

PARASITOIDS OF APHIDOPHAGOUS SYRPHIDAE
OCCURRING IN CABBAGE APHID (*BREVICORYNE
BRASSICAE* L.) COLONIES ON CABBAGE VEGETABLES*Beata Jankowska*

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Abstract: In 1993–1995 from the cabbage aphid colonies, fed on nine different varieties of *Brassica oleracea* L. syrphid larvae and pupae were collected. The remaining emerged adults of *Syrphidae* were classified to eight species. The parasitization varied within the years of observation and oscillated from 14,4% to 46,4%. Four parasitic *Hymenoptera*: *Diplazon laetatorius* (F.), *Diplazon* sp., *Pachyneuron grande* (Thoms.), and *Syrphophagus aeruginosus* (Dalm.) were reared. The parasitoids identified belong to the following three families *Ichneumonidae*, *Pteromalidae*, and *Encyrtidae*. The largest group of reared parasitoids belonged to the family *Ichneumonidae* of which the most frequent was *Diplazon laetatorius* (F.). It occurred in each year of observations. The parasitization by *D. laetatorius* reached 21,7%.

Key words : *Syrphidae*, syrphid parasitoids, *Brevicoryne brassicae*

INTRODUCTION

Syrphidae are one of the most important factors decreasing the number of cabbage aphid *Brevicoryne brassicae* L. – a main pest of cabbage vegetables (Wnuk 1971; Wnuk and Fusch 1977; Wnuk and Wojciechowicz 1993). Aphidophagous *Syrphidae* are attacked by a wide range parasitic *Hymenoptera*, common being *Ichneumonidae*, *Pteromalidae*, *Megasplidae*, *Encyrtidae* and *Figitidae* (Scott 1939; Evenhuis 1966; Dusek et al. 1979; Rotheray 1979; 1981a; b; 1984; Kartasheva and Dereza 1981; Pek 1982; Fitton and Rotheray 1982; Radeva 1983; Dean 1983; Thirion 1987; Fitton and Boston 1988). They reduce the number of syrphids and negatively affect their function in the control of aphid populations. The informations about syrphid parasitoids occurring in the region of Poland are given by Miczulski (1966), Malinowska (1973;1982), Jasiołek et al. (1974), Wnuk (1974; 1979), Kozłowska (1978), Wnuk and Wojciechowicz (1993), and Wojciechowicz-Żytko (2000).

The aim of the study was to identify the parasitoids of aphidophagous *Syrphidae* and determine their role in the reduction of syrphid population associated with *Brevicoryne brassicae* L. colonies feed on cabbage vegetables.

MATERIAL AND METHODS

The experiment was carried out in 1993–1995 at Mydlniki Experimental Station near Kraków. Syrphid larvae and pupae were collected from the cabbage aphid *Brevicoryne brassicae* L. colonies fed on the nine different varieties of *Brassica oleracea* L.: savoy cabbage cv. Vertus, white cabbage cv. Amager, red cabbage cv. Langendijker, brussels sprouts cv. Maczuga, cauliflower cv. Pionier, blue kohlrabi cv. Masłowa, white kohlrabi cv. Delikates, kale cv. Zielony Kędzierzawy and broccoli cv. Piast (except 1993). Vegetables were grown on plots of 30 m² each, in four replications. Every plot comprised 90 plants (10 plants of each vegetable, 60 × 60 cm spacing), planted in such a way that the plants of the same kind never adjoined. Every 3–4 days 12 plants from each variety were inspected. All syrphids were reared separately in Petri dishes in the laboratory until either parasitoid or host emergence. Larvae were daily fed on a diet of cabbage aphid. The emerged adults were identified to species using the Bańkowska's key (1963). Syrphid parasitoids were identified by prof. dr hab. Bartłomiej Miczalski from Agriculture University in Lublin.

RESULTS AND DISCUSSION

During performed observations 486 syrphid larvae and pupae were collected. The remaining 287 emerged adults of *Syrphidae* were identified to eight species: *Episyrphus balteatus* (Deg.), *Sphaerophoria scripta* (L.), *S. rueppelli* (Wied.) *S. menthastri* (L.), *Metasyrphus corollae* (Fabr.), *Scaeva pyrastris* (L.), *Syrphus vitripennis* (Meig.), *Paragus quadrifasciatus* (Meig.). Both population and number of syrphid species were different in individual years (Tab. 1).

Most larvae (in 1994) died during rearing, the remaining ones – 30% – were parasitized (Tab. 2). Parasitoids appeared every year. The parasitization varied within the year of observations and oscillated from 14,4% to 46,4% (Tab. 2). Wnuk and Wojciechowicz (1993) noted that syrphid larvae which attack *Brevicoryne brassicae* L., were infested from 27% to 40%.

Four species of parasitic *Hymenoptera* were reared from larvae and pupae.

Wnuk (1974) reared seventeen species of parasitic *Hymenoptera* from Kraków area. The reared parasitoids belonged to the following three families: *Ichneumonidae*, *Pteromalidae*, and *Encyrtidae* (Tabs. 2, 3). The largest group of reared parasitoids belonged to the family *Ichneumonidae* (Tab. 3), of which the most frequent was *Diplazon laetatorius* (F.), reared from 88 syrphid larvae. All of them were females. Schneider (1969), Dusek et al. (1979), Rotheray (1981a), Wnuk (1974), and Wojciechowicz-Żytka (2000) noted that the commonest syrphid parasitoids belonged to the subfamily *Diplazontinae*. Existing host records suggest that parasitoids of syrphids are polyphagous. Wnuk (1974) reared *D. laetatorius* from 8 syrphid species.

The family *Pteromalidae* was represented by *Pachyneuron grande* (Thoms.). It was responsible for the parasitization of 29 syrphid larvae. Each time numerous parasitoids (3–34 specimens), both females and males, hatched from each pupa

Table 1. Species composition and quantities of syrphids collected from colonies of *Brevicoryne brassicae* L. and their parasitization on different cabbage vegetables

Species of Syrphidae	Savoy cabbage	White cabbage	Blue cohlraabi	Kale	Year – 1993						Total
					Cauli-flower	Brussel sprouts	White cohlraabi	Red cabbage	Broccoli	Total	
<i>Episyrphus balteatus</i> (Deg.)	25	28	7	6	6	8	3	4	–	87	
<i>Metasyrphus corollae</i> (Fabr.)	6	4	–	–	–	–	1	2	–	13	
<i>Sphaerophoria scripta</i> (L.)	3	1	–	1	2	1	2	1	–	11	
<i>Sphaerophoria rueppelli</i> (Wied.)	1	2	–	–	–	1	–	1	–	5	
<i>Scaeva pyrastris</i> (L.)	1	1	–	–	–	–	–	1	–	3	
Larvae parasited by:	5	5	1	1	1	2	3	2	–	20	
<i>Diplazon laetatorius</i> (F.)	–	–	–	–	–	–	–	–	–	–	
Total number of larvae	41	41	8	8	9	12	9	11	–	139	
Parasitization %	12.2 a	12.2 a	12.5 a	12.5 a	11.1 a	16.7 a	33.3 a	18.2 a	–	14.4	
Year – 1994											
<i>Sphaerophoria rueppelli</i> (Wied.)	2	11	3	2	2	2	–	4	3	29	
<i>Sphaerophoria scripta</i> (L.)	4	6	1	–	1	6	1	4	1	24	
<i>Episyrphus balteatus</i> (Deg.)	–	–	–	1	–	1	–	1	2	5	
<i>Sphaerophoria menthasrri</i> (L.)	–	–	–	1	–	–	–	–	–	1	
<i>Paragus quadrifasciatus</i> Meig.	–	–	1	–	–	–	–	–	–	1	
Larvae parasited by:	8	5	5	3	3	6	4	3	4	41	
<i>Diplazon laetatorius</i> (F.)	–	–	–	–	–	–	–	–	–	–	
<i>Diplazon</i> sp.	–	1	2	–	–	1	–	–	–	4	
<i>Pachyneuron grande</i> Thoms	1	1	–	–	–	1	1	1	–	7	
Total number of larvae	15	24	12	7	7	17	6	13	11	112	
Parasitization %	60 a	29.2 a	58.3	42.8 a	57.1 a	47.1 a	83.3 a	30.8 a	45.5 a	46.43	
Year – 1995											
<i>Episyrphus balteatus</i> (Deg.)	5	24	6	–	2	1	5	2	–	45	
<i>Sphaerophoria scripta</i> (L.)	7	9	6	1	1	4	3	4	2	37	
<i>Sphaerophoria rueppelli</i> (Wied.)	1	12	2	–	–	–	–	2	1	18	
<i>Scaeva pyrastris</i> (L.)	–	3	1	–	–	–	2	–	–	6	
<i>Syrphus vitripennis</i> Meig.	–	2	–	–	–	–	–	–	–	2	
Larvae parasited by:	6	10	1	–	2	2	2	2	3	28	
<i>Diplazon laetatorius</i> (F.)	–	–	–	–	–	–	–	–	–	–	
<i>Pachyneuron grande</i> Thoms	4	10	1	1	2	2	–	2	–	22	
<i>Syrphidagus aeruginosus</i> (Dalm.)	–	1	–	–	–	–	–	–	–	1	
Total number of larvae	23	71	17	2	7	9	12	12	6	159	
Parasitization %	43.4 a	29.6 a	11.8 a	50 a	57.1 a	44.4 a	16.7 a	33.3 a	50 a	32.1	

Values in rows followed by the same letter do not differ at 5% level of significance (Duncan's multiple range test)

Table 2. Parasitization of syrphid larvae collected from *Brevicoryne brassicae* L. colonies (%)

Year	Total number of syrphid larvae	Larvae parasitized by:				Total	Parasitization %
		<i>Diplazon laetatorius</i> (F.)	<i>Diplazon</i> sp.	<i>Pachyneuron grande</i> Thoms.	<i>Syrphophagus aeruginosus</i> (Dalm.)		
1993	139	20	0	0	0	20	14.4
1994	112	41	4	7	0	52	46.43
1995	159	28	0	22	1	51	32.1
Total	410	89	4	29	1	123	30
%	100	21.7	1	7.1	0.2		

(Tab. 3). This species was described by Evenhuis (1966), Malinowska (1973) and Wnuk (1974) as a parasitoid of *Syrphidae*. The family *Encyrtidae* was represented by *Syrphophagus aeruginosus* (Dalm.). From one syrphid pupa 17 imagines of parasitoid (10 females and 7 males) were hatched (Tab. 3). This species was observed as parasitoid of *Syrphidae* by Scott (1939), Talickij (1966), Malinowska (1973) and Wnuk (1974).

At the beginning of observations the number of the parasitized larvae were small. As the number of syrphid larvae feeding in cabbage aphid colonies were increasing, the percentage of parasitized larvae also increased. The large number of plant penetrating parasitoids was also observed. The majority of infested syrphid larvae were found in the second decade of July in 1993 and the third decade of July in 1994 and 1995 (Fig. 1). In 1994 the aphid and syrphid larvae remained at a relatively high level until the third decade of September, and the higher parasitization was observed in the second decade of September too.

Parasitized syrphid larvae were collected from cabbage aphid colonies fed on the all observed vegetables. The percentage of parasitization varied between vegetables, but no significant differences were noticed. The relevant data are presented in table 1.

Table 3. Number and species composition of parasitoids reared from pupae of *Syrphidae*

Family – Species	Number of emerged parasitoids			
	year			Total
	1993	1994	1995	
Family: <i>Ichneumonidae</i>				
Subfamily: <i>Diplazontinae</i>				
<i>Diplazon laetatorius</i> (F.)	20	41	28	89
<i>Diplazon</i> sp.		4		4
Family: <i>Pteromalidae</i>				
<i>Pachyneuron grande</i> Thoms.	–	48 ♀ 23 ♂	159 ♀ 122 ♂	207 ♀ 145 ♂
Total	–	71	281	352
Family <i>Encyrtidae</i>				
<i>Syrphophagus aeruginosus</i> (Dalm.)	–	–	10 ♀ 7 ♂	10 ♀ 7 ♂
Total	–	–	17	17

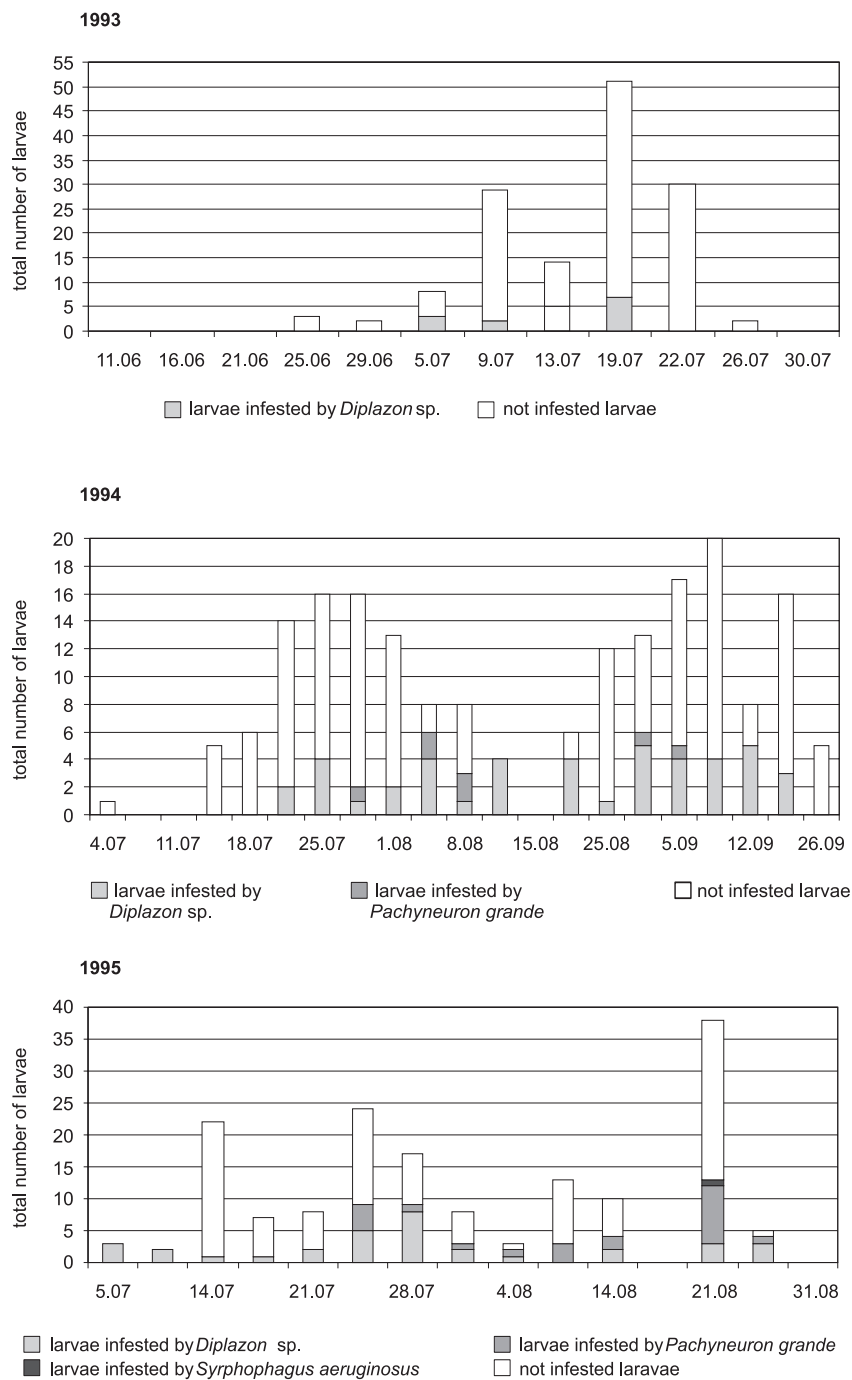


Fig. 1. Population dynamics of *Syrphidae* and its parasitization in years 1993–1995 (total on all tested vegetables)

According to Wnuk (1974) and Wnuk and Wojciechowicz (1993) the parasitization has no influence on feeding capacity of syrphid larvae, but parasitoids play a negative role in limiting the future populations of Syrphidae.

CONCLUSION

1. The parasitization of syrphid larvae occurring in cabbage aphid colonies varied within the years and oscillated from 14,4% to 46,4%.
2. Four parasitic *Hymenoptera*: *Diplazon laetatorius* (F.), *Diplazon sp.*, *Pachyneuron grande* (Thoms.) and *Syrphophagus aeruginosus* (Dalm.) were identified.
3. The dominant species was *Diplazon laetatorius* (F.), which occurred in each year of observations. The parasitization by *D. laetatorius* reached 21,7%.

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POLISH SUMMARY

PARAZYTOIDY MSZYCOŻERNYCH BZYGOWATYCH WYSTĘPUJĄCE W KOLONIACH MSZYCY KAPUŚCIANEJ (*BREVICORYNE BRASSICAE* L.) NA WARZYWACH KAPUSTNYCH

W latach 1993–1995 z kolonii mszycy kapuścianej *Brevicoryne brassicae* L. żerującej na różnych warzywach kapustnych zbierano i hodowano wszystkie larwy i poczwarki drapieżnych bzygowatych. Stwierdzono występowanie 8 gatunków *Syrphidae*. Spasożytność larw w poszczególnych latach wahała się od 14,4 do 46,4%. Wyhodowano 4 pasożytnicze błonkówki *Diplazon laetatorius* (F.), *Diplazon sp.*, *Pachyneuron grande* (Thoms.) and *Syrphophagus aeruginosus* (Dalm.) należące do 3 rodzin: *Ichneumonidae*, *Pteromalidae* and *Encyrtidae*. Dominującym gatunkiem okazał się *D. laetatorius* (*Ichneumonidae*). Występował on we wszystkich latach prowadzenia obserwacji i był sprawcą spasożytności 21,7% larw.