

## Hymenopteran Parasitoids (*Hymenoptera: Aphidiidae*) of Cereal Aphids (*Sternorrhyncha: Aphidoidea*) in Winter Wheat Crops in Slovakia

JÁN PRASLIČKA<sup>1</sup>, SHOKI AL DOBAI<sup>2</sup> and JOZEF HUSZÁR<sup>2</sup>

<sup>1</sup>Department of Zoology and Antropology, Faculty of Natural Sciences, Constantine the Philosopher University, Nitra, Slovak Republic; <sup>2</sup>Slovak Agricultural University, Nitra, Slovak Republic

### Abstract

PRASLIČKA J., AL DOBAI S., HUSZÁR J. (2003): Hymenopteran parasitoids (*Hymenoptera: Aphidiidae*) of cereal aphids (*Sternorrhyncha: Aphidoidea*) in winter wheat crops in Slovakia. *Plant Protect. Sci.*, **39**: 97–102.

During 1997–1999, occurrence of hymenopteran parasitoids of cereal aphids was observed in different localities in Slovakia. Altogether, seven species of aphid parasitoids were recorded. The total numbers of particular species over the last three years were as follows: *Aphidius uzbekistanicus* (160 individuals – 42.4%), *Aphidius ervi* (83 individuals – 22.0%), *Aphidius rhopalosiphii* (66 individuals – 17.5%), *Ephedrus plagiator* (40 individuals – 10.6%), *Praon volucre* (26 individuals – 6.9%), *P. gallicum* (1 individual – 0.3%), and *Aphidius picipes* (1 individual – 0.2%). The abundance of the parasitoids in each year was: 185 individuals (49.1%) in 1999, 122 individuals (32.4%) in 1998, and 70 individuals (18.6%) in 1997.

**Keywords:** winter wheat; cereal aphid; parasitoids

In the central Europe, the most numerous cereal aphid species are *Metopolophium dirhodum* (Walker), *Rhopalosiphum padi* (Linnaeus) and *Sitobion avenae* (Fabricius) (Huszár *et al.* 2000). More than 400 species of aphid parasitoids are known all over the world (Starý 1970). Out of the aphid parasitoids, the genera of the family *Aphidiidae*: *Aphidius* Nees, *Diaeretiella* Starý, *Ephedrus* Haliday, and *Praon* Haliday are the most important (Starý 1970, 1976, 1986, 1988). Adult parasitoids are very active during warm and sunny days, especially in the late hours of the morning and in the afternoon (Starý 1988). Various ways of parasitoids spreading in the environment have been recognised (Hodek *et al.* 1966; Starý 1970). Hymenopteran parasitoids of cereal aphids, their taxonomy, distribution and abundance in aphid populations have been discussed (Dean 1974; Starý 1976, 1981; Jones 1980; Powell 1982; Chambers *et al.* 1986; Höller 1990; Praslička & Al Dobrai 1997; Al Dobrai *et al.* 1999).

### MATERIAL AND METHODS

A species spectrum of cereal aphid parasitoids was observed at seven localities in Slovakia during 1997–1999 (Figure 1). At each sampling date, 100 tillers of winter wheat infested with aphids were randomly chosen for aphid collection. The sampling was carried out twice at the development stage of milk ripeness of wheat at all sampling places. The chosen tillers were carefully cut off and transported to laboratory inside plastic boxes. This collection method of aphid parasitoids is considered as the most appropriate (Starý 1970). In the laboratory, the material was kept for 1–2 days in refrigerator at the temperature of  $8 \pm 2^\circ\text{C}$ . All mummified aphids on the plant substrate were removed immediately and stored inside glass jars closed with nylon mesh. The jars were maintained at the temperature of  $18 \pm 2^\circ\text{C}$  until the parasitoids hatched and released the mummified aphid bodies. All of the hatched

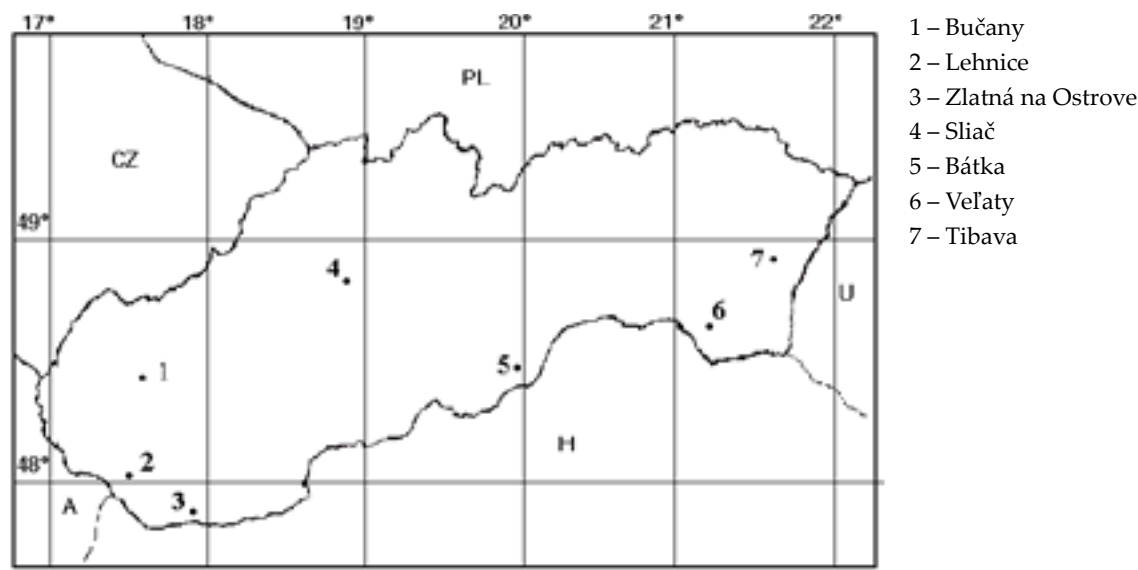


Figure 1. The localities of the cereal aphids sampling

insects were captured and killed by diethyl acetate. The material stored in the refrigerator was taken out and kept at the laboratory temperature. If some mummified aphids appeared on tillers, they were transferred into glass jars and treated in the same manner. This killed adult parasitoids were stored in plugged glass tubes and labelled with the sample number, locality name, date of hatching, and number of individuals.

The parasitoid genera were determined by coloration and shape of the aphid mummies. Species of the genus *Aphidius* hatch out of oval yellowish brown mummies, in genus *Ephedrus* the mummies are black, and in genus *Praon* the larvae make a white cocoon under the killed aphid.

The parasitoid species were determined by structure, shape and coloration of the wing veins as well as by other taxonomic features using the identification keys by STARÝ (1981) and POWELL (1982). RNDr. Petr Starý, DrSc., to whom the material was provided, confirmed these findings.

The species spectrum was evaluated and compared throughout the years and localities by the interval confidence  $p_1-p_2$  method (ANDĚL 1978).

## RESULTS

The species spectrum of cereal aphid parasitoids recorded in seven localities in Slovakia during 1997–1999 is shown in Table 1.

During the survey, seven species of parasitoids were identified (*Hymenoptera*, *Braconidae*, *Aphidii-*

*nae*), namely *Aphidius ervi* (Haliday 1834), *Aphidius rhopalosiphi* (De S.Perez 1902), *Aphidius uzbekistanicus* (Luzhetskii 1960), *Aphidius picipes* (Nees 1811), *Ephedrus plagiator* (Nees 1811), *Praon volucre* (Haliday 1833) and *Praon gallicum* (Haliday 1833).

In 1997 the most abundant species were *A. ervi* (32 individuals – 45.7%), *A. uzbekistanicus* (14 individuals – 20.0%), and *E. plagiator* (11 individuals – 15.7%); in 1998 *A. uzbekistanicus* (45 individuals – 36.9%), *A. rhopalosiphi* (35 individuals – 28.7%), and *A. ervi* (23 individuals – 18.8%); in 1999 *A. uzbekistanicus* (101 individuals – 54.6%), *A. ervi* (28 individuals – 15.1%), *A. rhopalosiphi* (24 individuals – 13.0%), and *Ephedrus plagiator* (21 individuals – 11.3%). Other species occurred in aphid populations in numbers of 1–11 (0.8–5.9%), whereas *A. picipes* and *P. gallicum* were only observed in 1998 and just one individual of both species was recorded. Overall, in the course of three-year study of parasitoid populations in Slovakia, the abundance of species was as follows: *A. uzbekistanicus* (160 individuals – 42.4%), *A. ervi* (83 individuals – 22.0%), *A. rhopalosiphi* (66 individuals – 17.5%), *E. plagiator* (40 individuals – 10.6%), *P. volucre* (26 individuals – 6.9%), *A. picipes* (1 individual – 0.3%) and *P. gallicum* (1 individual – 0.3%).

When the occurrence of aphid parasitoids was evaluated by the localities or years, the highest number of individuals was recorded in the locality of Veľatý in 1999 (85 individuals) and in the locality of Zlatná na Ostrove in 1998 (38 individuals). The parasitoids were also found quite regularly in the localities

Table 1. Representation of cereal aphid parasitoids in winter wheat at various localities of Slovakia in 1997–1999

Locality	Year	Parasitoids												Total		
		<i>Aphidius ervi</i>		<i>Aphidius rhopalosiphi</i>		<i>Aphidius uzbekistanicus</i>		<i>Aphidius picipes</i>		<i>Ephedrus plagiator</i>		<i>Praon volucre</i>			<i>Praon gallicum</i>	
		No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)		No.	(%)
Bučany	1997	4	30.76	2	15.38	5	38.46	0	0	1	7.69	1	7.69	0	0	13
	1998	5	20.83	12	50.00	6	25.00	0	0	0	0	1	4.16	0	0	24
	1999	7	28.00	3	12.00	11	44.00	0	0	2	8.00	2	8.00	0	0	25
Lehnice	1997	3	30.00	1	10.00	3	30.00	0	0	2	20.00	1	10.00	0	0	10
	1998	0	0	0	0	1	100.00	0	0	0	0	0	0	0	0	1
	1999	1	11.11	1	11.11	7	77.77	0	0	0	0	0	0	0	0	9
Zlatná na Ostrove	1997	4	40.00	1	10.00	2	20.00	0	0	1	10.00	2	20.00	0	0	10
	1998	6	15.78	10	26.31	18	47.36	0	0	0	0	4	10.52	0	0	38
	1999	4	21.05	0	0	14	73.68	0	0	0	0	1	5.26	0	0	19
Sliač	1997	11	57.89	3	15.78	1	5.26	0	0	3	15.78	1	5.26	0	0	19
	1998	3	13.63	5	22.72	11	50.00	1	4.54	0	0	2	9.09	0	0	22
	1999	4	23.52	1	4.45	11	64.70	0	0	0	0	1	4.54	0	0	17
Bátka	1997	8	80.00	0	0	1	10.00	0	0	0	0	1	10.00	0	0	10
	1998	3	23.07	5	38.46	5	38.46	0	0	0	0	0	0	0	0	13
	1999	1	6.25	2	12.50	5	31.25	0	0	5	31.25	3	18.75	0	0	16
Veľaty	1997	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1998	0	0	2	100.00	0	0	0	0	0	0	0	0	0	0	2
	1999	11	12.94	15	17.64	51	60.00	0	0	6	7.05	2	2.35	0	0	85
Tibava	1997	2	25.00	0	0	2	25.00	0	0	4	50.00	0	0	0	0	8
	1998	6	27.27	1	4.45	4	18.18	0	0	8	36.36	2	9.09	1	4.54	22
	1999	0	0	2	14.28	2	14.28	0	0	8	57.14	2	14.28	0	0	14
Total	1997	32	45.71	7	10.00	14	20.00	0	0	11	15.71	6	8.57	0	0	70
	1998	23	18.85	35	28.68	45	36.88	1	0.81	8	6.55	9	7.37	1	0.81	122
	1999	28	15.13	24	12.97	101	54.59	0	0	21	11.35	11	5.94	0	0	185
	Total	83	22.01	66	17.50	160	42.44	1	0.26	40	10.61	26	6.89	1	0.26	377

of Bučany (13–25 individuals), Sliač (17– 22 individuals) and Bátka (10–16 individuals).

Table 2 shows the results of statistical evaluation of the abundance of cereal aphid parasitoids in 1997–1999.

The abundance of *A. ervi*, *A. uzbekistanicus* and *A. rhopalosiphi* was significantly different from one another and also from other species, except of combinations *A. uzbekistanicus* and *A. rhopalosiphi* (in 1997), *A. ervi* and *A. rhopalosiphi* (in 1998, 1999), *A. ervi* and *E. plagiator* (in 1999), *A. rhopalosiphi* and *E. plagiator* (in 1999) where the difference in abundance was not significant. Significant differ-

ences were not found either between the numbers of *A. picipes* and *P. gallicum*, or between *E. plagiator* and *P. volucre*.

## DISCUSSION

The results presented in this work is in accordance with the observations of many other authors e.g. STARÝ AND REJMÁNEK (1981), BARABÁS (1982), RABASSE AND DEDRYVER (1983), CAMERON *et al.* (1984) and PANKANIN-FRANCZYK (1994). PANKANIN-FRANCZYK and SOBOTA (1998) also considered that out of the hymenopteran parasitoids of cereal aphids, the spe-

Table 2. Statistical evaluation of the cereal aphid parasitoids in 1997–1999

Species	Years		dH	Ae															
	dD	dH			dD	dH	Ar	dD	dH	Au	dD	dH	Ap						
Ar	1997	0.137	0.333	*															
	1998	-0.071	0.079	no															
	1999	-0.037	0.066	no															
Au	1997	0.143	0.338	*	-0.076	0.088	no												
	1998	-0.211	-0.048	*	-0.215	-0.052	*												
	1999	-0.419	-0.279	*	-0.433	-0.294	*												
Ap	1997	0.336	0.51	*	0.126	0.25	*	0.121	0.243	*									
	1998	0.177	0.294	*	0.173	0.289	*	0.296	0.435	*									
	1999	0.112	0.191	*	0.099	0.175	*	0.437	0.565	*									
Ep	1997	0.223	0.411	*	0.007	0.157	*	0.001	0.151	*	-0.153	-0.058	*						
	1998	0.128	0.253	*	0.124	0.249	*	0.248	0.393	*	-0.075	-0.014	*						
	1999	-0.047	0.058	no	-0.06	0.043	no	0.285	0.424	*	-0.184	-0.107	*						
Pv	1997	0.242	0.428	*	0.026	0.173	*	0.021	0.166	*	-0.131	-0.044	*	-0.045	0.08	no			
	1998	0.106	0.235	*	0.102	0.23	*	0.227	0.374	*	-0.099	-0.03	*	-0.063	0.022	no			
	1999	0.046	0.137	*	0.033	0.121	*	0.337	0.507	*	-0.085	-0.034	*	0.04	0.131	*	dD	DH	Pv
Pg	1997	0.33	0.504	*	0.119	0.245	*	0.114	0.238	*	-0.017	0.005	no	0.051	0.148	*	0.037	0.127	*
	1998	0.106	0.235	*	0.177	0.293	*	0.227	0.374	*	-0.009	0.017	no	0.019	0.078	*	0.035	0.103	*
	1999	0.112	0.191	*	0.099	0.175	*	0.437	0.565	*	0	0	no	0.107	0.184	*	0.034	0.085	*

Ae – *Aphidius ervi*, Ar – *Aphidius rhopalosiphi*, Au – *Aphidius uzbekistanicus*, Ap – *Aphidius picipes*, Ep – *Ephedrus plagiator*, Pv – *Praon volucre*, Pg – *Praon gallicum*  
 \*significant differences; no = no significant differences  
 dD – lower limit; dH – upper limit

cies *A. uzbekistanicus* is the most abundant. CARTER *et al.* (1980) found differences in the species structure of cereal aphid parasitoids between different years, *A. rhopalosiphi* being the most abundant in 1976, *A. rhopalosiphi* and *A. ervi* in 1977, and *A. picipes* in 1978. The differences in the species composition in different years can reside in the different thermal constant of various *Aphidius* species (LATTEUR 1976; McLEAN 1980). In the Netherlands, ANKERSMIT (1982) found that the most important species in the populations of cereal aphids was *A. rhopalosiphi*, and in some years, *A. picipes* as well.

Our results show that *A. rhopalosiphi* was fairly less abundant than *A. uzbekistanicus* or *A. ervi*. *A. picipes* was only seldom observed in aphid colonies in Slovakia. AL DOBAI *et al.* (1999) found similar compositions of species of cereal aphid parasitoids in Slovakia but aphid colonies were surveyed in different localities.

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## Súhrn

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Na vybraných lokalitách Slovenska sme v rokoch 1997–1999 na obilných voškách zaznamenali sedem parazitoidov. Podľa početnosti bolo nasledovné poradie zistených druhov: *Aphidius uzbekistanicus* (160 jedincov – 42,4 %), *Aphidius ervi* (83 jedincov – 22,0 %), *Aphidius rhopalosiphi* (66 jedincov – 17,5 %), *Ephedrus plagiator* (40 jedincov – 10,6 %), *Praon volucre* (26 jedincov – 6,9 %), *P. gallicum* (1 jedinec – 0,3%) a *Aphidius picipes* (1 jedinec – 0,2 %). Výskyt početnosti parazitoidov podľa rokov bol nasledovný: 1999 (185 jedincov – 49,1 %), 1998 (122 jedincov – 32,4 %) a 1997 (70 jedincov – 18,6 %).

**Kľúčové slová:** pšenica ozimná; obilné vošky; parazitoidy

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Corresponding author:

Prof. Ing. JÁN PRASLIČKA, PhD., Univerzita Konštantína filozofa, Fakulta prírodných vied, Katedra zoológie a antropológie, Nábřežie mládeže 91, 949 74 Nitra, Slovenská republika  
tel.: + 421 376 514 755, fax: + 421 376 511 008, e-mail: huszar@afnet.uniag.sk

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