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THE CONTROL of THE NUMBER OF BEET WEEVILS (*BOTHYNODERES PUNCTIVENTRIS GERM., TANYMECUS PALLIATES FABR., COLEOPTERA: CURCULIONIDAE*) IN THE SOWINGS of RED BEET IN THE FOREST STEPPE OF UKRAINE

According to the results of monitoring researches the main pests of red beet agrocenosis are listed. It was established that their harmfulness during the research period depended on several factors, the main of which was the numerical characteristics of population, weather conditions, the stage of plant development in the population and the nature of damage. The results of the research concerning the peculiarities of the features of biology and harmfulness of red beet weevils (Bothynoderes punctiventris Germ., Tanymecus palliates Fabr.) in the sowings of red beet and protection measures in the eastern Forest steppe of Ukraine are given. The effectiveness of the beet treatment with Kruizer 350FS that has shown the highest efficiency – 87–69%, and the share of the conserved crop (about 60%) are determined.

Keywords: red beet, plant protection, efficiency, pests.

Formulation of the problem. Red beet is damaged by many pests that can cause large crop losses and in their mass distribution– even a complete loss of red beet sowings.

The analysis of the main researches and publications in which the solution of the problem is proposed.

In Ukraine, the significant damage to crops of red beet is caused by beet weevils, beet flea beetles, leaf aphids, beet miner moth and beet fly. During some years the sowings are greatly damaged by polyphagous pests, caterpillars of winter and other cutworms, cabbage moth, larvae of beetles [1].

The monitoring researches of beet agrocenosis in the eastern Forest steppe of Ukraine have showen that a number and harmfulness of red beet weevils: usual and gray (*Bothynoderes punctiventris Germ., Tanymecus palliates Fabr*) have increased recently. From the point of view of researchers the reason of large increase of the number of weevils can be due to significant warming and related to it the imbalance of moisture supply towards its insufficiency, and the important role is played by the intensity of applying crop protection methods, sowings weediness by thistles and wintering conditions, which in turn lead to big yield losses, money expenditures on its protection , and make beet cultivation technology difficult [1, 7, 8].

Various methods of controlling red beet pests are used; the main of which is chemical.

This situation requires the detailed study of peculiarities of the biology of developing these species and improving measures to protect beet crops taking into consideration the biocenotic requirements to agrocenoses that was the purpose of our research.

The methodology of the research.

The research was conducted in the eastern Forest steppe of Ukraine during 2011–2014 years in the laboratory of adaptive vegetable-growing, storage and standardization of the Institute of Vegetables and Melon Growing, NAAS.

Field experiments were conducted according to the "Methods of the Research Work in Vegetable-growing and Melon Growing" [3]

The determination of insect species inhabiting agrocenosis of beet, were studied by field research that was carried out every ten days during all vegetation period. The accounting of pests was conducted by the method proposed by V.P. Omelyuta, I.V. Hryhorovych, V.S. Chaban [5].

The application of insecticides was performed according to the method proposed by S.O. Triebel' [4].

The reproduction coefficient was determined by the formula of M.O. Bilyk, A.V. Kulyeshov [6].

The received results were calculated according to the method of dispersion analysis according to B.A. Dospehov [2].

The experiments were conducted in beet sowings of variety Vital, bred at the Institute of Vegetables and Melon Growing, NAAS. The technology of growing in research is generally accepted for this crop [10].

The results of the study.

Among the specialized phytophages of this crop beet weevils – usual and gray (*Bothynoderes punctiventris Germ., Tanymecus palliates Fabr*) are the most harmful species. Output and distribution of phytophages during the years of research passed very actively.

We found that their harmfulness during our research period depended on several factors, the main of which was the numerical characteristics of population, weather conditions, phase of plant development in population and the nature of damage.

Thus, during the years of research in the third decade of April the output of usual weevil was noticed, when the temperature increased to + 18^0C the beginning of flying was observed. Sunny weather with high temperature and moderate humidity favoured it. With the appearance of beet shoots they concentrated on crops and caused significant damage to crops eating seedlings, before their appearance on the surface. On more developed crops the beetles bit leaves at the edges in the form of notches. The larvae of beet weevils nourished by beet roots.

According to the scientists' results the adaptation of gray beet weevil to different food allows it to live in the most diverse habitats on all lands and fields of field, forage, vegetable and other crop rotations [9].

According to our observations the beetles of gray weevil nourishing on the red beet gnawed the cotyledons and bit roughly young leaves.

When observing crops of beet during the years of research (in hot, dry weather) in the second or third decade of May and the first and second decade of June the number of ordinary and gray beet weevils on the shoots of beet exceeded ETH.

During the period 2010–2014 years the indicators of beet population varied in significant ranged from 0,2 to 3,0 copies/м^2 in spring and 0,1-4,2 copies/м^2 in autumn. By all indicators of quantity they exceeded the economic threshold of harmfulness (ETH). Among them we should determine the years with the increased number of pests (2011-2013 years). Along with them there are periods of constant, background quantity for this area – 2010, 2014 years. However, even in these periods the number of beet weevils is high, and the pest greatly damages the sowings of crops.

1. Population dynamics of ordinary beet weevil in the period during 2010-2014 years

Year	Population, copy/м^2		Coefficient of reproduction
	In spring	In autumn	
2010	0,5	0,3	0,6
2011	3	4,2	1,4
2012	2,8	2,8	1,0
2013	1,4	1	0,7
2014	0,2	0,1	0,5

Having analyzed spring and autumn population of pests we determined, how many times the population was increased or decreased during the growing season. Smaller than unit the coefficient of reproduction was observed in 2010 – 0,3; in 2014 – 0,5 (table 1). It indicates the limited potential possibility of reproduction. During other years, this indicator was in the range of 1 to 1,4. It means that autumn population remains at the level of spring population, or, as it is seen during the outbreaks, exceeds it almost twice.

Analyzing four years data, we can conclude that every year beet shoots were populated by beet weevils in various degree.

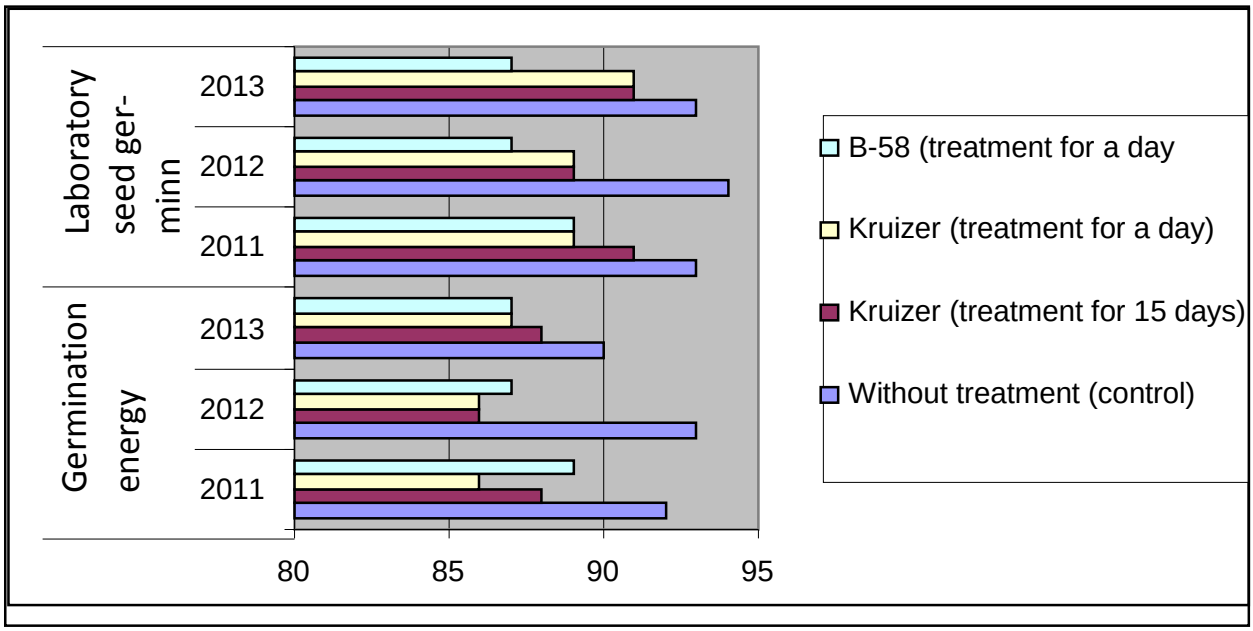
In 2010 and 2014 years during the period of beet shoots pest population was the lowest comparing with 2011–2013 years. During these years, the phase of increasing the number of ordinary beet weevils continued and amounted to 1,4-4,2 copies/м^2. The conducted researches indicate that during the period of crop population the percentage of populated areas increased

from 10 to 45. The tendency of increasing the population and the number of pest was confirmed by autumn survey of crops.

Prediction in advance of pest mass reproduction allows to get ready to protect the crop and avoid the damage, replanting and large losses.

It is very difficult, and in some cases impossible to provide reliable protection of beet shoots by traditional insecticide spraying. It often happens that beet crops are damaged and even destroyed by gray or ordinary beet weevil before beet shoots appearance. Such sowings of crops were resowed. To protect germinating seeds and to control harmful objects at the initial stages of plant development seed treatment by preparation Kruizer 350 FS was carried out. Seeds had just been treated before sowing (for a day) and for 15 days in advance.

The influence of preseeding processing of beet seeds by insecticides on germination energy and germination power was previously studied in laboratory conditions. It was established that the average energy of seed germination of beet in variants with treatment by preparation Kruizer 350 FS and B-58 (new) was decreased by 3–7%, seed germination in variants was lower on average than in control by 2-5% correspondingly, seed treatment preparations for a day before sowing - by 3% (table 1).The decrease of seed germination should be considered to ensure optimal density of crop shoots, particular by beet shoots.



Pic.1. Influence of presowing treatment of seeds with insecticide on germination energy and germination power of beet, (%)

Field research have shown that seed treatment by preparation Kruizer 350 FS, protects shoots and young crops from damage by phytophages. Thus

the efficiency of seed treatment before sowing was at the efficiency level of treatment 15 days earlier before sowing. The effectiveness of mordant Kruizer 350 FS on the 10th–21st day was 87–86%; 83–82%; with treatment by preparation B-58 new(standard) – 80–72%, correspondingly (table. 2). The most plants were damaged by phytophages on control variants, where the seeds were not treated, the average score of damage was 2, 4,4.

2. The effectiveness of seed treatment of red beet from beet weevils *Bothynoderes punctiventris Germ., Tanymecus palliates Fabr.* by insecticides (the average for 2011-2014 years).

Variant	The consumption rate ml / kg of seeds, the terms of application	Average score of damage per day			Efficiency per day,%		
		10	14	21	10	14	21
Without treatment (control)	-	1,3	2,0	4,4	–	–	–
Kruizer 350 FS	10 ml (15 days before sowing)	0,4	0,6	1,0	86,0	83,0	69,0
Kruizer 350 FS	10 ml(a day before sowing)	0,2	0,5	0,9	87,0	82,0	72,0
B-58(standart)	10 ml(a day before sowing)	0,9	1,1	1,2	80,0	72,0	60,0
LSD_{05}					0,7	1,0	1, Efficiency per day,%2

Taking into consideration the high harmfulness of beet weevils in beet sowings the compulsory measure is the use of chemical method of plant protection during growing season.

The results of researches testify that all studied preparation provided different efficiency of these phytophages.

The efficiency of tested preparations on 3d–14th – day after treatment was 88–60%; it significantly reduced the number of phytophages and its harmfulness in Chenopodiaceae agrocenoses (table 3).

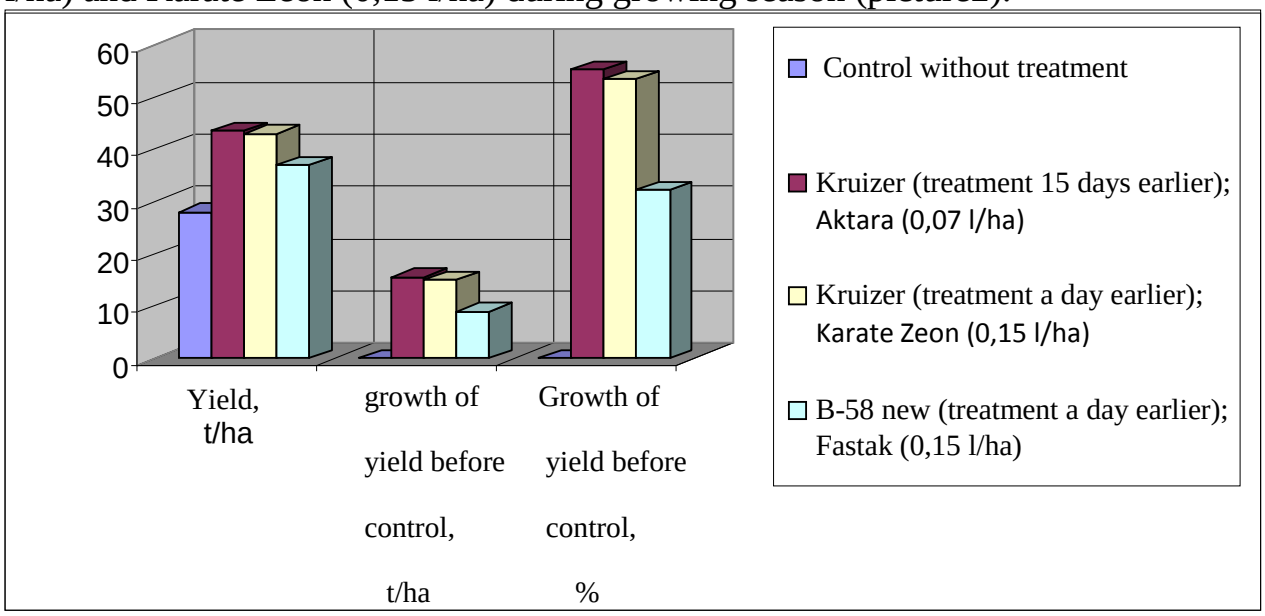
The highest efficiency was provided by insecticides Aktara (0,07 l/ha), Karate Zeon (0,15 l/ha) – 88–%; 87–65% correspondingly.

3. The effectiveness of insecticide action from beet weevils *Bothynoderes punctiventris Germ.*, *Tanymecus palliates Fabr*. on beet crops (the average for 2011–2014years.,%).

Variant	Rate of expenditures	Reducing the number of pest after treatment, day,%		
		3	7	14
Without treatment (control)	-	-	-	-
Fastak	0,15	85,5	79,3	60,0
Karate Zeon	0,15	87,0	82,0	65,3
Aktara	0,07	88,0	84,0	67,0
LSD_{05}		0,7	1,0	0,8

The use of insecticides for protection of crops from the populations of beet weevils helped to preserve plants from damage by this phytophages and accordingly - obtaining the higher quantitative indicators of yield comparing with the control.

The share of saved yield by conducting protective measures was 32–55,3%. The greatest economic efficiency was provided by variants with the use of treatment preparations Kruizer and spraying insecticides Aktara (0,07 l/ha) and Karate Zeon (0,15 l/ha) during growing season (picture2).



Pic. 2. The economic efficiency of the use of insecticide from beet weevils on beet plants , Vital variety (Institute of Vegetables and Melon Growing NAAS, the average for 2011–2014years)

Conclusions. Among the complex of specialized phytophages, the dominant place is occupied by weevils: ordinary and gray *Bothynoderes punctiventris* Germ., *Tanymecus palliates* Fabr. The population of beet weevils during the most years of research exceeded 70%.

To protect the crop from this phytophage it is recommended to treat it with insecticide Kruizer 15 days earlier before sowing or immediately before the sowing, the efficiency remains at the level and on the 10th–21st day – 87–69%. The terms of seed treatment do not affect the efficiency of treatment.

During the growing season it is recommended to spray the crop with insecticide Aktara (0,07 l/ha), Karate Zeon (0,15 l/ha); the effectiveness of tested preparations - 89–60%.

The share of saved yield while using crop protective measures is about 60%.

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Контроль чисельності бурякових довгоносиків (Bothynoderes punctiventris Germ., Tanymecus palliates Fabr., Coleoptera: Curculionidae) в посівах буряку столового в Лісостепу України.

За результатами моніторингових досліджень наведені основні шкідники агроценозу буряка столового. Встановлено, що їх шкідливість у роки досліджень залежала від ряду чинників, головним з яких є чисельна характеристика популяції, метеорологічні умови, фаза розвитку рослин при заселенні та характер пошкодження. Викладено результати досліджень, щодо особливостей біології розвитку та шкідливості бурякових довгоносиків (Bothynoderes punctiventris Germ., Tanymecus palliates Fabr) в посівах буряків столових і заходи захисту в Східному Лісостепу України. Встановлено ефективність протруйника Круїзер 350FS, який проявив найвищу ефективність – 87 – 69 %, а частка збереженого врожаю при цьому складає близько 60 %.

Ключові слова: буряк столовий, захист рослин, ефективність, шкідники.

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Контроль численности свекловичных долгоносиков (Bothynoderes punctiventris Germ., Tanymecus palliates Fabr., Coleoptera: Curculionidae) в посевах свеклы столовой в Лесостепи Украины

В результате мониторинговых исследований наведены основные вредители агроценозов свеклы столовой. Установлено, что их вредоносность в годы исследований зависела от ряда факторов, главным с которых есть численная характеристика популяции, метеорологические условия, фаза развития растений при заселении и характер повреждений. Приведены результаты изучения особенностей биологии, вредоносности свекловичных долгоносиков Bothynoderes punctiventris Germ., Tanymecus palliates Fabr. в посевах столовой свеклы и методы защиты в восточной Лесостепи Украины. Установлено эффективность протравителя Круизер, который проявил наибольшую эффективность – 87 – 69 %, а части сохраненного урожая при этом составляет около 60%.

Ключевые слова: свекла столовая, защита растений, эффективность, вредители