

THE VARIABILITY OF SOME PHENOTYPIC FEATURES AND LIFE CYCLE IN TWO *Aphis pomi* POPULATIONS FROM WESTERN ROMANIA

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Abstract. This paper presents data referring to the external morphological characteristics, the biometrical measurements and the life cycle of *Aphis pomi*. The researches have been carried out on the orchards from the experimental fields of the Didactic Station Timișoara (Timiș County) and Vârfurile, (Arad County), 2003-2008. At the *Aphis pomi* species the smallest length of the body established for aphids captured in the western zone of Romania was 1.80 mm, while the biggest was 2.00 mm. Regarding the length of the head and thorax, it may be noticed that the maximum length of these parts was 1 mm, and the minimum length was 0.65 mm. The minimum width of the head was 0.20 mm and the maximum width of the head was 0.35 mm. The thorax width had a minimum of 0.60 mm and a maximum of 0.80 mm. The minimum length of the abdomen was 0.90 mm and the minimum width was 0.70 mm, the maximum length of the abdomen was 1.20 mm and the maximum width was 0.90 mm. In the climatic conditions of Romania, *Aphis pomi* winters in the stage of egg in October usually on the stems of apple tree. In the second decade of March, the eggs hatch out and there appears the fundatrix giving birth to one or more generations of fundatrices, which are apterous parthenogenetic viviparous females. The winged aphid migrates to other nearby host plants like pear, peach trees and other herbaceous plants growing in the vicinity of apple trees. The reproductive process continues rapidly, the populations of aphids are developing quickly in a very short time. Green apple aphids usually remain on apple plants throughout the summer and gave birth parthenogenetically to 9 -12 generations. In October, Gynotypes (gynopara) give birth to wingless sexual, oviparous females, that mate with males and lay winter eggs.

Keywords: aphid, external morphology, biometrical observations, biology.

Rezumat. Variabilitatea unor caractere fenotipice și ciclul de viață în două populații de *Aphis pomi* din vestul României. Lucrarea prezintă date referitoare la morfologia externă, observațiile biometrice și ciclul de viață al speciei *Aphis pomi*. Cercetările au fost efectuate în livezile Stațiunii Didactice Timișoara (Timiș) și Vârfurile (Arad). La specia *Aphis pomi* cea mai mică lungime a corpului stabilită pentru afidele capturate în zona de Vest a României a fost de 1,80 mm, în timp ce cea mai mare a fost de 2,00 mm. În ceea ce privește lungimea capului și a toracelui, se poate observa că lungimea maximă a acestor părți a fost de 1 mm, iar lungimea minimă a fost de 0,65 mm. Lățimea minimă a capului a fost de 0,20 mm, iar lățimea maximă a fost de 0,35 mm. Lățimea toracelui a avut un minim de 0,60 mm și un maxim de 0,80 mm. Lungimea minimă a abdomenului a fost de 0,90 mm, iar lățimea minimă a fost de 0,70 mm, lungimea maximă a abdomenului a fost 1,20 mm, iar lățimea maximă a fost de 0,90 mm. În condițiile climatice din România, *Aphis pomi* iernează în stadiul de ou depus, în octombrie, pe tulpinile de măr. În a doua decadă a lunii martie apare fundatrixul care dă naștere la una sau mai multe generații de fundatrigenice care sunt femele aptere vivipare partenogenetice. *Aphis pomi* migrează spre alte plante gazdă din apropiere, cum ar fi părul, piersicul și alte plante erbacee care cresc în vecinătate. Procesul reproductiv continuă rapid, populațiile de afide se dezvoltă rapid într-un timp foarte scurt. Păduchele verde al mărilor rămâne de obicei pe măr pe tot parcursul verii și dă naștere partenogenetic de la 9 la 12 generații. Gynopara în octombrie dă naștere la formele sexuate, ovipare și masculi, care depun ouăle de iarnă.

Cuvinte cheie: afide, morfologia externă, măsurători biometrice, biologie.

INTRODUCTION

The green apple aphids (*Aphis pomi* De Geer, 1773) are economically significant pests of apple trees (FOOTITT et al., 2006; LOWERY et al., 2006). Aphids affect many agricultural and horticultural crops (BLACKMAN & EASTOP, 2007) and cause considerable loss by sucking their sap and transmitting many diseases. Although sometimes called Apple aphid, *Aphis pomi* is a member of the order Hemiptera, suborder Aphidinea, superfamily Aphidoidea, family Aphididae and they can be found worldwide (BUCZAKI, 2002). This species plays a role in disease transmission (BLACKMAN & EASTOP, 2006) and affects healthy growth of the hosts (KAAKEH et al., 1993).

Aphids have adapted their life cycle to different geographical regions depending upon the environmental conditions prevailing in the area of study. Though sufficient work with regard to the biology of *Aphis pomi* has been done by earlier workers like BAKER & TURNER (1916) in North America and GAUTAM & KUMARI (2004). In Romania, in the consulted, specialized literature, we could not find information about the biology of this pest. Chemical control of the *Aphis pomi* attack in Romania was studied by different groups of researchers (BOLBOSE, 2009; ȚUCĂ et al., 2010), while others studies have been focused on the sensitivity of different traditional apple-trees cultivars to the attack of this pest (BĂLINT et al., 2013).

The feeding of *Aphis pomi* causes downwards curling of young apple leaves, flower and immature fruit (<http://www.agri.huji.ac.il/mepests/pest/Aphispomi/>). Indirect injury results from honey-dew deposits on both fruit and leaves. A black fungus grows on this honeydew causing considerable sootiness, especially of early apples. This sooty mould on leaves can also affect photosynthesis and may reduce fruit yield (KAAKEH et al., 1993; LOWERY et al., 2006).

Pale-green tubercles may arise on the young fruit. Its meager honeydew output is usually collected by ants, with little attendant sooty mould (BASKY et al., 2001).

MATERIAL AND METHODS

The research was carried out for a period of five years. The biology of *Aphis pomi* was observed for five years: 2005 – 2008 and 2015.

The biometrical observations of *Aphis pomi* were made for a total of 30 individuals/year, species captured from the orchards of the Didactic Station Timișoara (belonging to BUASVM Timișoara, Timiș County) and Vârfurile (Arad County). The data were statistically analysed with STATISTICA 10.0, Basic Statistics. The aphids were collected with yellow vessel traps on a three day time period. Specimens were preserved in ethanol 80% just after they were collected in the field.

To determine accurately the species, there were consulted the works made by: BLACKMAN & EASTOP (2000a, b), FERICEAN et al. (2006), FERICEAN et al. (2012), PERJU (2004), REMAUDIERE & REMAUDIÈRE (1997), WILLIAMS & DIXON (2007).

RESULTS AND DISCUSSION

Morphology. Apterous adults have yellow-green color, and measure between 1.5 and 2 mm. The ovoid body has little antennal tubercles. The antennae have six segments and are shorter than the body, siphunculi are cylindrical, long and black. The cauda is short and sharp (Figs. 1, 2).

The cauda has 10 - 19 hairs (rarely less than 13). Marginal tubercles are present on abdominal tergites 2 - 4, and the fused last two rostral segments are more than 120 µm in length. The latter two characters are the best features to distinguish *Aphis pomi* from the very similar invasive *A. spiraecola* (FOOTTIT, 2009).

The alata individuals have lengths of 1.70 – 2.10 mm and they are pale green to pale yellow on the back and on each side. The head and thorax are black. The abdomen is green with black side circular spots with 3 pairs of black lateral circular spots on the anterior abdominal segments and a semicircular spot in front and behind each siphunculus (Fig. 2).

It can be observed that, out of a total of 30 individuals of the species *Aphis pomi* (Table 1), the smallest length of the body established for aphids captured in the western zone of Romania was 1.70 mm, while the biggest was 2.10 mm.

Table 1. The variability of the phenotypic charcters in *Aphis pomi*.

No. art.	Body length (mm)	Head+thorax length (mm)	Head width (mm)	Thorax width (mm)	Abdomen (mm)	
					Length	Width
Average	1.86 (1.86)	0.82	0.30	0.64	1.05	0.81
Average deviation	0.11	0.08	0.01	0.05	0.06	0.04
Standard deviation (s)	0.13	0.10	0.03	0.06	0.08	0.05
(m) Min	1.70	0.65	0.20	0.60	0.90	0.70
(M) Max	2.10	1	0.35	0.80	1.20	0.90

The average body length was 1.86 ± 0.11 mm (Fig. 3). The results are similar to those in the literature (DUBNIK, 1991), which states that the body length of *Aphis pomi* ranges from 1.80 to 2.00 mm.

By analyzing the data presented in Table 1 regarding the length of the head and thorax, it can be noticed that the maximum length of these parts was 1 mm and the minimum length was 0.65 mm. The average value calculated for the length of these parts was 0.82 ± 0.08 mm. The minimum width of the head was 0.20 mm and the maximum width of the head was 0.35 mm. The average value calculated for the head width was 0.30 ± 0.01 mm. As far as the thorax width is concerned, the minimum was 0.60 mm and the maximum 0.80 mm. The mean thorax width was 0.64 ± 0.05 mm

Analyzing the data on the length and width of the abdomen, it can be seen that the minimum length of the abdomen was 0.90 mm and minimum width was 0.70 mm, the maximum length of the abdomen was 1.20 mm and the maximum width was 0.90 mm. The mean length of the abdomen was 1.05 ± 0.06 mm, while the average value calculated for the abdomen width was 0.81 ± 0.04 mm.

Comparing the measurements related to the length of the head and thorax, the width of the head and thorax, abdomen width and length, with data from the literature cannot be carried out because we could not find their correspondent in the consulted specialized literature.

Aphids generally overwinter in the egg stage which hatches in spring into the females that reproduce parthenogenetically and give birth to young ones. Several generations of the pest are produced during the season in this way. BAKER & TURNER (1916) and GAUTAM & KUMARI (2004) during their studies reported that the aphids passed through a complex life cycle involving polymorphism, viviparity and telescoping of generations, stem mothers, wingless viviparous females, winged viviparous females, males and oviparous females in the study area.

In the conditions of the western part of Romania, (Fig. 4) *Aphis pomi* winters in the egg stage in October usually on the stems of apple-trees. In the second decade of March, the eggs hatch out and there appears the fundatrix giving birth to one or more generations of fundatrices, which are apterous parthenogenetic viviparous females. After a few days, they become mature and give birth to daughter aphids by parthenogenesis. The daughter aphids develop wings. Winged green apple aphids start appearing in the second period of May in Timișoara and in early June in Vârfurile.



Figure 1. *Aphis pomi* aptera (original)



Figure 2. *Aphis pomi* alata.(original).

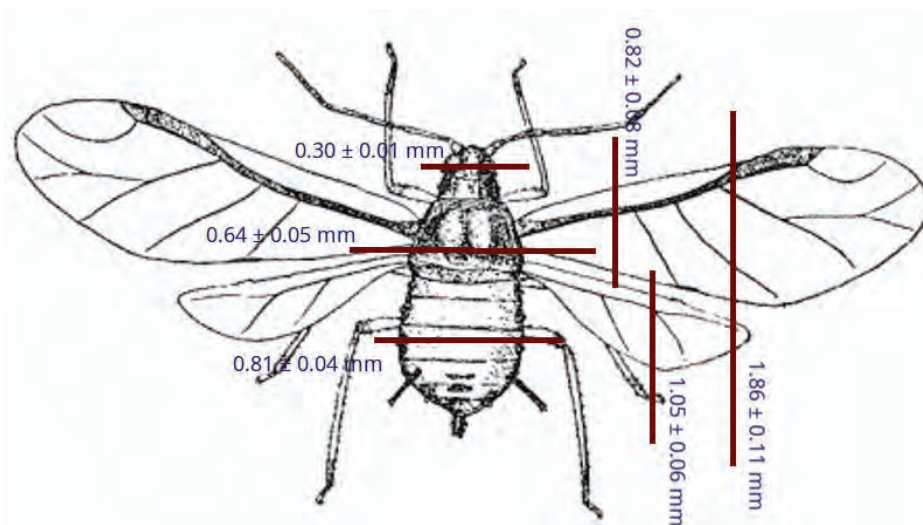


Figure 3. The body length of *Aphis pomi* (original).

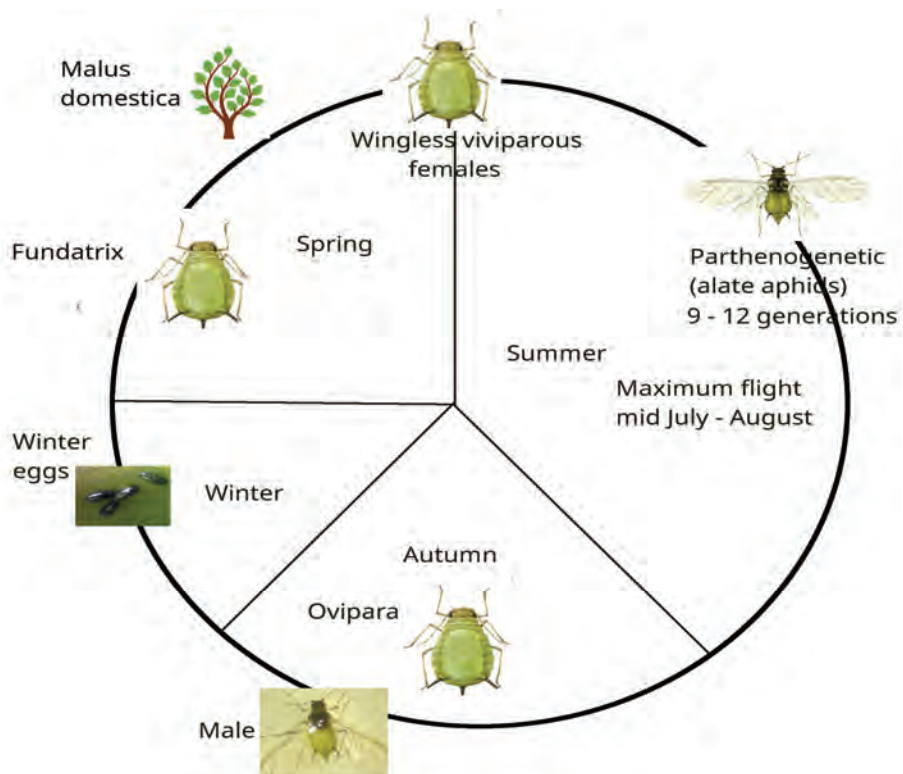


Figure 4. Life cycle of *Aphis pomi* (original).

Green apple aphids usually remain on apple plants throughout the summer and gave birth parthenogenetically to 10 to 12 generations in the conditions of Timișoara and to 9 to 10 generations in the conditions of the mountain area from Vârful. Although *Aphis pomi* is a species whose host plant is the apple tree, the winged aphid migrates to other nearby host plants like peach, pear trees and other herbaceous plant growing in the vicinity of apple trees. The reproductive process continues rapidly and the populations of aphids are developing quickly in a very short time.

The infestation of green apple aphid was found to be more intense in the apical parts of the plants (Fig. 5). Both nymphs and adults suck the sap from leaves, twigs, branches and young fruits, as a result of which the affected leaves curl up, blossoms shed and the young fruits drop prematurely and the quality of fruits is greatly impaired. Severely infected plants show stunted growth.

The average nymphal duration of this species is 13.50 ± 0.38 days which ranged from a minimum of 10.0 days to a maximum of 14.0 days. The average pre - reproductive, reproductive and post - reproductive periods of this aphid are 12.95 ± 0.27 , 17.50 ± 0.47 and 1.45 ± 0.17 days respectively. The reproductive period starts with the laying of young ones and the progeny produced by a female varied from 19 to 79 aphids and averaged 47.80 ± 4.39 aphids (STROYAN, 1984; FERICEAN et al., 2006).

In the studied orchard, in 2015, the maximum flight was recorded in the second part of July and the first part of August, depending on weather conditions.



a



b

Figure 5. *Aphis pomi* attack in apple - a; colony detail - b. (original).

In October, Gynotypes (Gynopara) give birth to wingless oviparous sexual females that mate with males and lay winter eggs.

Egg laying occurs in October until mid-November on vegetative buds and bark of trees. The egg is attached to the support through a sticky substance, which is eliminated with the egg and hardens quickly (DIXON & THIEME, 2007).

CONCLUSIONS

In the *Aphis pomi* species, the smallest length of the body established for aphids captured in the western zone of Romania was 1.80 mm, while the biggest was 2.00 mm.

The average value calculated for the length of the head and thorax was 0.82 ± 0.08 mm. The average value calculated for the head width was 0.30 ± 0.01 mm. The mean thorax width was 0.64 ± 0.05 mm. The mean length of the abdomen was 1.05 ± 0.06 mm, while the average value calculated for the abdomen width was 0.81 ± 0.04 mm.

In the orchard, in 2015, the maximum flight was recorded in the second part of July and the first part of August.

Green apple aphids usually remain on apple plants throughout the summer and gave birth parthenogenetically to 10 to 12 generations in the conditions of the Western Plain (Timișoara) and to 9 to 10 generations in mountain conditions (Vârfulurle).

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