RESEARCH ARTICLE

Application of a system of control measures in accordance with the development dynamics of apple fruit (psylla mali schm.) in the conditions of the Guba-Khachmaz economic region

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Abstract

The article describes the apple plant dangerous pest apple honeysuckle (Psylla financial Schm .) biological development and phenology , entomophagous , variety resistance , control of events time about information Observations tool with pest massive damage of the era April from the 1st decade of the month starting August of the month to the end like continue what he did has been identified . To the pest against in the fight from entomophages of use advantage researched , most very widespread species Psalms ambiguus Fall., Adalia bipunctata L., Coccinella quinquepunctata L., Chrysoperla carnela , Anthocoris nemorem L., Chilocorus bipusulatus where appointment Entomophages are densely populated . from the territories collected apple honey with infected plants on amount reproduction 20-25% reduction in pest population reason has been . Conducted research of their work to the results according to some introduction (Granny) Smith , Eve , Champagne reneti), selection (Azerbaijan , Makhmeri , Vatan , Qiziltaj , Chiraggala) folk selection (Golden Ahmadi) varieties other to varieties relatively sweet against sustainability determined and this varieties new fruit of the gardens in the setting usage recommendation was made . To the pest against Mostar 20%, Confidor SC 350 and Calypso OD 240 preparations efficiency determined, most high result Confidor SC 350 and Calypso OD 240 preparations from the application obtained (93.6-93.2 %).

Citation

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Introduction

In connection with the transition to a market economy in the republic, the national economy is another important factor in the development of the apple tree. Apple ranks first in terms of cultivated area and productivity among pome fruit crops in our country. The biggest drawback of this plant, which is a source of income for many rural families in the region, is that it has been exposed to the harmful effects of apple scab in recent years, along with many pests. For this reason, the fight against pests and disease agents that cause losses in crop production is a problematic area where producers spend the most money. Reducing costs depends on the correct selection of the time, type and timing of

control measures. For this reason, for the first time, the biology and phenological development sequence of apple scab, a dangerous pest of apple plants, have been studied and the optimal periods of control measures have been determined.

According to literature sources (Gurbanov et al. 2018, p. 24, Toprak: 2016, pp. 59-78) and our research, a large number of sucking (beetles, mites, aphids, etc.) and rodent (fruit eaters, leaf-eaters, flower eaters, anteaters, wood pests, etc.) pests have settled on fruit plants.

The results of observations conducted by researchers (Gurbanov et al. 2018, p. 15, Sadiqova: 2016, p. 42, Sadiqova: 2017, p. 81, Sadiqova et al. 2018, p. 631) show that the apple aphid is a very dangerous pest for apple plants and develops rapidly in mild and humid weather conditions. It is a source of danger, especially in gardens where disease and pest control measures are not taken, and requires an optimal temperature of +15+300 °C to damage the plant.

According to the results of our observations, it is possible to achieve positive results against apple honeydew at the end of the vegetation period, in addition to agrotechnical measures such as cutting and removing the parts infected with honeydew from the garden, pruning, cleaning tree trunks, etc., when bacterial preparations Nemabekt, Entonem-F, organophosphorus compounds (FOS) Diazinon, Dimethoate, pyrethroids Cypermethrin, Deltamethrin, Esfenvalerate and neonicotinoid insecticides Confidor SC 350 and Calypso 240 OD are applied on a rotational basis.

According to literature sources (Topraq: 2016, p. 78, Aviella et al: 1992. Reference 01.VI 2020), the main entomophagous species of the apple aphid, such as antocoris nemorum (Antocoris nemorum L.), ambiguus (Psallus ambiguus Fall.), and ladybugs (Adalia bipunctata L., Adonia Variegata, Coccinella quinquepunctata L.), are more effective in controlling the pest than other species.

Object of research: Apple aphid, entomophages, insecticides.

Purpose of the work: The research work consists of determining the effective cost norms of insecticides based on the biological and phenological development sequence, varietal resistance, entomophagous, and harmfulness threshold (IDT) of the apple aphid, and developing the calendar periods for control measures.

Scientific novelty of the work. In recent years, the apple aphid has spread more widely in the Guba-Khachmaz region and has caused economic damage to apple plants, so there is a need to conduct scientific research in this direction to solve the problem. As a result of the research, for the first time, the biological and phenological development sequence of the apple aphid, the resistance of fruit varieties to the pest, entomophagous, and the effect of insecticides on the pest and plant development in the conditions of the Guba-Khachmaz economic zone were analyzed, and a system of optimal control measures was developed in accordance with the dynamics of the development of the pest.

Methodology and methodology of the work. The research work was carried out according to the general methodology adopted in fruit growing (Michurinsk, 1980), the analysis of the obtained results was carried out by mathematical calculation, the biological efficiency of the preparations was determined by the Abbott formula, and the entomophages were determined by visual observation method based on samples taken from natural and cultural biocenoses, with the help of an atlas and a microscope.

Research results: The apple psyllid (Psylla mali Schm.) is a representative of the order Homoptera, suborder Psylloidae. In the 2015-2019 research years, the biology of the apple psyllid was studied and it was determined that the pest is a small insect measuring 2.5-2.8 mm in size, which damages only apple plants. Its wings are initially blue-green in color, and when it becomes an adult, it becomes straw-yellow in color. The back and upper side of the abdomen of females are red. Orange lines are observed on the back of the chest of males. Its eggs are orange-yellow.

The study of the phenological development sequence of the pest shows that the adult honeydew spends the wintering stage by laying eggs around the fruit buds at the end of the vegetation period, and in early spring, when the fruit buds begin to swell, larvae have been observed to emerge from the eggs. Larvae hatch at the end of March. Larvae enter through the top of the bud and feed by sucking the sap of unopened flowers and leaves. Winged individuals are mainly formed in the 4th instar (June). Since such individuals have the ability to fly, they migrate to other surrounding plants. In August, they return to the apple plant and lay eggs, ensuring their reproduction on that plant for the next year. Larvae spend 5 instar stages and damage the plant by sucking plant sap from the end of March to the end of August. Since the larvae secrete a sticky liquid, the surface of the buds, shoots, leaves and fruits are covered with a juicy secretion. Here, saprophytic fungi develop, covering the plant's organs with a black coating. Since the photosynthesis process in infected plants is disrupted, the plants are stunted and their productivity is reduced.

Multi-year (2015-2019) studies show that apple aphid damage occurs in 3 forms on plants.

1. The sap they secrete during their feeding process coats leaves, branches, buds, and fruits, causing saprophytic fungi to develop on them and giving the trees a sooty appearance.

2. They have a sucking mouthpart and release a harmful toxin into leaf tissues during feeding, causing burns called "honeydew" on the leaves and weakening the photosynthesis process.

3. It causes the weakening of the plant, the small size of the fruits, poor quality, and a decrease in market value.

Thus, the phenological analysis of the apple sawfly shows that the pest requires temperatures above +100 C for development, and +15+300 C for damage to the plant. The period of mass damage is in the larval stage, which lasts from the first decade of April to the end of August. The damage of the apple sawfly has been evaluated differently in different apple varieties.

In order to determine the resistance of apple varieties to apple scab, observations were conducted once a month starting from the end of March on (22 varieties) cultivated through selection, folk selection and introduced varieties (10 plants of each variety) in a 2.5 ha super-intensive type orchard, collection orchard and Zardabi territorial unitary orchard areas located in the Zardabi ETB of the M and CHETI. According to the results of the observations, the varieties were grouped according to their resistance characteristics as follows.

The varieties Yeva, Granny Smith, Golden Ahmadi, Azerbaijan, Golden Taj, Velvet, Renet Champagne and Vatan were infected at a rate of 1.2-2.0 points and were relatively resistant, the varieties Gandil Sinab, Elvin, Chiraggala were infected at a rate of 2.2-2.5 points and were moderately resistant, and the varieties Gala, Simusi, Golden Delicious, Renet Simirenko, Shabran, Nigar, Golden Spur, Starkrimson were classified as unstable varieties.

Due to their durability, Granny Smith, Yeva, Renet Champagne, M were selected from the introduced varieties, and Azerbaijan, Makhmeri, Vatan, Qiziltaj, Chiraggala from the selection varieties of the State Agricultural Research Institute, and Gizil Ahmadi from the people's selection varieties, and these varieties were recommended for use in the establishment of new orchards.

The determination of the role of entomophages in the resistance of varieties, regulation of the number of apple aphids, and minimal use of insecticides was carried out on the basis of entomological samples taken from natural and cultural biocenoses, and the most common species were studied.

The most common predatory beetle, the ambiguus (Psallus ambiguus Fall.), was observed in early spring when larvae hatched from honeydew eggs (March-April).

Among the predatory insects, the 2-spotted (Adalia bipunctata L.) and 7-spotted (Coccinella quinquepunctata L.) ladybugs complete their wintering periods in the adult stage in April-May and feed on honeybee larvae. During the research years, it was possible to reduce the number of pests by 20-25% by collecting ladybugs from plants where they are densely populated and infecting trees in the experimental area. It was found that one ladybug feeds on 95-100 honeybee larvae in 15 days. The active feeding period of ladybugs continued on apple plants until the end of August. The predators of the golden eye and xylokorus had a 25-37% efficiency in reducing the number of apple honeybees, and the active feeding period was observed in May-August.

Thus, the study of entomophages shows that in the Guba-Khachmaz economic zone, the predators of the beneficial insects feeding on the apple weevil, such as the ladybird beetle (Adalia bipunctata L., Coccinella quinquepunctata L.), the ladybird beetle (Chrysoperla carnela), the antokoris nemorem (Antokoris nemorem L.), the ambiguus (Psallus ambiguus Fall.), and the chilocorus (Chilocorus bipusulatus), are more common than other species. Since the development and active feeding period of the apple weevil and the entomophages coincide during the vegetation period, the use of insecticides should be applied only when the weevil exceeds the economic damage threshold (EDT) (Table 1).

Table 1. Economic damage threshold (EDT) of apple scab 2015-2019

s/n	Calendar period	Duration of observation according to the plant's development phases	Economic damage threshold, in numbers
1	2015 18-28/III 2016 17-30/III 2017 20-25/III 2018 10-25/III 2019 15-25/III	The plant's period of relative dormancy, before flowering	10-25 eggs 10vscm/branch or 10-15 eggs per fruit branch
2	2015 16-23/IV 2016 17-25/IV 2017 20-25/IV 2018 15-20/1V 2019 18-25/IV	Flower bud development or pink cone stage	5-10 larvae /1 flower bouquet
3	2015 24-30/V 2016 23-30/V 2017 25-30/V 2018 25-30/V 2019 24-30/F	During the development of fruits and buds after flowering	20-30% infestation/100 leaves or 50 aphids/100 shoots

In order to determine the economic damage threshold of the apple sawfly, the development dynamics of the pest were monitored starting from the second decade of March (the stage when the buds swell), and the emergence of larvae from eggs on the vegetative and generative organs of the plant was observed.

As can be seen from the table, the apple aphid infestation was recorded before flowering (10-30/III), during the pink cone stage (15-25/1V), and after flowering, during the development of fruits and buds (23-30/V), and this period was defined as the pest exceeding the economic damage threshold.

After collecting information on the population level of the apple aphid, the degree of damage, and the mechanism of action of insecticides, control methods and means were determined, chemical preparations were applied, and the biological effectiveness of these preparations was determined (Table 2).

As can be seen from the table, preparations containing 350 g/l of Imidaxloprid (0.04, 0.06 and 0.08% Confidor SC 350), 240 g/l of Thiaxloprid (0.05, 0.06 and 0.08% Calypso OD 240) and 20% Acetamiprid (0.06, 0.07 and 0.08% Mostar) as active ingredients were applied against apple honeydew.

The biological efficiency of Confidor SC 350 compared to the control variant was 84.0-89.0-93.6%, Calypso OD 240 84.1-88.0-93.2%, and Mostar 69.1-73.8-78.4%. The highest biological efficiency was observed in the variant of

application of 0.08% working solution of Confidor SC 350 and Calypso OD 240 compared to the control variant (93.6-93.2%), which is 15.2-14.8% higher than the standard (Mostar) variant (78.4%).

Table 2. Biological control of chemical preparations against apple honeydew efficiency indicators, in %

Experience options	Application rate, %	Biological efficiency by year, %					Biological efficiency in %
		2015	2016	2017	2018	2019	
Confidor SC 350 (tmImidachloprid)	0.04	82.8	82.5	88.0	78.1	87.0	84.0
	0.06	89.0	85.5	90.9	86.2	91.0	89.0
	0.08	96.4	89.9	94.7	93.0	94.0	**93.6**
Calypso OD 240 (tmThiacloprid)	0.05	78.8	82.6	90.3	77.9	91.0	84.1
	0.06	82.9	86.9	92.5	84.4	93.0	88.0
	0.08	95.1	88.6	95.6	92.4	94.4	**93.2**
Benchmark. Mostar (tm20% Acetamiprid)	0.06	70.4	65.0	70.4	67.8	71.9	69.1
	0.07	82.7	70.4	73.0	69.7	73.4	73.8
	0.08	85.4	79.3	79.0	72.8	75.4	78.4
Control (Farm)	-	-	-	-	-	-	-

The biological development sequence of the apple aphid, the stage of damage, the active development stage of entomophages, and the IZH have been studied, and it is proposed to carry out pest control in the following periods:

1. The first control measure is to be carried out in early spring, before the buds awaken (in March), in order to destroy the overwintering eggs during the plant's relative dormancy stage, when 20 eggs are observed on a 10 cm shoot or 5-10 eggs on a fruit branch, with one of the spring oils containing the active ingredient 350 g/l Imidaxloprid (Confidor OIL) or 240 g/l Thiaxloprid;

2. The second control measure is with one of the preparations Confidor SC 350 and Calypso OD 240 at 0.08% when 5-10 larvae/1 flower bouquet are observed during the development of flower buds or the pink cone stage;

3. It is recommended to carry out the 3rd and 4th chemical control measures with one of the mentioned preparations immediately after flowering in May and June, when the trees are leafing out and the shoots are growing intensively, when the juicy secretions released by the honeydew nymphs are visible, or when 50-60 larvae are observed per 100 leaves and shoots.

During the fruit formation period (June-July-August), based on the results of monitoring the 4th and 5th instar larvae of the pest, when 2-3 larvae are observed on a 10 cm shoot or 8-10 nymphs per leaf on 100 leaves taken from 10 trees, it is recommended to carry out a second control with one of the 0.08% Confidor SC 350 and Calypso OD 240 preparations.

The effect of the applied insecticides eliminated the harmful fungi developing on the leaf surface as a result of the sap secretion of the apple aphid, and normal development was observed in the fruits and leaves (Table 3).

Table 3. The apple psyllid *(Psylla mali Schm)* and parasitic saprophytic fungi that develop in plants due to its harmful effects, in %

Experience Options	The preparation	Effect on leaf awn development, cm ²						Effect on fruit development, gr (10 pcs.) (based on average fruit weight)				
		2017		2018		2019		2017	2018	2019	Increased on average	Control
		Area	Biological		Biological	Area	Biological	Biological growth	Biological growth	Biological growth		
Confidor SC	0.04	18.9	4.6	28.1	4.4	28.2	4.4	50.2	15.7	33.1	33.0	22.0
350 (tm Imidacloprid)	0.06	21.5	7.2	30.0	5.7	29.0	5.2	58.0	17.9	35.0	36.7	25.7
	0.08	23.4	**9.1**	33.4	**9.1**	33.2	**9.4**	67.3	23.8	36.7	42.6	31.6
Calypso OD	0.05	20.1	5.8	27.5	3.2	27.5	3.7	56.5	17.4	32.8	35.6	24.6
240 (tmThiachloprid)	0.06	23.8	9.5	28.0	3.7	29.1	5.3	62.2	16.3	33.9	37.5	27.5
	0.08	25.1	**10.8**	33.0	**8.7**	33.9	**10.1**	67.4	25.7	36.8	**43.3**	**32.3**
Benchmark. Mostar (tm 20% Acetamiprid)	0.06	17.2	2.9	25.9	1.6	26.7	2.9	37.0	11.5	29.4	30.0	19.0
	0.07	18.6	4.3	28.1	3.8	27.9	4.1	41.1	12.3	30.1	29.0	18.0
	0.08	19.8	***5.5***	29.8	***5.5***	28.0	**4.2**	47.5	18.0	31.0	32.2	21.2
Control (farm)	-	14.3	-	24.3	-	23.8	-	9.0	9.0	15.0	11.0	-

As can be seen from the table, as a result of the application of Confidor SC 350 and Calypso OD 240 preparations, a

biological increase of 9.1-9.1-9.4 cm2, 10.8-8.7-10.1 cm2 was achieved in the leaf axil area compared to the control variant, which is 3.6-3.6-5.2 and 5.3-3.2-5.9 cm2 more than the reference (Mostar) variant.

In terms of fruit mass growth indicators, a biological increase of 42.6 g was achieved in the variants, compared to the control variant, 31.6 g, and in the other variant, 43.3 g, compared to the control variant, 32.3 g.

The productivity indicators achieved as a result of the application of Calypso OD 240 and Confidor SC 350 preparations against the apple honeydew, against the background of the complex application of agrotechnical, biological and chemical control measures and the general cultivation measures carried out by the farm, are shown in Table 4.

Table 4

Parameters of the effect of Confidor SC 350 and Calypso OD 240 preparations on yield in an apple orchard that has not reached full harvest, against the background of general cultivation measures.

Experience options	Average across options productivity indicators, kg/tree		Medium productivity,	Per area unit falling	Control option increase compared to, sen/ha
	2018	2019			
Confidor SC 350 (tmImidachloprid)	2.4	3.5	3.0	50.0	13.0
Calypso OD 240 (tm Thiachlopride)	2.6	4.0	3.3	55.0	18.0
Benchmark. Mostar (tm 20% Acetamiprid)	2.2	3.0	2.6	43.3	6.3
Control (farm)	1.8	2.5	2.2	37.0	-

As can be seen from the table, the average yield indicators for the variants were 3.0-3.3-2.6-2.2 kg/tree, and 50.0-55.0-43.3-37.0 sen/ha of yield was obtained per unit area. As a result of the application of Confidor SC 350 and Calypso OD 240 preparations in the experimental area, 6.7-11.7 sen/ha more yield was obtained from the Gala and Simusi varieties compared to the reference variant (Mostar 20%), and 13.0-18.0 sen/ha more yield was obtained compared to the control variant.

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