

## THE BEHAVIOUR, LIFE CYCLE AND BIOMETRICAL MEASUREMENTS OF *APHIS FABAE*

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**Abstract:** This paper presents data referring to the colonization and dispersal behaviour; the life cycle of aphid species from potato cultivations for a period of three years 2005-2007, from Didactic Station Timisoara and Varfurile, Arad county, and biometrical measurements which point out the morphological characteristics of *Aphis fabae*. Apterous adult have green-brown or black ovoid body and big marginal tubercles on prothorax and on abdominal segments I and VII; body length varies from 1.8 to 2.4 mm. Alatae aphid are more elongate with head and thorax shiny black; oviparous females with distinctly swollen hind tibiae and abdomen is black-green. The smallest length of the body established for aphids captured in West Zone of Romania was 1,40 mm, while the biggest was 2.20 mm. The average body length was  $1,83 \pm 0,20$  mm. Regarding the length of the head and thorax, it may be noticed that the maximum length of these parts was 0,95 mm and minimum length was 0,50 mm. The average value calculated for the length of these parts was  $0,77 \pm 0,12$  mm. The minimum width of head was 0.20 mm and the maximum width of head was 0.45 mm. The average value calculated for head width was  $0.32 \pm 0.05$  mm. As far as the thorax width is concerned, this was minimum 0.40 mm and maximum 0,80 mm. Mean thorax width was  $0.61 \pm 0.02$  mm the minimum length of the abdomen was 0,80 mm and minimum width was 0.50 mm, the maximum length of the abdomen was 1.40 mm and the maximum width was 1 mm. The mean length of the abdomen was  $1.06 \pm 0.12$  mm, while the average value calculated for abdomen width was  $0,79 \pm 0,14$  mm. *Aphis fabae* winters in egg stage on the bark of stems or branches and plum trees, where the fundatrix. in March, give birth to apterae. The average multi-annual date of flight towards the potato is 20th May. From May onwards, winged virginoparae colonize numerous secondary host plants, depositing apterous nymphs on the underside of leaves or at the tips of stems. Aphid colonies increase rapidly until mid-June, then declining progressively. Winged sexuparae appear in autumn and return to primary hosts; The rate of reproduction is positively correlated with temperature which affects all biological stages. For an estimation situations of attack can be useful to be known the most common places of colonization. Also, knowledge of potato aphid life cycle constitutes a basic element of the integrated potato pests control.

**Key words:** *Aphis fabae*, behaviour, life cycle, biometrical measurements

### INTRODUCTION

Although sometimes called 'blackfly', the black bean aphid is actually a true bug (a member of the order Hemiptera, suborder Aphidinea, superfamily Aphidoidea, family Aphididae, subfamily Aphidinae, tribe Aphidini, subtribe Aphidina, genus *Aphis*). All true bugs are united by the possession of specialised piercing and sucking mouthparts, which are used in this species to obtain plant juices. It is this characteristic, coupled with its prolific reproductive capabilities that has made the species a notorious enemy of farmers and gardeners alike (Buczaki, 2002).

The pest causes the greatest damage on vegetable and sugar beet, beans, haricot beans, potatoes, sunflower, and tomato. It causes harm to more than 200 species of cultivated and wild

plants.

In Romania researches were carried out at ICCP, Brasov by Donescu (1996), (1997), (1998), (2001) and DRAICA (1996). In the climatic conditions specific for the West zone aphids have characteristic life cycle.

The scientific literature shows that there are differences regarding the aphid species virulence and that not all forms of the same species are transmitting the viruses in the same way (Buioc, 1998). *Aphis fabae* have a virulence of 0,10.

#### MATERIAL AND METHODS

The researches have been carried out for a period of three years, in the experimental field of the Didactic Station Timisoara (STN) and Varfurile, Arad county. The aphids have been collected with the yellow vessel traps on a two days.

#### RESULTS AND DISCUSSIONS

Apterous adult have green-brown or black ovoid body and big marginal tubercles on prothorax and on abdominal segments I and VII; body length varies from 1.8 to 2.4 mm

Alatae aphid are more elongate with head and thorax shiny black; antennae not exceeding 2/3 of body length; oviparous females with distinctly swollen hind tibiae and abdomen is black-green

It can be observed that, out of a total of 30 individuals of the species *Aphis fabae*, (table 1) the smallest length of the body established for aphids captured in West Zone of Romania was 1,40 mm, while the biggest was 2.20 mm. The average body length was  $1,83 \pm 0.20$  mm. (figure 2)

By analyzing the data presented in the table regarding the length of the head and thorax, it may be noticed that the maximum length of these parts was 0,95 mm and minimum length was 0,50 mm. The average value calculated for the length of these parts was  $0,77 \pm 0.12$  mm.

The minimum width of head was 0.20 mm and the maximum width of head was 0.45 mm. The average value calculated for head width was  $0.32 \pm 0.05$  mm.

As far as the thorax width is concerned, this was minimum 0.40 mm and maximum 0,80 mm. Mean thorax width was  $0.61 \pm 0.02$  mm

Analyzing data on the length and width of the abdomen, it can be seen that the minimum length of the abdomen was 0,80 mm and minimum width was 0.50 mm, the maximum length of the abdomen was 1.40 mm and the maximum width was 1 mm. The mean length of the abdomen was  $1.06 \pm 0.12$  mm, while the average value calculated for abdomen width was  $0,79 \pm 0,14$  mm.

Table 1

Biometrics measures *Aphis fabae*

Nb. art.	Body length (mm)	Head+thorax length (mm)	Head width (mm)	Thorax width (mm)	Abdomen (mm)	
					length	width
1	2,10	0,90	0,40	0,80	1,20	1
2	1,70	0,60	0,30	0,70	1,10	0,80
3	1,80	0,80	0,30	0,60	1,10	0,80

4	1,90	0,90	0,30	0,60	1	0,80
5	1,95	0,95	0,30	0,60	1	0,9
6	1,70	0,80	0,20	0,60	0,90	0,7
7	1,80	0,70	0,30	0,65	1,10	0,8
8	1,40	0,60	0,30	0,50	0,80	0,5
9	1,65	0,75	0,20	0,50	1	0,5
10	1,60	0,70	0,30	0,60	0,90	0,7
11	2,20	0,90	0,40	0,8	1,30	1
12	2,20	0,80	0,40	0,70	1,40	1
13	2,10	0,80	0,45	0,70	1,30	0,90
14	1,80	0,70	0,30	0,55	1,10	0,80
15	1,70	0,80	0,30	0,50	1	0,70
16	1,50	0,50	0,25	0,40	1	0,50
17	1,50	0,60	0,30	0,50	0,90	0,55
18	1,50	0,50	0,30	0,50	1	0,60
19	1,85	0,75	0,35	0,60	1,10	0,85
20	1,90	0,95	0,35	0,60	0,95	0,80
21	1,90	0,85	0,30	0,65	1,05	0,85
22	2	0,90	0,40	0,70	1,10	0,90
23	2	0,95	0,35	0,65	1,05	0,85
24	2	0,85	0,30	0,60	1,15	0,80
25	1,85	0,70	0,30	0,60	1,15	0,85
26	1,80	0,80	0,30	0,60	1	0,80
27	1,75	0,65	0,30	0,55	1,10	0,85
28	1,95	0,85	0,35	0,65	1,05	0,80
29	1,90	0,80	0,35	0,60	1,10	0,85
30	1,80	0,80	0,30	0,60	1	0,90
Average	1.83	0.77	0.32	0.61	1.06	0.79
<b>Average deviation</b>	0,04	0,02	0,01	0,02	0,02	0,03
<b>Standard deviation (s)</b>	0.20	0.12	0.05	0.09	0.12	0.14

<b>(m) Min</b>	1,40	0,50	0,20	0,40	0,80	0,50
<b>(M) Max</b>	2,20	0,95	0,45	0,80	1,40	1

Colonization and dispersal behaviour

Some aphids form large colonies, others are solitary and only when there is a massive multiplication cohesive populations are formed. During an annual cycle, alternations between apterous and winged forms of aphids were observed. For *Aphis fabae* species, first alates seen in spring are individuals that migrate from the primary host to colonize secondary hosts, usually cultivated plants, on which the next generations spend the entire season. During spring and summer there is a disseminating flight, which allows aphids to colonize new secondary host plants. In the autumn, aphids migrate again to the primary host plants. These flights are made by individuals involved in sexual reproduction, ginopars and males.

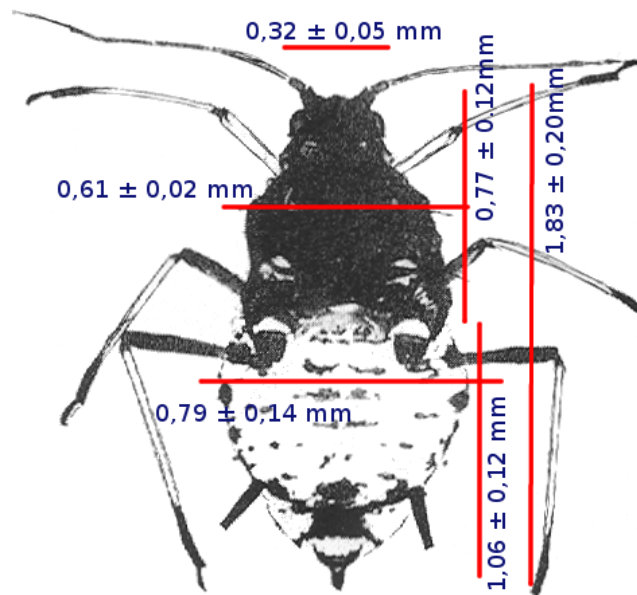


Fig. 2: Biometrical measures of *Aphis fabae*

For aphids, distinction should be made between migration flights and dispersion flights. The migration flight is a migration of the alates from wooden winter hosts to herbaceous summer host plants.

In the autumn aphids migrate back to the primary hosts. What determines them to migrate is the colour yellow and green. Some types of aphids, after landing on plants, take samples by puncture. If the answer is negative, they move on or pass to any neighboring plants. Once they have settled on a host plant, they give birth to other generations. After giving birth to some larvae on one plant, *Aphis fabae* goes to the next plant and gives birth to a few larvae there as well.

In a dispersion flight, the population is spreading to larger areas. Both flights aim to preserve the species.

The population of aphids can be influenced by the action of some species of ants.

Thus, Stary (1970) showed that, due to the activity of ants, aphids can remain in the good places of a plant for a longer period of time and in a greater number than in the absence of ants.

Orlob (1963) observed that predatory Coccinellidae adults and larvae were attacked by ants and this is one of the factors that determined the populations of aphids to multiply.

According to Bodenheimer and Swirski (1957) colonies of aphids attended by ants have double or triple speed of multiplication colonies as compared to the unattended ones.

Aphids live in symbiotic relationships with ants. Aphids' faeces are rich in sugary substances. They are avidly consumed by ants, bees and some species of flies.

Wheeler believes that aphids show changes in structure and behaviour that provides indisputable evidence that they have adapted to life with ants: aphids do not try to escape or to defend themselves.

Aphids release honeydew slowly when are visited by ants instead of eliminating it as quickly as they do in their absence. Many of the aphids that usually live with ants have developed an anal brim of hairs to support the drop of honeydew until it can be swallowed by ants. The modifications undergone by ants to benefit more from their association with aphids are almost entirely behavioural.

Ants do not eat or kills aphids; they protect them from predators and parasites. Some species of ants move aphids to a safer place if they are disturbed. Some ants hide the colonies of aphids in shelters.

In the three years of the study, analyzed species *Aphis fabae* has reached the greatest number of individuals in 2007 from the first decade of May and reached the maximum value in the last decade of the same month. In August, due to adverse climatic conditions for growth and development of potato, aphids disappear from the potato culture. In 2006 the maximum flight took place in the last decade.

In the conditions of the Western Plain, the species *Aphis fabae* evolved on the potato in 8 – 9 generations in the year 2005 – 2006 and in the year 2007 it only presented 6 – 7 generations. The activity of this species is constant throughout the whole vegetation period of the potato, having relatively large populations and the maximum of flight in the last part of May and June.

On secondary host plants, *Aphis fabae* prefer leaves closest to the earth for solar radiation protection and they like wet earth. There are also differences depending on the season. For example, when the weather is cooler with more rainfall, aphids seek protection in the leaves that are rolled.

In the conditions of the Western Plain the species *Aphis fabae* winters in egg stage on the bark of stems or branches and plum trees, where the fundatrix. In March, give birth to apterae whose progeny includes an increasing proportion of winged individuals

The winged fundatrigenous aphids start migrating to secondary host plants (e.g. potato) in the second decade of May. The average multi-annual date of flight towards the potato is 20th May.

From May onwards, winged virginoparae colonize numerous secondary host plants, depositing apterous nymphs on the underside of leaves or at the tips of stems. Aphid colonies increase rapidly until mid-June, then declining progressively due to the action of parasites, predators and food quality

Winged sexuparae appear in autumn and return to primary hosts; During the warmer months aphids give birth to as many as five live young a day, so large colonies can develop very quickly.

When the colonies become over-populated, they move to different locations by producing winged aphids. During the cooler months, aphids mate and produce eggs which overwinter.

The rate of reproduction is positively correlated with temperature which affects all biological stages.

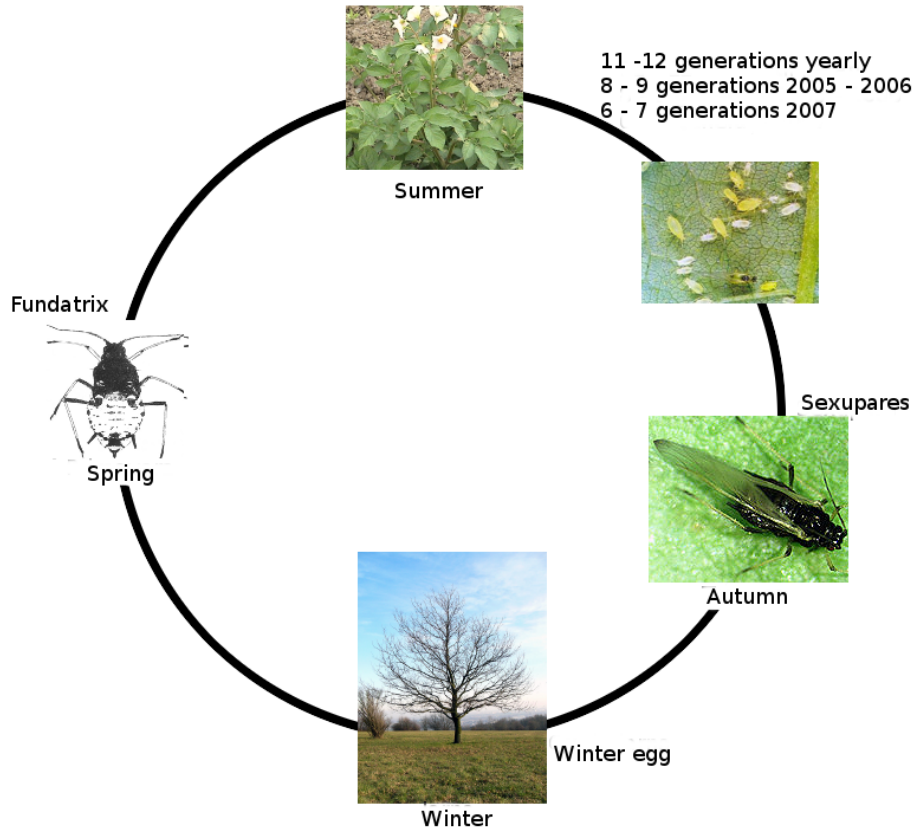


Fig. 3: *Aphis fabae* life cycle

### CONCLUSIONS

The average multi-annual date of flight towards the potato is 20th May. From May onwards, winged virginoparae colonize numerous secondary host plants, depositing apterous nymphs on the underside of leaves or at the tips of stems. Aphid colonies increase rapidly until mid-June, then declining progressively

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