

Agricultural Sciences

Innovative Insecto-Acaricidal Preparation Against Peach Aphids

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ABSTRACT. Pyrethroid preparation against plant pests named “Antipest” was prepared using natural compound of turpentine. Preparation contains synthetic pyrethroid and turpentine oil, natural compound obtained from plant remains (pine resin). Content of turpentine oil in the composition of “Antipest” defines the prolonged action of synthetic pyrethroid. As a result, low concentration of the synthetic pyrethroid in the preparation is enough for the whole period of development of pest cycle. The content of pyrethroid (cypermethrin) in the “Antipest” is 40% less than in a widely used imported cypermethrin-containing acaricidal preparation “Arivo”. The results of application of new insecto-acaricidal preparation “Antipest” against peach aphids (*Mysodes persicae*, *Hyalopterus pruni*) both in laboratory and field conditions are presented in the paper. In lab conditions the optimal effective concentration of “Antipest” working solutions causing maximal mortality of green peach aphids was determined. Effective concentration of the working mixtures of “Antipest” determined under lab conditions were used in the pilot site of peach orchard. Highly effective and costly imported acaricidal preparations “Confidor” (Bayer, Germany) and “Actara” (Syngenta, Switzerland) were taken as references for comparison. According to the testing results the effectiveness of “Antipest”, in accordance with the percentage of mortality of pests, is higher than that of “Confidor” and is slightly lower than that of “Actara”. It should be taken into account that the estimated cost of “Actara” is 10 times lower than of the imported preparations taken as reference for comparison. Residual amount of pyrethroid (cypermethrine) was determined in the fruits of peaches treated with “Antipest”. The result of the analysis is 0.006–00.012 mg/kg, while according to European Food Safety Authority (EFSA) the maximum residue level (MRL) of cypermethrin in nectarine and peach is 2.0 mg/kg. Thus, “Antipest” is an effective and cheap preparation to protect plants from pests and its application is absolutely safe for people and the environment. © 2017 Bull. Georg. Natl. Acad. Sci.

Key words peach, aphids, acaricide, cypermethrin

Production of ecologically safe products is important for the economy of Georgia. Respectively, elaboration of ecologically safe systems for protection of fruit trees is necessary. For practical implementation of this system use of means against pests with safe insecto-acaricidal and fungicidal properties created on the biological principles is necessary.

Peach is one of the important export products in Georgia. In recent years an interest of Georgian farmers in cultivation of peach gardens, especially of Nectarines (*aganonuai persica Rehd*) and Brunions (*sclera nucipersica Rehd*) is growing. In order to increase export of Georgian fruits and to make the cultivation of fruits more profitable it is necessary to improve the quality characteristics of fruits. To do this, it is necessary to fight with pests and diseases of fruit plants with ecologically safe and low-risk means considering modern ecological requirements.

Great harm to the quality and quantity on the harvest of peaches is brought by aphids (*Mysodes persicae*, *Hyalopterus pluni*). They settle on the back side of the peach leaf, on petiole, green shoots sucking the fluids out of them. As a result, the leaves are curled, deformed and fall prematurely. Aphids excrete liquid excrements which cover leaves, fruits and branches. At the damaged places the fungus of the genus *Capnodium* develops causing the blackness, which significantly reduces the quality of the peach [1-3].

Considering strict environmental requirements, ecologically safe and low-risk means against plant pests and diseases were developed in the Laboratory of Problems of Chemical Ecology, Petre Melikishvili Institute of Physical and Organic Chemistry [4-9]. The Paper presents the results of study carried out in laboratory and field conditions. The efficacy of new acaricidal preparation "Antipest" with low environmental load against peach aphids (*Mysodes persicae*, *Hyalopterus pruni*) is defined.

Methods

The mortality of aphids both in laboratory and field conditions (in experimental plots) was determined by means of formula widely used in practice:

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

a - number of dead aphids after processing with "Antipest";

b - number of the surviving aphids after processing with "Antipest".

The residual content of cypermethrin in fruits was determined with Varian CP-3800 gas chromatograph, equipped with electron capture detector (ECD). Column CP Sil 14 CB (25 m × 0.25 mm) was used. The analysis was carried out according to the method of M.M. 268-1.3-5000.

Results and Discussion

A pyrethroid drug against plant pests, of low environmental load conditionally called "Antipest" was prepared using natural compound of turpentine, obtained from plant remains (pine resin). The obtained preparation was tested against green aphids of peach that is widely spread in Georgia. The tests were conducted both in laboratory and field conditions in experimental plots (v. Skra, Gori Municipality, Georgia).

An effective concentration of "Antipest" working solutions, causing maximum mortality of the green peach aphids colonized on the experienced peach sprouts was established by laboratory tests after their treatment with operational mixtures of various concentrations. The mortality of aphids was determined by means of formula widely used in practice. For control untreated peach shoots infected with aphids were taken. Recorded results are shown in Table 1.

Natural mortality of green aphids on the control peach shoots was about 1-2%.

Effective concentration of operational mixtures of "Antipest" was determined in lab conditions. Then, operational mixture with optimal 0.01% concentration was used against aphids in the field conditions, v. Skra, in the peach orchard of farmer V. Kakashvili on various species: Krimchaki (white, not separated from ossicle), Elberta (yellow, separated from ossicle), Starterd Gold (Nectarine). Insecto-acaricidal preparations "Confidor" (Germany, Bayer) and "Actara" (Switzerland, Syngenta) were taken as ref-

Table 1. Results of testing of preparation “Antipest” in various concentrations against green peach aphids in lab conditions

Content of cypermethrin in operational mixtures of “Antipest” %	The average number of aphids per leaf			Mortality of the green peach aphids %
	Alive	Dead	Total	
0.0006	40	59	99	59.5
0.0012	25	53	78	67.9
0.0025	8	56	64	87.5
0.005	3	94	97	96.9
0.01	0	88	88	100

Table 2. Trial results of application “Antipest”, “Confidor” and “Actara” against the green peach aphid in natural conditions, mortality rates (%) by days

Day of aphids recording	Preparations used against the green peach aphid											
	Pilot				Reference							
	Antipest 0.01 %				Confidor 0.01 %				Actara 0.01 %			
	Alive	Died	all	Mortality	Alive	Died	all	Mortality	Alive	Died	all	Mortality
2 nd	23	38	61	62.2	26	48	74	64.8	16	37	53	69.8
5 th	11	50	61	82.2	16	58	74	78.3	7	46	53	86.7
8 th	6	55	61	91.1	10	64	74	86.4	4	49	53	92.4
14 th	4	57	61	93.4	7	67	74	90.5	2	51	53	96.2

erence. For controlling untreated peach trees infected with aphids were taken.

For determination of the effectiveness of the used preparation, the results of aphid mortality were recorded at 2, 5, 8 and 14 days after spraying. Alive aphids were counted on leaves taken from all four sides of the tree (10 leaves from each side). Results are summarized in Table 2.

Natural mortality rate of aphids on the control trees is between 3-5%. During the recording period the number of stages of winged aphids - imago grew gradually.

According to modern requirements of food safety the amount of pesticide residues in peach fruits is important. Three species of peaches, treated with “Antipest” were selected for analyses - “Krimchaki”, “Elberta” and “Start red gold”. In selected samples the residual content of cypermethrin - the main active compound of “Antipest” were determined. The results of analysis are given in Table 3.

Turpentine oil in the recipe “Antipest” determines the prolonged action of synthetic pyrethroids. In this case low concentration of the main active substance

of pyrethroide in the composition mixture of preparation containing turpentine oil is enough for the whole period of development cycle of the pest. Consequently, in the “Antipest”, the pyrethroid (cypermethrin) is 40% less than in the “Arivo”, widely used, imported acaricide. The efficiency of the “Antipest” and “Arivo” (in the fight against parasites and pests of grape and fruit plants spider mite – *Tetranychus telarius*, Mealybugs - *Planococcus citri* Risso and cottony maple scale - *Pulvinaria innumerabilis*, is almost the same [4,5].

The conducted field tests showed that in the laboratory conditions, the concentrations of “Antipest” working solutions were set correctly.

Table 3. Amount of cypermethrin residues in various species of peach fruits

Nº	Peach species	Content of cypermethrin mg/kg
1	Krimchaki	0.006
2	Elberta (Yellow freestones)	0.019
3	Start red gold (Nectarine)	0.012

According to Table 2, as a results of the field test the effectiveness of “Antipest” by the percentage of mortality of pests is higher, than that of the preparation “onfidor” and is slightly lower in comparison with the preparation “Actara”. However, due to the low content of the pyrethroid, “Antipest” is environmentally less dangerous, locally manufactured and significantly cheaper than the imported ones. The estimated cost of “Actara” for 1 liter is 20\$, and the cost of the “onfidor” and “Actara”- 200 and 300 \$, respectively.

At the same time it should be noted that the content of turpentine oil in “Antipest” composition causes not only prolonged action of pyrethroid but also provides its good detention (apprehension) over the plant as well as maintenance of its efficiency against pests for a long time.

According to the results of the analysis of peach fruits the residual amount of pyrethroid (cypermethrin) is 0.006÷0.012 mg/kg, while according to European Food Safety Authority (EFSA) the maximum residue level (MRL) of cypermethrin in nectarine and peach is 2.0 mg/kg.

Conclusion

The content of turpentine oil in the formulation “Antipest” determines the sufficiency of low

pyrethroid content for the effectiveness of the preparation and its low environmental stress on the environment.

Effectiveness of “Antipest” and high-quality European and American acaricidal preparations are almost identical. At the same time, the estimated cost of “Antipest” is 10-15 times lower than that of the imported acaricidal preparations.

The results of the determination of residual amount of pyrethroid (cypermethrin) in peach fruits revealed that application of “Antipest” against pests is absolutely safe for humans and environment.

In case of usage of “Antipest” by farmers, the protection of plants from pests will be more safe and prolonged. The number of treatments of plants with “Antipest” and, as a result the costs of their protection will be reduced. It will result in increased interest to preparation “Antipest”. Gradually, the consumer will be convinced that usage of this preparation is more preferable.

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სასოფლო-სამეურნეო მეცნიერებანი

ინოვაციური ინსექტო-აკარიციდული პრეპარატი ატმის ბუგრების საწინააღმდეგოდ

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§ სოფლის მეურნეობის სამეცნიერო კვლევითი ცენტრი, მცენარეთა ინტეგრირებული დაცვის დეპარტამენტი, თბილისი, საქართველო

შემუშავებულია მცირე ეკოლოგიური დატვირთვის აკარიციდული პრეპარატი, პირობითი სახელწოდებით, “ანტიპესტი”. პრეპარატი მზადდება სინთეზური პირეტროიდისა და მცენარეული ნარჩენებიდან (ფიჭვის ფისიდან) მიღებული ბუნებრივი ნაერთის, ტერპენტინების ზეთის გამოყენებით. “ანტიპესტი”-ს რეცეპტურულ შედგენილობაში ტერპენტინების შემცველობა განაპირობებს პირეტროიდის გაზანგრივებულ მოქმედებას. შედეგად, პრეპარატში ძირითადი სინთეზური პირეტროიდის დაბალი კონცენტრაცია საკმარისია მფენბლის განვითარების ციკლის ხანგრძლივობის მთელი პერიოდისთვის. “ანტიპესტი” პირეტროიდის (ციპერმეტრინის), შემცველობა 40%-ით ნაკლებია, ვიდრე ფართოდ გამოყენებულ იმპორტულ ციპერმეტრინის შემცველ პირეტროიდულ პრეპარატში “არიფო”.

სტატიამო მოცემულია პრეპარატ “ანტიპესტის” გამოყენების შედეგები ატმის ბუგრების (*Mysodes persicae*, *Hyalopterus pruni*) წინააღმდეგ როგორც ლაბორატორიულ, ისე საველე პირობებში. ლაბორატორიული ცდებით დადგინდა ბუგრების მაქსიმალური სიკვდილიანობის გამომწვევი “ანტიპესტი”-ს სამუშაო ხსნარის ოპტიმალურად ეფექტური კონცენტრაცია. ლაბორატორიულ პირობებში დადგენილი “ანტიპესტი”-ს ეფექტური კონცენტრაციის სამუშაო ხსნარები გამოყენებულ იქნა ატმის ბაღის საცდელ ნაკვეთში (გორის მუნიციპალიტეტი, სოფ. სკრა) გავრცელებული ბუგრების წინააღმდეგ. შესადარებელ ეტალონად აღებული იყო მაღალეფექტური და ძვირადღირებული იმპორტული პრეპარატები “აქტარა” (სინგეტა, შვეიცარია) და “კონფიდორი” (ბაიერი, გერმანია). ცდების შედეგების მიხედვით “ანტიპესტი”-ს ეფექტურობა ატმის მწვანე ბუგრების წინააღმდეგ ბრძოლაში უკეთესია ვიდრე “კონფიდორი”-ს და მცირედით ჩამორჩება “აქტარა”-ს. მხედველობაში მისაღებაა ის გარემოება, რომ “ანტიპესტი”-ს საორიენტაციო ღირებულება 10-ჯერ დაბალია, ვიდრე ეტალონად აღებული პრეპარატების. “ანტიპესტი” დამუშავებული ატმის ხეების ნაყოფში განისაზღვრა პირეტროიდის (ციპერმეტრინის) ნარჩენი რაოდენობის შემცველობა. ანალიზის შედეგია 0.006 ± 0.0012 მგ/კგ, ხოლო სურსათის უსაფრთხოების საერთაშორისო ორგანიზაციის (EU MRLs) მოთხოვნით ატმებსა და ნექტარინებში ციპერმეტრინის დასაშვები ნორმაა 2,0 მგ/კგ. ამდენად, ჩატარებული ცდების თანახმად “ანტიპესტი” იაფი და ეფექტური საშუალებაა ატმის მფენბლებისაგან დასაცავად და მისი გამოყენება აბსოლუტურად უსაფრთხოა ადამიანისა და გარემოსათვის.

REFERENCES

1. Batiashvili I., Dekanoidze G. (1974) Entomology, Special part. Tbilisi, 514 pp. (in Georgian).
2. Trudgill D. L. (1991) Resistance to and tolerance of plant parasitic nematodes in plants. *Annual Review of Phytopathology*, 29, :167-192.
3. Lucas George B., Campbell C.L., Lucas L.T. (1992) Introduction to plant diseases: identification and management, Second edition, 364 pp.
4. Taralashvili L., Lomtadze O., Tskhvedadze L. (2010) Testing of modified acaricide against *Schizotetranychus pruni* Did. *Bulletin of the Georgian Academy of Agricultural Sciences*, 28: 95-99 (in Georgian).
5. Shalamberidze N., Tskhvedadze L., Dolidze A. (2011) Testing of modified acaricide “Antisepti” against *planococcus citri* Risso and *neopulvinaria imeretina* Hadj. *Bulletin of the Georgian Academy of Agricultural Sciences*, 29:97-100 (in Georgian).
6. Tskhvedadze L., Dolidze A., Lomtadze O. et al. (2016) A new phosphate fungicide against leaf curl of peach. *Proceedings of the Georgian National Academy of Sciences, Chemical Series*, **42**, 2:181-183 (in Georgian).
7. Lomtadze O., Tskhvedadze L., Kakashvili D. et al. (2015) Environmentally low hazard drugs against apple pests. *Proceedings of the Georgian National Academy of Sciences, Chemical Series*, **41**, 4:378-381 (in Georgian).
8. Lomtadze O., Tskhvedadze L., Kakashvili D. et al. (2016) Humic nutritional preparation containing the active silicon. *International scientific-practical conference “Modern engineering technologies and environmental protection” part 1*:127-129 (in Georgian).
9. Dolidze A., Lomtadze O., Tskhvedadze L. et al. (2015) Fight against of fruit rot -”*Monilia fruitigena*”. *Bulletin of the Georgian Academy of Agricultural Sciences*, 34: 97-100 (in Georgian).

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