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MONITORING THE SPECIES DIVERSITY OF AGROCENOSES TO COMPARE THE EFFECTIVENESS OF PHYTONCIDES FOR CROP PROTECTION AND THEIR ADVANTAGES OVER SYNTHETIC ANALOGUES

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Abstract: This article provides an overview of the problem of monitoring the biological diversity of agroecosystems under significant anthropogenic impact, namely chemical pollution with synthetic pesticides, insecticides and herbicides. The article also reflects the need to select the safest means of combating agricultural pests, as an option – the use of plant phytoncides and preparations based on them for environmentally friendly pest control.

Keywords: Monitoring, biodiversity, pesticides, insecticides, herbicides, phytoncides.

INTRODUCTION

In the deterioration of the environment, chemical anthropogenic impact ranks first. The steady growth of the human population and the associated food problem generates the need for intensive agricultural development. The active use of synthetic pesticides, insecticides and herbicides, various combined fertilizers in large quantities turns the agricultural sector of the economy into one of the main enemies of the environment.

Agrocenoses are constantly exposed to negative factors, due to which the species, structural and genetic diversity in communities of living organisms is disrupted.

Without objective information on the state of the environment and trends in its change, the practical implementation of measures to protect the species diversity of the biogeocenosis and the environment as a whole is impossible. In this regard, local monitoring is of particular importance, on the basis of which the necessary data on the state of the region and the flora and fauna in this region are obtained.

With evidence of the negative impact of synthetic crop protection products on the state of the environment, the search for environmentally friendly, natural analogues of crop protection from various pests is also becoming increasingly relevant.

MAIN PART

Species of living organisms in communities are divided into dominant, semi-dominant and rare [1][6].

Of the total number of species in a biocenosis (agrocenosis) of a certain trophic level or community as a whole, only a few are dominant, that is, have a large number (or biomass).

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Sometimes dominant species are absent, and many species are characterized by intermediate abundance.

Species diversity consists of two components:

- species richness or species density, which is characterized by the total number of available species;

- evenness, based on the relative abundance or other indicator of the significance of the species and its position in the dominance structure. Species diversity can increase with an increase in the size of the surveyed area.

When a community is exposed to negative influences, species diversity can decrease, which occurs in agrocenoses subject to pesticide treatments [1].

Ecologists believe that a decrease in species and genetic diversity resulting from human activity interferes with the adaptation of the life of the species in both natural ecosystems and agroecosystems.

Two approaches are used to analyze species diversity:

1. comparisons of relative abundance or dominance-diversity curves;

2. comparisons based on diversity indices, which are relationships between the number of species and their significance

One of the main components is species richness (diversity), or species density, which is the total number of species, which for comparative purposes is usually expressed as the ratio of the number of species to the surveyed area or the number of species to the number of individuals.

The second important aspect of diversity is the evenness of the relative distribution of individuals by species. For example, in a cotton field there are two systems: cutworms and herbivorous and predatory mites, each system consists of ten species and 100 individuals.

These systems can have different evenness indices depending on the distribution of 100 individuals among ten species.

Another approach uses diversity indices. They are characterized by the independence of the sample and the relative simplicity of calculation (Species Richness Index, Shannon Index, Pielou Evenness Index, Simpson Index, etc.) [1].

When monitoring, it is often necessary to determine the toxicity of various toxic substances, such as pesticides, for components of biocenoses (agrocenoses) in laboratory conditions in order to know the potential danger of these substances.

Insectoacaricidal activity is assessed by the percentage of arthropod mortality in experimental variants compared to the control. As a control variant, either untreated arthropods or those treated with the solvent used to prepare working solutions, or contact of arthropods with a surface treated with a solvent should be used.

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Systemic insecticides used in modern agriculture allow achieving high pest mortality. However, along with good biological efficiency, spraying with insecticides is ecologically unsafe: the environment is polluted, useful entomofauna and microorganisms are destroyed [3] [6].

According to monitoring of biological diversity in various biocenoses, as a result of the use of chemical pesticides, the number of pollinating insects decreases annually by 20-35%, which negatively affects the state of ecosystems as a whole [3] [5].

Also, the use of chemicals causes changes in the physicochemical composition of the soil, which can significantly reduce its fertility, and when released into water bodies, it can cause toxic poisoning of animals and humans.

Taken together, all of the above creates the need to use alternative methods of pest control.

Today, there are two directions of biological pest control:

- Natural enemies: the use of predators, parasites and bacteria to destroy pests.

- Biological preparations: the use of biological substances, usually of plant origin, with insecticidal activity.

One of these substances are phytoncides. Phytoncides are a series of biologically active substances secreted by plants to combat pests. From a chemical point of view, phytoncides represent a whole range of substances secreted by plants in volatile and non-volatile form. These are essential oils, tannins, glucosides, sulfur-containing compounds, alkaloids, catechins, anthocyanins, organic acids and others [2].

Scientific interest in phytoncides is due to the relevance of finding alternative methods of fighting insect pests that will be safe for the environment. Moreover, it is advisable to use not only preparations based on phytoncides isolated from plant materials, but also to plant phytoncide-containing plants near agricultural crops. For example, marigolds and dill can repel the Colorado potato beetle, the mole cricket is afraid of garlic, calendula and alder, the cabbage moth is repelled by basil and celery, etc.

The spectrum of antimicrobial action of phytoncides is also very wide. They neutralize some pathogens of plant diseases of bacterial and fungal nature [2][5].

Considering the wide spectrum of action of special plants and their phytoncides in the system of protection of agricultural crops, the classification by the purpose of biological species can be considered optimal. Within its framework, phytoattractants are distinguished for attraction, phytoarrestants – for the creation of clusters, phytostimulants – for providing active action, phytorepellents – for repelling, phytodeorientants – for disorientation. In the fight against certain pests, phytoinsecticides are relevant – against insects, phytoacaricides – against ticks, phytonematocides – against nematodes, phytoorodenticides – against rodents, phytobactericides – against pathogens of bacterial diseases, phytovirocides – against viral diseases, phytofungicides – against fungal diseases.

In addition, the list includes alelopaths – crops that affect other plants, including weeds [2][4][5].

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The advantage of phytoncides is that, unlike synthetic pesticides, insecticides and herbicides, they are safe for the environment and their impact on the native ecosystem is minimal.

CONCLUSION

The extreme population density of the Earth and its continuing steady growth leads to an ever-increasing destructive impact on nature. The main anthropogenic factors that destroy the habitat are: urban growth, mining, agriculture, including the use of pesticides.

In order to effectively reduce the destructive impact of humans on nature while maintaining current progress, regular local monitoring of ecosystems, including agroecosystems, is necessary.

Based on the data obtained during biological monitoring of species diversity, measures are taken to regulate the number of autochthonous species.

Along with the preservation of species diversity, special attention should be paid to maintaining the purity of soil, air and water, which are also subject to chemical pollution.

Today, the most relevant is the use of natural, environmentally friendly means of protecting agricultural crops, such as phytoncides and preparations based on them.

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