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ВІННИЦЬКИЙ НАЦІОНАЛЬНИЙ АГРАРНИЙ УНІВЕРСИТЕТ

Сільське господарство та лісівництво

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EFFICIENCY OF CONTROL OF PHYTOPHAGES OF APPLE TREES IN THE CONDITIONS OF THE RIGHT-BANK FOREST STEPPE

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This article presents the results of research on clarifying the characteristics of the development of dominant apple phytophages and research on the effectiveness of protective measures. It was established that the following phytophages caused the greatest damage: apple fruit eaters (34%), aphids (22%), leafhoppers (16%), mites (11%), flower eaters (10%), hairy deer (7%).

The highest technical efficiency in the control of the apple flower borer was recorded when spraying an apple tree in the budding phase with the pyrethroid Decis 100 EC, which was 86.9%. When processing in the "pink bud" phase, the highest efficiency in the control of leafhoppers was recorded in the variant using the drug Napoval, EC, which on the 5th day was 81.0%, in the control of mites, the highest technical efficiency was observed when using the drug Syntak, EC and on the 5th day was 93.4%, and in the control of aphids, the highest technical efficiency on the 5th day after application was noted when spraying the plantations with Napoval, EC, which was 83.8%. In the control of hairy deer with the use of chemical insecticides, the highest technical efficiency was noted on the 5th day after application when spraying plantations with the drug Viares, CS, which was 87.0%, which exceeded the effectiveness of the insecticide Calypso 480 SC by 2.4%. Spraying plantations with biological preparation Aktarophyt K1.8 made it possible to reduce the number of phytophagous plants by 75.5%. In the control of the apple fruit borer when processed in the "walnut" phase, the highest technical efficiency was noted on the 5th day after application when spraying plantations with Ampligo 150 ZC, which was 86.2%, which was 11.2-13.5% higher than technical efficiency of insecticides Knockout Extra, EC and Silker, EC.

The use of insecticides in the control of phytophages made it possible to obtain a higher yield of apple trees, which in the control was 12.8 t/ha and to obtain a harvest of higher quality, in particular, I and II grades, in the control these indicators were 20.8 and 42.6%, respectively.

The economic expediency of the use of means of protection has been confirmed. The cost of grown products from plantations that were not treated with protective means was UAH 45,197, which is 1.6-1.9 times lower than the cost of products obtained from options that involved the use of insecticides, which recorded the highest technical efficiency and yield according to experiments: Decis 100 EC, Napoval, EC, Viares, EC and Ampligo 150 ZC, and the cost of additional products was 25120, 27160, 36444 and 40079 UAH. in accordance.

Key words: *apple tree, phytophages, insecticide, productivity, economic efficiency.*
Table 8. Lit. 14.

Introduction. The apple tree has been the main fruit crop of Ukraine for several centuries. This is caused by the soil and climatic conditions favorable for its cultivation in most regions of the country, as well as the traditions of the population. In addition to the fact that apple trees do not require increased attention, their fruits have a high nutritional value, they are consumed fresh, processed into juice, jam, jams and compotes, and added to baked goods. In addition, the fruits of this culture have a large supply of useful components, including vitamin C and iron.

The area of apple orchards in Ukraine has decreased by 3.5 times over the past 22 years. At the same time, the productivity of apple trees increased 4 times - from 2.9 to 11.8 t/ha. Phytophagous damage is a significant factor affecting the quantitative and qualitative indicators of the obtained products.

Ukraine ranks eleventh in world apple production and fourth in Europe. The total demand is 1,228,000 tons, and during the studied period there is a trend towards an increase in export deliveries from 5,000 tons in 2015 to 54,000 tons in 2019 (10.8 times). The opposite situation with imports - volumes decreased by 2.4 times - to 24 thousand tons. One of the reasons was the strengthening of requirements by EU countries for the content of certain active substances of pesticides in products, in particular neonicotinoids [10].

The purpose of the article is to clarify the species composition and distribution of harmful organisms of the apple tree and to study effective means of protection for the control of harmful organisms of the apple tree.

Analysis of recent research and publications. The apple tree is one of the most common fruit plants in the world. The area under apple orchards is almost 5 million hectares. According to 2020 data, the area of apple plantations in Ukraine is 94.9 thousand hectares, and the gross production of fruits is 1114.6 thousand tons.

It is known that about 180 types of pests that feed on various parts of the tree - roots, wood, trunks, branches, buds, flowers, fruits, leaves - cause considerable damage to apple orchards. Therefore, the number of certain species and the degree of damage to different breeds and varieties are different in different natural and climatic zones. In a systematic way, pests are distributed as follows: Ticks - 6%; Insects - 91%, of which Homoptera - 26%, Hemiptera - 1%, Coleoptera - 21%, Lepidoptera - 33%, Hymenoptera - 7%, Diptera - 3%; vertebrates (rodents, birds) – 3% [1].

Among the leafhoppers (Torticidae), the most common are: apple borer (Laspeyresia pomonella L.). and the bud leaf (Spilonota ocellana F.) [4].

The apple borer is a dangerous pest of apple trees. It gnaws the direct passage to the seed chamber, eats the seeds in the fruit. Caterpillars that have finished feeding hibernate under the exfoliated trunk bark, in its cracks (39.4%), at the root neck (50.7%), at a depth of 3 cm in old soil (1.7-13.0 %) and young gardens (33.1%). [2].

In the forest-steppe, 30-40% of caterpillars pass into the second generation. Apple fruit losses reach 60-70%. This damage is aggravated by the fact that most of the damaged crop (up to 65%) comes from the peripheral part of the crown, which, as is known, produces the highest quality fruits.

During the annual sum of effective temperatures of 985–1162^{0}C and hydrothermal coefficient of 1.27–1.83, the development of the population of the overwintering and optional summer generation is observed. The average butterfly catches are 8-12 specimens/trap in 5 days. The population of the apple borer develops in two generations. If the warming trend continues, the second facultative generation of the apple borer becomes mandatory [6].

The budworm damages buds, leaves, flowers and fruits of apple, pear, plum, cherry, cherry, apricot, peach, quince, as well as some berry and forest species [3].

Caterpillars of the third age hibernate in white web cocoons near the buds, in the crevices of the bark and in the branches of the branches. In the spring, when the air temperature reaches 8^0C above zero, the caterpillars come out of the cocoons, bite into the buds and damage them. After the buds open, the caterpillars feed on leaves and buds, pulling them into a dense bundle with a web. Inside such a bundle there is one caterpillar, which makes a cover for itself from scraps of leaves and petals. After the flowering of the trees, the caterpillars pupate inside bundles of leaves in web cocoons or climb into the branches of thin branches and crevices of the bark and pupate there. The economic threshold of harmfulness is 4-6% of damaged inflorescences or rosettes on trees [4, 5].

Fedorenko V.P. indicates that the main method of protection against leafhoppers is a chemical method. Under the conditions of settlement of 2-3 fruit-eater eggs per 100 fruits 1-2 days before the emergence of the first caterpillars or at the beginning of the hatching of caterpillars, the first spraying of apple orchards with insecticides from the pyrethroid group is carried out (Balazo 100, EC (0.4-0.5 l/ ha), Mavrik, ME (0.2-0.6 l/ha), Talstar, EC (0.4-0.6 l/ha)), organophosphorus compounds (Bi-58 new, EC (0.8- 2 l/ha), Dursban 480, EC (2.0 l/ha), Pirinex Super, EC (1.25-1.5 l/ha)) or neonicotinoids Calypso 480 SC (0.25-0.3 l/ha), (Coragen 20, EC (0.15-0.175 l /ha), Voliam Flexi 300 SC (0.3-0.5 l/ha)), further applications are carried out after 14-15 days, which reduces the number of pests by 77-90% [7].

The list of apple tree pests also includes a fairly significant number of aphids (Aphidinae), but it is most damaged by the green apple aphid (Aphis pomi Deg.), an insect from the family of aphids of the Isoptera family. Larvae and adults suck juice from buds that swell and open, populate the underside of leaves, green shoots, sometimes ovaries. Damaged leaves curl and die. Shoots are stunted in growth and twisted. On severely damaged trees, the fruits become smaller, and the skin often cracks. Fertilized eggs overwinter on young shoots at the base of buds. During the period of swelling and budding, the larvae are reborn and start feeding [16]. In the summer, winged female settlers develop simultaneously with the wingless ones (starting from the third generation), which fly away and inhabit new fodder plants. In September-October, female stamens appear, reviving the larvae, which turn into amphigonic females and males. Fertilized females lay 2-5 wintering eggs. The nature of their development is full-cycle, monoecious. During the season, it gives from 6 to 19 generations [11].

The authors indicate the need to carry out during the growing season (in the phases of "pink bud", "flowering", "after flowering" and in the summer during "formation" and "growth of fruits"), in case of significant numbers, to ash, to spray plantations with organophosphorus compounds (according to temperature regime - +17 – +250C) (Pirinex Super 420, EC (1.5 l/ha), Bi-58 new, EC (2.0 l/ha), Dursban 480, EC (2.0 l/ha)) or neonicotinoids or their derivatives (Aktara 25 WG, VG (0.14

kg/ha), Mospilan, VP (0.2 l/ha), Dantop 50, VG (0.07 kg/ha). For a significant number of overwintering aphid eggs, early spring spraying of apple trees with Preparat 30 V, EC (40 l/ha) is recommended. In addition, as one of the elements of protection, it is recommended to remove the basal symbionts, on which the pest's eggs hibernate, which subsequently reduces the number of the population by 27-40% [8].

Significant damage to apple orchards is caused by a complex of species of moths from different families, which eat leaves, gnaw them in web nests or make moves in shoots, and sometimes in the pulp of fruits. In apple orchards, the apple lower lateral passing moth (Lithocolletis pyrifoliella Grsm.) is widely present, which damages only apple trees. The caterpillars first make ribbon-shaped, then oval mines, later they feed in a folded ptichonoma (roof-like convex spot) on the underside of a leaf. To protect against moths, it is recommended to clean the bark, collect and burn burnt leaves, plant remains, apply lime to trunks and the bases of skeletal branches, collect nests with moth caterpillars and pupae from trees and then destroy them. It is also recommended to cultivate the soil before bud break in order to destroy the pupae before the butterflies leave, and with a large number of ovipositors during this period, it is effective to spray the trees with Preparation 30 V, EC [6].

In order to limit the harmfulness of the phytophagous plant, it is recommended to treat the trees with insecticides during the budding period, before and immediately after the flowering of the apple tree, if there is a significant population of plantations with moths. In the summer, insecticidal treatments of plantations with insecticides from the groups of pyrethroids, organophosphorus compounds or neonicotinoids against fruit eaters are effective against moths at the same time [7].

Among the mites (Acariformes), various species of which cause significant damage to apple plantations, the garden spider mite (Schisotetranychus pruni Oudms) is the most common. Leaves damaged by spider mites discolor along the veins, turn brown, and curl. The mite overwinters in small colonies in the soil, under fallen leaves and under exfoliated areas of bark on fruit trees. In the spring, during bud break, they migrate to the leaves, where they multiply and create large colonies. Gives five to six generations. Measures to protect against ticks include keeping the garden clean of weeds, cleaning and burning dead bark in winter, treating trees before the start of vegetation with paraffin oil or pure paraffin, which is used in the pharmaceutical industry. In the period from the phenophase of the "green cone" to the phenophase of the "pink bud", as well as in the summer, when there are more than 5 individuals per leaf or when more than 50% of the leaves are occupied by them, the plantation is sprayed with one of the approved insect acaricides: Bi-58 new, EC (0, 8-2 l/ha), Vertimek 0.18 ES (1.0-1.5 l/ha), Dursban 480, EC (2.0 l/ha), Envidor 240 SC (0.4 -0.6 l/ha), Masai, SP (0.4-0.6 kg/ha), Nissoran, SP (0.3-0.6 kg/ha), Talstar, EC (0.4-0 .6 l/ha) etc., the effectiveness of which against phytophagous is 68-95% [3, 7].

Of the lamellae, significant damage is caused by the hairy deer beetle (Epicometis hirta Poda.) [9], the beetles feed on the flowers of fruit and many other crops, damaging young leaves and buds. Beetles hibernate in the soil at a depth of 15-40 cm, leave their wintering places in early spring. Summer begins in the II-III decade of April with an average daily air temperature of 14.4^{0}C and humidity of 63-85%. Mass summer falls on the third decade of May - June. The beetles emerging from the pupae remain in the soil for the winter. Spraying fruit trees of apple trees during flowering with the bee-safe insecticide Calypso 480 SC (0.25 l/ha), Mospilan, SP (0.25 kg/ha) before flowering or immediately after flowering with Mavrik, EW (0.2-0.6 l/ha) makes it possible to reduce the number of pests by 80-97% [9].

Conditions and methods of research. The research was carried out in apple plantations of Vinnytsia National Agrarian University. This territory is assigned to the central subzone of the Right-Bank Forest-Steppe and is located in the northern subprovince within the Vinnytsia-Nemyriv subdistrict of the agro-soil district of the Vinnytsia region. Analysis of agrometeorological observations shows that the hydrothermal conditions of 2023 in certain periods differed from the average long-term data. In particular, in the period from October 2022 to February 2023, the average daily temperature exceeded the long-term average, which in turn contributed to the overwintering of apple phytophages. In general, the temperature indicators of the spring-summer period of 2023 exceeded the long-term average. In particular, the air temperature during March-April this year exceeded the long-term average by 0.4-1.3 ^{0}C, and during May-June – by 0.7-1.2 ^{0}C, which in turn contributed to the development of phytophages. The level of precipitation was uneven, in particular, in March it fell 2 times more than normal, while in April this figure was 6 mm lower than the long-term average. July 2022 turned out to be 2.8 ^{0}C warmer compared to long-term indicators, but the level of precipitation was 2 times lower. In general, weather conditions contributed to the development of culture.

The object of research: the development of a complex of phytophages in the agrocenosis of an apple tree and the formation of crop productivity when applying various insecticides.

Subject: Champion apple variety. Insecticides and pests of apple trees. Each variant of the experiment occupied an area of 20 m^2. Repeatability in experiments is 4 times. Placement of options is randomized Scheme of the experiment Treatment in the phase of bud extension

Scheme of the experiment

Processing in the budding phase

1. Decis 100 EC – 0,15 l/ha
2. Nuredin Super, EC – 1,25 l/ha
3 Aktara 25 WG – 0,14 l/ha

Treatment in the pink bud phase

1. Sintak, SC – 0,2 l/ha
2. Napoval, SC – 0,2 l/ha
3. Knockout Extra, SC – 0,1 l/ha
4. Super Bison, EC – 2,0 l/ha

Treatment in the flowering phase

1. Viares, SC – 0,1 l/ha
2. Calypso 480 SC, – 0,25 l/ha
3. Aktarophyte К1,8 – 2,0 l/ha

Processing in the "walnut" phase

1. Ampligo 150 ZC – 0,3 l/ha
2. Knockout Ekstra, SC – 0,1 l/ha
3. Silker, CE– 750 ml/ha

In the course of the research, the effectiveness of various insecticides in controlling the number of dominant phytophages of apple trees was studied. We carried out 4 sprays during the growing season of the apple tree, the purpose of each was to assess the effectiveness of plant protection products in the control of phytophages dominant in a particular period of apple tree development. Counts of phytophagous colonization were carried out according to the generally accepted methods of Omeluta V.P. [13] in the phases of apple tree development: "bud swelling", "green cone", "bud extension", "bud separation", "pink bud", "flowering", "end of flowering", "fruit formation", "fruit growth" and "fruit ripening". Pesticide tests and technical efficiency of preparations were determined according to the method of S.O. Trybel [12].

Presentation of the main material of the research.

For effective prevention of crop losses and rational use of material resources, it is necessary to make specific operational decisions on protective measures, taking into account the biological characteristics of the development of pests, the spread and characteristics of the development of apple diseases. Phytosanitary monitoring makes it possible to assess the condition of the orchard, establish the species composition, the prevalence of harmful and beneficial organisms, their number, population or damage to apple trees, identify foci and causes of diseases, determine the optimal timing and number of treatments [9].

According to the results of the research, during 2022, the following phytophages caused the greatest damage to the apple agrocenosis of VNAU (Fig. 1): apple codling

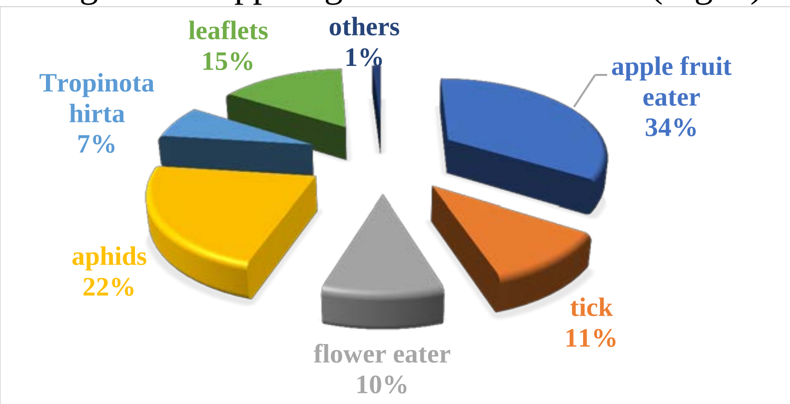

Fig. 1. Species composition of phytophages of apple trees, (experimental field of VNAU, 2022-2023)

The source is formed on the basis of own research results moth (34%), aphids (22%), moths (16%), mites (11%), flower beetle (10%), Tropinota hirta (7%).The most harmful phytophage in the apple orchard was the codling moth, which develops in two generations. The beginning of the flight of the pest imago in early May, when 2 ind./trap were caught in 7 days. The peak number of adults of the first generation was observed in the first decade of June and amounted to 4-7 ind./trap for 7 days. The beginning of the flight of the second generation was noted in the third decade of June, the peak of the number was in the middle of August 4-7 ind./trap. The number of pests during autumn surveys was 2-5 caterpillars per tree. Caterpillars of the first generation damaged 3-8%, the second – 7-12% of the fruits. In the "fruit growth" phase, the flight intensity of butterflies of the first generation reached 6.4 ind./trap, which was 1.3 times higher than the threshold level of harmfulness for this pest, and of the second generation – up to 5.5 ind./trap. Economic threshold of harmfulness (ETH) 3 ind./trap in 7 days.

The codling moth causes direct yield losses as the caterpillar gnaws a direct passage to the seed chamber and eats away at the seeds in the fruit. Carrying out protective measures is mandatory to obtain high-quality fruits. For the timely detection of phytophage, it is necessary to use pheromone traps in order to control and destroy the pest.

Analysis of literature sources [1, 14] and research results show that, taking into account fluctuations in annual weather conditions, pheromone traps for monitoring the flight of adults should be hung at the end of apple blossoming, then in the phase of "fruit the size of a walnut" and in the phase of "fruit ripening" (mid-August).

During the monitoring of apple pests, a complex of leafhoppers was observed, which developed during the growing season, but their number was at the subthreshold level. In the phase of "bud swelling", there were 2.3 egg-laying sessions per 2 m of branches with an ETH of 10. In the phase of "bud separation", the number of phytophages was 2.8 caterpillars per 100 leaf rosettes, which was half the level of ETH. Counts in the phenophases of apple development "pink bud" and "flowering" recorded the number of moths by 3.2-2.4 caterpillars per 100 flower rosettes, which also did not exceed the threshold level for phytophage. Also, the level of ETH of the leafhopper complex did not exceed their number during the subsequent phenophases of apple tree development – fruit growth and ripening, but 5.4% of rosettes were damaged by moth caterpillars.

Also, during the entire growing season, the population of apple trees with aphids was observed. In the "bud swelling" phase, the overwintering stages of green apple aphids amounted to 12.5 colonies/100 shoots and inflorescences, which exceeded the ETH by 22%. In the "green cone" phenophase, the number of aphids was at the level of 6.4 colonies/100 flower rosettes, which is also higher than the ETH (5 colonies/100 flower rosettes). In the "pink bud" phenophase, the number of aphids was 6.8 colonies/100 flower rosettes, which exceeded the level of ETH (5 colonies/100 flower rosettes). The larvae and adults suck the sap from the swollen and blooming buds, inhabit the underside of the leaves, green shoots, and sometimes ovaries. Damaged leaves curl and die. The shoots are stunted and curved. On severely damaged trees, the fruits become smaller, the skin often cracks on them.

Subsequently, the abundance decreased to 3.8 colonies/100 leaves in the "end of flowering" phenophase, but increased to 18.4 colonies/100 leaves when the fruit was hazel-sized. The decrease in population to 10.6-8.4 colonies/100 leaves by the pest of apple plantations occurred during the "ripening of fruits", which can be explained by dry and hot summer weather.

Counts carried out in the bud extension phase recorded the number of apple flower beetle larvae at 45.3 larvae per tree, which is 13.3% higher than the threshold level. Damage is caused by beetles and phytophage larvae. Damage to the buds is especially dangerous in early spring, when beetles gnaw deep pits in them, which resemble injections. Droplets of juice protrude from such wounds ("weeping buds"). The larvae feed on stamens and pistils, gnaw out the receptacle, glue the petals from the inside. The bud does not bloom, turns brown and dries up.

The apple flower beetle is especially harmful in years with a cold spring, when the budding period lasts more than 20 days and the beetles have time to lay a significant number of eggs. The pest is also dangerous in years with weak flowering. It was found that in the conditions of 2022, 4.7% of the inflorescences were damaged by the flower beetle.

Studies have found that the wintering stock of ticks did not exceed the ETH – 2000 eggs/2 m of one or three year-old branches. In the "pink bud" phenophase, the number of mobile stages of mites was 364 individuals/100 leaves, and in the "end of flowering" phase of apple plantations, the number was 325 individuals/100 leaves, which in both cases exceeded the level of ETH. In the "fruit growth" phase, the number of mites decreased. up to 186 individuals/100 leaves, which is significantly lower than the ETH (300 individuals/100 leaves).

Also in recent years, the danger from the shaggy deer, whose beetles feed on the blossom, eating its contents, has been growing.

The period of mass settlement and damage occurred in the phase of "flowering" of the apple tree, when the number of beetles of the shaggy deer was at the level of 9.6-8.4 specimens/tree.

On the basis of the conducted research, the periods of harmfulness of the dominant phytophages of apple agrocenosis in the conditions of the Central Forest-Steppe were clarified and the main periods of protective measures for the control of pests, the level of which exceeds the threshold level, were determined, which became the basis of our field research. In particular, the overwintering stages of aphids, mites and moths must be controlled in the swelling of the buds. Control of the apple flower beetle - in the phase of bud extension, to prevent damage to the flower. In the development phase of the apple tree, the "pink bud" is harmed by aphids, mites and partially leafhoppers. Control of hairy deer beetles should be carried out during flowering. Starting from the phenophase of fruit growth, especially in the "hazel" and "walnut" phases, it is important to control the codling moth.

According to the experts of the Institute of Plant Protection of the National Academy of Agrarian Sciences of Ukraine, among the factors that hinder the realization of the potential productivity of crops in the range of 80-85% and obtaining the maximum possible yield, the share of pests accounts for 33-35%. This, in turn, indicates that even partial prevention of losses by controlling the number of phytophages is an important factor in increasing the productivity of the crop.

In the course of this study, the technical efficiency of insecticides, which include active substances of different mechanisms of action in the control of the apple flower beetle, which was the dominant phytophage in the bud extension phase, the number of which exceeded the threshold level of this phytophage (40 ind./tree) at this stage of apple tree development, was evaluated Counts carried out on the 5th day after treatment showed that the use of insecticides contributed to a decrease in the number of phytophage (Table 1).

Table 1

Technical efficiency of control of phytophages of apple trees (bud extension phase), 2022-2023

Options	Abundance, ind./tree		Technical efficiency, %
	to processing	on the 5th day	
Control	45,3	54,6	-
Decis 100 EC – 0,15 l/ha	47,3	6,2	86,9
Nuredine Супер, EC – 1,25 l/ha	46,8	8,4	82,1
Aktara 25 WG – 0,14 l/ha	48,2	9,6	80,1

The source is formed on the basis of own research results

In particular, the lowest number of apple flower beetle – 6.2 ind./tree, on the 5th day after spraying with insecticides was observed in the variant with Decis 100 EC, which was 8.8 times lower than in the control. The use of Nuredin Super, EC and Aktara 25 WG also contributed to a decrease in the number of apple flower beetles, which on the 5th day after application was 8.4 and 9.6 ind./tree, respectively, which is 6.5-5.7 times less than the number of this phytophage in the control.

The highest technical efficiency in the control of the apple flower beetle was recorded when spraying an apple tree in the budding phase with the pyrethroid Decis 100 EC, which was 86.9%. The use of the combined drug Nuredin Super, EC, which belongs to the class of organophosphate compounds and pyrethroids, provided technical efficiency at the level of 82.1%. And the lowest technical efficiency – 80.1%, among the studied drugs was recorded when using the neonecotinoid Aktara 25 WG. The use of all studied insecticides contributed to a decrease in the number of apple flower beetles below the threshold level.

In the course of counting the number of phytophages in the phase of development of the "pink bud" apple tree, the population of aphids was noted, the number of which according to the variants was 5.9-7.3 colonies per 100 shoots and inflorescences (Table 2). Depending on the drug used, the population of phytophages on the 5th day after spraying decreased to 1.1-2.2 colonies per 100 shoots and inflorescences, the lowest number was recorded when using the drug Napoval, SC, and the highest when using insecticides Knockout Extra, SC and Super Bison, EC and acaricide Sintak, SC.

The population of ticks by variants was 348-384 individuals/100 leaves. Spraying the apple tree contributed to a decrease in the number of ticks, which on the 5th day after spraying decreased to 24-113 individuals/100 leaves, the lowest number was recorded when using the acaricide Sintak, SC, and the highest when using the pyrethroid drug Knockout Extra, SC. In the control, there was an increase in the number of ticks to 472 individuals/100 leaves, which was 1.6 times higher than the level of ETH and could be explained by the increased temperature, which favors the development of ticks.

Table 2

Technical efficiency of apple phytophage control (pink bud), 2022-2023

Options	Number of phytophages						Technical efficiency, %		
	To processing			On the 5th day					
	Aphids, colonies per 100 shoots and inflorescences	Ticks, individuals/100 leaves	Leafhoppers, cat./ 100 flowers. Outlets	Aphids, colonies per 100 shoots and inflorescences	Ticks, individuals/100 leaves	Leafhoppers, cat./ 100 flowers. Outlets	Aphids, colonies per 100 shoots and inflorescences	Ticks, individuals/100 leaves	Leafhoppers, cat./ 100 flowers. Outlets
Control	6,4	378	4,3	8,3	472	5,4	-	-	-
Sintak, SC – 0,2 l/ha	6,2	362	4,5	2,2	24	1,9	64,5	93,4	57,8
Napoval, SC – 0,2 l/ha	6,8	384	4,2	1,1	82	0,8	83,8	78,6	81,0
Knockout Extra, SC – 0,1 l/ha	5,9	348	3,9	1,4	113	1,3	76,3	67,5	66,7
Super Bison, EC – 2,0 l/ha	7,3	368	4,7	1,5	56	1,1	79,5	84,8	76,6

The source is formed on the basis of own research results

Also, in the course of the census, the population of plantations with moths was recorded, the number of which approached the threshold level and amounted to 3.9-4.7 cat./100 flowers. Outlets. On the 5th day after spraying, it decreased to 0.8-1.9 cat./100 flowers. outlets, the lowest number was recorded when using the drug Napoval, SC, and the highest when using the acaricide Sintak, SC.

The use of all the studied preparations made it possible to control apple phytophages and reduce their number below the threshold level. The highest efficiency in the control of leafhoppers was recorded in the variant using the drug Napoval, SC, which on the 5th day was 81.0%. Other drugs provided a slightly lower technical value, which on the 5th day was 66.7-76.6% in the drugs Knockout Extra, SC and Super Bison, CE, respectively.

In tick control, the highest technical efficiency was observed with the use of Sintak, SC and on the 5th day was 93.4%, which was 8.6-25.9% higher than the effectiveness of other studied variants. The efficacy of other preparations was ensured by lower indicators of phytophage population control, which on the 5th day were 67.5-84.8%.

In the control of aphids, the least effective on the 5th day after application was the application of Sintak, SC, the technical efficiency of which in controlling the spread of phytophage was 64.5%, which is 11.8-19.3% lower than that of other preparations, and the highest technical efficiency on the 5th day after application was noted when spraying plantations with Napoval, SC, which was 83.8%, which was 4.3-7.3% higher than the effectiveness of Super Bison EC and Knockout Extra, SC.

When carrying out counts of phytophages in the flowering phase of an apple tree, it was found that during this period the dominant phytophage was the shaggy deer, the imago of which, feeding on flowers, could cause a decrease in the future yield of the crop. The number of adults exceeded the threshold level and amounted to 9.1-9.6 ind./tree. Therefore, in this experiment, the technical efficiency of chemicals that are allowed to be used during flowering and a biological product that is effective in the control of Coleoptera were evaluated. On the 5th day after spraying, it decreased to 1.2-2.3 ind./tree, the lowest number was recorded when using Viares, SC, and the highest when using the biological product Actarophyte K1.8 (Table 3).

Table 3

Technical efficiency of control of the hairy deer (flowering phase), 2022

Options	Abundance, ind./tree		Technical efficiency, %
	To processing	On the 5th day	
Control	9,6	12,7	-
Viares, SC – 0,1 l/ha	9,2	1,2	87,0
Calypso 480 SC – 0,25 l/ha	9,1	1,4	84,6
Aktarophyte K1,8 – 2,0 l/ha	9,4	2,3	75,5

The source is formed on the basis of own research results

In the control of deer hairy with the use of chemical insecticides, the highest technical efficiency on the 5th day after application was noted when spraying plantations with Viares, SC, which was 87.0%, which is 2.4% higher than the effectiveness of the insecticide Calypso 480 SC. Spraying of plantations with the biological product Actarophyte K 1.8 made it possible to reduce the number of phytophages by 75.5%.

When monitoring the phytosanitary state of apple cenosis in the phase of fruit ripening "walnut", it was found that the dominant phytophages were aphids, mites and adults of the codling moth (Table 4).

The number of aphids according to the variants was 16.4-17.2 colonies per 100 leaves. Depending on the drug used, the population of phytophages on the 5th day after spraying decreased to 2.2-4.3 colonies, the lowest number was recorded when using Silker, CE, and the highest when using insecticides Ampligo 150 ZC and Knockout Extra, SC.

The population of ticks by variants was 176-190 individuals/100 leaves. Spraying of apple trees contributed to a decrease in the number of mites, which on the 5th day after spraying decreased to 24-64 individuals/100 leaves, the lowest number was recorded when using Ampligo 150 ZC. In the control, an increase in the number of ticks to 248 individuals/100 leaves was observed.

In the control of the codling moth with the use of chemical insecticides, the highest technical efficiency on the 5th day after application was observed when spraying plantations with Ampligo 150 ZC, which was 86.2%, which is 11.2-13.5% higher than the technical efficiency of insecticides Knockout Extra, SC and Silker, CE.

Table 4

Technical efficiency of control of phytophages of apple (walnut), 2023

Options	Number						Technical efficiency, %		
	To processing			On the 5th day					
	Aphids, colonies per 100 leaves	Ticks, individuals/100 leaves	Codling moth (2 generations), specimen/trap	Aphids, colonies per 100 leaves	Ticks, individuals/100 leaves	Codling moth (2 generations), specimen/trap	Aphids	Ticks	Codling moth (2 generations)
Control	16,4	186	5,4	20,3	248	6,8	-	-	-
Ampligo 150 ZC – 0,3 l/ha	17,2	190	5,8	3,8	24	0,8	77,9	87,4	86,2
Knockout Extra, SC – 0,1 l/ha	16,8	176	5,2	4,3	64	1,3	74,4	63,6	75,0
Silker, CE – 750 ml/ha	16,5	183	5,5	2,2	32	1,5	86,7	82,5	72,7

The source is formed on the basis of own research results

After analyzing the economic efficiency of insecticides in the control of phytophages, it was found that spraying allowed to obtain a higher yield of apple trees, which was 12.8 t/ha in the control. Also, the use of protective equipment made it possible to obtain a crop of higher quality, in particular I and II grades, in the control these indicators were 20.8 and 42.6%, respectively (Table 5).

The application of insecticides in the budding phase contributed to a decrease in the number of apple flower beetles and subsequently a higher yield, which in the variant with Decis 100 EC was 15.4 t/ha, which is 2.6 t/ha higher than the yield in the control control and by 0.8-1.7 t/ha, respectively, with the use of Nuredin Super, EC and Aktara 25 WG. Also, spraying plantations with insecticides helped to improve the quality indicators of the harvested crop. Thus, the yield of products of the first grade when using the pyrethroid preparation Decis 100 EC was 34.5%, which was 13.7% higher than the control variant and 1.7-4.3% higher than the corresponding indicator when spraying the garden with Nuredin Super, EC and Aktara 25 WG. It

Table 5

Economic efficiency of insecticides in the control of apple phytophages and calculation of the cost of apple production per 1 ha, thousand UAH, 2023

Indicators	Variant													
	Control	Decis 100 EC,– 0,15 l/ha	Nuredin Super, EC – 1,25 l/h	Aktara 25 WG – 0,14 l/ha	Sintak, SC – 0,2 l/ha	Napoval, SC – 0,2 l/ha	Knockout Ekstra, SC – 0,1 l/ha	Super Bizon, SC – 2,0 l/ha	Viares, SC – 0,1 l/ha	Kalipso 480 SC – 0,25 l/ha	Aktarofit K1,8 – 2,0 l/ha	Ampligo 150 ZC – 0,3 l/ha	Knockout Ekstra, SC – 0,1 l/ha	Silker, CE.– 750 ml/ha
Yield, t/ha	12,8	15,4	14,6	13,7	14,3	16,4	15,1	15,6	17,4	16,2	14,3	18,2	16,6	14,7
incl. I grade, %	20,8	34,5	32,8	30,2	32,4	36,6	34,5	32,3	43,6	40,7	36,3	48,3	44,8	45,6
II genre, %	42,6	52,6	50,3	51,3	46,3	45,2	44,7	47,5	43,2	42,2	42,9	36,3	36,9	36,7
non-standard,%	36,6	12,9	16,9	18,5	21,3	18,2	20,8	20,2	13,2	17,1	20,8	15,4	18,3	17,7
incl. I grade, t/ha	2,66	5,31	4,79	4,14	4,63	6,00	5,21	5,04	7,59	6,59	5,19	8,79	7,44	6,70
II Variety, t/ha	5,46	8,10	7,34	7,03	6,62	7,41	6,75	7,41	7,52	6,84	6,13	6,61	6,13	5,39
non-standard, t/ha	4,68	1,99	2,47	2,53	3,05	2,98	3,14	3,15	2,30	2,77	2,97	2,80	3,04	2,60
Price for 1 t. I grade, UAH.	6000													
Price for 1 t. II grade, UAH.	4500													
Price for 1 ton non-standard, UAH	1000													
I variety, thousand tons. UAH.	15,9	31,8	28,7	24,8	27,7	36,0	31,2	30,2	45,5	39,5	31,1	52,7	44,6	40,2
II Variety, thousand tons UAH.	24,5	36,4	33,0	31,6	29,7	33,3	30,3	33,3	33,8	30,7	27,6	29,7	27,5	24,2
non-standard thousands, UAH.	4,6	1,9	2,4	2,5	3,0	2,9	3,1	3,1	2,2	2,7	2,9	2,8	3,0	2,6
Total, thous. UAH.	45,2	70,3	64,2	58,9	60,6	72,3	64,7	66,7	81,6	73,1	61,0	85,0	75,2	67,1
Additional products, thousand tons UAH	-	25,1	19,0	13,7	15,4	27,1	19,5	21,5	36,4	27,8	16,5	40,0	30,0	21,9

The source is formed on the basis of own research results

was also noted that the use of insecticides in the budding phase contributed to a decrease in the number of non-standard fruits, which was 12.9-18.5% when using protective equipment, which was 23.7-18.1% higher than the corresponding indicator of the control version, where the application of protection products was not carried out. A similar pattern was observed when spraying apple plantations with insecticides in other phenophases.

In particular, the application of insecticides in the development phase of the "pink bud" apple tree made it possible to control the number of aphids, mites and moths and made it possible to obtain a higher yield, which in the variant with the combined preparation Napoval, SC was 16.4 t/ha, which is 3.6 t/ha higher than the yield in the control control and by 0.8-2.1 t/ha, respectively, with the use of Sintak, SC, Knockout Extra, SC and Sintak, SC. Also, spraying plantations with preparations led to a higher harvest of products of the first grade. In particular, the harvest of apples of the first grade when using Napoval, SC was 36.6%, which was 1.8 times higher than this indicator in the control and by 2.1-4.3% when spraying the orchard with other preparations.

Similarly, it was noted that the control of dominant phytophages in the "pink bud" phase reduces the percentage of non-standard fruits, the number of which was recorded at the level of 18.2-21.3% when using plant protection products, which was 1.7-2% higher than the corresponding indicator of the control variant, where the application of protection agents was not carried out.

During the flowering phase, it was important to control the development of the shaggy deer, which, feeding on the flower, influenced the future harvest. The application of insecticides permitted by the regulations contributed to a decrease in the number of phytophages, which in turn had a positive effect on the yield, which was the highest in the variant with Viares, SC and amounted to 17.4 t/ha, which is 4.6 t/ha higher than the yield in the control control and by 1.4 t/ha the yield of the variant using the neonecotinoid Calypso 480 SC. A higher yield of 1.5 t/ha, compared to the control, was also observed when using the biological preparation Actarofit K1.8. Also, spraying plantations with insecticides contributed to the improvement of the quality indicators of the harvested crop, in particular, the collection of products of the first grade in the version of Viares, SC. was 43.6%, which is 22.8% higher than the control variant and 2.9-7.3% higher than the corresponding indicator when spraying the garden with Calypso 480 SC and Actarofit K1.8. It was also noted that the use of insecticides in the flowering phase contributed to a decrease in the number of non-standard fruits, which was 13.2-20.8% when using protective equipment, which was 1.8-2.8 times higher than the corresponding indicator of the control version, where the application of protection products was not carried out.

Spraying with insecticides in the development phase of the walnut apple tree made it possible to control the number of a dangerous phytophage – the apple codling moth, the caterpillars of which cause significant damage and allowed to obtain a higher yield, which in the variant with the combined preparation Ampligo 150 ZC was 18.2 t/ha, which is 5.7 t/ha higher than the harvest in the control control and by 1.6-3.5 t/ha, respectively, with the use of Knockout Extra, SC & Silker, CE.

Also, spraying plantations with preparations led to a higher harvest of products of the first grade. In particular, 48.3% of apples of the first grade were harvested when using Ampligo 150 ZC, which was 2.3 times higher than this indicator in the control and by 2.7-3.5% when spraying the orchard with other preparations. Similarly, it was noted that the control of phytophages such as the codling moth, aphids and mites in the "Greek sin" phase reduces the percentage of non-standard fruits, the number of which was recorded at the level of 15.4-18.3% when applying plant protection products, which is 2-2.4% higher than the corresponding indicator of the control variant, where the application of protection products was not carried out.

According to the results of the assessment of economic efficiency, the use of insecticides in critical phases of apple development allows you to get a higher yield and collect a larger number of fruits of the first grade and, accordingly, reduces the number of non-standard products. The use of protective equipment in the cultivation of apple trees makes it possible not only to significantly increase the yield, improve its quality, but also to reduce labor costs and production costs of these products. The different cost of production was also taken into account, depending on the quality indicators of the crop. It was found that spraying plantations with insecticides helped to reduce damage to apple trees and allowed to obtain a higher quality crop, which was reflected in the cost of grown products (Table 6).

Table 6

Economic efficiency of insecticides in the control of dominant apple phytophages per 1 ha, 2023

Indicators	Variant													
	Control	Decis 100 EC– 0,15 l/ha	Nuredin Super,EC – 1,25 l/ha	Aktara 25 WG – 0,14 l/ha	Sintak, SC – 0,2 l/ha	Napoval, SC – 0,2 l/ha	Knockout Ekstra, SC – 0,1 l/ha	Super bizon, EC – 2,0 l/ha	Viares, SC – 0,1 l/ha	Kalipso 480 SC – 0,25 l/ha	Aktarofit K1,8 – 2,0 l/ha	Ampligo 150 ZC – 0,3 l/ha	Knockout Ekstra, SC – 0,1 l/ha	Silker, CE.– 750 ml/ha
Yield, t/ha	12,8	15,4	14,6	13,7	14,3	16,4	15,1	15,6	17,4	16,2	14,3	18,2	16,6	14,7
Cost of production, thousand tons UAH.	45,2	70,3	64,2	58,9	60,6	72,3	64,7	66,7	81,	73,09	61,	85,	75,	67,
Production costs, thous. UAH.	31,	33,1	33,	33,	33,5	33,1	34,2	36,1	34,4	35,4	37,7	36,6	37,1	36,5
incl. additional	–	1,2	1,8	1,3	1,6	1,2	1,0	2,3	1,1	1,9	4,5	2,4	1,0	2,1
of them in defense	–	0,2	0,85	0,39	0,63	0,27	0,06	0,13	0,1	0,9	3,5	1,4	0,06	1,1
Cost of 1 ton, thousand tons UAH.	2,5	2,1	2,3	2,4	2,3	2,1	2,2	2,3	1,9	2,1	2,6	2,1	2,2	2,4
Conditional net profit, thous. UAH.	13,2	37,1	30,4	25,6	27,0	39,1	30,5	30,6	47,1	37,6	23,9	48,6	38,0	30,5
Profitability level, %	42	112	90	77	80	118	89	85	137	106	63	132	102	83,0

The source is formed on the basis of own research results

In particular, the cost of grown products from plantations that were not treated with plant protection products amounted to 45197 UAH, which is 1.6-1.9 times lower than the cost of products obtained from the variants that involved the use of insecticides, on which the highest technical efficiency and yield were recorded according to experiments: Decis 100 EC, Napoval, SC, Viares, SC and Ampligo 150 ZC, and the cost of additional products was 25120, 27160, 36444 and 40079 UAH. Under.

Conclusions and prospects for further research. According to the results of the research, the species composition was clarified and the features of the development of dominant phytophages of the apple orchard in the conditions of the experimental field of VNAU were investigated. Optimal tank mixtures and technological combinations of insecticides have been determined, which provide a high level of technical efficiency of the dominant pests of apple trees.

1. According to the results of research, during 2022, the following phytophages caused the greatest damage to the apple agrocenosis of VNAU: apple codling moth (34%), aphids (22%), moths (16%), mites (11%), flower beetle (10%), shaggy deer (7%).

2. The highest technical efficiency in the control of the apple flower beetle was recorded when spraying an apple tree in the budding phase with the pyrethroid Decis 100 EC, which was 86.9%.

3. When treated in the "pink bud" phase, the highest efficiency in the control of leafhoppers was recorded in the variant using the drug Napoval, SC, which was 81.0% on the 5th day, in the control of mites, the highest technical efficiency was observed when using the drug Sintak, SC and on the 5th day was 93.4%, and in the control of aphids, the highest technical efficiency on the 5th day after application was noted when spraying plantations with Napoval, SC, which was 83.8%.

4. In the control of shaggy deer with the use of chemical insecticides, the highest technical efficiency on the 5th day after application was noted when spraying plantations with Viares, SC, which was 87.0%. Spraying of plantations with the biological product Actarophyte K1.8 made it possible to reduce the number of phytophages by 75.5%.

5. In the control of the codling moth when treated in the "walnut" phase, the highest technical efficiency on the 5th day after application was observed when spraying plantations with Ampligo 150 ZC, which was 86.2%.

6. The use of insecticides in the control of phytophages made it possible to obtain a higher yield of apple trees, which was 12.8 t/ha in the control, and to obtain a yield of higher quality, in particular of I and II varieties, in the control these indicators were 20.8 and 42.6%, respectively.

7. The cost of grown products from plantations that were not treated with plant protection products was 45197 UAH, which is 1.6-1.9 times lower than the cost of products obtained from the options that involved the use of insecticides, which recorded the highest technical efficiency and yield according to experiments: Decis

100 EC, Napoval, SC, Viares, SC and Ampligo 150 ZC, and the cost of additional products was 25120, 27160, 36444 and 40079 UAH.

Список використаної літератури

1. Борзих О.І. Шкідлива ентомофауна яблуні. *Карантин і захист рослин.* 2012. № 11. С. 12-13.

2. Буткалюк Т. О., Пінчук Н. В., Вергелес П. М. Контроль чисельності та шкодочинності основних шкідників і хвороб яблуневого саду. *Сільське господарство та лісівництво*. 2017. № 6. Т. 2. С. 159-168.

3. Власова О.Г. Кліщі – небезпечні шкідники плодових культур. *Карантин і захист рослин*. 2012. № 5. С. 27-28.

4. Вергелес П.М. Особливості розвитку та шкідливості розанної листовійки в Центральному Лісостепу України. *Збірник наукових праць ВНАУ. Серія: Сільськогосподарські науки*. 2011. № 7 (47). С. 67-71

5. Гродський В.А., Неверовська Т.М. Моніторинг садових листокруток у яблуневих садах Степової зони України. *Захист і карантин рослин*. 2012. Вип. 50. С 308-312.

6. Гродський В.А. Захист садів від плодожерок та мінуючих молей. *Карантин і захист рослин*. 2010. № 7. С. 18–19.

7. Гунчак М.В. Захист яблуні від шкідливих організмів. Чернівці: Місто, 2019. 36 с.

8. Захист яблуні від шкідливих комах, кліщів та хвороб (Південний і Південно-Східний Степ). Рекомендації / О.І. Борзих та ін. К.: «Колобіг», 2014. 44 с.

9. Забродіна І.В. Ефективність обприскування яблуневих насаджень у фенофазі висування бутонів проти садових довгоносиків. *Вісник Харківського національного аграрного університету ім. В.В. Докучаєва. Серія: Рослинництво, селекція і насінництво, плодоовочівництво.* 2010. № 1. С. 48–51.

10. Гунчак М.В. Економічна ефективність різних систем захисту яблуні (Malus domestica Borkh.) у Придністров'ї. *Садівництво*. 2018. Вип. 73. С. 74-81.

11. Гунчак М.В. Фітосанітарний моніторинг яблуневих насаджень в Південно-Західному Лісостепу. *Збірник наукових праць Національного наукового центру «Інститут землеробства НААН»*. 2017. Вип. 2. С. 115-125.

12. Методики випробування і застосування пестицидів; за ред. С.О. Трибеля. Київ: Світ, 2001. 448 с

13. Омелюта В.П. Облік шкідників і хвороб сільськогосподарських культур. К: Урожай, 1986. 296 с.

14. Перелік пестицидів і агрохімікатів, дозволених до використання в Україні. Офіційне видання. К.: Юнівест Медіа, 2022. 1008 с.

Список використаної літератури у транслітерації / References

1. Borzykh O.I. (2012). Shkidlyva entomofauna yabluni [*Harmful entomofauna of apple trees*]. *Karantyn i zakhyst roslyn− Quarantine and plant protection*. № 11. 12−13. [in Ukrainian].

2. Butkaliuk T.O., Pinchuk N.V., Verheles P.M. (2017). Kontrol chyselnosti ta shkodochynnosti osnovnykh shkidnykiv i khvorob yablunevoho sadu [*Control of the number and harmfulness of the main pests and diseases of the apple orchard*]. *Silske hospodarstvo ta lisivnytstvo − Agriculture and forestry*. № 6. Vol. 2. 159−168. [in Ukrainian].

3. Vlasova O.H. (2011). Klishchi – nebezpechni shkidnyky plodovykh kulʹtur [*Ticks are dangerous pests of fruit crops*]. "*Karantyn i zakhyst Roslyn − Quarantine and plant protection*. № 7 (47). 67−71. [in Ukrainian].

4. Verheles P.M. (2011). Osoblyvosti rozvytku ta shkidlyvosti rozannoyi lystoviyky v Tsentralʹnomu Lisostepu Ukrayiny [*Peculiarities of the development and harmfulness of the rose-leaved leafwort in the Central Forest-Steppe of Ukraine*]. *Silske hospodarstvo ta lisivnytstvo − Agriculture and forestry*. № 7 (47). 67−71. [in Ukrainian].

5. Hrodsʹkyy V.A., Neverovsʺka T.M. (2012). Monitorynh sadovykh lystokrutok u yablunevykh sadakh Stepovoyi zony Ukrayiny. [*Monitoring of garden leafhoppers in apple orchards of the Steppe zone of Ukraine*]. *Zakhyst i karantyn roslyn − Protection and quarantine of plants*. Issue. 50. 308-312. [in Ukrainian].

6. Hrodsʹkyy V.A. (2010). Zakhyst sadiv vid plodozherok ta minuyuchykh moley [*Protection of gardens from fruit eaters and changing moths*]. *Karantyn i zakhyst roslyn−Quarantine and plant protection*. № 7. 18−19. [in Ukrainian].

7. Hunchak M.V. (2019). Zakhyst yabluni vid shkidlyvykh orhanizmiv. [*Protection of apple trees from harmful organisms*]. Chernivtsi: Misto [in Ukrainian].

8. Borzykh O.I. (2014). Zakhyst yabluni vid shkidlyvykh komakh, klishchiv ta khvorob (Pivdennyy i Pivdenno-Skhidnyy Step). [*Protection of apple trees from harmful insects, mites and diseases (Southern and Southeastern Steppe)*]. K.: Kolobig. [in Ukrainian].

9. Zabrodina I.V. (2010). Efektyvnistʹ obpryskuvannya yablunevykh nasadzhenʹ u fenofazi vysuvannya butoniv proty sadovykh dovhonosykiv. [*Effectiveness of spraying apple plantations in the budding phenophase against garden weevils*]. *Visnyk Kharkivskoho natsionalnoho ahrarnoho universytetu im. V.V. Dokuchaieva. Seriia: Roslynnytstvo, selektsiia i nasinnytstvo, plodoovochivnytstvo−Bulletin of Kharkiv National Agrarian University named after V.V. Dokuchaeva Series: Crop production, selection and seed production, fruit and vegetable production*. № 1. 48−51. [in Ukrainian].

10. Hunchak M.V. (2018). Ekonomichna efektyvnistʹ riznykh system zakhystu yabluni (Malus domestica Borkh.) u Prydnistrovʺyi [*Economic efficiency of different protection systems for apple trees (Malus domestica Borkh.) in Transnistria*]. *Sadivnytstvo− Gardening*. Issue. 73. 74−81. [in Ukrainian].

11. Hunchak M.V. (2017). Fitosanitarnyy monitorynh yablunevykh nasadzhenʹ v Pivdenno-Zakhidnomu Lisostepu [*Phytosanitary monitoring of apple plantations in the South-Western Forest Steppe*]. *Zbirnyk naukovykh prats Natsionalnoho naukovoho tsentru «Instytut zemlerobstva NAAN»− Collection of scientific works of*

the National Scientific Center "Institute of Agriculture of the National Academy of Sciences" Issue 2. 115−125. [in Ukrainian].

12. Trybel S.O. 2001. Metodyky vyprobuvannia i zastosuvannia pestytsydiv. [*Test methods and application of pesticides*]. Kyiv: Svit [in Ukrainian].

13. Omelyuta V.P. (1986). Oblik shkidnykiv i khvorob silʹsʹkohospodarsʹkykh kulʹtur. [*Registration of pests and diseases of agricultural crops*]. K.: Urozhay. [in Ukrainian].

14. Perelik pestytsydiv i ahrokhimikativ, dozvolenykh do vykorystannya v Ukrayini (2022). Ofitsiyne vydannya. [*List of pesticides and agrochemicals approved for use in Ukraine. Official publication*]. K. : Yunivest Media. [in Ukrainian].

АНОТАЦІЯ
ЕФЕКТИВНІСТЬ КОНТРОЛЮ ШКІДНИКІВ ЯБЛУНІ В УМОВА ЛІСОСТЕПУ ПРАВОБЕРЕЖНОГО

У даній статті наведено результати досліджень з уточнення особливостей розвитку домінуючих фітофагів яблуні та дослідження ефективності захисних заходів. Встановлено, що найбільшої шкоди завдавали такі фітофаги: яблунева плодожерка (34%), попелиці (22%), листовійки (16%), кліщі (11%), квіткоїд (10%), оленка волохата (7%).

Найвищу технічну ефективність в контролі яблуневого квіткоїда зафіксовано при обприскуванні яблуні у фазу бутонізації піретроїдом Децис 100 ЕС, к.е., яка становила 86,9%. При обробці у фазу «рожевий бутон» найвища ефективність в контролі листовійок зафіксовано у варіанті з використанням препарату Наповал, КС, яка на 5-й день становила 81,0%, в контролі кліщів найвища технічна ефективність спостерігалась при використанні препарату Сінтак, КС і на 5-й день становила 93,4%, а в контролі попелиць найвищу технічну ефективність на 5-й день після внесення відмічали при обприскуванні насаджень препаратом Наповал, КС, яка складала 83,8%. В контролі оленки волохатої при застосуванні хімічних інсектицидів найвищу технічну ефективність на 5-й день після внесення відмічали при обприскуванні насаджень препаратом Віарес, КС, яка складала 87,0% що на 2,4% перевищило ефективність інсектициду Каліпсо 480 SC, КС. Обприскування насаджень біопрепаратом Актарофіт К1,8 дозволило знизити чисельність фітофага на 75,5%. В контролі яблуневої плодожерки при обробці у фазу «грецький горіх» найвищу технічну ефективність на 5-й день після внесення відмічали при обприскуванні насаджень препаратом Ампліго 150 ZC, ФК, яка складала 86,2% що на 11,2-13,5% перевищило технічну ефективність інсектицидів Нокаут Екстра, КС та Сілкер, к.е.

Застосування інсектицидів в контролі фітофагів дозволило отримати вищу урожайність яблуні, яка на контролі становила 12,8 т/га та отримати урожай вищої якості, зокрема I і II сорту, на контролі дані показники становили 20,8 та 42,6% відповідно.

Підтверджена економічна доцільність застосування засобів захисту. Вартість вирощеної продукції з насаджень, які не оброблялися засобами захисту становила 45197 грн., що в 1,6-1,9 рази нижче вартості продукції, отриманої з варіантів, що передбачали використання інсектицидів, на яких зафіксовано найвищу технічну ефективність та урожайність по дослідах: Децис 100 ЕС, к.е., Наповал, КС, Віарес, КС та Ампліго 150 ZC, ФК, а вартість додаткової продукції становила 25120, 27160, 36444 та 40079 грн. відповідно.

Ключові слова: *яблуня, фітофаги, інсектицид, урожайність, економічна ефективність.*

Table 5. Lit. 14.

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