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Some bioecological peculiarities of panaphis juglandis (Goeze, 1778) and chromaphis juglandicola (Kaltenbach, 1843) (Hemiptera, Aphididae) the pests of Persian walnut (*Juglans regia* L.) in Azerbaijan

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Abstract

The article was prepared on the basis of researches carried out in Ismayilli 40° 52' 71" N, 48° 04' 17" E, Gabala 40° 54' 21" N, 47° 57' 28" E and Zagatala regions 41° 28' 30" N, 46° 29' 5" E. (North-Eastern regions of Azerbaijan,) in March-December 2017. Two species of aphids *Panaphis juglandis*, (Goeze, 1778) and *Chromaphis juglandicola* (Kaltenbach, 1843) damaging the leaves of the Persian walnut were recorded. Natural enemies of these pests were revealed and some bioecological features were studied. Seven predatory entomophags *Adalia bipunctata* L., *Adalia decempunctata* L., *Oeponia conglobata* L., *Harmonia axyridis* P., *Calviadecempunctata* L., *Coccinella septempunctata* L., *Propyleaquadecimpunctata* L. belonging to Coccinellidae and one Chrysoperla carnea to Chrysopidae was detected.

Keywords: pest, aphid, *Panaphis juglandis*, *Chromaphis juglandicola*, Aphididae, entomophag

Introduction

The persian walnut (*Juglan regia* L.) has widely been spread throughout the world and cultivated by people from the very ancient times due to the high nutritional properties of the fruits and the great importance of wood in the furniture industry and decorative appearance [1]. Azerbaijan is one of the naturally occurring places of the walnut tree, so that spontaneous walnut forests (3-5 hectares) are found in the Greater and Lesser Caucasus. The place, where the walnut is naturally spread is considered Talish in the Caucasus [5, 16]. Nakhchivan has also been famous for its walnut plant from ancient times. The optimal conditions for growth and fruiting of walnut in the mountains range from 600-800 to 1600-1800 m above sea level [15]. On the southern slopes of the Greater Caucasus Range, Lesser Caucasus and the Talysh Mountains within Azerbaijan, the walnut tree naturally grows on an area of 25 thousand hectares and is widely cultivated [8].

The demand for this precious plant grows steadily. The monoculturized Persian walnut is exposed to some pests and diseases that need to be intensively combated in the vast area that they should intensively be fought.

The sustainability of any ecosystem for harmful insects is significantly weakened by human activity. The effects of industrial wastes, recreational loading, and other factors reduce the durability of biocenosis and contribute to massive growth of insects. The artificially laid out forest stripes are less resistant. In most cases, laying out monocultural massives is carried out without taking ecological indications into consideration, which are not suitable for this condition. Because the crowns of trees are the same in forests consisted of trees of the same species, the dendrophilous insects easily dominate in such forests. In the areas where the same aged trees grow, favorable condition is created for the population and increase of pest insects and their sets become wider. It was revealed that species composition of pests is richer and their number is higher in the forests consisting of trees of the same type.

More than hundred species of pest insects of Persian walnut have been noted. The leaves are attacked by 2 species of aphids from the Aphididae family: *Panaphis juglandis* (Goeze, 1778) and *Chromaphis juglandicola* (Kaltenbach, 1843). The specific symptoms damage caused by aphids are lag in the development of shoots and weak photosynthesis. Aphids also damage the generative organs and fruits. The fruits usually become smaller in trees suffered from sucking.

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insects and they fall off.

Panaphis juglandis – is also named as the large walnut aphid. It was widely spread in the mountainous and foothill areas in Azerbaijan [18]. The species is widespread in Europe, from Spain, Italy and Greece, north to Denmark and Sweden; in Denmark from South Jutland (SJ), East Jutland (EJ) and North East Zealand (NEZ); in Sweden Skåne (Sk); eastwards to Central Asia; also western North America [7, 13]. These aphids have been registered in the Ganja-Kazakh districts of Azerbaijan [3], in Ukraine [2], in Turkey (Guchlu, S. Hayat and Ozbek, 1995) These aphids have been registered in the Ganja-Kazakh districts of Azerbaijan [6], in Ukraine [17], in Turkey [14]. In Poland the number dynamics of population of *Panaphis juglandis* and *Panaphis juglandis* [9] in the city condition and appearance term of *Chromaphis juglandicola* have been studied [3]. Akkopru E.R. and others have studied the resistance of five cultural species of the Persian walnut against *Panaphis juglandis* in desert conditions [2]. The role of entomophages in the biological control of the aphids damaging of Persian walnuts has been studied in California [11]. *Chromaphis juglandicola* K. was registered in the Ilisu village of Gakh region of Azerbaijan [18]. Here provide study objective. The aim of the research was studying of bioecological abilities and revealing the entomophages of aphids damaging Persian walnut in Azerbaijan.

Materials and Methods

The research was carried out in 2017 on the Persian walnut planted on individual trees in areas subject to varying degrees of anthropogenic impact (in private gardens and along the main motorway) in Ismayilli, Gabala and Zagatala regions on individual trees and parks in Baku and Absheron. Field surveys were conducted twice a month along the route, and every week in the stationary areas. 15-20 trees have been examined in the fields of nearly 50 nut trees and 25-30 trees in the fields of more than 100 trees [10]. Mainly the leaves of nut tree have been visually examined as it has been mentioned above. Samples taken from 10 areas of 20 hectares were used to identify the damage of the pests to walnut trees. The leaves are taken from each tree's crown.

The rate of damage, the intensity of the damage, the most accurate calculation of the number of items in each of the 20 herbs was evaluated on the 5-point scale: 0 points - no aphid was found, 1 point – rare examples, 2 points – 1-2 small colonies with 5-10 aphids per colony, 3 points - more than 20 aphids settled down in colonies and in 50% of leaf blade, 4 points - if there were more than 50 aphids in colonies and if they were located in 75% of the leaf blade and 5 points – if the aphid colonies occupy whole surface of the leaves.

In order to determine the threshold of ecological damage (TED) caused by aphids their number is determined in the autumn and summer months. During the autumn observations the resources of aphids have been taken into consideration on the stems and young branches in the length of 1-2 meters. Totally 100 leaves have been looked through and total adults and larvae have been calculated in spring and summer months in each tree. The TED for aphids was 15 colonies per 100 leaves.

The fossilized leaves were collected and labeled in entomologic bags and glass containers and brought to the laboratory for subsequent comparative observations. Collected materials were accordingly included into the collection and appropriately determined [4].

Results and Discussion

Two species of aphids *Panaphis juglandis* (Goeze, 1778) and *Chromaphis juglandicola* (Kaltenbach, 1843) were noted in the leaves of Persian walnut (*Juglans regia* L.) in Ismayilli, Gabala and Zakatala regions of Azerbaijan in May, June and July of 2017. Both species were monophags and fed on the Persian walnut, causing serious damage to the leaves and fruits. There is no detailed information about these two species in Azerbaijan.

There was dark-colored vessels on the large aphid *Panaphis juglandis* of the Persian walnut. Viviparous forms are winged. There are brown strips on the upper surface of the abdomen of the fourth instar nymphs. The matured, winged forms have possessed firm body structure. They have the head of darkish color, and yellow bodies, spotted with dark-brown points. The length of body of the winged specimens was 3,5-4,3 mm (Figure.1).

Panaphis juglandis both non-mature and mature individuals were fed on the top surface of the leaf and have a yellow and dark brown preventive color that replaces each other. This is for protection of the predators from feeding them. The nymphs have large dark brown spots on bright yellow on their body, and in adult flies, they are clearly visible in the form of yellow and brown stripes. The preventive color is typical for the aphids living in the visible places. But aphids living under the leaf do not need to be hidden from the potential predator, so they don't have such a preventive color. The fact that these aphids on walnut are not eaten by the vertebrate animals is related to the toxicity of them or there are other reasons, which should be clarified.

Panaphis juglandis is located on the upper surface of the leaves of the Persian walnut (*Juglans regia* L.) along the main vein. Leaf blade is both feeding and settlement place of the aphids. One of the most attractive indications is that aphids build harmoniously along the main vein of the leaf in large colonies. The aphids usually gather on the one side of the vein or on the both sides of it beginning from the base of the leaf to the end of it. Sometimes, there are some nymphs on the vein. Sucking juice flowing from the main vein makes the nutrition more effective for aphids and helps to stay close to the center and protect them from the wind.

There three forms are observed in the colonies of the *Panaphis juglandis*: winged viviparous partenogenetic females, wingless oviparous females and winged males. The winged viviparous partenogenetic females occur in the spring and summer months. Wingless oviparous females and winged males occur when the number of aphids is decreased.

The eggs of the *Panaphis juglandis* hibernate. Because of the fact that this aphid is monophagous the wintering eggs are laid under the bark of the Persian walnut, between the cracks on the formerly infected branches. In the summer, starting with April, virgin females begin to appear, it means, along with larvae, winged females also appear in the aphid colony. Reproducing virginally during summer and spring each time they give rise to 45-50 larvae and these larvae also grow rapidly and form new colonies (Figure.2). Winged viviparous partenogenetic females migrate to other leaves of the walnut tree or to the neighboring trees of the same species. Thus, these individuals promote the growth, relocation and dissemination of colonies. In October, close to autumn, the winged males and wingless ovipositor females are formed from these larvae. They are fertilized and each female lay eggs for winter.

The increase in the number of *Panaphis juglandis* is also depended on the length and temperature of the day. So, colonies formed parthenogenetically occur during the summer and spring months. *Panaphis juglandis* gives 10-11 generations in a year and the generations overlap with each other. From the first few months of autumn the shortening of the day and the fall in temperature stimulate the occurring of the individuals reproducing sexually. Often the ants also surround them. As a result of life's activity, the aphids secrete sweet delicious dew as an experiment and the ants are licking it. Thus, a mechanism has been created to help each other with ants. The aphids feed the ants, and the ants protect them from predators and carry new healthy leaves. It is shown in the literature that these aphids coexist with *Plagiolepis pugmaea* [17], and the *Crematogaster sp.* ants were found near *Panaphis juglandis* colonies by us (Figure 3).

Panaphis juglandis is freely spreading in walnut trees and outbreaks in certain years. The outbreak of this species has been observed in the trees planted along the main highway in the area of Zagatala region in 2017. As a result of nutrition, the tree loses its plastic materials and is "dehydrated". Feeding a large number of nutrients on the leaf body causes them to sprout and prematurely spill. *Panaphis juglandis* feeding causes the core of the leaf to darken, as the ball dew is toxic, and in some varieties of walnut, the leaves were darkened.

As a result of the mass increase of pest, the decorative view of the walnut trees spoils and affects negatively on the quality of the grown fruit.

Panaphis juglandis is not much affected by the temperature in the summer months, i.e. the larvae having awakened from winter sleep begin to increase since April, but the hot, dry weather (temperature above 30 °C) and torrential rainfall

observed in July and August have a negative impact on the number in the aphid population.

***Chromaphis juglandicola* (Kaltenbach, 1843).** The colony of this aphid was located under the leaves of the Persian walnut along the vessels and that's why they are also called the lower aphids of the walnut. *Chromaphis juglandicola* is ambisexual. The female and all the parthenogenetic generation are winged. Larvae begin to hatch from the hibernated eggs. During the vegetation period, the increase in the population takes two peak period - spring and autumn. Amphigonic generation develops from September till October. In the third decade of October after the female ones of these aphids get fermented, lay eggs on to the ends of the young branches and to the base of shoots.

Like other species, these species are also fed with the juice of the phloem of the leaf. It is an interesting fact that these two aphid species were not met on the same tree, even in the same garden, or even in the same territory. If the environmental condition is favorable for one species it displaces another one. There is a food competition between *Panaphis juglandis* and *Chromaphis juglandicola*. Norwegian scientists [12] have found out as a result of lab experiments that *Chromaphis juglandicola* lives longer.

The aphid population mostly harms the plants mainly at the beginning of spring and summer months. These aphids weaken them and damage directly the productivity of the harvest by nourishing with these trees. Besides the harm that they do on the trees, they secrete too much honeyed dew, which drops on the leaves and fruits and creates favorable conditions for the development of parasitic fungi. The fungi also cause the trees to weaken by reducing the level of photosynthesis on the leaf.

Table 1: The aphids and wild entomophages met on the Persian walnut (*Juglan regia* L.).

The Importance of the species	Names of Species	Locations			
		I	II	III	IV
Pest	<i>Panaphis juglandis</i> (Goeze, 1778) (Hemiptera, Aphididae)	4	1	1	0
	<i>Chromaphis juglandicola</i> (Kaltenbach, 1843) (Hemiptera, Aphididae)	2	0	0	2
Entomophages	<i>Chrysoperla carnea</i> (Stephens, 1836) (Neuroptera, Chrysopidae)	+	+	+	+
	<i>Adalia bipunctata</i> (Linnaeus, 1758) (Covvinellifae)	+	+	+	+
	<i>Adalia decempunctata</i> (Linnaeus, 1758) (Covvinellifae)	+	+	+	+
	<i>Oeponia conglobata</i> L. (Covvinellifae)	+	-	-	-
	<i>Harmonia axyridis</i> (Pallas, 1773) (Covvinellifae)	+	+	+	+
	<i>Calviadecemguttata</i> (Linnaeus, 1767) (Covvinellifae)	+	-	-	-
	<i>Coccinella septempunctata</i> (Linnaeus, 1758) (Covvinellifae)	+	+	+	+
	<i>Propyleaquatuordecimpunctata</i> (Linnaeus, 1758) (Covvinellifae)	+	+	-	-

Notes: I – Shaki-Zagatala motorway edge, II – Zagatala, Mughanli villages,

III – Zagatala, Kebeloba village, IV – Baku-Absheron.

The damage intensity of lice: 0 points - no aphid was found, 1 point – rare examples, 2 points – 1-2 small colonies with 5-10 aphids per colony, 3 points - more than 20 aphids settled down in colonies and in 50% of leaf blade, 4 points - if there are more than 50 aphids in colonies and if they are located in 75% of the leaf blade and 5 points – if the aphid colonies occupy whole surface of the leaves.

Frequency of occurrence of entomophages: - none, + a few specimen.

The results of the calculations are used to forecast. Additionally, permanent implementation of calculations allows for a long-range forecast of the dynamics of the pest population and to distinguish between zones characterized by damaged plants.



Fig 1: *Panaphis juglandis* nymphs and winged adults nourishing on the upper surface of the leaf. Zagatala 21.06.2017 on walnut



Fig 2: *Panaphis juglandis* nymphs. Zagatala 20.06.2017.



Fig 3: *Panaphis juglandis* IV instar nymphs and *Crematogaster* sp. Zagatala. 21.06.2017 on walnut.

The main predatory entomophagous of the pests of the Persian walnut are lacewings (Chrysopidae) and ladybugs (Coccinellidae). The larvae of common green lacewing (*Chrysoperla carnea* L.) can feed 200-300 aphids during their development.

The wild Coccinellidae are much eaters, thus they can eat up hundreds of small insects, including aphids during a whole day. They not only nourish with adults, but also with larvae and eggs. In our conditions, ladybugs increase several times a year, and the females of different species can produce between 200 and 400 to 1500 eggs. Females lay their eggs in places where the aphids are gathered. Thus, the ladybug larvae are fed on aphids as they leave the eggs. Ladybugs feed in summer and summer, especially during the sunny days and always seek their own food.

The high efficiency of Coccinellidae and rapid increase of their number in the favorable condition make them one of the main agents of the biological control of pests, including aphids.

Conclusions

1. Two species of Aphididae family (*Panaphis juglandis*, (Goeze, 1778) and *Chromaphis juglandicola* (Kaltenbach, 1843)) damage Persian walnut in Azerbaijan. *Panaphis juglandis* gives 10-11 generations in a year. There are two peaks (spring and autumn) in number of population during vegetation of *Chromaphis juglandicola*.
2. Seven entomophagous belonging to Coccinellidae and one to Chrysopidae were revealed as predators of *Panaphis juglandis* and *Chromaphis juglandicola*.
3. *Panaphis juglandis* was more active in the Shaki-Zagatala motorway edge, whereas *Chromaphis juglandicola* in Baku-Absheron.

References

1. Abstract on the flora of Azerbaijan. v.II. 2006, 128.
2. Akkopru EP, Atliha R, Okut H, Chi H. Demographic Assessment of Plant Cultivar Resistance to Insect Pests: A Case Study of the Dusky-Veined Walnut Aphid (Hemiptera: Callaphididae) on Five Walnut Cultivars. *Journal of Economic Entomology*. 2015; 108(2):378-387.
3. Boenna Jakiewicz, Katarzyna Kmie. The occurrence of *Panaphisjuglandis* (Goetze) And *Chromaphis juglandicola* (Kalt.) on walnut under the urban conditions of Lublin. *Acta Scientiarum Polonorum Hortorum Cultus*. 2007; 6(3):15-26.
4. Determinants of insects in the European part of the USSR T.I. Coleoptera and Strepsiptera / edited by the correspondent member G.Y. Bey-Bienko. M.L. "Science", (Determinants of the USSR fauna, published by the Zoological Institute of the USSR Academy of Sciences; issue No.89.), 1965; 319-26. -668.
5. Flora of Azerbaijan. Baku, Azerbaijan, 1952; 5:78-80.
6. Guliyeva Kh.F, Ibrahimov JE. The main sucking pests of fruit crops of the Ganja-Kazakh zone of Azerbaijan, *News of Baku State University*, 2013; 1:27-34.
7. Heie OE. The Aphidoidea (Hemiptera) of Fennoscandia and Denmark. II. The Family Drepanosiphidae. *Fauna Entomologica Scandinavica*. 11. 176 pp. Scandinavian Science Press Ltd., Klampenborg, Denmark. 1982,
8. Ibrahimov ZA. Biological diversity of walnut in Azerbaijan. *Journal of Forestry*. M. 2009; 5:23-25.
9. Karczmarz, Katarzyna. Dynamics of population and bionomics of *Panaphisjuglandis* (Goeze, 1778) (Homoptera, Phyllaphidae) on common walnut (*Juglansregia* L.) in Lublins parks and gardens. *Acta Scientiarum Polonorum Hortorum Cultus*. 2012; 11(2):53-70.
10. Lazarov A, Grigorov P. *Karantinana Rasteni Jata*. Zemidat, Sofia. 1961, 258.
11. Mace KC, Mills NJ. Connecting natural enemy metrics to biological control activity for aphids in California walnuts. *Biological Control*. 2017; 106:16-26.
12. Magnussen T, Hansen LO. *Panaphisjuglandis* (Goeze, 1778) and *Chromaphis juglandicola* (Kaltenbach, 1843) (Hemiptera, Aphididae) in Norway- two aphid species associated with common walnut (*Juglansregia* L.). *Norwegian Journal of Entomology*. 2014; 61:186-189.
13. Nieto Nafria JM. *Fauna Europaea: Family Aphididae*. In: Nieto Nafria, J.M. *Fauna Europaea: Superfamily Aphidoidea*. *Fauna Europaea*, version 2.6. <http://www.faunaeur.org>, 2014.
14. Remzi Atlihan M, Salih Özgökçe M, Bora Kaydan, Ismail Kasap, Neşet Kiliçer, *et al.* Vangölü havzası ceviz ağaçlarındaki böcek faunası. *Türk. entomol. derg.* 2011; 35(2):349-360.
15. *Trees and bushes of Azerbaijan*. V. I. 1961;
16. Mamedov T, Iskander E, Talybov T. *Rare trees and bushes of Azerbaijan*, Baku: Elm. 2014, 380
17. Vasilyev V.P. *Pests of agricultural crops and forest plantations*. T.1, Kiyev. 1973, 266.
18. Vazirov NJ. *Aphids in Azerbaijan*. Homoptera, Aphidinea, Baku, Science. 1995, 520.