Brevicoryne brassicae L. (INSECTA: HOMOPTERA) PARASITOID COMPLEXES FROM SOME CABBAGE CULTURES ON BLACK SEASIDE AREAS

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Abstract. *During 2007, we investigated the parasitoid complex which controlling Brevicoryne brassicae L. populations from some cabbage cultures on Black Seaside areas. There were identified 17 parasitoids species, from 10 genera, which are grouped into 5 families. Also, we tried to explain trophic relationships between parasitoid species and we made a synecologic analysis on parasitoid species from the perspective of the role of each species in biological control of Brevicoryne brassicae L. populations.*

Keywords: *aphids, parasitoids, hyperparasitoides, biological control, natural equilibrium.*

Rezumat. Complexul de parazitoizi din coloniile de *Brevicoryne brassicae* L. (Insecta: Homoptera) din unele culturi de varză de pe litoralul Mării Negre. *În cursul anului 2007 am urmărit complexul de parazitoizi care controlează populaţiile de Brevicoryne brassicae L. în unele culturi de varză de pe litoralul românesc al Mării Negre. Au fost identificate 17 specii de parazitoizi, care aparţin la 10 genuri, grupate în 5 familii. Am elucidat relaţiile trofice dintre speciile parazitoide şi am efectuat o analiză sinecologică a speciilor de parazitoizi pentru a putea aprecia rolul fiecărei specii în controlul populaţiilor de Brevicoryne brassicae L.*

Cuvinte cheie: *aphide, parasitoizi, hiperparasitoizi, control biologic, echilibru natural*.

INTRODUCTION

We made researches concerning to entomophagous species which controlling *Brevicoryne brassicae* L. populations during last four decades. In Moldova areas were been identified a large number of predators (26 species) and parasitoids (21 species) which act inside of *Brevicoryne brassicae* L. colonies (MUSTAŢĂ, 1986). Those researches were been made especially on Moldova areas. The pedoclimatic conditions from Dobrudja areas are different from Moldova areas, and because of this reason, we made some researches concerning entomophagous species which controlling *Brevicoryne brassicae* L. populations.

This paper presents parasitoid species. The main reason of our researches was the large number of species and their trophic relationships which are established inside of these complexes. In this context, we elaborate a new concept named "parasitoid biocoenosis", which explained how biological systems work (MUSTAŢĂ, 1974, 1983; MUSTAŢĂ et al., 2000; MUSTAŢĂ, MUSTAŢĂ, 2001).

The enthomologic material was preserved from some cabbage cultures from areas of Black Seaside. It gives us the opportunity to demonstrate all meanings of "parasitoid biocoenosis" concept applied on some complexes used to explain structure of trophic network.

MATERIAL AND METHODS

During 2007, we preserved 1708 *Brevicoryne brassicae* L. mummies which were been investigated on laboratory conditions, for to obtain adults of parasitoids. The mummies were been preserved from colonies of some cabbage cultures from: Agigea, Valul lui Traian and Castelu. From all 1708 mummies, there had enclosure only 1664 parasitoid insects (97.42%). Some of them didn't enclosure, and some other were been sacrificed to establish trophic relationships between species. In the same experiment, using binocular method (field glasses), we investigated the mummy contents after parasites enclosure.

We elaborated an edifying trophic network and we used it to explain trophic relationships between parasitoid species. Also, we realized a synecologic analysis of parasitoid species used for to evaluate the role of each species in biological control of *B. brassicae* (abundance and index of ecological significance). From all these 1664 mummies, there were enclosed all of them and they were included into 17 species (Table 1).

Parasitoid species acting as primary, secondary, tertiary and even quaternary parasitoids, as following:

Primary parasitoids:

- **Aphidiidae** family: 1. *Diaeretiella rapae* (MCINTOSH.), 2. *Dyscritulus planiceps* (MARSH.), 3. *Ephedrus nitidus* (GAHAN), 4. *Praon volucre* (HAL.), 5. *Trioxys angelicae* (HAL.);

Secondary parasitoids

- **Charipidae** family: 6. *Charips arcuatus* (KIEFF.), 7. *Ch. brevicornis* (KIEFF.), 8. *Ch. dolichocerus* (CAM.), 9. *Ch. fusicornis* (HARTIG), 10. *Ch. leunisii* (HARTIG); 11. *Ch. longicornis* (HARTIG); 12. *Ch. tscheki* (GIR.);
- **Encyrtidae** family: 13. *Syrphophagus aphidivorus* (MAYR.)
- **Megaspilidae** family: 14. *Dendrocerus aphidum* (ROND.), 15. *D. carpenteri* (CURTIS);

Tertiary parasitoids

- **Pteromalidae** family: 16. *Asaphes vulgaris* (WALK.), 17. *Pachyneuron aphidis* (BCHÉ.).

For explanation concerning to trophic relationships established between parasitoid species, we elaborated an edifying trophic network (Figure 1). As we could see, only **Aphidiidae** species act as primary parasitoids. They form mummies, which are easily recognized and they could be collected from *B. brassicae* colonies. Ten of these species act exclusive as secondary parasitoids. Only *Asaphes vulgaris* and *Pachyneuron aphidis* species act as tertiary parasitoids inside of this trophic network. But, we observed that they could act as secondary and quaternary parasitoids. These last two species are parasite one for each other. Their position inside of trophic network seems to be uncertain. Because of their multiple ecological abilities and their actions as secondary, tertiary and quaternary parasitoids, these species realized a real buffer-mechanism inside of this biocoenotic system. Their preferences for a host or another depending on biomass quantity. In other words, as bigger is the number of larva as faster they parasite these species. In this way, they stopped the exponential development of this specie. Their role is very important for keeping the natural equilibrium between normal values.

If we presume that we could grow a primary parasite into a laboratory and, after that, we used it for biological control of aphid specie, than, the buffer-mechanism act especially as secondary parasite for reducing specie population which have the largest number of individuals. Concerning to the human economy, the action of buffer-mechanism is undesirable. But, in nature economy, this is a perfect mechanism used for keeping natural equilibrium.

For the evaluation of actions realized by each species in biological control of *B. brassicae* colonies, we realized a syecological analysis on parasitoid species (Table 2).

During our studies concerning the abundance, we classified these species depending on this criterion. On first place is situated *Diaeretiella rapae* (501 individuals). It is followed by *Pachyneuron aphidis* (258 individuals) and *Syrphophagus aphidivorus* (208 individuals). Therefore, on the first place is situated a primary parasitoid, it is followed by tertiary and secondary parasitoids. The next primary parasite is situated on the eighth place (*Praon volucre*).

Not all species have the same importance into this biocoenotic complex. Moreover, seven of those species are euconstant, five of them are constant and five of them are accessories. Concerning to dominance, there were been identified: five eudominant species, two dominant species, three subdominant species, 2 recedent species and the rest of them are subrecedent. Concerning the index of ecological significance, there were been identified: three species with a maxim value (W_5), three species with W_4, and the rest of them which have smaller values.

In figure 2 we present ratio between the most significant parasitoid species.

Our researches demonstrate that inside of *B. brassicae* colonies act many parasitoid species. The number of primary parasitoids is reduced, and their efficiency into biological control is strongly affected by the intervention of a huge number of secondary parasitoids.

Therefore, into a biocoenotic complex like this we can't apply the methods of biological control. The efficiency of primary parasitoids launched on fields could be reduced after few generations.

CONCLUSIONS

During 2007, we investigated the parasitoid complex which controlling *Brevicoryne brassicae* L. populations from some cabbage cultures on Black Seaside areas (Agigea, Valul lui Traian and Castelu). From all collected mummies enclosed individuals from 10 genera and 5 families.

There were been explained trophic relationships between parasitoid species and it was been realized an edifying trophic network for these explanations.

We realized a synecologic analysis of parasitoid species used for to evaluate the role of each species in biological control of *B. brassicae* (abundance and index of ecological significance).

Our researches confirmed previously studies which mentioned, especially for Moldavia Districts, the existence of a huge number of parasitoid species which act inside of *Brevicoryne brassicae* colonies.

The mentioned arguments came to confirm the "parasitoid biocoenosis" concept used by us to research these biological complexes.

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Table 1. Parasitoid complex of *Brevicoryne brassicae* from *Brassica oleracea* var. *capitata* L. cultures.
Tabel 1. Complexul de parazitoizi din coloniile de *Brevicoryne brassicae* din culturile de *Brassica oleracea* var. *capitata* L.

Nr. crt.	Place	Date	*Diaeretiella rapae*	*Dyscritulus planiceps*	*Ephedrus nitidus*	*Praon volucre*	*Trioxys angelicae*	*Charips arcuatus*	*Charyps brevicornis*	*Charyps dolichocerus*	*Charyps fusicornis*	*Charips leunisii*	*Charips longicornis*	*Charips tschecki*	*Syrphophagus aphidivarus*	*Dendrocerus aphidum*	*Dendrocerus carpenteri*	*Asaphes vulgaris*	*Pachyneuron aphidis*	*TOTAL*
1	Agigea	15.08.2007	37		-	5	1	8	-	2	-	7	18	11	15		1	8	51	164
2	Agigea	22.08.2007	61	3	-	-	3	12				4	9	18	29	1		6	25	171
3	Agigea	29.08.2007	25		-	12	-	-	3			-	21	8	8		3	14	10	104
4	Agigea	14.09.2007	49	7	-	8	5	6				2	-	16	23			-	24	140
5	Valul lui Traian	15.08.2007	27		2	3	-	7	2	3		8	12	4	20	2		9	17	116
6	Valul lui Traian	22.08.2007	32	2	-	-	-	-	1			-	8	32	-		1	23	19	128
7	Valul lui Traian	29.08.2007	64		-	7	-	5		2		11	15	19	9	3	1	7	21	164
8	Costelu	15.08.2007	87		7	-	2	9		1	4	-	21		37	1	5	11	3	188
9	Costelu	22.08.2007	35		-	4	-	16			5	7	29	5	22		2	28	45	198
10	Costelu	29.08.2007	29		3	11	3	12		2		9	-	8	16	2		8	16	119
11	Costelu	14.09.2007	55		9	-	6	7		1	3	-	37	7	29		1	-	27	182
			501	12	21	50	20	82	6	11	12	48	170	128	208	9	14	114	258	1664
			30.10	0.72	1.26	3.00	1.20		0.36	0.66	0.72	2.88	10.21	7.69	12.5	0.54	0.84	6.85	15.50	

Table 2. Synecological analysis on parasitoid species from *Brevicoryne brassicae* colonies.
Tabel 2. Analiza sinecologică a speciilor parazitoide din coloniile de *Brevicoryne brassicae.*

Nr. crt.	Specie	Abundance	Constant	Dominance	Index of ecological significance
1	*Diacretiella rapae*	501	100 – C4	30.10 – D5	30.10 – W5
2	*Pachyneuron aphidis*	258	100 – C4	15.50 – D5	15.50 – W5
3	*Syrphophagus aphidivorus*	208	90 – C4	12.50 – D5	11.25 – W5
4	*Charips longicornis*	170	81 – C4	10.21 – D5	8.27 – W4
5	*Charips tschecki*	128	90 – C4	7.69 – D4	6.92 – W4
6	*Asaphes vulgaris*	114	81 – C4	6.85 – D4	5.54 – W4
7	*Charips arcuatus*	82	81 – C4	4.92 – D3	3.98 – W3
8	*Praon volucre*	50	63 – C3	3.00 – D3	1.89 – W2
9	*Charips leunisii*	48	63 – C3	2.88 – D3	1.81 – W2
10	*Ephedrus nitidus*	21	36 – C3	1.26 – D2	0.45 – W1
11	*Trioxys angelicae*	20	54 – C3	1.20 – D2	0.64 – W1
12	*Dendrocerus carpenteri*	14	63 – C3	0.84 – D1	0.52 – W1
13	*Dyscritulus planiceps*	12	27 – C2	0.72 – D1	0.19 – W1
14	*Charyps fusicornis*	12	27 – C2	0.72 – D1	0.19 – W1
15	*Charyps dolichocerus*	11	54 – C3	0.66 – D1	0.35 – W1
16	*Dendrocerus aphidum*	9	45 – C2	0.54 – D1	0.24 – W1
17	*Charyps brevicornis*	8	27 – C2	0.36 – D1	0.09 – W1

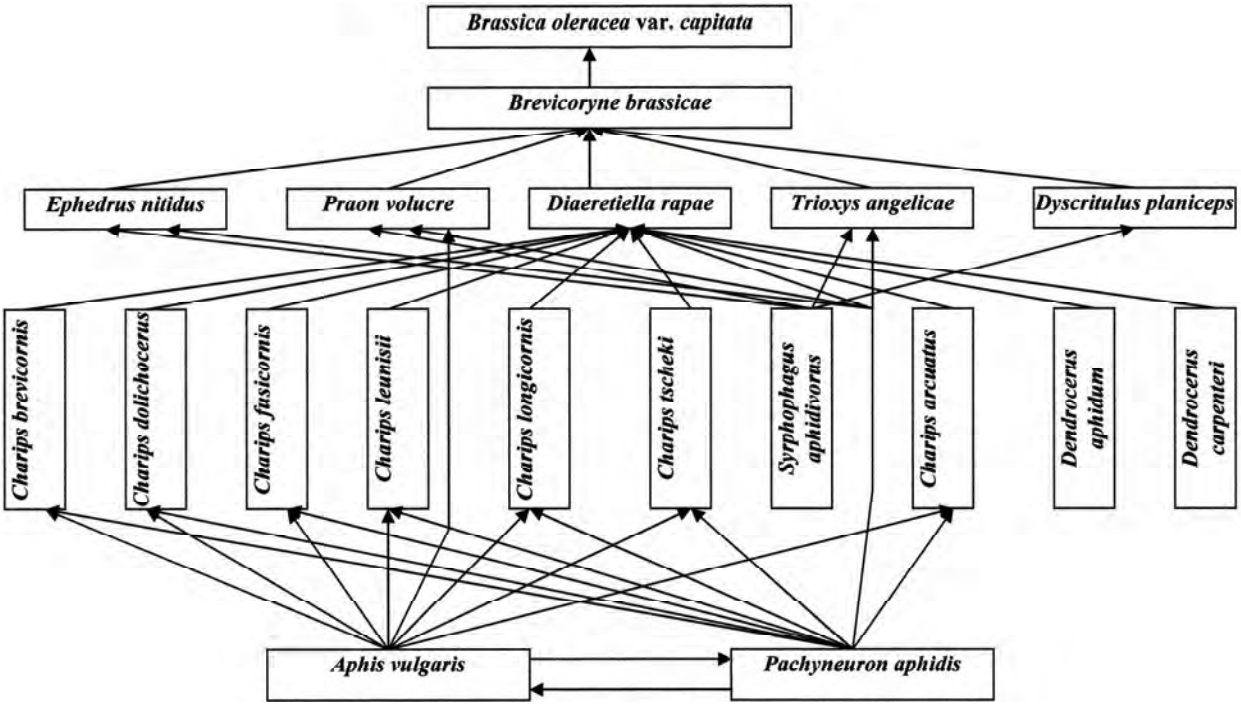

Fig. 1. The trophic network specific for parasitoid biocoenoses from certain aphids colonies.
Fig. 1. Rețea trofică specifică coloniilor de *Brevicoryne brassicae* L.

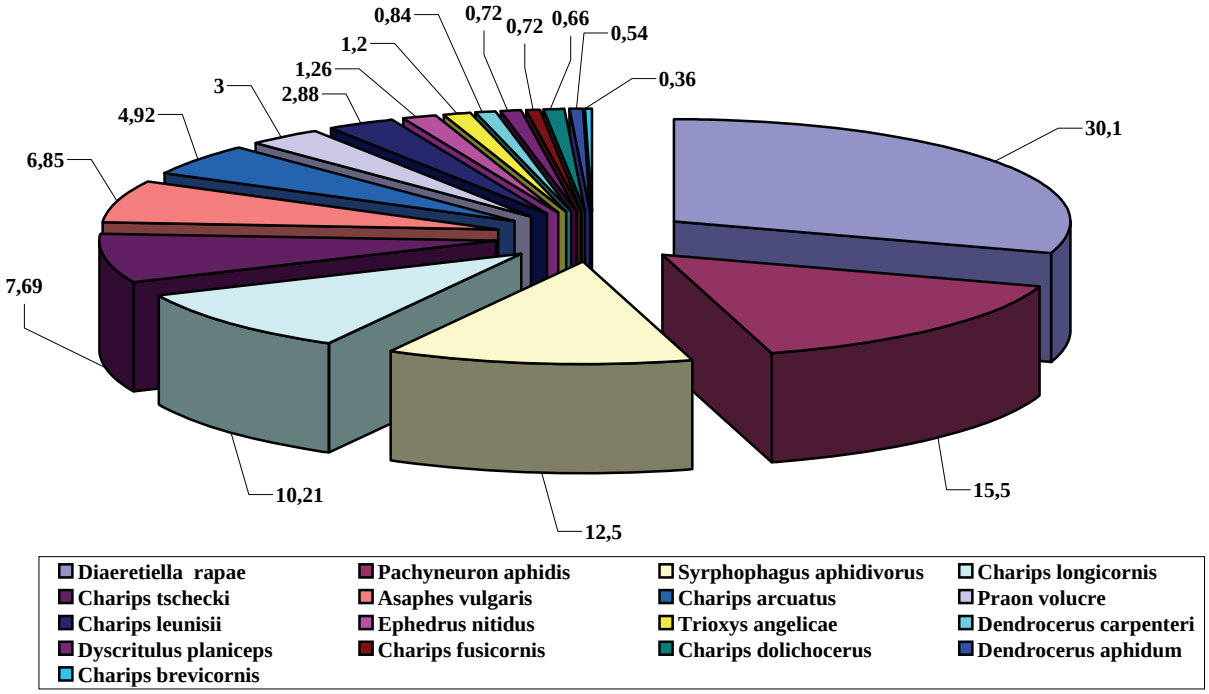

Fig. 2. Synecological analysis on parasitoid species from *Brevicoryne brassicae* colonies (dominance).
Fig. 2. Raportul dintre speciile de parazitoizi din coloniile de *Brevicoryne brassicae*.

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