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INVESTIGATION OF THE IMPACT OF THE PROTECTION SYSTEM ON THE LIMSTED OF SUGAR BEET PESTS ON THE RIGHT BANK FOREST STEPP

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The article highlights the theoretical generalization and a new solution to the problem, which is to develop and substantiate elements of the system of protection of sugar beet from pests and control of their numbers in Vinnytsia region, which is based on number when using insecticides for seed treatment and spraying crops with chemical and biological drugs. The species composition of the harmful entomofauna of sugar beet has been specified and 14 species of pests have been identified, including 9 dominant species. It was determined that phytophagous plants of the Coleoptera series dominate in the taxonomic structure of the harmful entomocomplex in sugar beet crops (Agriotes obscurus L.*, Agriotes lineatus* L.*, Melolontha melolontha* L. *– 34.3%, Homoptera (Aphis fabae* Scop.*, 17%) (Scotia segetum* Schiff.*, Heliothis viriplaca* Hfn.*) – 16,3% and Diptera (Pegomyia betae* Curt.*) – 6,3%, among which there are both polyphagous and specialized species, from the class Diplopoda – 22,5%.*

The effectiveness of modern insecticides against the dominant pests of sugar beet is evaluated and the methods of their application are optimized. It was found that the Cruiser 350 FS provided the greatest technical efficiency in the treatment of sugar beet seeds against Aphis fabae Scop. *– 95,4%. The technical efficiency of other disinfectants was in the range of 76,9–84,6%. Treatment of sugar beet seeds against seed pests with insecticide Poncho 600 FS, TH reduced the number of phytophages by 86,5%, Cruiser 350 FS, t.k.s. – 78.0%, Gaucho 70 WS, pp – 75,4%, Emesto Quantum 273,5 FS, TH – 63,2%. Treatment of sugar beet seeds with insecticidal pesticides Gaucho 70 WS, z.p. (60.0 kg/t), Emesto Quantum 273.5 FS, TH (0.3 l/t), Poncho 600 FS, TH (3.0 l/t) and Cruiser 350 FS, t.k.s. (15.0 l/t) ensured the preservation of the yield of 8,3–12,6 t/ha.*

***Key words**: sugar beet, sugar beet pests, chemical and biological preparations, efficiency, harvest.*

Table 10. Fig 1. Lit. 18.

Introduction. Sugar beet is one of the highly productive cultivated plants from which sugar and raw materials for industrial production are obtained. An important condition for the realization of potential productivity of a variety or hybrid is the use of high quality seeds, and the obstacle to increase its production and improve quality is the damage of sugar beets by pests.

At the same time, the protection of crops from them is one of the main reserves for increasing yields, marketable quality of root crops and an integral part of the technology of growing crops. Therefore, at present it is quite important to study the biology and harmfulness of the dominant species of sugar beet phytophagous and justify methods of regulating their numbers [2].

The development of ecologically safe methods of sugar beet protection to limit the number and harmfulness of phytophagous, increase the efficiency of natural factors, which will reduce the pesticide load on the agrocenosis, preserve its natural diversity and obtain environmentally friendly products.

The most important task in all civilized countries is to provide their citizens with food, the use of which in the physiologically necessary norms and range contributes to the normal functioning of the body and its efficiency. Of the diverse range of foods included in the consumer basket, of particular importance are roots, the products of which are processed and their direct consumption occupy a significant place in the diet of people and in many processing industries. These include sugar beets [13].

Sugar beet is an important technical crop, as it is the only raw material in our country for the production of sugar – a product that is essential for maintaining the vital functions of the human body. A person needs 80–100 g of sugar per day or 29–37 kg per year.

Quite valuable are the by-products of sugar beets: buckthorn, silage, pulp, which occupy a significant share in the feed balance of livestock. Thus, according to the yield of sugar beet roots 50 t/ha, an additional 2,8 t/ha of pulp, 1,8 t/ha of molasses and 36 t/ha of silage from the bud are obtained, which can be equated to the yield of winter wheat 8,3 t/ha. Ha. Thus, sugar beets are not only a valuable technical but also a forage crop, unique and unique in its purpose. It is used by humans and animals, and root crop processing is actually a completely waste-free production [1, 2].

Soil and climatic conditions of the beet belt of Ukraine (Forest-Steppe zone, where about 78,5% of the area, partly Polissya (15,5%) and Steppe (6,0%) meet the biological characteristics of beets, so for centuries Ukraine has been a leader among beet sowing countries in terms of sugar production and sugar production.

Changes in the forms of management in Ukraine and the deterioration of the economic condition of beet farms have had a negative impact on the beet industry: the yield of root crops and sugar beet seeds has decreased. The area of cultivation of both factory crops and sugar beet plantations has decreased, a number of farms have significantly deteriorated agricultural cultivation techniques – rational crop rotations, tillage system, fertilization and pest control systems are not observed.

Despite the current state of the industry, there is no reason to change their attitude to sugar beets, not to see them as a priority, the need for revival in new market conditions [2].

Analysis of recent research and publications. Sugar beet damages a large number of pests belonging to different classes, orders and families, which during the growing season they cause various types of damage to plants: eat sown seeds and sprouts, damage seedlings and aboveground part of vegetative plants, roots.

Soil pests that damage sown seeds, sprouts, underground stems, roots and root crops include: *Atomaria linearis* Steph., larvae of Elateridae, Scarabaeidae, *Asproparthenis* (*Bothynoderes*) *punctiventris* Germ., caterpillars gnawing scoops *Pemphigus fuscicornis* Koch [4].

Seedlings damage the *Tanymecus palliatus* F., *Chaetocnema concinna* Marsh, *Cassida nebulosa* L., *Opatrum sabulosum* L., which leads to the death of crops, as well as significant losses and reduced crop quality.

The group that damages the aboveground part of vegetative plants includes: larvae and beetles of beetles Silphidae, *Cassida nebulosa* L., beet leaf (bean) aphids (*Ahpis fabae* Scop.), larvae of the beet fly (*Pegomyia betae* Curt.), caterpillars of the meadow butterfly (*Margaritia sticticalis* L.), *Scrobipalpa ocellatella* Boyd., leaf-eating moths, etc. [5, 8].

One of the most dangerous ground insects that significantly damage sugar beets at the beginning of their growing season are click beetles, namely their larvae – wireworms (family Elateridae, a number of hard-winged or beetles – Coleoptera), which damage the underground parts of plants. According to many researchers, there are 171 species of the blacksmith family in Ukraine, of which 60 species are common in Polissya, 82 in the forest-steppe zone, 51 in the steppe zone, 129 in the Carpathians and Transcarpathia, and 50 species in the mountainous Crimea [13].

The most common species of click beetles in the Polissya zone of Ukraine are striped (*Agriotes lineatus* L.), shiny (*Selatosomus aeneus* L.) and dark (*Agriotes obscurus* L.) [12].

Beetles and larvae overwinter in the soil. Beetles do not cause significant harm; they come to the surface of the soil in April-May. After mating, females lay eggs in groups of 3–5 pieces in the ground to a depth of 3–5 cm (150–200 eggs). After 20–30 days, larvae (wireworms) are reborn.

The development of larvae lasts 3–5 years. During their development, they molt 9–11 times and before each molt they adsorb 14–30% of water from body weight [12, 17].

Starting from the second year of life, the larvae can cause significant damage to cultivated plants: they damage seedlings, the underground part of the stem of young plants, bite into the tillering node, gnaw off roots and eat out germinating seeds. In the non-chernozem zone, soils are considered to be poorly populated, in which there are up to 5 larvae per m2, medium – 6–15, strongly – more than 15 larvae per m^2. Having finished feeding, the larvae turn into a pupa in the soil, and after 2–3 weeks, young beetles appear, which remain there for the winter [17].

Common beet weevil (*Asproparthenis* (*Bothynoderes*) *punctiventris* Germ.). On the territory of Ukraine, it was discovered in the 40s of the 19th century as the most widespread and harmful species on sugar beet crops; in recent decades, it has been studied very carefully by many researchers [15].

The pest is common in the forest-steppe and steppe zones of Europe, Kazakhstan, Altai erritory, Crimea, as well as Romania, Hungary, Yugoslavia, Bulgaria, Austria, Poland, Germany, Turkey, China, the Balkans etc. In Ukraine, it is distributed in the central, southwestern and eastern regions.

Beetles hibernate mainly in last year's beet fields in the soil at a depth of 15–45 cm, but after a cold and rainy summer and with the early onset of cold weather, larvae and pupae partially hibernate. In some years, a significant part (up to 15%) ranges and leaves the soil after 2–3 years.

Harm is caused by beetles and larvae. Beetles eat cotyledons, gnaw through sprouts, gnaw leaves. Especially dangerous during the development of seedlings before the formation of 2–4 pairs of leaves. When seedlings emerge, one beetle can destroy 10–15 plants per day; during its life, it eats 9–12,5 g of the green mass of leaves (100 times its own mass) [6].

Trybel′ S.O. notes that even with the implementation of protective measures at an average level, the shortage of sugar beet crops can be 30% or more [13].

The *Tanymecus palliatus* F. belongs to the subfamily Tanymacinae, belongs to the group of short-proboscis weevils (*Curculionidae adelognathi*). Described by Fabricius. Distributed throughout Europe. [13].

In Ukraine, the *Tanymecus palliatus* F has been known since the end of the 19th century. It is distributed everywhere, however, it enters the zone of increased harmfulness in the central and eastern Forest-steppes. The long-term population dynamics of the gray long-beaked boll was studied by V.P. Fedorenko, V.T. Sabluk [7, 17].

Overwinter in the soil, at a depth of 15–20 cm, sexually mature beetles and larvae of different ages of two adjacent generations.

V.P. Fedorenko notes that one beetle is able to eat 24 mg of puff mass per day. Moreover, it was noted that life expectancy when eating exclusively sugar beets is the smallest and is 64 days. According to the data, if the beetle eats leaves without damaging the growing point, then sugar beet plants survive [18].

Females lay their eggs in groups in the surface layer of the soil. The reborn larvae are very mobile, penetrate the roots and gnaw out shallow holes in them. The generation is two years old, however, a small part of the larvae do not have time to complete their development and overwinter a second time, completing the biological cycle in three years.

In 2018, 16–100% of sugar beet areas were populated by it, 3–8%, maximum 10–32% of plants were damaged in a weak and medium degree. The phytophage posed the greatest threat to seedlings in Kyiv, Vinnitsa, Khmelnytsky, Chernivtsi and Kharkiv regions, with a maximum abundance of 1–2 ekz./m^2.

Since the end of the 19th century, beet fleas belonging to the family of leaf beetles (Chrysomelidae) have been known as pests of sugar beet seedlings from hardwings. Out of 350 species of flea beetles of our fauna, the following are registered on sugar beet: *Chaetocnema concinna* Marsh., *Chaetocnema breiuscula* Fld., *Chaetocnema tibialis* [1, 18].

According to the researchers, the harmfulness of the *Chaetocnema concinna* Fall., to a large extent on weather conditions and the condition of plants. Warm spring causes early awakening and high activity of beetles.

Sexually mature beetles overwinter in plant litter in forest belts, gardens, on roadsides, and in fields of perennial grasses. In cold and rainy seasons, as well as in the north and west of Ukraine, up to 50% of beetles hibernate in the soil at a depth of 20–30 cm [13].

Mass settlement of sugar beet crops occurs in the phase of the fork or the first pair of true leaves. Egg laying begins in late May – early June. After 10–14 days, the larvae are reborn, which penetrate the roots and feed for 26–40 days. Larvae burrow in earthen cradles in the soil at a depth of 10–20 cm. One generation develops per year.

Overwintered beetles are harmful from the moment of germination to the phase of 2–3 pairs of true leaves. They gnaw out from above on the leaves of the ulcer, leaving the lower epidermis intact [14].

In the Polissya zone of Ukraine, among the Scarabaeidae family, larvae of the *Melolontha melolontha* L. cause significant damage to beet plants. It is distributed in all beet-growing zones of Ukraine [4, 12].

The larvae and beetles overwinter in the soil. The mass emergence of beetles is observed at a soil temperature of +9…+14 °C at a depth of 10 cm. Fertility is 60–70 eggs.

After 25–30 days, the larvae regenerate and feed on small roots and humus until autumn. In September, the larvae go deep into the soil for 1 m and deeper. This is due to the low cold resistance of larvae. Pupae develop 30–40 days. Newly formed beetles remain in the earthen cradle until spring. The larvae of the May beetle develop within 3–4 years, the full development of the pest is completed in Polissya and the western Forest-Steppe in 5 years [7].

The larvae gnaw small roots and main roots, and in the root gnaw holes of various shapes. Such damage leads to wilting and death of well-developed roots.

Among the Homoptera series, one of the dangerous pests of sugar beet, common in all beet-growing zones, is the leaf beet (bean) aphid (*Ahpis fabae* Scop.), a representative of the Aphididae family. The pest belongs to the group of aphids migrating from woody (primary) host plants to herbaceous vegetation [3]. In recent years, according to the forecast of the MDCSU, beet aphids annually populate sugar beets throughout Ukraine. It is most common in the forest-steppe and Polissya zones, especially in Vinnitsa, Ivano-Frankivsk, Kyiv, Khmelnytsky, Sumy, Rivne and Cherkassy regions, where it inhabits 100% of the cultivated area [17].

It hibernates in the phase of eggs, which it lays in autumn on the branches and stems of primary host plants. The most intensive oviposition occurs on the European peritoneum (50 ind./m). However, quite often they occur singly, and only in some years – massively [3, 5].

In April, larvae are reborn from overwintered eggs, which, after 12–14 days of feeding on buds and leaves, turn into wingless founding females, which revive 5–8 larvae daily, 50–70 on average. In late May – early June, winged parthenogenetic females appear, scattering in search of intermediate herbaceous plants and, in particular, sugar beet. On beets and other herbaceous plants, aphids quickly reproduce parthenogenetically by autumn, giving during this time 8–10 or more generations of wingless and winged aphids. During the spring-summer period, development from 12 to 17 generations is possible [14].

The aphid inhabits the leaves from the underside, sucking the juice out of them. Damaged leaves are deformed, twisted in the longitudinal direction, then wither and dry out. The damaged plant lags behind in growth, its sugar content decreases (up to 0,7%) and the weight of root crops (up to 30%), seed yield decreases and its quality deteriorates.

According to V.P. Fedorenko, with a strong population of sugar beet phytophagous and high agricultural cultivation techniques, the weight of root crops decreased by an average of 28% and sugar content by 1,0% [17].

At the same time, beet cane is one of the most common carriers of pathogens of very dangerous viral diseases of sugar beet – jaundice (*Beet yellow virus*) and mosaic (*Beet mosaic virus*) [3].

In 2017 beet leaf aphid intensively damaged beets in all beet-growing regions of Ukraine. The pest inhabited 60–100% of the areas out of 5–45% of inhabited plants.

Among a number of Diptera in the beet agrocenosis, the *Pegomyia betae* Curt., Belonging to the family (Anthomyidae). It is widespread in Ukraine, but according to researchers, increased damage is observed in the western forest-steppe.

Winters in the upper soil layers. According to many scientists, the depth of false cocoons varies from 2 to 10 cm, depending on soil moisture [13].

In the spring, at the end of April-May, the adult takes off. Females lay eggs on the underside of sugar beet leaves in several pieces (up to 20) in parallel rows.

According to scientists, the duration of the period of laying eggs ranges from one to two months. After 2–5 days, the larvae hatch, which penetrate under the skin of the leaf and eat the parenchyma in it. As a result of feeding, the upper skin of the leaf lags behind and a membranous swelling is formed – a mine, inside which the larvae feed. When three or more larvae are fed in one leaf, it withers, turns yellow and dries out. Particularly dangerous damage to plants in the phase of thorns and the first true leaves [18].

The whole cycle of fly development lasts three to five weeks. *Pegomyia betae* Curt. develops in Ukraine in two or three generations. Particularly dangerous damage to beets in the phases of the «fork» and the first pairs of true leaves.

The largest family of Lepidoptera is the scoop family Noctuidae. Today, 673 species are known in Ukraine, of which about 150 species are dangerous pests of crops and forests.

According to the way of life of caterpillars, peculiarities of their nutrition and damage to plants, the family of scoops is divided into two main morpho-biological groups: gnawing or soil-living and leaf-eating or terrestrial.

The most harmful phytophagous beet agrocenosis from gnawing scoops are: *Scotia segetum* Schiff., *Agrotis exclamationis* L.

The main leaf-eating moths that damage beet crops include the following species: *Mamestra brassicae* L., *Heliothis viriplaca* Hufn., *Autographa gamma* L., *Xestia c-nigrum* L. [12, 13].

Harmfulness of scoops is quite significant. The caterpillars of the first two ages of leaf-eating moths damage the skeletal leaves, then eat them from the edges or pierce them. Unlike leaf-eating scoops, which chaotically damage beet leaves, the caterpillars of gnawing scoops live in the top layer of soil. Along with this, the caterpillars gnaw the petioles of individual leaves and stems, or eat the holes in the upper part of more developed roots. These phytophages also destroy sown seeds and seedlings. One caterpillar of the first generation can destroy 10–15 sugar beet plants overnight [14].

In recent years, the phytosanitary situation in beet fields has been complicated by the growing number of many phytophagous plants that annually damage crops. Their harmfulness is determined by the weather conditions of the spring-summer period and is reduced by a set of measures aimed primarily at preventing the mass accumulation of phytophagous. Timely monitoring of pests and the application of more rational measures to control their numbers, create conditions for preserving crops and improving product quality and reduce environmental pollution by insecticides [16].

Chemical method of plant protection. Improving the technology of protection of sugar beets is impossible without analysis of the structure and seasonal and long-term dynamics of harmful entomofauna agrobiocenoses, as well as changes in entomofauna at the biocoenotic and population levels [9].

Due to the intensification of beet growing and the great complexity of seedling pest control, researchers have studied agronomic and mechanical, chemical and other measures to control phytophagous.

Thus, the use of organochlorine preparations (HCG, Heptachlor, Hexachlorane, DDT, etc.) in the 50–60s of the last century allowed to reduce damage to sugar beet plants by soil-dwelling pests by 20–30%, and reduce the number of wireworms even by 70–90 %. However, as a result of insecticide seed treatment, sprout development slowed down, crop density decreased by 12–27%, and their efficiency depended on the composition and properties of the soil [5, 18].

A new method of chemical protection of seedlings - application of insecticides on seeds was proposed by I.V. Kyrychuk This method is widely used in beet sowing countries in Europe. According to V.T. Sabluka and others. the consumption of the active substance of pesticides is reduced by almost 20 times compared to the use of granular drugs. However, in our country this method is not widely used due to the phytoncide properties of the then existing drugs [4, 9].

But, as noted by Tribel S.O., long-term unsystematic use for the treatment of beet seeds of drugs of the carbofuran group contributes to the formation of resistance to toxic to them shoots of weevils, thymus, fleas and other phytophages. Harmfulness, and hence damage to crops from these phytophagous, has almost doubled. Reseeding after the destruction of seedlings by a complex of pests became more frequent, the number of which increased to a level that is 5–10, and sometimes 50 times higher than the economic thresholds of harmfulness [16, 18].

In recent decades, very little attention has been paid to the study of the harmful entomocomplex of sugar beet and the protection of crops from phytophagous. Toxicity of crop plants with pre-sowing treatment of seeds with insecticides is becoming more widespread, which provides high efficiency against seedling pests at a cost rate that is an order of magnitude lower than when spraying. Rational and purposeful treatment of seeds with pesticides allows you to more effectively and environmentally safely protect crops from phytophagous [9].

In the protection of plants from pests used neonicotinoids – drugs with a new mechanism of toxic action, which inhibit nicotine – acetylcholine receptors and are effective against resistant populations of arthropods. In crop production, neonicotinoids are used as systemic insecticides to protect plants from sucking and leaf-eating insects. As a result, there is an induced immunization of plants, which increases the duration of the protective effect of drugs. In addition, the latter are successfully used to protect plant seedlings from soil-dwelling pests [11].

In recent years, research has been conducted to further improve the technology of beet seed treatment with new insecticides. Eliminating the use or minimizing terrestrial chemical treatments of crops with insecticides and localizing them on seed in order to obtain toxic to phytophagous beet seedlings, allows not only to preserve plants in the beet field, but also useful entomofauna that maintains a certain number of pests. Due to this, in recent decades there has been no mass population of beet fields with weevils (common, gray, black), beetroot, root aphids and other phytophagous, which significantly reduces their harmfulness on crops in large areas.

Timely application of these insecticides is important in achieving high efficiency. Thus, due to weather conditions, in some years, the duration of toxic effects of pesticides and the time of relocation of pests to beet crops do not coincide. In this case, it is recommended to spray these insecticides edge strips 45–60 cm wide when 10% of plants are inhabited by beet leaf aphids or 30% by passing flies, and if necessary the whole field. It is also necessary to take into account that the caterpillars of gnawing scoops of older (after the 3rd) age show increased resistance to pesticides [5, 9].

Widespread method of applying artificial shells to seeds (inlay, coating, etc.), which include insecticides, fungicides, growth regulators, trace elements. The effectiveness of such protective and stimulating compositions against the main pests of beet seedlings is studied.

Researchers claim that the chemical method will remain the most effective means of pest control for a long time to come, as it is the most mobile and can contain outbreaks in different agrocenoses of crops [16, 18].

However, with the intensification of beet growing, the protection of sugar beet crops from terrestrial and soil-dwelling pests requires detailed study, refinement, improvement and development of new environmentally friendly methods [9].

Biological method of plant protection. Among the methods of integrated plant protection system an important place belongs to biological plant protection, which in economically developed countries is the main strategy of integrated plant protection system.

Today, the introduction of environmentally friendly plant protection products to limit the number of pests, including biological products, is becoming especially important. [10].

The most tangible link in the chain of ecological approach to plant protection against pests are biological products based on entomopathogenic bacteria. Studies on the use of microbiological agents based on crystal-forming bacteria of the group Bacillus thuringsensis 1–4 serotypes against the most common pests show that when used correctly, biological products protect crops from a number of phytophagous.

Thus, the analysis of literature sources shows that the harmful entomofauna of the beet agrocenosis is quite numerous and harmful. Particularly dangerous in the study area are *Aphis fabae* Scop., beet fleas, *Pegomyia betae* Curt., Elateridae, weevils, gnawing and leaf-eating moths. In this regard, there is an urgent need to conduct research to clarify the biology of these species in sugar beet crops, determine their harmfulness and justify measures to protect plants, using drugs from the modern arsenal of pesticides that meet their requirements and improve the environmental situation in beet agrocenosis [9,10].

The aim of our research was to search for the most effective pesticides to control the number of populations of sugar beet pests during pre-sowing seed rations.

Materials and methods of research. The research was conducted at Agrocomplex Zelena Dolyna LLC, Vinnytsia region, during 2020–2021, the species composition of the harmful entomocomplex of sugar beets and control of their numbers were studied.

Two weeks before sowing of sugar beet, the seeds were treated with insecticidal pesticides. During the growing season, the plants were sprayed with biological products and chemical insecticides. The norms of drug use were determined based on the purpose and objectives of research, as well as using the list of «Pesticides and agrochemicals…».

The size of the production area of sugar beet was 0,5 ha, the area of the experimental area in the field experiment was 50 m^2. Repeat four times. The experiments were based on a single-tier arrangement of replicates by a randomized method.

During the treatment of sugar beet seeds studied the effect of insecticides, the scheme of the experiment to evaluate the effectiveness of which is shown in Table 1.

Table. 1

The scheme of the experiment to assess the effectiveness of pesticides for the treatment of sugar beet seeds against a complex of pests of seedlings (average 2020-2021)

№ p/p	Variant	Consumption rate, kg (l) / t
1	Control (without insecticides)	Water
2	Gaucho 70 WS, z.p. (imidacloprid, 700 g/kg)	60,0
3	Cruiser 350 FS, t.k.s. (thiamethoxam, 350 g/l)	15,0
4	Emesto Quantum 273,5 FS, TH (clothianidin 207 g/l, penflufen 66,5 g/l)	0,3
5	Poncho 600 FS, TH (clothianidin 600 g/l)	3,0

The source is formed on the basis of own results of researches

During the growing season of sugar beet plants studied the effectiveness of biological and chemical insecticides schemes of experiments to assess the effectiveness of which are given in Tables 2 and 3:

Table 2

The scheme of the experiment to evaluate the effectiveness of drugs for spraying sugar beet crops against Aphis fabae Scop. in the phase of 2-3 leaves and closing the leaves in rows (average 2020-2021)

№ p/p	Variant	Consumption rate, l (kg)/ha
1	Control (without insecticides)	Water
2	Aktofit, k.e. (aversectin C, 0,2%.)	2,0
3	Confidor, v.r.k. (imidacloprid, 200 g/l)	0,2
4	Bitoxybacillin-BTU, rf (*Bacillus thuringiensis* var *Thuringiensis*, endospores – titer 1,0x109 CFU/cm^3)	5,0

The source is formed on the basis of own results of researches

The effectiveness of insecticides was determined by the degree of damage to plants. Pest damage was recorded during the period of intensive beet infestation and 7, 14, 21 days after the first records.

Table 3

Scheme of the experiment to evaluate the effectiveness of spraying sugarbeet crops against Lepidoptera pests in the phase of 8-10 leaves and leaf closure between rows (average 2020-2021)

№ p/p	Variant	Consumption rate, l (kg)/ha
1	Control (without insecticides)	Water
2	Bitoxybacillin-BTU, rf (*Bacillus thuringiensis* var *Thuringiensis*, endospores – titer 1,0x109 CFU/cm^3)	5,0
3	Lepidotsid-BTU, r.f. (*Bacillus thuringiensis* var. *Kurstaki*, 3 serotype, titer $1{,}0x10^9$ spores/ml)	3,5
4	Match 050 EU, k.e. (lufenuron, 50 g/l)	0,4
5	Dimilin, z.p. (diflubenzuron 250 g/kg)	0,5

The source is formed on the basis of own results of researches

Calculated the sum of the frequencies of points ∑ (a × b) the sum of the products of the number of plants for the corresponding damage score. Next, we calculated the average score (B) of plant damage according to formula 2.1:

$$B=\sum(a \times в) / n \qquad (2.1)$$

where n – is the total number of plants in the sample.

Technical efficiency was calculated by the average score of plant damage by formula (2,2):

$$E_{d1} = 100\times(b_к-b_d)/ b_к , \qquad (2.2),$$

where Edi is the effectiveness of the drug, %;

b_k – the average score of plant damage in the control;

b_d – the average score of plant damage in the experimental version

Settlement of crops by pests and counting of their number in the period from emergence to the phase of 2 pairs of leaves was carried out once every 5 days. From the phase of 2 pairs of leaves to technical maturity, respectively in 10 and 5 days.

Species composition of entomofauna and determination of the number of dominant species of pests was established by the following methods:

- by the method of soil excavations: 8 pits placed in a checkerboard pattern, size 50×50 cm, depth up to 80 cm, were dug at each site.
- visual inspection of 10 plants in 10 places of the variant;
- digging crops with ditches and wells;
- Petlyuk's device on platforms of 25×25 cm;
- using poisoned baits (1 bait per 100 m^2);
- mowing with an entomological net (10 attacks in 10 places);
- by means of a trough with noisy molasses (1 trough on 0,5 hectares).

The degree of damage to the underground part of the seedlings by soil pests was determined by selecting 100 plants, on a 5-point scale Sabluka V.T. [7]

The degree of damage to the aboveground part of vegetative plants by common beet flea, dead beetle, moths, beet fly was determined by examining 100 plants on a 9-point scale Tribel S.O. [14].

The average score (A_s) and the coefficient of damage (Cd) of plants by pests were calculated by formula 2.3, 2.4 [14]:

$$A_s = \sum(a \times b) / n, \qquad (2,3)$$

where, ∑ (a × b) is the sum of the products of the number of inhabited plants by the corresponding population score;

n – is the total number of inhabited plants in the sample.

Based on these data, calculated the population ratio by the formula:

$$Кп = А \times Б / 100, \qquad (2,4)$$

where, Kn – population rate;

A – population of plants by beet aphids, %;

B – average population score.

The experiments determined the productivity of sugar beets, in particular seed yield, as well as its sowing qualities: weight of 1000 fruits, fractional composition.

Tillage, root crops and seed care were common for the area.

To determine the yield of table beets, plant samples were taken from 10 m^2 test sites.

Crop losses from pests were calculated by formula 2,5:

$$Q = \frac{100(A - a)}{A} \qquad (2,5)$$

where Q is the yield loss, %;

A – yield of intact plants, g / m2;

a – the harvest of damaged plants.

Economic efficiency was determined according to the generally accepted method [14].

Statistical processing was performed taking into account the number of pests on variants and replicates, the yield was calculated according using computer programs Excel.

Research results. According to the results of monitoring the harmful entomofauna of sugar beet in the Vinnytsia region during 2020–2021, representatives of the arthropod type were identified, namely insect classes (Insecta) – 14 species of phytophagous and millipedes (Diplopoda). Dominated in the taxonomic structure of the harmful entomocomplex phytophagous from the series Coleoptera – 34,3%, Juliformia – 22,5%, Homoptera – 17,1%, Lepidoptera –16,3% and Diptera – 6,3%. Among them are both polyphagous and specialized species (Fig. 1).

The most dangerous and common pests that harmed the beet agrocenosis of the Coleoptera were from the following families: Chrysomelidae – *Chaetocnema concinna* March., which accounted for 7,8% of the total species composition, Elateridae – *Agriotes sobscurum* L. – 4,6% and *Agriotes lineatus* L. – 4,3% (the average share of which among the family Elateridae was 53% and 41% respectively), Scarabaeidae – *Melolontha melolontha* L. – 4,6% and Silphidae – *Silpha obscura* L. – 0,3%.

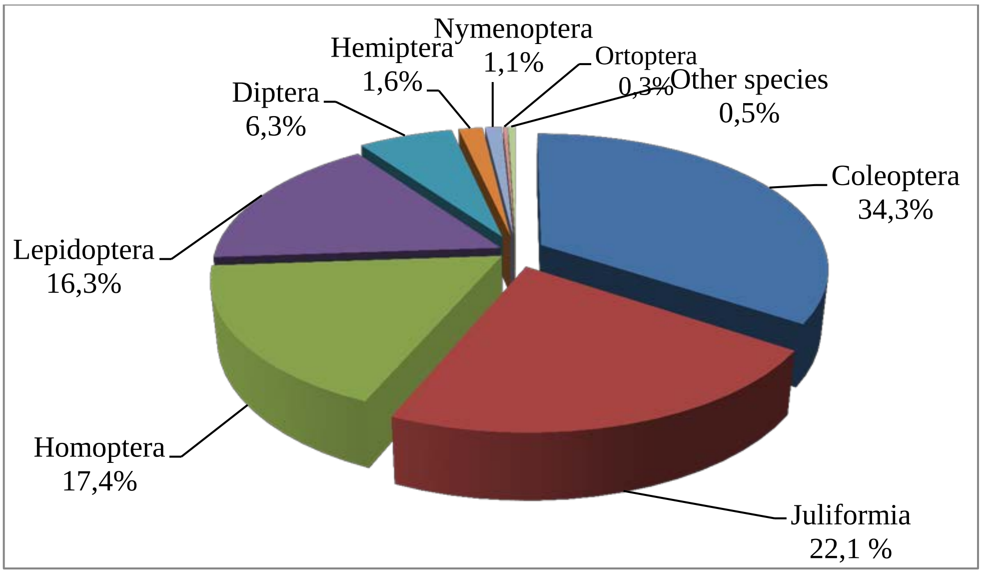

Fig. 1. Taxonomic structure of the harmful entomocomplex of suga beet of Vinnytsia region (on average 2020–2021).

The source is formed on the basis of own results of researches

Among the Lepidoptera, sugar beet crops were most damaged by members of the Noctuidae family, whose share in the species diversity of scale insects was 96%, of which gnawing scoops accounted for 54%, leaf-eating – 41%. Among the gnawing scoops the most numerous was the *Scotia* (*Agrotis*) *segetum* Schiff., the share of which was 88%, of the leaf-eating scoops – *Heliothis viriplaca* Hfn. – 72% (the share of which among the total species was 5,8 and 10,8% respectively).

Of the Homoptera family, the aphid family (Afididae) was dominated by the *Aphis fabae* Scop. – 18,2%, and of the Diptera family, the Anthomyiidae – *Pegomyia betae* Curt.) – 3,4%.

Significant damage to sugar beet crops during all years of research was caused by bugs (Diplopoda class, Juliformia series) – 22,1%.

Click beetles have damaged sugar beet crops since the seedlings. The maximum number of larvae of *Agriotes obscurum* L. averaged 13,0 ekz./m^2, *Agriotes lineatus* L. – 0,8–2,3 ekz./m^2. Sugar beet seedlings were particularly threatened by, most notably *Chaetocnema concinna* March, which inhabited and damaged crops from the cotyledon phase and the first pair of leaves. The maximum number in the years of research was 3,6 ekz./ m^2.

Starting from the phase of 2–3 pairs of leaves, sugar beet crops were damaged by larvae of beet fly, *Melolontha melolontha* L., *Aphis fabae* Scop.

Damage of sugar beet by larvae of the Melolontha melolontha L. in the years of research averaged 4,6% with a number of 0,8–2,1 ekz./ m^2.

In the phase of leaf closure in between rows, the greatest damage to sugar beet was caused by the beet fly, Noctuidae, *Aphis fabae* Scop. and *Necrodes littoralis*.

Damage by larvae of the *Pegomyia betae* Curt. Reached 7,2%, and the number of larvae of the pest was 1,0–1,3 ekz./plant.

The most numerous in the entomocomplex of sugar beet was *Aphis fabae* Scop., plant population ranged from 15,1 to 30,2%.

It should be noted that in recent years in the beet agrocenosis increased the harmfulness of Noctiidae, especially *Scotia* (*Agrotis*) *segetum* Schiff.

The number of caterpillars of the *Scotia* (*Agrotis*) *segetum* Schiff. was 1,5–2,5 ekz./m^2, the *Heliothis viriplaca* Hfn. 2,8–3,9 ekz./m^2. Lepidoptera phytophages caused the greatest damage to crops during the period of leaf closure between rows and at the beginning of root formation. During the years of research, on average 10,5–19,5% of plants were damaged by scoop caterpillars.

The highest number of *Necrodes littoralis* was 0,3 ekz./m^2, which did not pose a threat to the beet agrocenosis. Sugar beet crops were severely damaged, especially in areas with shallow groundwater. Their number in the years of research was in the range of 8,1–9,2 ekz./m^2, and crop damage reached 77,2% of plants.

In the years of outbreaks of one or another phytophage on sugar beet crops, the question of their timely and effective protection arises. Toxicity of crop plants with pre-sowing treatment of seeds with insecticides is becoming more widespread, which provides high efficiency against seedling pests at a cost rate that is an order of magnitude lower than when spraying. Rational and purposeful treatment of seeds with pesticides allows more effective and environmentally safe protection of crops from phytophagous [16].

In the protection of plants from pests used neonicotinoids – drugs with a new mechanism of toxic action, which inhibit nicotine – acetylcholine receptors and are effective against resistant populations of arthropods. In crop production, neonicotinoids are used as systemic insecticides to protect plants from sucking and leaf-eating insects. As a result, there is an induced immunization of plants, which increases the duration of the protective effect of drugs. In addition, the latter are successfully used to protect plant seedlings from soil-dwelling pests [9].

The effect of insecticidal pesticides on the population of sugar beet crops by beet leaf aphids (*Aphis fabae* Scop.) was studied (Table 4). The highest technical efficiency was provided by the Cruiser 350 FS, as: on the 21-st day after germination, the number of this pest decreased by 95,4% compared to the control.

Table 4

Technical efficiency of insecticidal pesticides *against Aphis fabae* Scop. for treatment of sugar beet seeds (average 2020-2021)

Variant	Consumption rate of the drug, kg (l)/t	Inhabited by aphid plants, %		Ball inhabited		Population inhabited		Technical efficiency, %	
		Days after germination							
		21	28	21	28	21	28	21	28
Control (without insecticides)	-	7,6	11,8	1,3	1,6	0,11	0,2	-	-
Gaucho 70 WS, z.p.	60	1,9	4,2	0,3	0,5	0,006	0,02	76,9	68,7
Cruiser 350 FS, t.k.s.	15,0	0,5	2,5	0,06	0,2	0,0003	0,005	95,4	87,5
Emesto® Quantum 273,5 FS, TH	0,3	1,1	2,5	0,2	0,3	0,002	0,007	84,6	81,2
Poncho 600 FS, TH	3,0	1,3	3,3	0,2	0,4	0,003	0,01	84,6	75,1

The source is formed on the basis of own results of researches

During the period of intensive population of plants by beet leaf aphids, the technical efficiency of Emesto Quantum 273,5 FS, TH and Poncho 600 FS, TH was 84,6%, Gaucho 70 WS, z.p. – 76,9%. The population coefficient in the experimental variants was in the range of 0.0003 – 0.01. Even on the 28th day after germination, pesticides reliably protected sugar beet crops: aphid infestation in the version with Cruiser 350 FS, t.k.s. decreased by 87,5%, Emesto Quantum 273,5 FS, TH – 81,2%, Poncho 600 FS, TH – 75,0%, Gaucho 70 WS, z.p. – 68.7%

According to the results of research, it was found that the *Chaetocnema concinna* March. and *Pegomyia betae* Curt. during pre-sowing treatment of seeds with insecticides Cruiser 350 FS, HP, Gaucho 70 WS, ZP, Poncho 600 FS, TH, Emesto Quantum 273,5 FS, TH technical efficiency against these pests was higher and on the 7th day after germination in the version with the most effective disinfectant Poncho 600 FS, TH the number of *Pegomyia betae* Curt. decreased by 78,6%, *Chaetocnema concinna* March. – 76,3%. Technical efficiency Cruiser 350 FS, t.k.s. was 67,7–67,9%, Gaucho 70 WS, z.p. – 68,4%. Slightly less efficiency was provided by Emesto Quantum 273,5 FS, TN – 47.4–49,8% (Table 5).

On the 21st day after germination in crops, the technical efficiency of drugs against *Chaetocnema concinna* March. and *Pegomyia betae* Curt. was in the version of Poncho 600 FS, TH – 72,7 and 70,5%, Cruiser 350 FS, t.k.s. – 62,5%, Gaucho 70 WS, z.p. – 62,0, and 62,5%, Emesto Quantum 273,5 FS, TH – 41,5 and 45,1% for damage 2,1–7,8% of plants with a damage score of 0,6–1,8, damage factor 0,01–0,31.

Table 5

Technical efficiency of insecticidal pesticides against *Chaetocnema concinna* March. and *Pegomyia betae* Curt. sugarbeet (average 2020–2021)

Variant	Norm (drug consumption, l kg/t	*Chaetocnema concinna* March.					*Pegomyia betae* Curt.				
		Technical efficiency on… day after emergence, %		Plant damage,%	Average damage score	Coefficient of damage	Technical efficiency on… day after emergence, %		Plant damage,%	Average damage score	Coefficient of damage
		7	21				7	21			
Control (without insecticides)	-	-	-	7,3	1,6	0,1	-	-	4,2	1,5	0,06
Gaucho 70 WS, z.p.	60,0	68,4	62,5	2,7	0,6	0,02	68,4	62,4	1,5	0,56	0,008
Cruiser 350 FS, t.k.s.	15,0	67,9	62,5	2,8	0,6	0,02	67,7	62,5	1,5	0,56	0,008
Emesto® Quantum 273,5 FS, TH	0,3	47,4	41,5	4,4	0,93	0,04	49,8	42,1	2,5	1,45	0,04
Poncho 600 FS, TH	3,0	76,3	70,5	2,1	0,47	0,009	78,6	72,7	1,4	0,41	0,006

The source is formed on the basis of own results of researches

With the use of insecticides against the larvae of click beetles and western May beetle Poncho insecticide 600 FS, TH on the 7th day after germination reduced the number of click beetles by 86,5%, *Melolontha melolontha* L. – 84,5%, which is 1/3 higher than other disinfectants. The technical efficiency of Emesto Quantum 273.5 FS, TH was 52,3 and 56,9%, Gaucho70 WS, s.p. – 66,6 and 75,4%, Cruiser 350 FS, so – 73,1 and 78,0%, respectively (Table 6).

Table 6

Technical effectiveness of insecticidal protruists against larvae of click beetles *(*Elateridae*)* and larvae of *Melolontha melolontha* (average 2020–2021)

Variant	Norm (drug consumption, l kg)t	larvae of click beetles *(*Elateridae*)*					larvae of *Melolontha melolontha*				
		Technical efficiency on… day after emergence, %		Plant damage,	Average damage score	Coefficient of damage	Technical efficiency on… day after emergence,%		Plant damage,	Average damage score	Coefficient of damage
		7	21				7	21			
Control (without insecticides)	-	-	-	5,7	1,0	0,05	-	-	4,6	1,1	0,05
Gaucho 70 WS, z.p.	60,0	75,4	69,1	1,7	0,34	0,006	66,6	59,7	1,8	0,44	0,008
Cruiser 350 FS, t.k.s.	15,0	78,0	72,2	1,6	0,24	0,004	73,1	66,3	1,5	0,77	0,01
Emesto® Quantum 273,5 FS, TH	3,0	63,2	56,9	2,5	0,48	0,01	52,3	46,3	2,5	1,1	0,03
Poncho 600 FS, TH	0,3	86,5	80,2	1,1	0,21	0,002	84,5	77,6	1,1	0,51	0,005

The source is formed on the basis of own results of researches

Treatment of sugar beet seeds with insecticidal pesticides Gaucho 70 WS, z.p., Emesto Quantum 273,5 FS, TN, Poncho 600 FS, TH and Cruiser 350 FS, t.k.s. positively affected the performance of culture. As a result, yields increased by 19,1–26,4%. The highest indicators of plant productivity were obtained in the case of Poncho insecticide, because the weight of one root crop increased by 44 g, or 26% compared to the control variant, which allowed to obtain an additional 12,6 t/ha of root crops (Table 7).

Table 7

Economic efficiency of insecticide pesticides against sugar beet pests
(average 2020-2021)

Variant	Consumption rate of the drug, kg (l)/t	Density before harvest thousand / ha	Population inhabited	Yield, t/ha	
				Actual	Saved
Control (without insecticides)	-	208	0,7	35,1	-
Gaucho 70 WS, z.p.	60,0	222	0,2	45,7	10,6
Cruiser 350 FS, t.k.s.	15,0	221	0,1	46,1	11,0
Emesto® Quantum 273,5 FS, TH	3,0	224	0,1	47,7	12,6
Poncho 600 FS, TH	0,3	216	0,3	43,4	8,3

The source is formed on the basis of own results of researches

The lowest yield was observed in the variant with the use of the drug Emesto® Quantum 273,5 FS, TH, because the preserved yield did not exceed 8,3 t/ha.

Modern plant protection system is the integration of various methods to reduce the number of harmful species to economically intangible levels. An integral part of the integrated protection of sugar beet from sucking phytophages is the chemical method of control over spraying crops, which is characterized by high technical efficiency, the most mobile and cost-effectiveAt the same time, the introduction of environmentally friendly plant protection products to limit the number of pests, including biological products, is becoming especially important today. Their use allows to obtain high-quality (environmentally friendly) products while maintaining the biological diversity of agrocenoses.

Under favorable conditions, *Aphis fabae* Scop. are able to quickly increase the number in a short time due to the rapid biotic and parthenogenetic potential of reproduction. On beets, aphids breed until autumn, giving 8–10 or more generations of wingless and winged individuals, thanks to which they quickly spread throughout the culture. At a temperature of + 23–28 ° C and relative humidity of not less than 60–80%, one generation develops in 10–14 days. Therefore, first of all, for timely and effective implementation of a set of plant protection measures against *Aphis fabae* Scop., it is important to take into account its biological characteristics, natural factors and select plant protection products that effectively regulate the number of phytophagous.

During 2020–2021, the effectiveness of the fungal biological preparation Aktofit, k.e. (aversectin C, 0,2%.), bacterial – Bitoxybacillin-BTU, liquid form (*Bacillus thuringiensis* var *Thuringiensis*, endospores – titer 1.0x10^9 CFU/cm^3), insecticide Confidor, v.r.k. (imidacloprid, 200 g/l) against sugar *Aphis fabae* Scop.

The highest technical efficiency of these drugs was provided on the 3rd day after spraying with insecticide Confidor, v.r.k. with a consumption rate of 0,2 l/ha, the number of aphids decreased to 77,5% (Table 8).

Table 8

Technical effectiveness of insecticides against *Aphis fabae* Scop. of sugar beet
(average 2020-2021)

Variant	Consumption rate, kg (l)/t	Technical efficiency on … day after emergence,%		Populated plants,%	Average damage score	Coefficient of damage
		3	14			
Control (without insecticides)	-	-	-	15,1	2,1	0,32
Bitoxybacillin-BTU, rf	5,0	76,4	53,5	7,1	0,98	0,07
Aktofit, k.e.	2,0	76,9	54,4	6,9	0,96	0,07
Confidor, 200 SL, PK	0,2	77,5	56,4	6,6	0,91	0,06

The source is formed on the basis of own results of researches

The damage score in this variant was 0,9 while in the control it reached 2,1. Biopreparation Aktofit, k.e. with a consumption rate of 2,0 l/ha provided a reduction in the number of phytophagous to 76,9%, Bitoxybacillin, rf (5,0 l/ha) – 76,4%. The average damage score was in the range of 0,9–1,0.

14 days after spraying, the number of pests continued to increase. The highest technical efficiency of the drugs was provided in the version with Confidor, v.r.k. the number of pests decreased by 56,4%, Aktofit, k.e. – 54,4%, Bitoxybacillin–BTU, r.f. – 53,5%.

Thus, when spraying sugar beet crops against *Aphis fabae* Scop., the technical efficiency of Confidor, v.r.k. reached 77,5%. Biological preparations Aktofit 0,2%, k.e., Bitoxybacillin-BTU, rf provided a reduction in the number of phytophagous by 76,4–76,9%.

To limit the number of Lepidoptera insects and damage to sugar beet, bacterial biological products were studied: Bitoxybacillin (BTU), liquid form (*Bacillus thuringiensis* var *Thuringiensis, endospores* – titer 1,0x109 CFU / cm^3); Lepidocide – BTU, liquid form (*Bacillus thuringiensis* var. *Kurstaki*, 3 serotype, titer 1.0 x109 spores/ml) and insecticides Dimilin, z.p. (diflubenzuron 250 g/kg) and Match 050 EC, k.e. (lufenuron, 50 g/l) for spraying crops. The results of the research showed that the drugs provide high technical efficiency against Noctuidae (*Heliothis viriplaca* Hfn., *Agrotis segetum* Schiff.) (Table 9). The number of scoops is controlled by both chemical insecticides (Dimilin, zp, Match 050 ES, k.e.) with a technical efficiency of 78,5–81,2%, and biological products (Bitoxybacillin-BTU, rf, Lepidocide BTU, RF, whose technical efficiency was 75,0–77,6%.

Table 9

Technical efficiency of insecticides against scoops (average 2020–2021)

Variant	Norm (drug consumption, l kg) t	*Heliothis viriplaca* Hfn.				*Agrotis segetum* Schiff.				
		Technical efficiency per day…after germination, %			Damaged plants, %	Technical efficiency per day…after germination, %			Damaged plants, %	Number of copies / trough
		3	7	14		3	7	14		
Control (without insecticides)	-	-	-	-	6,2	-	-	-	9,4	48
Bitoxybacillin-BTU, rf	5,0	75,0	70,8	67,4	2,0	73,5	69,6	64,5	3,3	16
Lepidotsid-BTU, r.f.	1,5	74,2	70,0	65,0	2,1	72,4	68,2	63,3	3,4	17
Match 050 EU, k.e.	0,4	73,2	69,0	63,9	2,2	72,1	67,6	62,4	3,5	18
Dimilin, z.p. з.п.	0,5	79,1	74,8	69,6	1,9	76,3	71,7	66,5	3,1	15

The source is formed on the basis of own results of researches

On the 3rd day after spraying sugar beet technical efficiency was higher against *Heliothis viriplaca* Hfn. In the version with the use of Bitoxybacillin-BTU, rf with a consumption rate of 5 l/ha, the number of phytophagous decreased by 75%, Lepidotsid-BTU, rf (1,5 l/ha) – 74,2%, Dimilin, z.p. (0,5 l/ha) – 79,1%, Match 050 EU, ke (0,2 l/ha) – 73,2%.

The results of research showed that the inclusion in the protection system of sugar beet biopreparations (Aktofit 0.2%, k.e., Bitoxybacillin-BTU, rf, Lepidocid-BTU, rf), for spraying crops helped to reduce plant damage phytophagous during the growing season of the crop, which ensured the preservation of the crop up to 5,3–7,0 t/ha. The highest yield was determined by the use of the drug Aktofit 0,2%, kE – 41,3 t/ha. The weight of the root was 187,7 g, yield reached 41,8 t/ha. (Table 10).

Table 10

Economic efficiency of insecticide application against sugar beet pests
(average 2020–2021)

Variant	Consumption rate, kg (l)/t	Density before harvest thousand/ha	Mass of root crops, g	Population inhabited	Yield, t/ha	
					Actual	Actual
Control (without insecticides)	-	211	162,5	0,7	34,4	-
Aktofit, k.e.	2,0	220	187,7	0,3	41,3	7,0
Confidor, 200 SL, PK	0,2	218	190,8	0,3	41,6	7,3
Bitoxybacillin-BTU, rf	5,0	216	184,7	0,4	39,9	5,6
Lepidotsid-BTU, r.f.	1,5	215	184,6	0,4	39,7	5,4
Match 050 EU, k.e.	0,4	216	186,1	0,4	40,2	5,9
Dimilin, z.p. з.п.	0,5	219	190,1	0,3	41,8	7,5

The source is formed on the basis of own results of researches

Conclusions. As a result of the conducted researches the species composition of pests in sugar beet crops was established, the peculiarities of their number andharmfulness were studied, the elements of the system of sugar beet protection from the pest complex were developed and substantiated.

In the crops of sugar beet in Vinnytsia region, 2020–2021 of the right-bank Forest-Steppe of Ukraine, phytophages from the Coleoptera series dominate in the taxonomic structure of the harmful entomocomplex (*Agriotes obscurus* L., *Agriotes lineatus* L., *Melolontha melolontha* L., *Chaetocnema concinna* March.) – 34,3%, Homoptera (*Aphis fabae* Scop.) – 17,1%, Lepidoptera (*Scotia* (*Agrotis) segetum* Schiff., *Heliothis viriplaca* Hfn.) – 16,3% and Diptera (*Pegomyia betae* Curt.) – 6,3%. Among them are both polyphagous and specialized species. Of the Diplopoda class, beetles caused significant Julida series – 22,5%). Treatment of sugar beet seeds with insecticides of systemic action Gaucho 70 WS, z.p., Emesto Quantum 273.5 FS, TN, Poncho 600 FS, TH and Cruiser 350 FS, t.k.s. provides high technical efficiency against the complex of seedling pests (*Agriotes lineatus* L., *Agriotes sputator* L., *Chaetocnema concinna* Marsh., *Melolontha melolontha* L., *Silpha obscura* L., *Pegomyia betae* Curt.) at the level of 63,2–86–5%; *Aphis fabae* Scop. – Cruiser 350 FS, t.k.s. – 95,4%, Emesto Quantum 273.5 FS, TH – 81,2%; Poncho, t.k.s. – 97,3%.

For spraying sugar beet crops with biological products Aktofit, k.e. (2,0 l/ha), Bitoxybacillin-BTU, r.f. (5,0 l/ha) the number of *Aphis fabae* Scop. decreases by 73,1–76,9%; Bitoxybacillin-BTU, rf (5 l/ha), Lepidotsd-BTU, r. F. (1,5 l/ha) – 77,6%.

Treatment of sugar beet seeds with insecticidal pesticides Gaucho 70 WS, z.p. (60,0 kg/t), Emesto Quantum 273,5 FS, TH (0,3 l/t), Poncho 600 FS, TH (3,0 l/t) and Cruiser 350 FS, t.k.s. (15,0 l/t) ensured the preservation of the harvest of 8,3–12,6 t/ha.

Spraying of sugar beet crops with biological preparations Aktofit, k.e. (2,0 l/ha), Bitoxybacillin-BTU, r.f. (5,0 l/ha), Lepidotsid-BTU, r.f. (1,5 l/ha) during the growing season, allows to obtain high quality products, helps to preserve the yield of root crops up to 5,3–7,0 t/ha.

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АНОТАЦІЯ

ДОСЛІДЖЕННЯ ВПЛИВУ СИСТЕМИ ЗАХИСТУ У ОБМЕЖЕНІ ЧИСЕЛЬНОСТІ ШКІДНИКІВ БУРЯКА ЦУКРОВОГО ПРАВОБЕРЕЖНОГО

У статті висвітлено теоретичне узагальнення і нове вирішення проблеми, що полягає у розробці і обґрунтовані елементів системи захисту буряка цукрового від комплексу шкідників та контролю їх чисельності в умовах Вінницька обл., яка ґрунтується на уточнені видового складу фітофагів у посівах буряка цукрового, їх шкідливості та обмеження чисельності при застосуванні інсектицидів за обробки насіння і обприскування посівів хімічними і біологічними препаратами.

Уточнено видовий склад шкідливої ентомофауни буряка цукрового та виділено 14 видів шкідників, серед них 9 домінуючих видів. Визначено, що у посівах буряка цукрового домінують в таксономічній структурі шкідливого ентомокомплексу фітофаги із рядів Coleoptera (ковалик темний (Agriotes obscurus L.*), ковалик смугастий (Agriotes lineatus* L.*), західний травневий хрущ (Melolontha melolontha* L.*), звичайна бурякова блішка (Chaetocnema concinna* March.*) – 34,3 %, Homoptera (бурякова листкова попелиця – Aphis fabae* Scop.*) – 17,1 %, Lepidoptera (совка озима – Scotia segetum* Schiff*, совка люцернова – Heliothis viriplaca* Hfn.*) – 16,3 % та Diptera (бурякова мінуюча муха – Pegomyia betae* Curt.*) – 6,3 %. Серед них є як багатоїдні, так і спеціалізовані види. Із класу Diplopoda – 22,5 %. Оцінено ефективність сучасних інсектицидів проти домінуючих шкідників буряка цукрового та оптимізовані способи їх застосування. Встановлено, що за обробки насіння буряка цукрового проти бурякової листкової попелиці (Aphis fabae* Scop.*) найбільшу технічну ефективність забезпечив Круїзер 350 FS, т.к.с. – 95,4%. Технічна ефективність інших протруйників знаходилася в межах 76,9–84,6%. Протруювання насіння буряка цукрового проти шкідників сходів інсектицидом Пончо 600 FS, ТН знизило чисельність фітофагів на 86,5 %, Круїзер 350 FS, т.к.с. – 78,0 %, Гаучо 70 WS, з.п.– 75,4 %, Еместо Квантум 273,5 FS, ТН – 63,2 %. Обробка насіння буряка цукрового інсектицидними протруйниками Гаучо 70 WS, з.п. (60,0 кг/т), Еместо Квантум 273,5 FS, ТН (0,3 л/т), Пончо 600 FS, ТН (3,0 л/т) і Круїзер 350 FS, т.к.с. (15,0 л/т) забезпечила збереження урожаю до 12,6 т/га.*

Ключові слова: *буряк цукровий, шкідники буряка цукрового, інсектициди, ефективність, урожай.*

Табл. 10. Рис. 1. Літ. 18.

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