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Innovative plant protection means prepared natural raw materials

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ABSTRACT

Were developed new compositions preparation against pests and diseases of plant: Insekto-acaricide "Antipest", Fungicide "Antifungal", a drug against of overwintering pests "Proinsekt" and nutritious preparation "Si-humate".

The effectiveness of trial oil-emulsion preparation "Proinsect" was assessed by the spread of pests - San Jose scale (*Diaspidiotus perniciosus*) and mountain ash bentwing (*Leucoptera scitella Costa*) on treated trees. According to field testing, the efficiency of preparation "Proinsect" exceeds the effectiveness of one of the best imported oily preparation "Sipcomol", which was selected as a reference.

Joint content in composition of synthetic pyretroids with turpentine oil, supposedly synergism takes place (turpentines cause prolonged action of synthetic pyrethroid). In working solutions, obtained from turpentine oil containing composition concentration of pyretroid is low, but it is enough during the whole period of pest development cycle. According to the comparative field testing of "Antipest" and imported preparations, against for fruits pests their efficiency is at almost one level, despite the low content (by 30–40%) of pyrethroid (cypermethrin) in "Antipest".

The developed phosphate preparation "Antifungal" is a little bit less effective compared to Bordeaux mixture. If well take into account significant decrease of intensity of disease spread and development after the action of phosphate preparation, also very low toxicity zinc hydro- and dihydrophosphates compared to the blue vitriol (Copper(II) sulfate), the developed fungicide preparation can be successfully used instead of traditional Bordeaux mixture and in particular against the peach leaf curl.

According to the results of field trials, effect, of developed silicon containing humic nutrient composition -"Si-humate" on experimental 2-year-old seedlings apples and peach is on the average 15–17% better than the control ones in terms of growth and development index. It should also be noted that no harmful diseases were found on the treated seedlings.

The developed compositional formulations can be successfully used for integrated protection of plants against pests and diseases. Their use is absolutely safe for the human and the environment.

Introduction

Improvement of fruit qualitative indicators and enhancement of its safety as a food product is a very important problem, considering modern environmental requirements. In order to make Georgian fruit interesting for the EU market, it is necessary to improve the quality of fruit crop due to modern ecological requirements.

To address this issue, it is necessary to develop an ecologically safe system of protection against fruit pest-diseases. For the practical support of this system, it is necessary to reduce synthetic chemicals in plant protection and the production of safe insecticidal-acaricidal, fungicidal and nutrient preparations against fruit pests using natural raw materials [1–3].

Due to strict environmental requirements at the Petre Melikishvili Institute of Physical and Organic Chemistry, Laboratory of Problems of Chemical Ecology, ecologically safe and less dangerous preparations are being developed against plant pests and diseases [4–12]. This article presents the results of laboratory and field testing results of preparations with a low environmental load, a new insectoacaricide "Antipest", fungicide "Antifungal", preparation against overwintering pests -"Proinsect" and nutritional

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preparation “Si-humate”, which are developed at above mentioned laboratory.

The oil-emulsion preparation with new recipe against the overwintering pests has been prepared on the basis of Vaseline oil, derived from pipeline sedimentary wastes. “Antipest” was obtained with the addition of a natural compound-turpentine, derived from plant waste (pine resin) in a synthetic pyrethroid composition.

Fungicide preparation “Antifungal” was prepared on the basis of soluble forms of hydro- and dihydrogen phosphates of zinc.

Local raw materials were used for the preparation of Si-Humate. In particular, humic compounds were obtained from local peat (Poti, Maltakva field) and brown coal (Akhaltsikhe field), as a mineral containing SiO2, the diatomite of Kisatib field (Akhaltsikhe Municipality) was used.

Computational methods

After treatment of fruit trees with a working solution with different concentrations of the pyrethroid, the percentage of pest death (in laboratory as well as in the field conditions) was determined using the quantitative calculation of dead and live pests (on leaves), using a formula adopted in practice:

$$K = \frac{(a - b) \cdot 100}{a}$$

where,

a – the number of dead pests after the treatment;
b - the number of pests, that survived after the treatment.

Each fifth tree of the fruit garden was registered to determine the spread of disease on fruit leaves (according to variants). The spread of the disease was calculated using the formula:

$$X = \frac{n \bullet 100}{c}$$

where,

X- Dissemination of the disease in percentages;
n - Number of diseased plants;
c – Total number of registered plants.

The intensity of the spread of the plant leaf disease was measured with 4-point scales:

0 point - Spots on the leaves in small units;
1 point - Leaf diseased area less than 25%;
2 point - Leaf diseased area more than 25%
3 point – More of the half leaf is diseased;

100-100 leaf, from all four sides of different plants (25 leaves from each side) are registered and observed. The intensity of the disease is calculated by the formula:

$$R = \frac{\sum r \times b \times 100}{n \times c}$$

where,

R- Disease intensity coefficient in percentages,
b - The total number of diseased leaves multiplied by the appropriates score;
n - The total number of leaves;
c - The total number of plants.

For determining the biological effectiveness (B) of preparations, used against pests and disease of fruits is used formula:

$$B = \frac{(Pk - Pc) \times 100}{Pk}$$

where,

B- Biological effectiveness
Pk - Dissemination of the disease on the controlling version;
Pc- Dissemination of the disease on the test version.

The effectiveness of the food preparation “Si-humate” was observed on biennial seedlings of apple and peach, according to the effect on growth and height.

In order to determine the residual amount of the pyrethroid (Cypermethrin), the samples of different apple and peach varieties were analyzed on gas chromatograph (Varian), model - P-3800, an electronic capture detector (ECO), column CP Sil 19CB, with size 25 m × 0.25 mm.

The quantitative content of the zinc was determined by inductively coupled plasma spectrophotometer, Model-Varian Liberty II Axial emission. Conditions - wavelength - 213.856 nm; capacity - 1,2 kwt; voltage PMT – 450 V, repeatability- 3, integration time- 5.0 s, scan window- 0,120 nm, diffraction level- 4, consumption of argon – 15,0 l/min.

Results and discussion

One of the most important measures against pests of fruits is the effective control of overwintering phases, in which oil preparations are widely used. In the oil-emulsion preparation “Proinsect” developed by us, two surfactants are used - hydrophilic and organophilic, to provide a high (80%) content of oil phase. Such high oil content causes reliable fixation of working solutions on the tree for a long time, even in the rain.

The efficacy of the preparation was tested in field conditions. In early spring (the first decade of March) in the apple garden of the farmer Vano Kakashvili (Gori municipality, village Skra). The trial apple trees (variety-Golden) were treated with the product “Proinsect”. Imported oily preparation-“Sipcamol” was used as a reference (Company - Sipcam, Italy). After the treatment with these preparations, the data about spread of pests on test, reference and control trees are shown in Table 1.

Insecticidal-acarycidal preparation “Antipest”, obtained using the terpentine oils, was tested against the green peach aphids (Mysodes persicae, Hyalopterus pruni) and apple aphid (Aphis pomi), widely spreaded pests in Georgia. As a result of leaf sucking the aphids cause massive damage of leaves, that are curled, deformed and prematurely falling. Sprouts are curling and they stop growth [13]. The efficiency of preparation “Antipest” against aphids has been tested both in the laboratory and field conditions.

In laboratory conditions the efficiency of “Antipest” has been established by the accounting the number of dead and live aphids, after the spraying of damaged sprouts peach and apple with the different concentrations of working solution. The results of accounting (mortality of aphids (%) are calculated by the formula adopted in practice) is shown in Tables 2 and 3.

The effective concentration 0,01% (established in lab conditions) of the working solution of “Antipest”, was used in field conditions (Gori Municipality, village Skra) in farmer V. Kakashvili's peach and apple gardens. Testing against the peach aphids was carried out on varieties: “Krimchak” (white, not separates from ossicle), “Elberta” (yellow, separates from ossicle), “Stark Red Gold”- (Nectarine). Insecticidal-acarycidal preparations, used in production, such as