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THE PARASITOIDS COMPLEX WHICH CONTROL THE *APHIS FABAE* SCOP. COLONIES INSTALLED ON DIFFERENT CROP SPECIES AND SPONTANEOUS PLANTS

BY

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In this work we present a complex of 12 parasitoid species which act in the *Aphis fabae* colonies installed on *Helianthus annuus, Beta vulgaris, Papaver rhoeas, Phaseolus vulgaris, Centaurea scabiosa* and *Arctium minus Bernh* plants. In this complex, 4 species are primary parasitoids and the other species act as secondary or tertiary parasitoids.
We accomplish a synecological analysis of the parasitoid species and we elucidate the relations among them.

Introduction

Aphis fabae Scop. families attract, by their presence on different culture or spontaneous plants, a series of parasitoid and hyperparasitoid species which establish greatly complex interrelations among them.

The *Aphidiidae* species act as primary parasitoids limiting the *Aphis fabae* colonies. Their action is however much limited by the intervention of certain hyperparasitoid species. It is not only a matter of secondary parasitoids but also of much more complex parasitism degrees (tertiary end even quaternary parasitoids). The relations among the species are greatly complex and we try to elucidate them by means of a trophic network, as we also try to appreciate the role of each species in certain bioncenoses of this type. (Fig. 1). The biocenoces with such a complex structure proves us that, in nature, when man does not cause serious unbalances it is possible to accomplish and preserve a stable natural balance.

Materials and work method

During the period between 2003-2004 we collected 3791 mummies produced by some aphid species in the *Aphis fabae* colonies installed in *Helianthus annuus, Beta vulgaris, Phaseolus vulgaris, Papaver rhoeas, Centaurea scabiosa* and *Arctium minus*

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plants. The collections were achieved in 20 locations from the counties of Botoşani, Suceava, Iaşi,Vaslui, Bacău,Vrancea, Neamț and Constanța

The collected mummies were followed in laboratory conditions to obtain the parasitoids complex. In order to elucidate the trophic relations among the species we followed isolated mummies, after which we examined their contents after the appearance of the individuals so that, based on these samples we could accomplish a trophic network specific to such biocenotic complexes.

In order to elucidate the role of each species in the biocenotic complex we accomplished the synecological analysis of the identified species.

Results and discussions

From the 3791 collected mummies we obtained 3652 parasitoids which belong to 12 species from the Hymenoptera order, included in the following families:

Aphidiidae family: 1. *Lysiphlebus ambiguus* (Hal.) 2. *Lysiphlebus fabarum* (Marsh.) 3. *Lysiphlebus melandriicola* (Stary) and 4. *Praon dorsale* (Hal.) All these species act as primary parasitoids, playing a positive role in man's economy.

Charipidae family: 5. *Charips arcuatus* (Kieff.), 6. *Charips leunisii* (Hrtg.), 7. *Charips vitrix infuscatus* (Cam.), 8. *Charips melanogaster* (Hrtg.), species that act exclusively as secondary parasitoids.

Encyrtidae family: 9. *Syrphophagus aphidivorus* (Mayr), it acts as a secondary parasitoid.

Pteromalidae family: 10. *Pachyneuron aphidis* (Bché.). It can act as a secondary or tertiary parasitoid.

Ceraphronidae family: 11. *Dendrocerus bicolor* (Curtis) and 12. *Dendrocerus carpenteri* (Curtis).

Aphis fabae is a species with a very large polyphagous spectrum. It is an aphid which migrates in a biological cycle from the primary host plants to the secondary ones. As primary host plants, they serve *Philadelphus coronaris*, *Euonimus verucosa* and *Viburnum lantanum*. As secondary plant hosts they serve over 200 species herbal plants. We followed the parasitoids complex only from the colonies from certain secondary host plant species. There is a certain preference of parasitoid species for the *Aphis fabae* colonies from certain plant species. We cannot elucidate anything based on these data. We can ascertain the presence of *Lysiphlebus* species in the colonies from all the plants. The relation among these can be followed in table I. The presence of *Praon Dorsale* seems to be accidental. Yet not only this specie has an accidental presence, as we can see in table II. Only three species are euconstant, eudominant and with a maximum ecological significance index (*Syrphophagus aphidivorus*, *Lysiphlebus fabarum* and *Pachyneuron aphidis*). Two species are constant in the researched biocenoses (*Lysiphlebus ambiguus* and *Lysiphlebus melandriicola*), and the other species are accidental. *Lysiphlebus ambiguous* acts as a dominant species and with the ecological significance index W4, and *Lysiphlebus melandriicola* acts as a dominant species and with the ecological significance index W3.

In picture 1 we present a trophic network specific to a parasitoid biocoenosis of this type, where in a host aphid only one parasitoid develops. As can be seen in table II, the coenotic affinity among the species is sufficiently reduced. We mustn't be surprised as long as many species have an accidental presence in this biocenotic complex.

In picture 2 we illustrate the relation among the main parasitoid species. The dominant species is *Syrphophagus aphidivorum* with 33.84%, followed by *Lysiphlebus fabarum* with 33.73% and, at a long distance, by *Pachyneuron aphidis* with 19.27%, followed by *Lysiphlebus ambiguus* with 7.80%.

What we can clearly observe is the great percentage of the *Syrphophagus aphidivorus* species and even of the *Pachyneuron aphidis* species. The latter species should act as a tertiary parasitoid, yet based on our data; it acts almost only as a secondary parasitoid. This happens because in most of the samples the secondary parasitoids from the *Charipidae* family are missing. *Pachyneuron aphidis* acts as a secondary parasitoid as well as a tertiary one, playing the role of a real blocking system in the biocoenotic complex, not allowing the exponential development of a species.

Considering separately the data obtained from the *Helianthus annuus* colonies, we can follow in tables III and IV and in picture 3, the relation among the parasitoid species. We could consider that the host plant can influence the preference of certain parasitoid species. We cannot, however, state that with complete certainty. Yet we considered that the observation of the situation in the case of this species wasn't less interesting.

Conclusions

During the period 2003-2004 we collected 3791 mummies fixed in *Aphis fabae Scop*. colonies installed on a number of 6 host plant species. The collections were made in some locations from the following counties: Botoşani, Suceava, Iaşi, Vaslui, Bacău, Vrancea, Neamț and Constanța.

We identified 12 parasitoid species which belong to the families *Aphidiidae*, *Charipidae*, *Pteromalidae*, *Encyrtidae* and *Ceraphronidae.* The aphidiidae species act exclusively as primary parasitoids playing a positive role in man's economy. Their role is greatly limited by the secondary parasitoids which control the populations. *Pachyneuron aphidis* can act as a secondary parasitoid as well as a tertiary one playing the role of a blocking system in the biocenotic complex.

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Table I. The parasitoids complex from the Aphis fabae Scop. colonies

No.	LOCATION AND DATE	HOST PLANT	PRIMARY PARASITOIDS					HYPERPARASITOIDS								
			Praon dorsale	**Lysiphlebus fabarum**	**Lysiphlebus ambiguus**	**Lysiphlebus melandriicola**	**Total**	**Syrphophagus aphidivorus**	**Pachyneuron aphidis**	**Charips melanogaster**	**Charips vitrix infuscatus**	**Charips arcuatus**	**Charips leunisii**	**Dendrocerus bicolor**	**Dendrocerus carpenteri**	**Total**
1	Albeşti –Botoşani 25.06.2003	Helianthus annuus		90	42	34	**166**	2	4							**6**
2	Albeşti –Botoşani, 25.06.2003	Helianthus annuus		351	37	27	**415**	17								**17**
3	Tudor Vladimirescu (Botoşani), 26.06.2003	Helianthus annuus		52	21	14	**87**	3	2							**5**
4	Satu Nou – Botoşani, 27.06.2003	Helianthus annuus		72			**72**	2								**2**
5	Letea – Bacău, 25.06.2004	Helianthus annuus		62	50	14	**126**	136	95							**231**
6	Horia – Neamț, 25.06.2004	Helianthus annuus		13	8	4	**25**	31	52							**83**
7	Paşcani – Iaşi, 27.06.2004	Helianthus annuus		25	14	3	**42**	42	36							**78**
8	Răchiţeni – Neamț, 27.06.2004	Helianthus annuus		21	8	3	**32**	75	26							**101**

No.	LOCATION AND DATE	HOST PLANT	PRIMARY PARASITOIDS					HYPERPARASITOIDS								
			Praon dorsale	Lysiphlebus fabarum	Lysiphlebus ambiguus	Lysiphlebus melandriicola	Total	Syrphophagus aphidivorus	Pachyneuron aphidis	Charips melanogaster	Charips vitrix infuscatus	Charips arcuatus	Charips leunisii	Dendrocerus bicolor	Dendrocerus carpenteri	Total
9	Budăi – Iaşi, 27.06.2004	Helianthus annuus		19	11	7	**37**	131	89							**220**
10	Cristeşti – Suceava, 28.06.2004	Helianthus annuus		29	9	15	**53**	32	47							**79**
11	Soleşti – Vaslui, 29.06.2004	Helianthus annuus		14	5	3	**22**	21	18							**39**
12	Bălţăteşti – Iaşi, 30.06.2004	Helianthus annuus		18	11	9	**37**	81	39							**120**
13	Răcăcium – Bacău, 30.06.2004	Helianthus annuus		61	30	18	**109**	39	56							**95**
14	Fărăuani – Bacău, 30.06.2004	Helianthus annuus		32	5	8	**45**	12	19							**31**
15	Leţcani – Iaşi, 03.07.2004	Helianthus annuus						24	13							**37**
16	Leţcani – Iaşi, 04.07.2004	Helianthus annuus		10	4	3	**17**	201	55							**256**
17	Leţcani – Iaşi, 05.07.2004	Helianthus annuus		3			**3**	10								**10**
18	Leţcani – Iaşi, 06.07.2004	Helianthus annuus		1			**1**	31	5							**36**

No.	LOCATION AND DATE	HOST PLANT	PRIMARY PARASITOIDS					HYPERPARASITOIDS								
			Praon dorsale	Lysiphlebus fabarum	Lysiphlebus ambiguus	Lysiphlebus melandriicola	Total	Syrphophagus aphidivorus	Pachyneuron aphidis	Charips melanogaster	Charips vitrix infuscatus	Charips arcuatus	Charips leunisii	Dendrocerus bicolor	Dendrocerus carpenteri	Total
19	Podu Iloaiei – Iaşi, 07.07.2004	Helianthus annuus		1			**1**	109	23							**132**
20	Tg Frumos – Iaşi, 08.07.2004	Helianthus annuus		9	2		**11**	99	14							**113**
21	Fălticeni – Suceava, 29.06.2003	Beta vulgaris		132	2		**134**	30	20	1						**51**
22	Fălticeni – Suceava, 30.06.2003	Beta vulgaris	1	167	2	1	**171**	37	12							**49**
23	Adjud – Vrancea, 27.06.2004	Phaseolus vulgaris		31	15	4	**50**	27	39		5		4	3	1	**79**
24	Agigea – Constanța, 22.06.2004	Papaver rhoeas		15	9	2	**26**	35	40	3			4	1	1	**87**
25	Gradina Botanica Iaşi, 01.07.2004	Centaurea scabiosa						9			3					**9**
26	Tg. Frumos – Iaşi, 04.07.2004	Arctium minus Bernh					**4**									
	TOTAL: 3652		**1**	**1232**	**285**	**169**	**1686**	**1236**	**704**	**4**	**5**	**3**	**8**	**4**	**2**	**1966**

Table II. The synecological analysis of the parasitoids complex from the *Aphis fabae* Scop. colonies

Abundance	Constancy		Dominance		Ecological significance index (w)		No.	SPECIES	COENOTIC AFFINITY (Q)											
									1	2	3	4	5	6	7	8	9	10	11	12
1236	96	C_4	33.84	D_5	32.53	W_5	1	Syrphophagus aphidivorus	-	88	84	69	68	8	4	8	8	4	8	4
1232	92	C_4	33.73	D_5	31.13	W_5	2	Lysiphlebus fabarum			80	79	71	8	4	8	8	4	8	4
704	81	C_4	19.27	D_5	15.56	W_5	3	Pachyneuron aphidis				82	73	10	5	10	10	5	10	5
285	73	C_3	7.80	D_4	5.69	W_4	4	Lysiphlebus ambiguus					89	11	5	11	11	5	11	5
169	65	C_3	4.62	D_3	3.02	W_3	5	Lysiphlebus melandriicola						12	6	6	12	6	12	6
8	8	C_1	0.21	D_1	0.01	W_1	6	Charips leunisii							50	33	100	50	100	0
5	8	C_1	0.13	D_1	0.004	W_1	7	Charips vitrix infuscatus								0	50	0	50	0
4	8	C_1	0.10	D_1	0.007	W_1	8	Charips melanogaster									33	50	50	0
4	8	C_1	0.10	D_1	0.007	W_1	9	Dendrocerus bicolor										50	100	0
3	4	C_1	0.08	D_1	0.003	W_1	10	Charips arcuatus											50	0
2	4	C_1	0.05	D_1	0.0038	W_1	11	Dendrocerus carpenteri												0
1	4	C_1	0.02	D_1	0.0007	W_1	12	Praon dorsale												-

Table III. The parasitoids complex from the *Aphis fabae* Scop. colonies on *Helianthus annuus*

NO.	LOCATION AND DATE	PRIMARY PARASITOIDS				HYPERPARASITOIDS		
		Lysiphlebus fabarum	**Lysiphlebus ambiguus**	**Lysiphlebus melandriicol**	**Total**	**Syrphophagus aphidivorus**	**Pachyneuron aphidis**	**Total**
1	Albeşti –Botoşani, 25.06.2003	90	42	34	**166**	2	4	**6**
2	Albeşti –Botoşani, 25.06.2003	351	37	27	**415**	17		**17**
3	Tudor Vladimirescu (Botoşani), 26.06.2003	52	21	14	**87**	3	2	**5**
4	Satu Nou – Botoşani, 27.06.2003	72			**72**	2		**2**
5	Letea – Bacău, 25.06.2004	62	50	14	**126**	136	95	**231**
6	Horia – Neamţ, 25.06.2004	13	8	4	**25**	31	52	**83**
7	Paşcani – Iaşi, 27.06.2004	25	14	3	**42**	42	36	**78**
8	Răchiţeni – Neamţ, 27.06.2004	21	8	3	**32**	75	26	**101**
9	Budăi – Iaşi, 27.06.2004	19	11	7	**37**	131	89	**220**
10	Cristeşti – Suceava, 28.06.2004	29	9	15	**53**	32	47	**79**
11	Soleşti – Vaslui, 29.06.2004	14	5	3	**22**	21	18	**39**
12	Bălţăteşti – Iaşi, 30.06.2004	18	11	9	**37**	81	39	**120**
13	Răcăcium – Bacău, 30.06.2004	61	30	18	**109**	39	56	**95**
14	Fărăuani – Bacău, 30.06.2004	32	5	8	**45**	12	19	**31**
15	Leţcani – Iaşi, 03.07.2004					24	13	**37**
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17	Leţcani – Iaşi, 05.07.2004	3			**3**	10		**10**
18	Leţcani – Iaşi, 06.07.2004	1			**1**	31	5	**36**
19	Podu Iloaiei – Iaşi, 07.07.2004	1			**1**	109	23	**132**
20	Tg Frumos – Iaşi, 08.07.2004	9	2		**11**	99	14	**113**
	TOTAL	**883**	**257**	**162**	**1302**	**1098**	**593**	**1691**

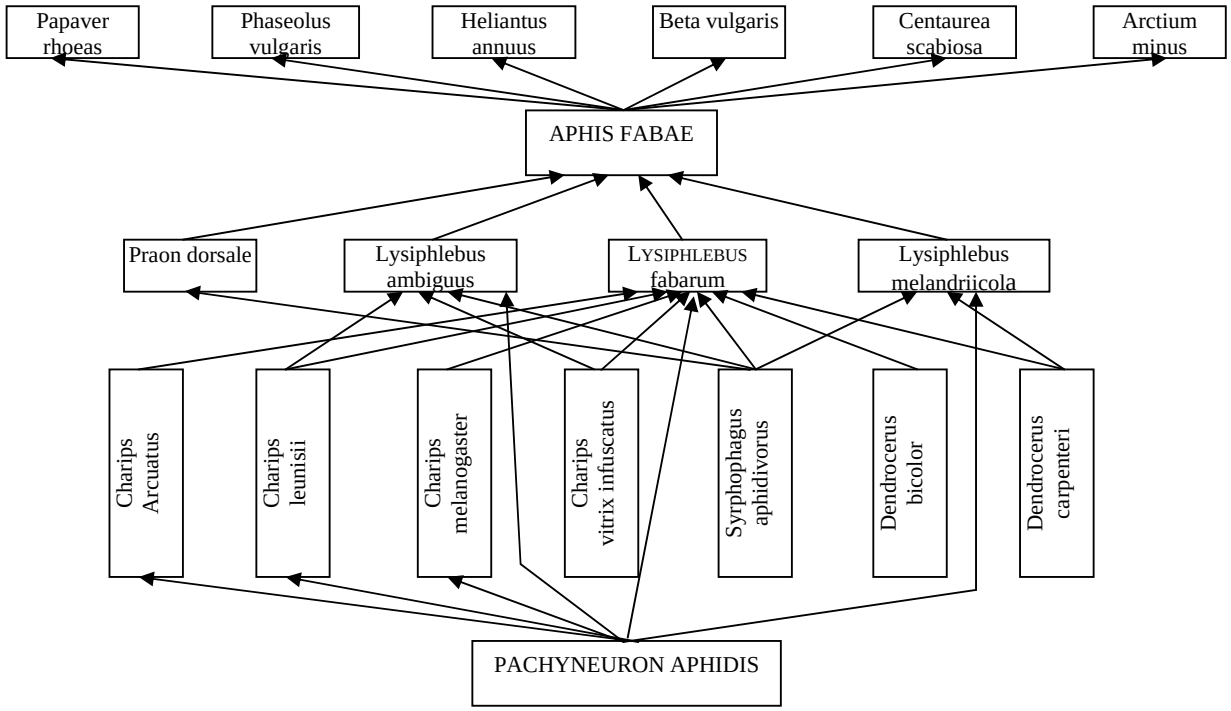

Fig. 1 The trophic network specific for parasitoid biocoenoses of *Aphis fabae* Scop.

Fig. 2 The percentage relation among the parasitoid species from certain *Aphis fabae* Scop. colonies

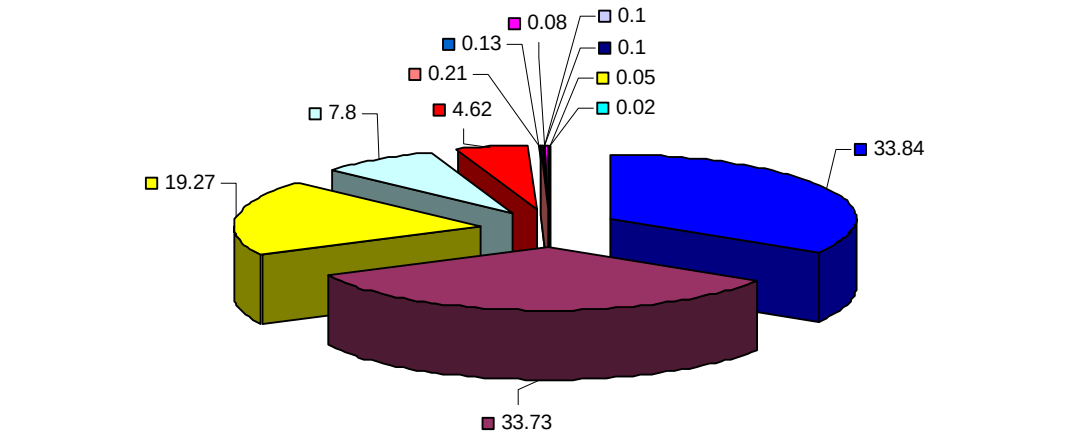

Fig. 3 The percentage relation among the parasitoid species from certain *Aphis fabae* on *Helianthus annuus*