordvilko) on *Filipendula ulmaria* (Linnaeus) Maximowicz; *Macrosiphum euphorbiae* on *Galega officinalis* Linnaeus and *Solanum tuberosum* Linnaeus; *Metopolophium dirhodum* (Walker) on *Avena sativa* Linnaeus, *Avena sterilis* Linnaeus, *Avena* Linnaeus sp., *Hordeum vulgare* and *Triticum aestivum* Linnaeus; *Myzus persicae* (Sulzer) on *Gossypium herbaceum* Linnaeus and *Nicotiana tabacum* Linnaeus; *Rhopalosiphum padi* Linnaeus on *Hordeum vulgare*; *Schizaphis graminum* (Rondani) on *Triticum aestivum*; *Sitobion avenae* on *Dactylis glomerata* Linnaeus, *Festuca* Linnaeus sp., *Hordeum murinum* Linnaeus, *Hordeum vulgare*, *Secale* Linnaeus sp., *Setaria verticilata* (Linnaeus), *Triticum durum* Desf. and *Triticum aestivum*; and *Sitobion fragariae* (Walker) on *Festuca sp.* (Starý, 1973; Pennacchio, 1989).

***Figure 1**: Female of parasitoid Aphidius ervi (Photo: K. Kos).*

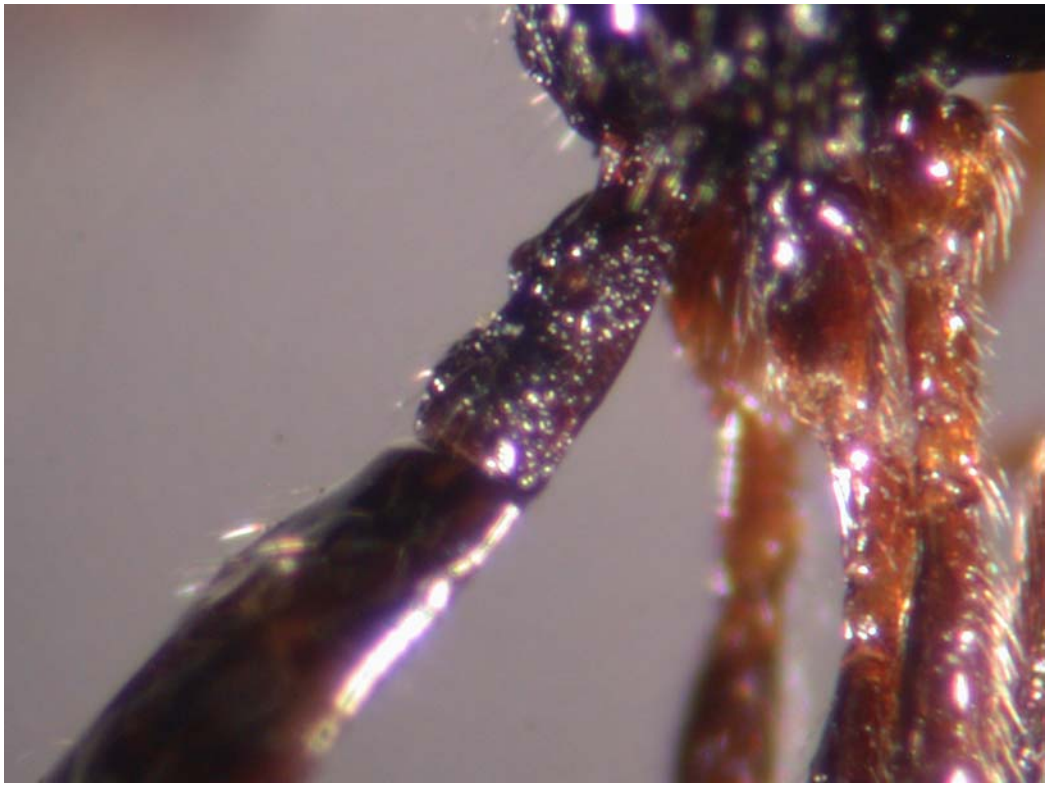

***Figure 2**: Rugose petiole of Aphidius ervi female in lateral view (Photo: K. Kos).*

***Figure 3**: Forewings of Aphidius ervi female (Photo: K. Kos).*

***Figure 4**: Empty mummy of an aphid, parasitised by parasitoid Aphidius ervi (Photo: K. Kos).*

Parasitoid *Aphidius ervi* is used for biological control of bigger aphid species like *Macrosiphum euphorbiae* and *Acyrthosiphon pisum* since 1996. The total development of wasp takes 26 days at 14 °C, 13.5 days at 20 °C and 12 days at 23.6 °C. A female lays about 350 eggs in a life time of which most are laid during the first 5 to 7 days at a rate of about 55 eggs per day. The recommended release rate to control *Macrosiphum euphorbiae* ranges from 0.15 m^2 to 1 m^2. *Aphidius ervi* has a very good searching ability. Developmental stage at which *Aphidius ervi* is released to control aphids is pupae in form of aphid mummies (van Lenteren, 2003). The parasitic wasp is applied in crops such as tomato, sweet pepper, eggplant, gerbera, rose, cucumber, bean, etc. Biological control of aphids by aphid parasitoids presents a long lasting form of control on several crops, it can be introduced preventatively and it has fast results (Biobest Biological Systems, 2009).

The purpose of this research is to find the indigenous species of aphid parasitoids in Slovenia and to offer environmentally friendly systems of plant production with reduced use of chemical insecticides. Our aim is to explore the possibilities of introduction of biological control agents, their vitality and longevity under certain circumstances of plant production and the efficacy of artificial habitat, which offers food, shelter and alternative hosts/prey to natural enemies.

2 MATERIAL AND METHODS

The sampling took place from 25 April till 30 August 2008 in agro-ecosystems in different regions in Slovenia; in Ljubljana (central Slovenia), Lower Styria (Štajerska), Prekmurje, Upper Carniola (Gorenjska), Lower Carniola (Dolenjska), Goriška and in Slovenian Istria. Aphids, their parasitoids and host plants were collected on cultivated and wild-growing plants.

While sampling parasitoids, we modified the method according to the life cycle of parasitoids in their hosts (after Brajković in Tomanović, 2005). Parasitoids develop in yet living aphids, this way we collected living aphids and their mummies in plastic pots, together with their host plants. The pots were covered with nylon patch, which enabled air flow and at the same time prevented the escape of aphids and later flown out parasitoids. The samples were marked with the successive number of sample, date of sampling and location (place of collection). Additionally, we annotated also species of host plants, on which the samples were collected.

The samples of aphids for identification were kept in an Eppendorf tube (1.5 ml) together with 70 % solution of ethanol. Each tube was marked with the number of sample according to the number on the pot. Because of the easier identification we gathered only bigger specimens of winged and non-winged aphids.

We left pots closed for 2 to 3 weeks, in some cases even longer, so that the wasps flew out from the mummies and died. Afterwards we put the content of the pot on the white surface and separated the parasitoids with the brush from the rest of the content. The parasitoids were kept in the vessels, which were marked with the corresponding number of the sample. Identification of aphids was performed on the Faculty of Agriculture in Zemun (Serbia) and identification of parasitoids was done on the Faculty of Biology in Belgrade (Serbia) (Kos, 2007; Kos *et. al*., 2008).

3 RESULTS WITH DISCUSSION

Parasitoid *Aphidius ervi* was found on nine different host plants; corn, pea, alfalfa, red clover, oat, wheat, onion, potato and barley (Table 1), while aphids are still in process of identification.

***Table 1**: Number of females and males of A. ervi in different regions of Slovenia on 9 different host plants (f=female, m=male; CS=central Slovenia, LS=Lower Styria (Štajerska), P=Prekmurje, UC=Upper Carniola (Gorenjska), LC=Lower Carniola (Dolenjska), G=Goriška and SI=Slovenian Istria).*

	CS		LS		P		UC		LC		G		SI		
Host plant/sex	f	m	f	m	f	m	f	m	f	m	f	m	f	m	Total
Pisum sativum				1			1			2		1	1	1	7
Trifolium pratense		1													1
Medicago sativa	1	5					1		4	2	4		6	3	26
Solanum tuberosum													1	2	3
Allium cepa											1				1
Hordeum vulgare											2				2
Zea mays		2								1					3
Triticum aestivum											1				1
Avena sativa	1										1				2
Total	2	8	0	1	0	0	2	0	4	5	9	1	8	6	46

Among 2173 primary parasitoids found in Slovenia, there were 46 individuals of *Aphidius ervi*, 21 males and 25 females. 26 members of *A. ervi* were found on alfalfa and 7 on pea. In Prekmurje we did not find any members of *A. ervi*, while in other regions we found 14 individuals in Slovenian Istra, 10 in Goriška and Central Slovenia and 9 in Lower Carniola.

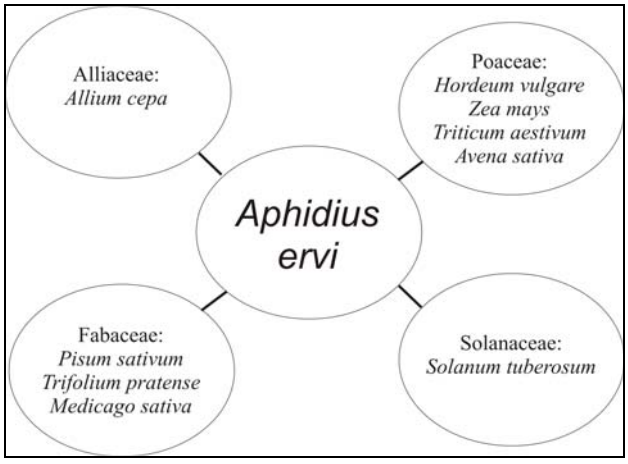

***Figure 5**: Host plants of Aphidius ervi, found in Slovenia in 2008.*

Nine different host plants, where we found *A. ervi*, belong to 4 botanical families: Alliaceae, Poaceae, Fabaceae and Solanaceae (Fig. 5).

4 CONCLUSIONS

The results of the present study indicate that *Aphidius ervi* uses different host plants and is widely distributed in Slovenia, while we found it in almost all Slovenian regions. Data of He *et. al*. (2006) research suggests that this parasitoid has high potential to suppress aphid population, when the latter increases. *Aphidius ervi* is an effective biological control agent for many aphid species. It has proven high efficiency in controlling greenhouse aphid pests. It is effective in controlling *Acyrthosiphon pisum*, *Macrosiphum euphorbiae* and *Myzus persicae*.

Results of our two year research exhibit species diversity and wide circulation of parasitoids in different agricultural ecosystems on selected locations in Slovenia (Kos *et. al*., 2007; 2008; 2009). In 2006 and 2008 we found and identified 2173 primary parasitoids, belonging to 30 species from 8 genera: *Aphidius, Binodoxys, Diaeretiella, Ephedrus, Lipolexis, Lysiphlebus, Monoctonus* and *Praon*. In the future we must pay attention on the conservation of the natural enemies, the conservation of their natural habitats that represents alternative food, hosts and shelter, or even to increase the number of natural enemies in Slovenia with the aim to reduce application of insecticides.

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