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CONTROL OF THE NUMBER OF SUCKING PESTS OF WINTER WHEAT IN THE CONDITIONS OF THE RIGHT-BANK FOREST STEPPE

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This article theoretically summarizes and solves an important scientific problem regarding the clarification of the species composition of the entomocomplex of phytophages in winter wheat crops and the development of effective measures to control their number, depending on the use of plant protection products.

As a result of entomological monitoring of winter wheat in Vinnytsia region, 34 species of insects from 16 families that damage this crop were specified. The Diptera range consisted of 11 species, the Coleoptera range was characterized by the greatest species diversity (14 species), their share in the structure of the entomocomplex was 30% of the total. 9 species of phytophages from a number of bugs, or Hemiptera, were identified. The share of Lepidoptera and Homoptera in the structure of the entomocomplex was 8% and 10% each. The orders of Thysanoptera and Hymenoptera had 2 species each. Orthoptera represented the smallest number of species – 2%.

The main and most dangerous phytophages that cause significant damage to winter wheat crops from a complex of insect pests have been identified, namely: thrips, cereal aphids, and bread bugs.

The effectiveness of modern insecticides against the dominant pests of winter wheat and the optimized methods of their application were evaluated. According to the results of winter wheat seed treatment with insecticides-protozoans, it was established that the lowest number of phytophagous was noted in variants with protozoans Cruiser 350 FS t.c.s. (0,5 l/t), the aphid occupancy rate was 0,04%, in the version where Promet 400 µ.s. (2,0 l/t) occupancy rate 0,06%. Accordingly, the technical efficiency of the Cruiser 350 FS t.c.s. (0,5 l/t) was 90.7%; Promet 400, m.s. (2,0 l/t) – 86.0%, while in the control, the density of larvae of these types of pests was almost 4,5 times higher.

It was noted that the highest yield was observed in the version using the insecticide Cruiser 350 FS t.c.s., where the preserved yield was 2,6 t/ha. The lowest grain yield – 3,5 t/ha was noted in the variant with the use of the drug Gaucho 70% s.p. the saved yield did not exceed 0,1 t/ha. It was established that the treatment with protoxins had a positive effect not only on yield, but also on seed quality, in particular, on the weight of 1000 grains. In variants using insecticides, the weight of 1000 grains compared to the control increased by 10,0, 12,5, 14,8 g compared to the control.

It was established that the use of insecticides during the winter wheat growing season, which were studied, showed high effectiveness in controlling aphids, bugs and thrips. However, it should be noted that the use of drugs Engeo 247 SC, 1,8 l/ha and Nurelle D, KE, 1,1 l/ha best limited the abundance of these phytophages. When using them, an increase in productivity was observed by – 4,5–4,9 t/ha, in the control – 4,0 t/ha.

Key words: *winter wheat, main phytophages, harmfulness, insecticides, efficiency, yield.*
Table 7. Fig 1. Lit. 19.

Introduction. Taking into account the high rate of population growth, the intensive use of energy reserves and the awareness of the aggravation of the problems of stable supply of food to the earthly civilization, the question of increasing the gross harvest of grain crops has become acute.

One of the most important reserves for increasing the gross harvest of agricultural products is the reduction of crop losses from harmful organisms, which currently reach 42–50%, of which 26,3% are from pests.

In today's conditions, winter wheat is the most valuable and widespread grain food crop, because bread, pastries and pasta products are present in almost all kitchens of the world. In world production, it occupies the first place in terms of cultivated area (about 220 million hectares). In Ukraine, over the past 10 years, the gross harvest of grain averaged about 15,5–22,3 million tons on a sown area of more than 6 million hectares. The potential productivity of modern varieties is in the range of 8–12 t/ha, but its realization is carried out by only 30%. Among the reasons that limit the productivity of winter wheat varieties are the instability of sown areas, violations of cultivation technologies, global warming, as well as the weakening of protective measures against harmful organisms, in particular, pests are the main reasons for the decrease in the productivity of winter wheat agrocenoses, crop losses from pests are on average 12, 7%, and in some years exceed 30% [1].

Starting from the period of seed germination and throughout the growing season, wheat plants are damaged by various types of phytophagous insects. Some of them damage the sown germinated seeds, the underground part of the stem, grain in the ear, others – gnaw the leaves and stems, suck the juice. Pests cause the greatest damage – bread bugs, bread beetles, bread weevils, cereal aphids, wheat thrips. They not only lead to a significant shortage of the crop, but also worsen its baking and sowing qualities.

Cultivation of high permanent crops of winter wheat is impossible without reliable protection of the culture against harmful organisms. But, as practice shows, carrying out special pest control measures is not always economically justified, especially when it comes to chemical protection of plants. So, for example, the widespread use of chemical agents often leads to negative consequences: contamination of products and other environmental objects with pesticide residues, disruption of the ecological balance, deterioration of human health.

To prevent negative consequences in plant protection, great attention should be paid to the study of the peculiarities of ties in the agrocenosis system and, based on this, to develop the most effective measures, which will become a scientific basis for improving the existing system of plant protection [2, 3].

Therefore, in order to increase the effectiveness of protective measures and avoid possible negative consequences when using insecticides in the formation phase – milk-wax maturity of wheat grain and to deepen the study of the safe use of insecticides, which is gaining special relevance.

Analysis of recent research and publications. More than 300 species of phytophagous plants harm grain crops in Ukraine, among which about 140 species are of significant importance. Dangerous pests of winter wheat that sporadically or systematically cause considerable damage include about 50 species of phytophages, among which ear pests (bread bugs, bread beetles, cereal aphids, wheat thrips) take the leading place. The feeding of these insect pests by wheat plants affects not only the productivity of the crop, but also the quality of the products [3].

Bread bugs. Bread grains are damaged by several types of bread bugs, among which there are quite similar species, although representatives of different families: Scutellaridae (*Eurygaster maurus* L. and *Eurygaster austriacus* Schrk.) and Pentatomidae (*Aelia acuminata* L. and *Aelia rostrata* Boh. [5, 6, 7].

The harmful beetle (*Eurygaster integriceps* Put.) is one of the most dangerous pests of winter wheat, which dominates among other bread bugs and accounts for an average of 89,4% of the total number. Widespread in the steppe and forest-steppe. Cyclical local damage is possible in the forest-steppe areas of Kharkiv, Poltava and southern Cherkasy and Vinnytsia regions. However, in recent years, due to global warming, there is an obvious tendency to expand the range of the *Eurygaster integriceps* Put. and increase its share among other bugs. The increase in the number of the insect pest is also evident in the central part of the forest-steppe zone and adjacent areas, where this phytophage is found in above-threshold numbers [8].

Adult bugs hibernate under leaves in forests, field protection strips, gardens and other places with tree and shrub vegetation. During wintering *Eurygaster integriceps* Put. are in a state of diapause, which allows them to withstand the difficult conditions of winter with less energy expenditure. It has been established that hibernating bed bugs use up the fat body slowly and very sparingly. Bedbugs lie motionless on their backs, covered with leaf litter. *Eurygaster integriceps* Put. in the southern and lightly shaded areas of the forest appears in the upper layer of the litter after warming it to 12–13 °C, and the air to 8–9 °C. Mass flight of *Eurygaster integriceps* Put. to crops occurs when the average daily temperature exceeds 12–14 °C, and the maximum reaches 18–20 °C [10].

Males are the first to fly to the fields, as they are the first to leave their wintering grounds. By the end of the flight, the ratio of males and females equalizes. By this sign, it is possible to judge the end of colonization of crops by the shell.

Depending on the weather conditions, 10–20 days after the flight from the wintering places, egg laying begins and continues until the end of the life of the bugs. Mating of pests begins at temperatures above +13 °C. Fertility of individual females at an optimal temperature of 20–21 °C and relative humidity of 60–70% is 146–260 eggs with an average lifespan of 28–31 days. According to research data, the maximum fertility was established – 13 clutches with a total number of 182 eggs. In field conditions, the average fertility of a turtle most often does not exceed 2–3 clutches – 28–42 eggs. Fertility of the bug, as noted by M.P. Sekuna depends not only on abiotic factors, but also on the phase of development of bread grains during their feeding period [5].

The embryonic development of the pest lasts 6–12 days, and in cool weather – up to 20 days. Optimum conditions for the rapid maturation of the eggs of the shell bug are created at an air temperature of +20,4...+21.4 °C and a temperature of 0,5–0,7. The duration of larval development is from 20 to 60 days, depending on temperature and air humidity. Larvae go through five ages in their development.

Development from an egg to an adult takes at least 35–37 days, but can reach 50–60 days depending on the availability of food and weather conditions [8].

This pest damages winter wheat, starting from the moment it appears on the crops and until it leaves for wintering. First, when settling, the bug damages the leaves of the plants, later the stem and ear. When injected into the stem at the beginning of the emergence of plants into the tube, the upper leaf of the plant turns yellow and dries up. According to M. P. Sekun, stem damage can lead to a 50–54% yield reduction. If the stem is damaged before earing, then during earing, such an ear is characterized by partial or complete white spikes. In the presence of one bug per square meter, grain losses amount to 0,5–1,0 t/ha [9].

But the main damage to winter wheat crops is caused by larvae: during the period of grain formation and grain pouring – larvae of younger ages (L_1–L_3), waxy grain maturity – larvae of older ages (L_4–L_5) and adults of the new generation. Grain damaged by young larvae is deformed, and its mass decreases by 50–70% When harvesting, the so-called self-cleaning takes place – from the grain of light mass. Larvae during this period reduce the harvest and have little effect on its quality. According to numerous literature data, the criteria for the number of harmful beetle larvae for the first period of harmfulness is as follows: on crops of strong and valuable wheat – up to 10, and on ordinary – up to 15 ekz./m^2 [10].

When larvae of older ages feed on the mass of grain, especially when it is damaged in the phase of wax and full ripeness, it decreases slightly, and self-cleaning from it does not occur during harvesting. A minor admixture of such grain negatively affects the technological and nutritional qualities of the crop and may even lead to the loss of the condition of strong and valuable wheat. This is a consequence of the fact that the larvae of older ages, as well as bugs of the new generation, pierce the integumentary tissues with stylets, the aleurone layer, inject saliva into the central part of the grain endosperm, with the help of an enzyme extragastric digestion of plant protein occurs, which is then sucked out. It is this part of the endosperm during grain grinding that makes up the flour fraction. The content and quality of gluten in wheat grain is significantly reduced, which worsens its baking properties. As long as flour is dry, enzymes do not work, but when water is added to it to make dough, the process of splitting protein molecules begins and gluten loses its properties or degrades. Research by T.V. Topchiy established that if there are 2,5% of damaged grains in a lot, the quality of gluten decreases to the third group in winter wheat varieties Bezosta 1 and others. The criterion for the number of larvae in this period is reduced to 2–6 ekz./m^2 [5].

According to the researchers, in the presence of 19 larvae per 1 m^2 of wheat in the phase of milk ripeness, 18% of the grains were damaged, the yield decreased by 2,2 tons/ha. And Y. M. Sudenko claims that with the number of overwintering bugs of 1–3 ekz./m^2, crop losses range from 1,3 to 3,7 tons/ha [3, 11].

The harmfulness of the *Eurygaster integriceps* Put. is not limited to the deterioration of grain quality. The most dangerous damage is directly to the embryo. According to the Institute of Plant Protection, with 6% grain damage, grain germination decreases by 2,5–3,1%, germination energy – by 1,7–2,4%, and with the same damage to the embryo – by 22,1 –25,9 and 18,3–21,6%, respectively [13].

Eurygaster maurus L. widespread in all soil and climatic zones of Ukraine. The color of the body is very variable – from brownish-gray with small blackish dots to almost solid black The larva is smaller and darker than that of *Eurygaster austriacus* Schrk. and *Eurygaster integriceps* Put. The mandible of older instar larvae (III–V) is of the same length as the cheekbones and is placed almost in the same plane with them. The lateral edges of the front back are straight or slightly concave in the middle part. The larval phase lasts 35–38 days (I st age – 5–8 days, II – 7–8, III – 7–12, IV – 8–14, V – 8–18 days) [5].

Mass laying of eggs is observed in late May – early June. On average, there are 14 eggs in one clutch (7 in two rows). Masonry is always two-row [9, 10].

Winter wheat crops are inhabited by the following species*:* *Eurygaster austriacus* Schrk., *Aelia acuminata* L., and *Aelia rostrata* Boh. biology and pest is similar to the *Eurygaster integriceps* Put.

Thrips. Studies of the species diversity of wheat thrips were conducted in a number of European countries, for example, in Germany, Serbia, Norway, Finland, Lithuania, and Poland. According to publications from these countries, the most common species for agrocenoses of winter wheat are *Frankliniella tenuicornis*, *Limothrips denticornis*, *Limothrips cerealium*, *Haplothrips aculeatus*. In Lithuania, 13 species were found on winter wheat, in Poland – 14. According to research conducted in Poland, the distribution of *Haplothrips tritici* is limited to southern regions. Some species of thrips are the most dangerous pests of grain [3, 12].

About 50 species grow on cereal crops in Ukraine. Among them, the most numerous and harmful *Haplothrips tritici* Kurd, *Anaphothrips obscurus* Muller, *Limothrips cerealium*, *Limothrips denticornis* Halid. and some others.

Haplothrips tritici Kurd. Widespread especially in steppe and forest-steppe areas. In the last 5 years, it has occupied 40–90 and even 100% of the cultivated areas in the steppe zone and 12–65% in the forest-steppe zone; in Polissia – few in number [7].

Larvae hibernate. Their wintering in conditions of high humidity takes place in the basal part of the stubble, cracks in the soil and in the remains of straw, and in the case of a lack of moisture – in the soil. The depth of penetration into the soil varies from 5–20 cm in the forest-steppe zone to 50–90 cm in dry steppes.

In the spring, the larvae wake up when the soil warms up to 8 °C. At this time, the main mass of them penetrates into plant remains, where in May it turns into a pronymph and a nymph. Development of nymphs lasts 7–13 days. The mass appearance of adult thrips coincides with the beginning of earing of winter wheat. First, they feed on spikelet scales, and then penetrate the spikelet and begin to lay eggs, usually 4–8 in total on the inner side of the spikelet scales. Fertility of one female is on average 23–28 eggs. Their most intense deposition continues until the phase of complete weeding within 8–12 days. On the 6th-8th day, larvae appear, which pass 2 ages. First, they suck the juice from spikelet scales and flower membranes, and then damage the grain, which is in a soft state. Before the phase of waxy grain maturity, the larvae complete their development and go to winter in the soil. During the year, one generation develops [12].

The number of thrips increases in dry and warm weather during the earing and flowering of wheat (the period of imago egg laying and the beginning of larvae feeding); both air drought and cool rainy weather are unfavorable. Hot, dry weather at the end of summer is also unfavorable, contributing to the rapid ripening of grain, and, accordingly, to the reduction of larval nutrition. In autumn and spring, many larvae die in rainy weather, which promotes the development of entomopathogenic fungi. The harmfulness of the *Haplothrips tritici* Kurd. is due to feeding of the imago on the flag leaf and ear, which causes their deformation. But the greatest damage is caused by larvae that suck out the contents of unripe wheat grains. Yellow-brown spots appear on the grain, as they ripen, they lighten, and on the ripe grain they look much lighter than undamaged parts. The groove of damaged grains expands and deepens, the shape of the grain changes – they take on the appearance of underdeveloped, frail. If there are 20–30 thrips per spike at the beginning of the earing phase, yield losses reach more than 14%. Larvae feeding on grains leads to a decrease in grain yield by 2–5%, in case of mass reproduction – up to 14–24%. Almost every year, they cause a 10–30% decrease in the mass of 1000 grains. In addition, the baking qualities of grain and sowing seeds deteriorate [12].

Thrips damage has local significance (for example, *Haplothrips tritici* Kurd. larvae – grain or its parts), but often spreads systemically and causes the drying of sprouts, sterility of the ovary, twisting and drying of leaves.

Grain aphids. The most common and most harmful are the species that damage the aerial organs of plants, namely: *Sitobian avenae* F., *Schizaphis graminum* Rond., *Brachycolus noxius* Mordv. and *Rhopalosiphum padi* L. aphids [3, 6, 14].

According to the cycle of development, aphids are divided into monoecious (*Sitobian avenae* F., *Schizaphis graminum* Rond., *Brachycolus noxius* Mordv.) and dioecious – *Rhopalosiphum padi*.

Schizaphis graminum Rond. The homeland of aphids of this species is the Palearctic, but they have spread to other parts of the world and are now observed in North and South America, Europe, Asia and Africa. In Ukraine, it occurs more often in the south of the forest-steppe zone, in the Steppe and the temporarily occupied territory of Crimea, in other areas it is less common in mass quantities [7, 13].

The life cycle is monoecious. Lives in large colonies on the lower and upper surfaces of cereal leaves. Eggs overwinter on leaves of seedlings of winter crops and wild cereals. Female founders emerge from overwintering eggs in early to mid-April. In warm, dry weather, aphids multiply in large numbers, especially in southern areas, where they cause more damage in the absence of moisture.

During the growing season, it can develop in 10–12 generations. In places of damage, plants become discolored, sometimes red. In addition to direct damage, aphids transmit viral diseases of cereals.

Sitobion avenae F. is widespread. Mass breeding is more often observed in the steppe zone and the temporarily occupied territory of Crimea.

The life cycle is monoecious. Eggs overwinter on winter cultivated or wild cereals. In April–May, larvae of founding females emerge, which form open colonies on the colossus, less often on leaves and stems. Winged individuals appear starting from the first generation and settle in the spring of cereals. It develops in several generations during the growing season [14].

Brachycolys noxius Mordv. is widespread. The life cycle is monoecious. Lives in a leaf twisted into a tube or on a damaged colossus. The leaves turn yellow and dry, the ear of corn curls. With a large population, especially during a drought, all plants dry up and die.

Eggs overwinter on leaves of barley and wheat. The rebirth of the foundress larvae occurs in early spring. The duration of larval to adult development is up to 8 days on average. In May–June, winged females appear and inhabit crops of cereals and other crops. In September–October, the sexual generation appears, the fertilized females of which lay wintering eggs [13].

Rhopalosiphum padi L. is common everywhere, it is a carrier of a dangerous viral disease – *Barley yellow dwarf luteovirus* (BYDV) [11].

Eggs overwinter on pine trees. At the beginning of budding, the founders hatch from them, feeding on the underside of the leaves and on the inflorescences. In May, winged aphids migrate to cereals, where they form colonies on leaves, ears, and in leaf axils. In the fall, winged stamens appear and migrate to cherry trees.

The colonies of aphids in different periods of vegetation of fodder plants have different morphotype composition, which to some extent affects the formation of their number. Changes occurring in the composition of morphs during the ontogenesis of aphid populations reflect their historically formed relationships with food plants that formed life cycles. It is known that the volume of realized fecundity in wingless morphs of various species of aphids is higher than in winged ones.

The increased attention to aphids is due not only to their complex biology and their importance in biocenoses, but also to the economic damage that representatives of this group cause by damaging crop plants, as well as by transferring numerous phytopathogenic viruses [4, 11].

If the plants are slightly colonized by grain aphids, their colonies are concentrated at the base of the leaf plates from the upper or lower side, depending on the type of phytophagous plant. During the mass reproduction of aphids, the colonies connect and cover the entire leaf and even the stem, the leaves on the plants curl, dry prematurely, the ear is deformed, twisted and does not come out of the sheath. Such plants die during droughts. Sufficient moisture causes stunted grain, empty spikelet. As the lower leaves age and wither, aphids move to the upper leaves, and later to the ear scales [7].

According to T.M. Topchiy, the main harmfulness of aphids during development on winter wheat crops is limited to a decrease in grain weight. With an average number of aphids of 27,3 ekz./ear (phase of milky grain maturity) and a plant stand density of 350 plants per 1 m^2, the estimated yield loss was 6,31 t/ha [13].

Aphids belong to sucking pests that, by sucking nutrients from plants, affect the grain yield and its quality. In years of mass reproduction, aphids reduce the yield of winter wheat by 10–15%. In addition to direct damage, phytophages are carriers of viral diseases. The intensity of settlement and the harmfulness of aphids depend on weather conditions during the period of their parthenogenetic reproduction. Warm, sunny weather (decadal average air temperature of 17,0–19,5 ^{o}C) with a moderate amount of precipitation contributes to the rapid increase in the number of phytophagous plants. Wheat plants are suitable for feeding and rapid development of aphids before the onset of the milk-wax ripeness phase, therefore mass reproduction of insects is possible when optimal meteorological conditions coincide with the period of emergence of plants into the tube – the formation of grain. In the spring, during this period, the reproduction of aphids is often restrained by cool weather with significant precipitation, in the summer, in the phase of milk-wax maturity, excessively high temperature and low air humidity [16].

Chemical method of protection winter wheat pests. In the complex of protection of agricultural crops, the chemical method has a leading place. It is based on the use of poisonous substances that, entering the body of harmful insects in various ways, lead to their death.

The chemical method using industrial preparations was started more than 250 years ago, when in the middle of the 18th century, cereal seeds were treated with arsenic and mercury preparations, copper sulphate solutions. However, only in the middle of the 19th century did science-based work on the search for chemical preparations and the organization of their industrial production begin. The first commercially produced insecticide Paris green was used in 1867 in the state of Michigan (USA) against the Colorado potato beetle. However, the rapid development of the chemical method and the total use of insecticides began after the Second World War with the production of DDT and HCG preparations [18].

Despite some disadvantages of the chemical method, it is and will be the most mobile and widely used in the global practice of plant protection. There is still no alternative to it, besides, the range of pesticides, the tactics and strategy of their use have changed significantly. Modern preparative forms of pesticides and agrochemicals (microfertilizers and plant growth regulators) have also changed radically, compared to those used in the second half of the last century. They have become well balanced according to many indicators, often the composition of the drugs contains two or three components of the active substance, which significantly expands the favorability and simplifies the dosage of the drugs, the preparation of working fluids for their use [16].

Regarding the change in the range of insecticides, highly toxic and persistent drugs are banned or replaced by more effective and environmentally safer ones. Even such insecticides as pyrethroids (deltamethrin, bifethrin, etc.), which gained popularity due to the scale of their use in 1980–1990, in the last ten years gave way to neonicotinoids (imidacloprid, acetamiprid, thiamethoxam, thiacloprid).

According to S.O. Tribelia, pesticides are so important for humanity that no serious specialist will undertake to predict when the need for their use will disappear. However, the manifestation of negative consequences of chemical plant protection causes a discussion in the scientific literature about the prospect of its use. At the same time, an opinion is expressed about the need for a significant restriction, and in the future, a complete refusal from its application. Well-known scientists in the field of chemical protection have a different opinion: with skillful handling and proper organization of plant protection, pesticides provide a great benefit to the national economy [15].

Life on earth is based on the chemical interaction of living and non-living nature. Only an understanding of the essence and mechanisms of the connections existing in nature will make it possible to solve the issue of ecological strategy, in particular, regarding the ecological risk of pesticide use. In order to preserve the harvest, a person consciously uses chemical compounds as one of the means of intensification of agricultural production.

The development of the theory and practice of chemical plant protection should be related to the development of the issue of the justified inclusion of insecticides in integrated systems of phytosanitary measures, which take into account to a greater extent the ecological features of harmful and beneficial arthropods and the properties of chemical preparations [4, 16].

When choosing an insecticide, it is necessary to determine which drug is acceptable for use in a particular soil and climate zone in order to ensure high technical and economic efficiency against a complex of phytophages.

In order to ensure the use of pesticides, it is necessary to deepen the study of not only their effective action on harmful organisms, but also the after-effect on both the target objects and the environment. The radical direction of reducing the danger of their use is the development and improvement of integrated plant protection systems, where all existing methods (organizational-economic, agrotechnical, immunological, biological) should be harmoniously combined [18].

The aim of our research was to improve the system of protection of winter wheat from a complex of pests, taking into account the peculiarities of the biology of the dominant species of phytophages and the modern technology of crop cultivation in the conditions of the Vinnytsia region.

Materials and methods of research. The research was carried out in the conditions of the «Sad» farm, Vinnytsia region, in the zone of the Right Bank Forest-Steppe of Ukraine during 2021–2022, the species composition of the harmful entomocomplex of winter wheat and the control of their number were studied.

Winter wheat was grown in accordance with the cultivation technology recommended for the forest-steppe zone of the Vinnytsia region. When planning and conducting experiments, we were guided by the methodology of S.O. Trybel [19].

The size of the experimental plots is 20 m^2, the repetition of the experiment is 4 times. Placement of plots is randomized (in blocks). For field experiments, the research variety «Krayevyd», the seeds of which are pre-treated at the plant with a fungicide. The seeds in all versions are treated with the fungicide Maksym Star 0,25 FS, t.c.s. (fludioxonil) – 1,0 l/t.

The species composition of the entomofauna and the determination of the number of dominant species of pests were determined by the following methods:

- by the soil excavation method: 8 pits arranged in a checkerboard size of 50×50 cm, up to 80 cm deep were dug on each plot. The soil from each pit was sifted layer by layer by hand or sifted through sieves and the pests found in it were counted;
- visual inspection of 10 plants in 10 places of the option;
- digging up crops with ditches and wells;
- Petlyuk's device on 25×25 cm platforms;
- using poisoned lures (1 bait 100 m^2);
- mowing with an entomological net (10 sweeps in 10 places).

Records were made in the following phases of wheat organogenesis: regrowth of vegetation – tillering, emergence of the plant into a tube, earing – flowering, milky and full grain maturity. In parallel with the accounting, the morphophysiological state of the culture was determined.

The occupancy rate (*Or*) was determined according to formula (1) and according to a modified scale for cereal aphids:

$$Or = (N \times P) / 100, \quad (1)$$

where N – is the number of phytophages, ekz./cob, ekz./m^2;

P – population of plants, %.

Field germination was calculated on the 10th day after sowing. And they also determined the population of ladder pests. At the same time as the similarity, the energy of germination was determined, that is, the number of normally developed sprouts in a certain period (3–4 days).

The evaluation of the effectiveness of modern insecticidal poisons against sucking phytophages in autumn on winter wheat was carried out in field conditions. Seed treatment with insecticides was carried out the day before sowing. Norms and terms of use of drugs were determined based on the goal and task of research. The test options included drugs from different classes of chemical compounds that were included in the « The list of pesticides and agrochemicals allowed for use in Ukraine» [17]: carbamates – Promet 40% mk. s (furathiocarb), neonicotinoids – Gaucho 70% z.p. (imidacloprid), Cruiser 350 FS, t.k.s. (thiomethoxam); control – without processing. (Seeds in all variants were treated with the fungicide Maxim Star 0,25 FS, t.c.s. (fludioxonil) – 1.0 l/t) (Table 1).

The technical efficiency of insecticides-protozoans was determined by the formula:

$$Te = 100\ (O_k - O_v) / К_к, \quad (2)$$

where Te – is technical efficiency, %;

Oc – occupancy rate in control;

Ov – is the occupancy rate in the experimental version.

Table 1

The scheme of the experiment on the evaluation of the effectiveness of seed treatment for the treatment of winter wheat seeds in the autumn period from sucking pests (average, 2021–2022)

№ p/p	Variant	Consumption rate, l/t, kg (l) / t
1	Control (without insecticides)	Water
2	Promet 40% m.c. (furathiocarb)	2,0
3	Cruiser 350 FC, t.s.c. (thiamethoxam, 350 g/l)	0,5
4	Gaucho 70% z. p. (imidacloprid)	2,0

the source is formed on the basis of own research results

The study of the effectiveness of the preparations was carried out on the plots against the phytophages most common in winter wheat crops. Consumption rates and terms of use of insecticides were determined based on the purpose of research in accordance with the «The list of pesticides and agrochemicals allowed for use in Ukraine» (Table 2) [17].

Table 2

The scheme of the experiment on the evaluation of the effectiveness of insecticides when spraying winter wheat crops against phytophages (average, 2021–2022)

№ p/p	Variant	Consumption rate, l/t, kg (l) / t
1	Control (without insecticides)	Water
2	Standard – Bi-58 New, (dimethoate, 400 g/l)	1,5
3	Engeo 247 SC, c.s. (lambda-cyhalothrin, 106 g/l thiamethoxam, 141 g/l)	0,18
4	Karate-Zeon 050 CS, m.s. (lambda-cyhalothrin, 50 g/l)	0,20
5	Nurelle D, KE (chlorpyrifos, 500 g/l + cypermethrin, 50 g/l)	1,1

the source is formed on the basis of own research results

Spraying of wheat crops was carried out in the phase of the beginning of milk ripeness of the crop grain, during the period of mass appearance of larvae of wheat thrips, shell bug and cereal aphids. Variants of the experiment included preparations from different classes of chemical compounds: organophosphorus insecticides – Bi–58 New, 40% of (dimethoate, 400 g/l); combined insecticides – Engeo 247 SC, c.s. (lambda-cyhalothrin, 106 g/l + thiamethoxam,141 g/l); synthetic pyrethroids – Karate Zeon 050 CS, μ.s. (lambda cigalothrin, 50 g/l) and control – without spraying with insecticides. The method of application of drugs is continuous spraying of plants.

Censuses of the population of pests were carried out before spraying winter wheat plants and 3, 7, 14 days after the use of insecticides. The technical efficiency of insecticides was calculated based on the difference in indicators of plant population by pests in the control and experimental version, taking into account the correction for the change in the number of phytophages in the control version (formula 3):

$$Ed = 100\ (Ab – Бa) / Aa \qquad (3)$$

where Ed – is the effectiveness of the action corrected for control, %;

A – is the density of pests in the experimental version before treatment;

B – the density of insects in the experimental version after treatment;

a – the density of pests in the control at the first registration;

b – the density of pests in the control of the following records.

Economic efficiency was determined according to the generally accepted methodology. Mathematical processing of experimental data was carried out by the method of dispersion analysis with the help of a personal computer using special packages of Excel programs.

Research results. Climate change in recent decades is characterized by a warming trend. In the Forest Steppe of Ukraine, the average annual air temperature increased by 0,5–1 ºC. Such an increase in temperature affects the course of the phenophases of the development of crops, may lead to an increase in the number of populations of harmful organisms, and changes in economic dominants. Under such conditions, there is a need to clarify the species composition and dominance of pests, which will make it possible to apply a system of measures optimal for specific conditions in a timely manner in order to improve the phytosanitary condition of crops.

As a result of entomological monitoring of winter wheat crops in the Vinnytsia region during 2021–2022, 34 species of insects from 19 the family that damage this crop were found (Fig. 1).

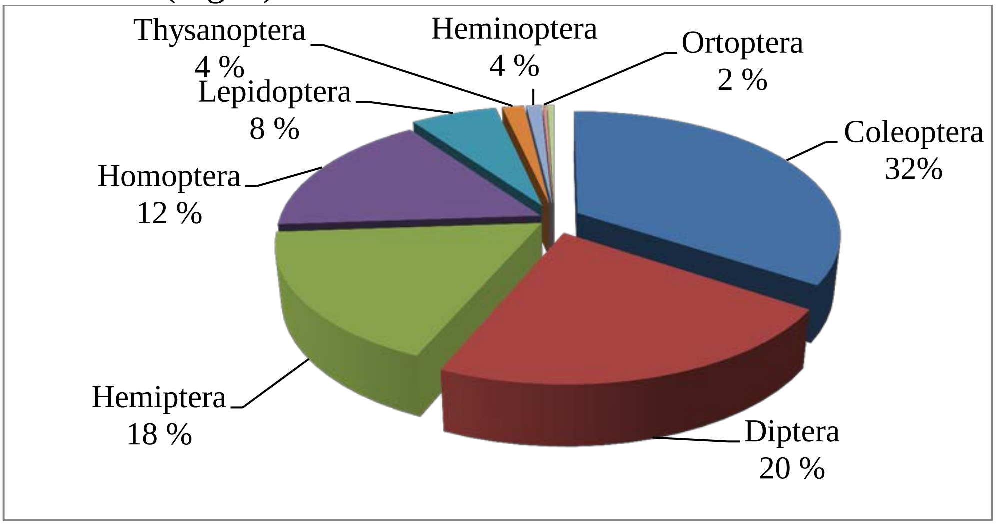

Fig. 1. The structure of the entomocomplex of winter wheat in Vinnytsia region (on average for 2021–2022)

the source is formed on the basis of own research results

The order of Diptera included 11 species from the the familyes Cecidomyiidae, midges (Opomyzidae), grain flies (Chloropidae), hoverflies (Agromyzidae) and flower midges (Anthomyiidae). The order of Coleoptera, was characterized by the greatest species diversity (14 species) and was represented by the following families: Scarabaeidae, Chrysomelidae, Elateridae and Carabidae. Their share in the structure of the entomocomplex was 30% of the total.

Detected 9 species of phytophagous insects were identified from the Hemiptera family, belonging to the Miridae, Pentatomidae, and Scutelleridae families. The share of Lepidoptera and Homoptera in the structure of the entomocomplex was 8% and10% each (5 species from the families Tineidae and Noetuidae and 5 species from the families Cicadinea and Aphididea. The orders of Thysanoptera and Hymenoptera included 2 species each from the Thripidae and Cephidae families. Orthoptera represented the smallest number of species – 2%.

The composition of insects in different periods of plant development consists of species that migrate from other biotopes, as well as species that winter in fields where crops are placed, and polyvoltine species, most of whose life cycle takes place in the same cenosis. The formation of the species composition of pests in winter wheat crops occurs gradually during the growing season of the plants.

The analysis of the overall dynamics of the number of pests and the observation of plant phenology made it possible to identify a complex of harmful insect species associated with certain stages of the organogenesis of winter wheat. According to the change in the number of phytophages during the growing season, it was possible to distinguish three periods of coincidence of the biochemical composition of the fodder crop favorable for insects with the appearance of a harmful stage: seedlings – tillering, emergence into the tube, flowering – ripening of grain.

In winter wheat crops, the spread and feeding of pests begins in autumn from the beginning of seed germination. Grains sown in the soil damage soil-dwelling insects: larvae of various species of sawflies (*Agriotes lineatus* L., *Agriotes sputator* L.) – wireworms, the caterpillar of the *Scotia segetum* Schiff. and *Scotia exclamationis* L. Larvae of the Scarabidae (*Miltotrogus aequinoctialis* Hrbst., *Melolontha melolontha* L.) and bread beetles (*Anisoplia austriaca* Hrbst., *Anisoplia segetum* Hrbst.) gnaw through young seedlings, stems, seedling roots, and gnaw pits in the stems.

Leaf-gnawing larvae of the *Zabrus tenebrioides* Goeze. wet the leaves, gnaw through the stem node, *Phyllotreta vittula* Redt. gnaw through holes. Damage by these pests leads to the thinning of plant density, and sometimes to the death of crops.

Seedlings and young plants of winter wheat are damaged by intrastem pests: larvae of cereal flies *Mayetiola destructor* Say., *Chlorops pumilionis* Bjerk., *Meromyza saltatrix* L., *Leptohylemya coarctata* Flln., *Opomyza germinationis* L., *Oscinella frit* L. Making moves inside the stem, the larvae damage the growth point, the central leaf, the node of the tiller, as a result of which the density of the productive stem is thinned, the intensity of bushing increases. Weakened plants die during the winter period or greatly reduce productivity, increase the duration of the growing season, ripen unevenly, which contributes to the harmfulness of ear pests.

The biggest threat to winter crops in the autumn period is sucking insects, in particular cereal aphids *Sitobion avenae* F., *Rhopalosiphum padi* L. and leafhoppers

Psammotettix striatus L., *Laodelphax striatella* Fall., *Macrosteles laevis* Rib. Due to damage that is imperceptible at first glance, they are often underestimated. However, during the extraction of nutrients, pests introduce toxic compounds that disrupt metabolic processes, suppress plant growth, worsen their bushiness, winter resistance, drought resistance In addition, cereal aphids and leafhoppers spread viral diseases in crops.

In the spring, after the recovery of winter wheat plant vegetation, *Oulema lichenis* Voet., *Oulema melanopus* L. join the leaf-gnawing and sucking phytophages that damaged crops in the fall. Imago pests gnaw through elongated holes, and the larvae eat the parenchyma of the leaf in the form of elongated strips, leaving the epidermis from below. Insects cause delayed – limit grubbing, reduce plant productivity. During the period of emergence of winter wheat plants in the tube on crops, the *Eurygaster integriceps* Put. and other insects from the order Homoptera – *Aelia acuminata* L.; *Carpocoris pudicus* Poda., *Dolycoris baccarum* L., *Notostira erratica* L., *Trigonotylus ruficornis* Geoffr., *Lygus rugulipennis* Popp.

Haplothrips tritici Kurd. was dangerous on winter wheat plants from the flowering phase until the grain ripens. The feeding of the pest's imago on the flag leaf and spike causes partial or complete white spikes, and the larvae – deformation, underdevelopment, and thinness of the grains. Bread sawflies (*Cephus pygmaeus* L., *Trachelus tabidus* F.) feed on the inner tissues of straw. The quality of winter wheat grain is reduced by the larvae of the harmful shell bug. Before harvesting and during its harvesting, part of the grains is damaged by bread beetles.

Thus, the results of the research revealed that in 2021–2022, the main and most dangerous pests that caused significant damage to winter wheat crops in Vinnytsia region were a complex of sucking pests: thrips, cereal aphids, bread bugs. Therefore, the winter wheat crop protection system was aimed specifically at limiting the number and harmfulness of these phytophages.

Effectiveness of insecticides of seed dressings. Among a number of factors that prevent the realization of the potential productivity of modern varieties in the range of 80–85%, the share of harmful organisms accounts for 33–35%, or losses on average reach about 3 t/ha of grain. This convincingly shows that even partial prevention of losses is an important factor in increasing crop productivity.

The successful solution of this task is largely facilitated by the protection of crops from pests. It is especially important to effectively and timely protect winter crops in the autumn growing season, which makes it possible to maintain the optimal density of plants and prevent a significant decrease in their winter hardiness due to damage by sucking pests and reduce the wintering stock of phytophagous plants.

Macrosiphum (Sitobion) avenae F. is the biggest threat to winter crops in autumn and winter. Because of their small size and damage that is imperceptible at first glance, they are often underestimated. However, when absorbing nutrients, pests introduce toxic compounds that disrupt metabolic processes, suppress plant growth, reduce their bushiness, winter resistance, and drought resistance. In addition, cereal aphids spread viral diseases in crops. That is why it is important to protect winter crops at the first stages of organogenesis, when plant resistance is very weak.

The evaluation of the effectiveness of modern insecticidal poisons in winter wheat crops against sucking pests was carried out in the field in 2021–2022 in the conditions of the Vinnytsia region.

Variants of the experiment included drugs from different classes of chemical compounds: carbamates – Promet 40% mk. s (furathiocarb), neonicotinoids – Gaucho 70% z.p. (imidacloprid), Cruiser 350 FS, t.k.s. (thiomethoxam); control – no treatment (seeds in all variants were treated with the fungicide Maksym Star 0,25 FS, t.c.s. (fludioxonil) – 1,0 l/t.

Inspection of winter wheat crops for aphid infestation was carried out in autumn. The density of pest in 2021. The appearance of cereal aphids in autumn on the seedlings of winter wheat was noted in the third decade of September. (EPS 5–10 ekz./plant). (Table 3).

Table 3

Technical efficiency of pre-sowing treatment of winter wheat seeds with insecticides against aphids (average 2021–2022)

Variant	Consumption rate of the drug, kg (l)/t	7 days		14 days	
		Coefficient of damage	Efficiency, %	Coefficient of damage	Efficiency, %,
Control (without insecticides)*	-	0,43	0	0,79	0
Gaucho 70% z. p.	2,0	0,15	65,1	0,36	54,4
Promet 40% m.c.	2,0	0,06	86,0	0,23	70,8
Cruiser 350 FC, t.s.c.	0,5	0,04	90,7	0,18	77,2

**Note:* In all variants, winter wheat seeds were treated with the fungicide Maxim Star 025 FS, t.c.s. (fludioxonil), 1 l/t*

the source is formed on the basis of own research results

According to the result of treatment of winter wheat seeds with insecticides, the population of aphids significantly decreased in all variants, compared to the control. The lowest number of phytophagous plants over the years of research was noted in versions with protoyners Cruiser 350 FS t.c.s. (0,5 l/t), the aphid occupancy rate was 0,04%, in the version where Promet 400 poison was used, µ.s. (2,0 l/t) occupancy rate 0,06%. The highest index of aphid population was noted in the control version, where the population ratio was 0,43%. Accordingly, the technical efficiency of the Cruiser 350 FS t.c.s. (0,5 l/t) was 90,7%; Promet 400, m.s. (2,0 l/t) – 86,0%, while in the control, the density of larvae of these types of pests was almost 4,5 times higher. The lowest technical efficiency was noted in the version with Gaucho 70% z. p. – 65,1%, respectively. In 14 days after the emergence of seedlings (the period of the greatest abundance of the phytophagous), the population ratio of plants in the control was 0,79%, which was 1,6–1,8 times higher than this indicator in the variants Promet 400, m.s., Gaucho 70% z.p., and 2 times larger compared to Cruiser 350 FS t.c.s. The protective effect of the poison was preserved. Accordingly, the technical efficiency of the Cruiser 350 FS t.c.s. (0,5 l/t) was 77.2%; Promet 400, µ.s (2,0 l/t) – 70,7%, while the density of aphids was almost 4,5 times higher than in the control. The lowest technical efficiency was noted in the version with Gaucho 70% z. p. – 54,4%, respectively.

As follows, the highest efficiency in winter wheat crops against sucking pests of seedlings was ensured by the insecticides Cruiser 350 FS t.c.s. and Promet 400, m.c.s.

The use of poisoners makes it possible not only to protect seedlings from pests, but also to increase the yield and quality of winter wheat grain (Table 4).

According to research results, the decrease in the number of sucking pests had a positive effect on the density of seedlings. The highest plant stand density is observed with the Kruiser 350 FS preparation, t.c.s. – 547,0 plants/m^2, while in the version with the preparation Gaucho, 70% z.p., of – only 522,0 plants/m^2.

The analysis of yield data of winter wheat shows that the use of poisoners led to a significant increase in yield in all variants compared to the control.

Table 4

Economic efficiency of winter wheat seed dressing (average 2021-2022)

Variant	Consumption rate of the drug, kg (l)/t	Plant density, ekz./m^2	Mass of 1,000 grains, g	Yield, t/ha	Preserved yield, t/ha
Control (without insecticides)	-	443,0	33,0	2,5	0
Gaucho 70% z. p.	2,0	522,0	43,0	3,5	1,0
Promet 40% m.c.	2,0	530,0	45,5	4,4	1,9
Cruiser 350 FC, t.s.c.	0,5	547,0	47,8	4,9	2,6

the source is formed on the basis of own research results

The highest yield was observed in the version using the insecticide Cruiser 350 FS t.c.s., where the preserved yield was 2,6 t/ha. The lowest grain yield – 3,5 t/ha was in the version with the use of the drug, the saved harvest of Gaucho was 70% of the crop. did not exceed 0,1 t/ha. The treatment with pro-poisoners had a positive effect not only on yield, but also on seed quality, in particular, on the weight of 1,000 grains. In variants using insecticides, the weight of 1000 grains compared to the control increased by 10,0, 12,5, 14,8 g compared to the control.

Thus, the use of poisons in winter wheat crops against sucking pests makes it possible to ensure reliable protection of seedlings and significantly increase plant productivity. It is most expedient to treat winter wheat seeds with Kruiser 350 FS t.c.s. and Promet

400, mc.s.

Effectiveness of insecticides for winter wheat spraying against sucking pests. To ensure the realization of the potential opportunities of crop-forming processes of agricultural plants at various stages of organogenesis, a complex of protective measures is necessary, among which the chemical method plays a rather significant role, as it is characterized by high economic and economic efficiency.

Among the pests of winter wheat, a special place belongs to sucking pests, which is due to the peculiarities of their nutrition and the negative impact of damage not only on the quantitative indicators of the wheat harvest, but also on its quality. Therefore, it is no coincidence that the development of chemical protection of crops is primarily related to these phytophages. Spraying of crops was carried out during the period of mass appearance of larvae of wheat thrips, shell bug and cereal aphids (the end of flowering – the beginning of milky grain maturity).

The obtained results indicate that the number of sucking pests in the control did not exceed the EPS. On the 3rd day, their number decreased compared to the control in all variants – by 4,7, 5,2, 9,1 times (Table 5).

Table 5

The influence of modern insecticides on the number of sucking pests in winter wheat crops, 2022

Variant	Consumption rate of the drug, kg (l)/g	Density of phytophages on … day after spraying								
		cereal aphids			*Eurygaster integriceps* Put.			*Haplothrips tritici* Kurd.		
		3	7	14	3	7	14	3	7	14
Control (without insecticides)	-	3,5	5,0	10,7	3,4	4,1	5,0	6,6	20,5	35,0
Bi-58 New, к.о.	1,5	0,4	1,2	3,6	0,4	0,9	1,7	0,8	5,0	10,7
Engeo 247 SC, k.s.,	1,8	0,9	0,9	2,9	0,1	0,3	0,9	0,2	3,7	7,8
Nurelle D, КЕ	1,1	0,3	1,0	3,2	0,2	0,5	1,1	0,5	4,1	8,3
Karate-Zeon 050 CS, m.s.	0,20	0,6	1,4	4,0	0,6	1,0	2,0	1,0	5,3	11,5

the source is formed on the basis of own research results

The studied drugs were characterized by different effectiveness when used. Thus, the most effective against sucking phytophages in the course of research was the drug Engeo 247 SC, k.s., which, at the rate of consumption of 0,18 l/ha, on the 3rd day provided a reduction in numbers at the level of 98,4–99,0%. A slightly lower efficiency was provided by the drug Nurelle D, КЕ – 92,4% and 94,2%. The efficiency of the standard Bi-58 New, 40% k.o. after application was 87,9% to 91,4%, and the insecticide Karate Zeon, 5% k.s. – 82,3% and 84,8, respectively (Table 6).

On the 7th day after spraying, the number of phytophages increased, reducing the technical effectiveness of the preparations in all variants. The least effective in our studies was the drug Karate-Zeon 050 CS, m.c., the effectiveness of which is 11,2–34,0% lower than that of Engeo 247 SC, k.s.

In 14 days after spraying winter wheat, the number of pests continued to increase, exceeding the number of EPS. The highest efficiency in this period was provided by Engeo 247 SC, k.s., Nurelle D, KE and Karate Zeon, 5% k.s., which reduced the number of pests on average by 73,4% compared to the standard Bi-58 New, 40% k.o. – by 67,2%.

As for *Haplothrips tritici* Kurd., according to the results of research, it was established that the effectiveness of insecticides was lower than against the *Eurygaster integriceps* Put., especially by 1,03 and 1,04 times. Obviously, this is related to the hidden way of life, which is characteristic of this phytophagous.

Table 6

Technical efficiency of insecticides against pests of winter wheat, 2022

Variant	Consumption rate of the drug, kg (l)/g	Technical efficiency on ... day after spraying %								
		3			7			14		
		cereal aphids	*Eurygaster integriceps* Put.	*Haplothrips tritici* Kurd.	*cereal aphids*	*Eurygaster integriceps* Put.	*Haplothrips tritici* Kurd.	*cereal aphids*	*Eurygaster integriceps* Put.	*Haplothrips tritici* Kurd.
Control (without insecticides)*	-	0	0	0	0	0	0	0	0	0
Bi-58 New, к.о.	1,5	91,4	88,2	87,9	76,0	78,0	75,6	66,3	66,0	67,2
Engeo 247 SC	1,8	99,0	99,0	98,4	84,0	92,7	81,9	72,9	82,0	77,7
Nurelle D, KE	1,1	94,2	94,1	92,4	80,0	87,8	80,0	70,1	78,0	76,3
Karate-Zeon 050 CS, m.s.	0,20	82,8	82,3	84,8	72,0	75,6	74,1	62,6	60,0	67,1

**Note: In all variants, winter wheat seeds were treated with the fungicide Maxim Star 025 FS, t.c.s. (fludioxonil), 1 l/t*

the source is formed on the basis of own research results

It should be noted that all drugs increased economic efficiency compared to the control. However, the highest one was provided by Engeo 247 SC, k.s., and Nurelle D, k.e. When using them, an increase in productivity was observed by – 4,5–4,9 t/ha, in the control – 4,0 t/ha.

As evidenced by the obtained results, an increase in the mass of 1,000 grains is observed in almost all variants after spraying the plants (Table 7).

The positive effect of spraying wheat crops with insecticides on the parameters of the crop structure was noted. In the version where Engeo 247 SC, k.s. at consumption rates of 1,8 l/ha, the mass of grain from an ear and the mass of 1000 grains exceeded the control indicator by 0,02 and 1,46 g, respectively.

Table 7

Economic efficiency of winter wheat insecticide spraying against sucking pests, 2022

Variant	Grain yield, t/ha	Technological indicators		
		mass 1000 grains, g	energy sprouting, %	similarity, %
Control (without insecticides)*	4,0	33,0	83,2	85,1
Bi-58 New, к.о.	5,1	43,1	85,2	86,2
Engeo 247 SC	5,8	48,4	89,5	91,7
Nurelle D, КЕ	4,5	48,2	88,6	90,2
Karate-Zeon 050 CS, m.s.	4,9	45,5	87,8	89,4
SSD_{05}	0,29	0,34	0,28	0,26

the source is formed on the basis of own research results

In variants with the use of Karate Zeon preparations, 5% k.s., the weight of 1000 grains, g was higher compared to the control, from 11,4 to 12,5 g, respectively, the value of the saved harvest was 1,2–1,3 t/ha. The combined drugs Engeo 247 SC, k.s. and Nurelle D, КЕ most effectively controlled the number of pests, which can be explained by the fact that they include two substances of different classes that provide an expansion of the spectrum of action, an increase in toxicity and the duration of the protective actions.

During the processing of sucking phytophages, their physiological state worsened, which affected their numbers and sensitivity to insecticides. Therefore, treatment with insecticides should be carried out taking into account the EPS, then spraying with insecticides is appropriate.

Therefore, during the accounting, we established that the use of the investigated insecticides showed high effectiveness in controlling aphids, bedbugs and thrips. However, it should be noted that the use of drugs Engeo 247 SC, k.s., 1,8 l/ha and Nurelle D, k.e. 1,1 l/ha best limited the abundance of these phytophages.

Conclusions. As a result of the conducted research, the species composition of the entomocomplex of pests in winter wheat crops and the control of their number, depending on the use of plant protection products, were clarified.

It was established that in the conditions of the Vinnytsia region, 34 *species* of pests from 16 familyes that damage this crop were found in winter wheat crops. The Diptera range consisted of 11 species, the Coleoptera range was characterized by the greatest species diversity (14 species), their share in the structure of the entomocomplex was 30% of the total. 9 types of phytophages from a number of bugs, or Hemiptera, were identified. The share of Lepidoptera and homoptera (Homoptera) in the structure of the entomocomplex was 10% each. The orders of Thysanoptera and hymenoptera (Hymenoptera) had 2 species each. Orthoptera represented the smallest number of species – 2%.

The main and most dangerous phytophages that cause significant damage to winter wheat crops from a complex of insect pests have been identified, namely: thrips, cereal aphids, and bread bugs.

The effectiveness of modern insecticides against the dominant pests of winter wheat and the optimized methods of their application were evaluated. According to the results of winter wheat seed treatment with insecticides-protozoans, it was established that the lowest number of phytophagous was noted in variants with protozoans Cruiser 350 FS t.c.s. (0,5 l/t), the aphid occupancy rate was 0,04%, in the version where Promet 400 poison was used, μ.s. (2,0 l/t) occupancy rate 0,06%. The highest index of aphid population was noted in the control version, where the population ratio was 0,43%. Accordingly, the technical efficiency of the Cruiser 350 FS t.c.s. (0,5 l/t) was 90,7%; Promet 400, m.s. (2,0 l/t) – 86,0%, while in the control, the density of larvae of these types of pests was almost 4,5 times higher.

It was noted that the highest yield was observed in the version using the insecticide Cruiser 350 FS t.c.s., where the preserved yield was 2,6 t/ha. The lowest grain yield – 3,5 t/ha was noted in the variant with the use of the drug Gaucho 70% s.p. the saved yield did not exceed 0,1 t/ha. It was established that the treatment with protoxins had a positive effect not only on yield, but also on seed quality, in particular, on the weight of 1000 grains. In variants using insecticides, the weight of 1000 grains compared to the control increased by 10,0, 12,5, 14,8 g compared to the control.

It was established that the use of insecticides during the winter wheat growing season, which were studied, showed high effectiveness in controlling aphids, bugs and thrips. However, it should be noted that the use of drugs Engeo 247 SC, k.s., 1,8 l/ha and Nurelle D, k.e. 1,1 l/ha best limited the abundance of these phytophages. When using them, an increase in productivity was observed by – 4,5–4,9 t/ha, in the control – 4,0 t/ha.

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АНОТАЦІЯ
КОНТРОЛЬ ЧИСЕЛЬНОСТІ СИСНИХ ШКІДНИКІВ ПШЕНИЦІ ОЗИМОЇ В УМОВАХ ПРАВОБЕРЕЖНОГО ЛІСОСТЕПУ

У даній статті теоретично узагальнено та вирішено важливу наукову проблему щодо уточнення видового складу ентомокомплексу фітофагів у посівах пшениці озимої та розробки ефективних заходів контролю їх чисельності, залежно застосування засобів захисту рослин.

В результаті проведеного ентомологічного моніторингу пшениці озимої в умовах Вінницької обл., уточнено 34 види комах із 16 родин, які пошкоджують дану культуру. Ряд двокрилі (Diptera) налічував 11 видів, ряд жуки, або твердокрилі (Coleoptera) характеризувався найбільшим видовим різноманіттям (14 видів), їх частка в структурі ентомокомплексу складала 30 % від загалу. Виявлено 9 видів фітофагів з ряду клопи, або напівтвердокрилі (Hemiptera). Частка лускокрилих (Lepidoptera) та рівнокрилих (Homoptera) у структурі ентомокомплексу складала по 8 % і 10 %. Ряди трипси (Thysanoptera) та перетинчастокрилі (Hymenoptera) налічували по 2 види. Найменшою кількістю видів був представлений ряд прямокрилі (Orthoptera) – 2 %.

Виявлено основні і найбільш небезпечні фітофаги, які завдають значної шкоди посівам пшениці озимої з комплексу комах – шкідників, а саме: трипси, злакові попелиці та хлібні клопи.

Оцінено ефективність сучасних інсектицидів проти домінуючих шкідників пшениці озимої та оптимізовані способи їх застосування. За результатами обробки насіння пшениці озимої інсектицидними-протруйниками встановлено, що найнижча чисельність фітофага була відмічена у варіантах з протруйниками Круізер 350 FS т.к.с. (0,5 л/т), коефіцієнт заселеності попелицею склав 0,04 %, у варіанті де застосовували протруйник Промет 400, мк.с. (2,0 л/т) коефіцієнт заселеності 0,06 %. Відповідно технічна ефективність Круізер 350 FS т.к.с. (0,5 л/т) становила 90,7 %; Промет 400, мк.с (2,0 л/т) – 86,0 %, в той час, як на контролі, щільність личинок даних видів шкідників, перевищувала майже в 4,5 разів.

Відмічено, що найвища урожайність спостерігалась у варіанті з використанням інсектициду Круізер 350 FS т.к.с, де збережена урожайність становила 2,6 т/га. Найнижча урожайність зерна – 3,5 т/га була відмічена у варіанті із застосуванням препарату Гаучо 70 % з.п., збережений урожай не перевищував 0,1 т/га. Встановлено, що обробка протруйниками позитивно вплинула не тільки на урожайність, а й на посівні якості, зокрема, на масу 1000 зерен. У варіантах з використанням інсектицидів маса 1000 зерен у порівнянні з контролем збільшилася на 10,0, 12,5, 14,8 г порівняно з контролем.

Встановлено, що застосування інсектицидів у продовж вегетації пшениці озимої, які досліджували показали високу ефективність у контролі проти попелиць, клопів та трипсів. Однак слід відмітити, що застосування препаратів Енжіо 247 SC, к.с. 1,8 л/га та Нурел Д, к.е. 1,1 л/га найкраще обмежували чисельність даних фітофагів. При їх використання спостерігалася підвищення урожайності на – 4,5–4,9 т/га, в контролі – 4,0 т/га.

Ключові слова: *пшениця озима, основні фітофаги, шкідливість, інсектициди, ефективність, урожай*

Табл. 7. Рис. 1. Літ. 19.

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