THE FLIGHT BEHAVIOUR OF APHIDS ON *PRUNUS AVIUM*

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Abstract. *On the global and national level, aphids are an entomological group most important in terms of their implications for agriculture and horticulture. They produce extended harm to most plants, either directly, by extracting the sap of the plant, or indirectly by the transmission of a large number of phytopathogenic viruses. Given these considerations, and that in Romania there is insufficient research on the structure of aphid fauna, flight dynamics on the cherry tree, our research can make important contributions in this area. The study presents data referring to the flight behavior of aphids on cherry tree. The research has been carried out in 2007. Species were collected from orchards from Didactic Station Timisoara (Timiş County - a plain area) and Varfurile, (Arad County - a mountain area) from Romania. In the pedoclimatic conditions in the West of Romania, following the researches carried out in 2017, the aphid fauna of the cherry in the plain area was very rich with a total of 12 species: Aphis fabae, Aphis frangulae, Aphis pomi, Aphis nasturti, Brachycaudus cardui, Brachycaudus, Dysaphis plantaginea, Hyalopterus pruni, Myzus persicae, Phorodon humuli, Rhopalosiphum padi, Rhopalosiphum poae. Regarding flight behavior of aphid populations, the month of May began with large population, reaching the highest number of individuals in the last decade, when there were collected 12 species of aphids. August is characterized by a regression period of the flight intensity, the population is reduced due to adverse thermal conditions and the fact that many species of aphids have migrated to secondary host plants. Regarding flight behavior, levels peak in May and September, when aphids return the primary host plant. Knowing aphids fauna of cherry tree and flight behavior is important for optimal timing of treatments application to combat aphids. The aim of this study was to investigate and identify aphid species in orchards of cherry tree in West of Romania.*

Keywords*: behaviour, aphids, Prunus avium, flight*

INTRODUCTION

Aphids are a group of insects that cause damage directly and indirectly especially as virus vector of a great number of plants.

Aphids excrete excess carbohydrates from their diet of phloem sap, providing a nutrient-rich substrate for sooty mold fungi to grow. Sooty mold can be a major problem in a number of agricultural crops because the mold can either render produce unmarketable or reduce plant quality of the commodity. Aphids are also important vectors of viruses that can kill their host plant or substantially reduce crop yield and quality (AGRIOs 2005)

The knowledge regarding aphids on cherry tree, in Romania are not yet existent. This study presents some data referring to abundance and dominance of the aphid on cherry tree. GALLO ET AL., (2002) said that the aphids wrinkle and deform the leaves, as well as affect the growth and development of branches and may change the plant shape (Salles, 1998).

The result obtained by LAZZARI AND LAZZAROTTO (2005) show that population dynamics and flight activity of aphids is influenced by environmental factors: variations in temperature, occurrence of rains, winds and lack of food.

MATERIAL AND METHODS

This study have been carried out in the year 2017, species were collected from orchards from Didactic Station Timisoara (Timiş County - a plain area) and Varfurile, (Arad County - a mountain area) from Romania. Aphid sampling was carried out using Moericke yellow water traps (YWT). Samples were collected once a week.

The capture of aphids began on first of May and lasted until 30th of September. Then the aphids were prepared, conserved and determined.

The diversity of aphid fauna was carried out using occurrence and dominance indices according to Abreu and Nogueira (1989) and Palma (1975). The dominance index of aphid species was calculated by the formula: D (%) = (Na*100)/N, in which Na = the total number of individuals of species found in the investigated samples and N = total number of individuals. The value obtained was classified as: accidental, where species represent 0.0 to 2.5% of total aphids; accessory, where species represent 2.6-5.0% of the total aphids; and dominant, where species represent 5.1-100% of the total aphids. The aphids was identifier under a light microscope using identification keys proposed by FERICEAN AND CORNEANU (2016), (2017), SCHUBER ET AL., 2009, GUALTIERI AND MC LEOD (1994), COSTA ET AL., (1993), FOOTTIT AND RICHARDS (1993).

RESULTS AND DISCUSSIONS

Regarding the populations dynamic, we can observe the difference between the months. In May were collected collected 12 species of aphids, with a total abundance of 1,650 individuals. In this month took place the most increased fly of aphids, reaching the greatest values in the last decade (657 individuals). (Table 1).

Table 1

Abundance and dominance of aphid species**,** May, 2017

Nr.	**Species**	**MAY**				
		I	**II**	**III**	**A**	**D**
1.	*Aphis fabae*	21	33	44	98	5,94
2.	*Aphis frangulae*	20	40	44	104	6,3
3.	*Aphis pomi*	2	4	14	20	1,21
4.	*Aphis nasturti*	45	54	59	158	9,58
5.	*Brachycaudus cardui*	5	7	8	20	1,21
6.	*Brachycaudus helichrysi*	27	53	78	158	9,58
7.	*Dysaphis plantaginea*	2	14	17	33	2
8.	*Hyalopterus pruni*	120	129	145	394	23,8
9.	*Myzus persicae*	45	55	60	160	9,7
10.	*Phorodon humuli*	31	41	42	114	6,91
11.	*Rhopalosiphum padi*	110	120	135	365	22,1
12.	*Rhopalosiphum poae*	6	9	11	26	1,58
TOTAL:		**434**	**559**	**657**	**1650**	

In May, the most abundant species were: *Hyalopterus pruni* with an abundance of 394 individuals, *Rhopalosiphum padi* with an abundance of 365 individuals, *Myzus persicae* with an abundance of 160 individuals, *Rhopalosiphum padi* and *Aphis nasturti* with an abundance of 158 individuals (figure 1).

In terms of dominance, the most dominant aphids species in May were: *Hyalopterus pruni* with a dominance of 23.8%, *Rhopalosiphum padi* with a dominance of 22.1%, *Myzus persicae* with a dominance of 9.7%, followed by *Brachycaudus helichrysi* and *Aphis nasturti* with a dominance of 9.58%. (Figure 2)

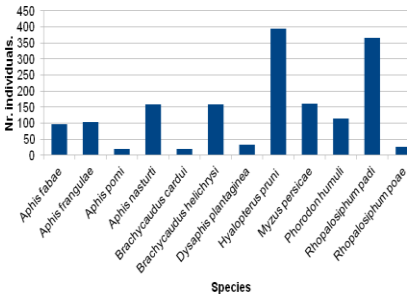

Fig. 1: Abundance of aphid species, May, 2017

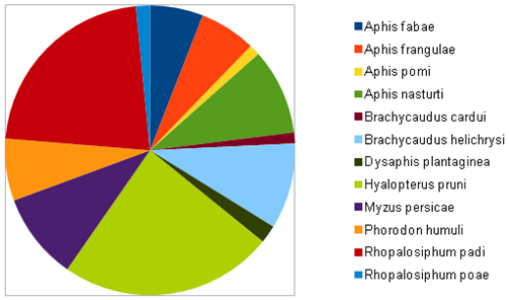

Fig. 2: Dominance of aphid species, May, 2017

In June the aphids population is declining due to the fact that some of the aphids migrate to secondary host plants such as herbaceous plants (Table 2). This month were collected 10 species of aphids, with a total abundance of 928 individuals.

Table 2

Abundance and dominance of aphid species, June, 2017

Nr.	Species	June				
		I	II	III	A	D
1.	*Aphis fabae*	44	39	33	116	12,5
2.	*Aphis frangulae*	31	30	29	90	9,7
3.	*Aphis pomi*	9	7	5	21	2,26
4.	*Aphis nasturti*	35	21	7	63	6,79
5.	*Brachycaudus helichrysi*	22	12	7	41	4,42
6.	*Hyalopterus pruni*	94	84	57	235	25,3
7.	*Myzus persicae*	28	22	14	64	6,9
8.	*Phorodon humuly*	44	38	31	113	12,1
9.	*Rhopalosiphum padi*	75	46	39	160	17,2
10.	*Rhopalosiphum poae*	9	8	8	25	2,69
TOTAL:		391	307	230	928	

The maximum number of individuals was collected in the first decade of June, and the minimum number in the third decade. The most abundant species were: *Hyalopterus pruni* with an abundance of 235 individuals, *Rhopalosiphum padi* with an abundance of 160 individuals, *Aphis fabae* with an abundance of 116 individuals and *Phorodon humuly* with an abundance of 113 individuals (Figure 3).

Regarding the dominance of aphids species in June, we can notice that the most dominant species were: *Hyalopterus pruni* with a dominance of 25.3%, followed by *Rhopalosiphum padi* with a 17.2% dominance, *Aphis fabae* with a dominance of 12.5% and *Phorodon humuly* with a 12.1% dominance (Figure 4).

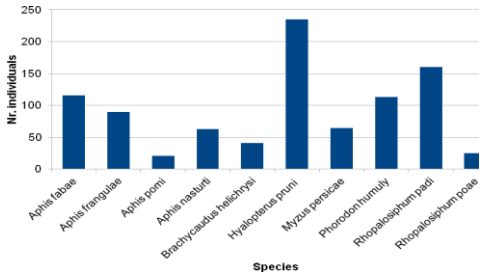

Fig. 3: Abundance of aphid species, June, 2017

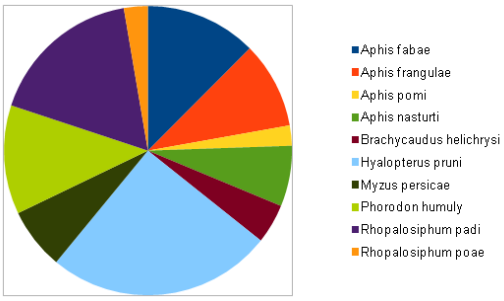

Fig. 4: Dominance of aphid species, June, 2017

In July, the population is declining, this month was collected 11 species of aphids with a total abundance of 613 individuals (Table 3).

Table 3

Abundance and dominance of aphid species, July, 2017

Nr.	Species	JULY				
		I	II	III	A	D
1.	*Aphis pomi*	3	2	1	6	0,98
2.	*Aphis frangulae*	26	22	12	60	9,79
3.	*Aphis fabae*	30	28	22	80	13,05
4.	*Aphis nasturti*	21	18	11	50	8,16
5.	*Brachycaudus cardui*	1	-	-	1	0,16
6	*Brachycaudus helichrysi*	7	1	1	9	1,47
7.	*Hyalopterus pruni*	60	52	51	163	26,5
8.	*Myzus persicae*	11	3	1	15	2,45
9.	*Phorodon humuli*	21	19	5	45	7,34
10.	*Rhopalosiphum padi*	70	55	45	170	27,7
11	*Rhopalosiphum poae*	7	5	2	14	2,28
TOTAL:		257	205	151	613	

In July, the species with the highest abundance were: *Rhopalosiphum padi* with an abundance of 170 individuals, *Hyalopterus pruni* with an abundance of 163 individuals, *Aphis frangulae* with an abundance of 80 individuals and *Aphis fabae* with an abundance of 80 individuals (Figure 5).

This month, due to the high temperatures that influenced negatively the prolificity of aphids, the number of individuals collected was lower compared to May and June. The maximum number of individuals was collected in the first decade of the month and the lowest flight intensity took place in the third decade of the month.

In July the most dominant species was *Rhopalosiphum padi* with a 27.7% dominance, and *Hyalopterus pruni* who showed a dominance of 26.5%. (Figure 6)

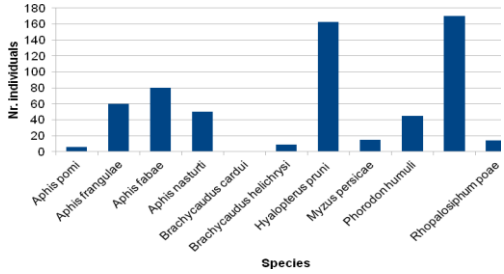

Fig. 5: Abundance of aphid species, July 2017

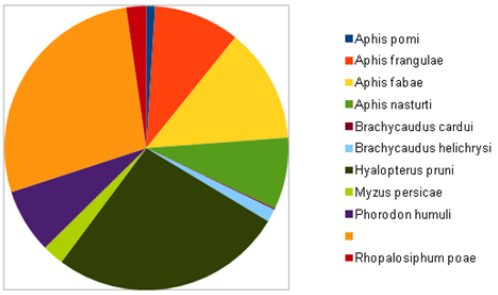

Fig. 6: Dominance of aphid species, July, 2017

August is characterized by a period of population regression; eight species of aphids were collected this month, with an abundance of 306 individuals. The smallest number of individuals was collected in the third decade of August (Table 4).

Table 4

Abundance and dominance of aphid species, August, 2017

Nr.	Species	AUGUST				
		I	II	III	A	D
1.	*Aphis frangulae*	1	4	5	10	3,27
2.	*Aphis fabae*	19	16	15	50	16,3
3.	*Aphis nasturti*	6	5	4	15	4,9
4.	*Brachycaudus helichrysi*	9	5	1	15	4,9
5.	*Hyalopterus pruni*	43	33	24	100	32,6
6.	*Myzus persicae*	3	2	1	6	1,96
7.	*Phorodon humuli*	5	5	5	15	4,9
8.	*Rhopalosiphum padi*	42	31	22	95	31,5
TOTAL:		128	101	77	306	

August is characterized by the fewest aphids species with the lowest abundance of individuals. The most abundant species were: *Hyalopterus pruni* with an abundance of 100 individuals, *Rhopalosiphum padi* an abundance of 95 individuals. (Figure 7)

In August, a small number of species were collected, the dominant species was *Hyalopterus pruni* with a 32.6% dominance, followed by *Rhopalosiphum padi* with a 31.5% dominance.

In September the abundance and the number of species began to increase, were colected 11 species with an abundance of 606 individuals. Flight intensity is low in the first decade of September by only 93 individuals, and at the end of the month will reach maximum values of 307 individuals due to the fact that aphids return from herbaceous plants that are secondary hosts on the primary host plant (fruit trees) (Table 5).

September is characterized by an increase of the abundance of the number of individuals due to the return on the primary host of the aphids preparing for the winter egg.

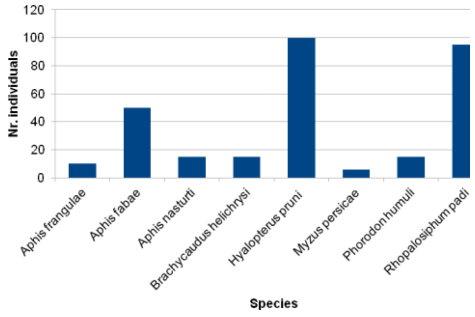

Fig. 7: Abundance of aphid species, August, 2017

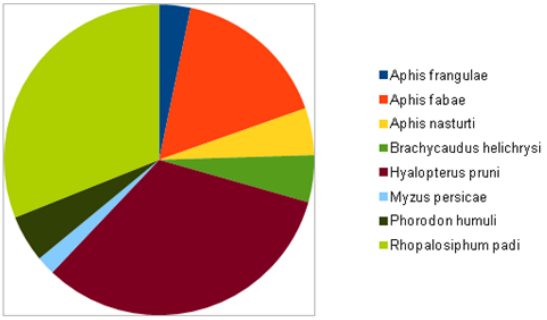

Fig. 8: Dominance of aphid species, August, 2017

Table 5

Abundance and dominance of aphid species, September, 2017

Nr.	Species	SEPTEMBER				
		I	II	III	A	D
1.	*Aphis fabae*	1	11	12	24	3,96
2.	*Aphis frangulae*	5	12	17	34	5,61
3.	*Aphis nasturti*	5	12	19	36	5,94
4.	*Aphis pomi*	1	1	3	5	0,83
5.	*Brachycaudus cardui*	1	1	2	4	0,66
6.	*Brachycaudus helichrysi*	2	14	24	40	6,6
7.	*Hyalopterus pruni*	33	44	54	131	21,6
8.	*Myzus persicae*	16	45	66	127	20,9
9.	*Phorodon humuli*	6	18	39	63	10,4
10.	*Rhopalosiphum padi*	22	47	69	138	22,7
11.	*Rhopalosiphum poae*	1	1	2	4	0,66
TOTAL:		93	206	307	606	

The most abundant species in September were: *Rhopalosiphum padi* with an abundance of 138 individuals, *Hyalopterus pruni* with an abundance of 131 individuals, *Myzus persicae* with an abundance of 127, *Phorodon humuli* with an abundance of 63 individuals, *Brachycaudus helichrysi* with abundance of 40 individuals (Figure 9)

In September, the species with the highest dominance were *Rhopalosiphum padi* with a dominance of 22.7%, *Hyalopterus pruni* with a dominance of 21.6%, *Myzus persicae* with a dominance of 20.9% and *Phorodon humuli* with a dominance of 10.4% (Figure 10)

The hight temperatures and precipitations have influenced the number of aphids collected by Möericke traps, as confirmed by IMENES AND BERGAMANN, (1984), CARVALHO ET AL., (2002) who concluded that prolonged periods of rain are unfavorable to aphids. The main cause seems to be due to the fact that aphids colonize the axial part of the leaves and can be easily washed from the plants, not being in protected places while OLIVEIRA (1971), LAMBOROT AND GUERRERO (1979) showed that drier periods promote aphid population.

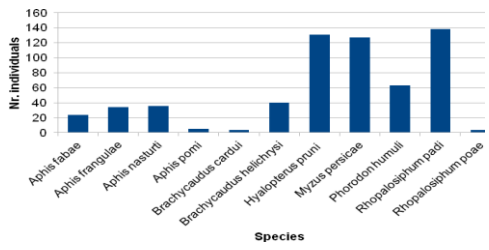

Fig. 9: Abundance of aphid species, September, 2017

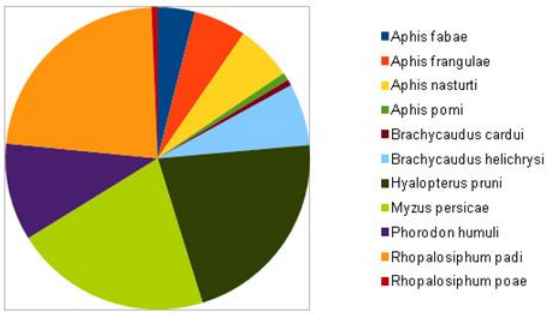

Fig. 10: Dominance of aphid species, September, 2017

Table 6

Frequencies of aphid species collected with Möericke traps in chery tree orchards, 2017

Nr.	Species	May		June		July		August		September	
		A	D	A	D	A	D	A	D	A	D
1.	*Aphis pomi*	20	1,21	21	2,26	6	0,98	-	-	5	0,83
2.	*Aphis frangulae*	104	6,3	90	9,7	60	9,79	10	3,27	34	5,61
3.	*Aphis fabae*	98	5,94	116	12,5	80	13,05	50	16,3	24	3,96
4.	*Aphis nasturti*	158	9,58	63	6,79	50	8,16	15	4,9	36	5,94
5.	*Brachycaudus cardui*	20	1,21	-	-	1	0,16	-	-	4	0,66
6	*Brachycaudus helichrysi*	158	9,58	41	4,42	9	1,47	15	4,9	40	6,6
7	*Dysaphis plantaginea*	33	2	-	-	-	-	-	-	-	-
8.	*Hyalopterus pruni*	394	23,8	235	25,3	163	26,5	100	32,6	131	21,6
9.	*Myzus persicae*	160	9,7	64	6,9	15	2,45	6	1,96	127	20,9
10.	*Phorodon humuli*	114	6,91	113	12,1	45	7,34	15	4,9	63	10,4
11.	*Rhopalosiphum padi*	365	22,1	160	17,2	170	27,7	95	31,5	138	22,7
12.	*Rhopalosiphum poae*	26	1,58	25	2,69	14	2,28	-	-	4	0,66
TOTAL:		1650		928		613		306		606	

Table 7

Faunal indices of aphids sampled by visual observations and Möericke traps in cherry orchards, with their dominance status, according to the classification of Palma (1975) May to September 2017

Nr.	Species					
		May	June	Iuly	August	September
1.	*Aphis pomi*	x	x	x	-	x
2.	*Aphis frangulae*	d	d	d	y	d
3.	*Aphis fabae*	d	d	d	d	y
4.	*Aphis nasturti*	d	d	d	y	d
5.	*Brachycaudus cardui*	x	-	x	-	x
6	*Brachycaudus helichrysi*	d	d	x	y	d
7	*Dysaphis plantaginea*	x	-	-	-	-
8.	*Hyalopterus pruni*	d	d	d	d	d
9.	*Myzus persicae*	d	d	x	x	d
10.	*Phorodon humuli*	d	d	d	y	d
11.	*Rhopalosiphum padi*	d	d	d	d	d
12.	*Rhopalosiphum poae*	x	y	x	-	x

Dominance indices: x) accidental; y) accessory and d) dominant

Regarding population dynamic, similar results were found in 2005 by LAZZARI AND LAZZAROTTO, who collected and identified the species of aphids, using Möericke traps. The great number of aphids species collected may be explained by trap attraction characteristics, because the yellow color attracts not only aphids characteristic for cherry tree, but also aphids who colonize nearby plants. Not all aphids collected by Möericke traps establish colonies. BLACKMAN , EASTOP (1984) and SOUZA-SILVA, ILHARCO (1995) showed that the occurrence of other species in great number is due to the higher diversity of Asteraceae family plants in the orchards, as these aphid species colonize preferably plants from that family. This study, (table 7) showed that *Rhopalosiphum padi* and *Hyalopterus pruni* are dominant every month and colonizing *Prunus avium* in Romania. BLACKMAN AND EASTOP (1984) reported *Rhopalosiphum padi* and *Hyalopterus pruni* as a pest of the crop and the species *Brachycaudus helichrysi* collonizing Brazilian peach orchards (SOUZA-SILVA AND ILHARCO,1995).

Some species as *Aphis pomi, Brachycaudus cardui, Dysaphis plantaginea, Rhopalosiphum poae,* because they are polyphagous and are highly attracted to the yellow traps were classified as accidental.

The species *Aphis fabae, Aphis frangulae, Aphis nasturti, Brachycaudus cardui, Brachycaudus helichrysi, Hyalopterus pruni, Myzus persicae, Phorodon humuli, Rhopalosiphum padi* are dominant in the orchard of *Prunus avium,*

CONCLUSIONS

The flying behavior of aphids on the cherry is influenced by climatic conditions, and some species are characteristic of the cherry tree, and others are present on random. In the pedoclimatic conditions in the West of Romania, following the researches carried out in 2017, the aphid of the cherry in the plain area was very rich with a total of 12 species: *Aphis fabae, Aphis frangulae, Aphis pomi, Aphis nasturti, Brachycaudus cardui, Brachycaudus helichrysi, Dysaphis plantaginea, Hyalopterus pruni, Myzus persicae, Phorodon humuli, Rhopalosiphum padi, Rhopalosiphum poae.*

May is characterized by the most increased fly of aphids, reaching the greatest values in the last decade. In this month there were collected 12 species of aphids. In June the aphids population is declining due to

the fact that some of the aphids migrate to secondary host plants such as herbaceous plants. This month were collected 10 species of aphids. In July, were collected 11 species of aphids.

August is characterized by a period of population regression; This month were collected 8 species of aphids.

In September, the abundance and the number of species began to increase, were colected 11 species. Flight intensity is low in the first decade of September and in the end of the month will reach maximum values due to the fact that aphids return from herbaceous plants that are secondary hosts on the primary host plant (fruit trees)

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