

RESEARCH ON THE EFFICACY OF SOME INSECTICIDES IN SAN JOSÉ SCALE - QUADRASPIDIOTUS PERNICIOSUS COMST. CONTROL IN MĂRĂCINENI-ARGEȘ FRUIT GROWING AREA

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Abstract

Quadraspidiotus perniciosus Comst. is one of the most dangerous pests in orchards attacking over 200 plant species, therefore the most efficient insecticides must be used to control it. Research were conducted at the Research Institute for Fruit Growing Pitești – Mărăcineni, in laboratory and field conditions during 2010 - 2012 with the objective of testing the efficacy of some insecticides in the San José scale control.

Experiments were effected in a research field of the agrotechnics laboratory and two fields of production farm no. 1, on Stanley plum cultivar, on Golden Delicious apple variety and on "mixed" varieties of apple cultivars.

During dormancy, to control the overwintered larvae of Drupaceae, the Confidor Oil SC 004 product is recommended in a concentration of 1.5%, having an average efficacy of 84.9% with a maximum of 96.8%. The best efficacy for Pomaceae had the product Nuprid Oil 004 CE in a concentration of 1.5%. A high efficacy against the overwintered larvae had also the product Reldan 40 EC (E%=98.86%) used in a concentration of 0.15% or 0.125%, related to the biological resistance of the pest.

Regarding the efficacy of some insecticides used against the first generation larvae, very good results were obtained with the products Actara 25 WG- 0.01% (E%=98.50%), Calipso 480 EC – 0.025% (E%=92.37%). Pyrinex Quick – 0.1% (E%=93.80%) and Decis 25 WG – 0.003% (E%=87.60%).

Keywords: San José scale, pest, control, efficacy, insecticide

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1. INTRODUCTION

Quadraspidiotus perniciosus Comst. is one of the most dangerous pests in the orchards spread all over the Romanian territory (Humă R. *et al.*, 2010). The insect attacks over 200 species of trees, shrubs and herbaceous plants, especially woody plants. The scale pricks different plant organs and absorbs the sap from tissues (English L.M., 2007). In those places tissues redden and necrose due to a substance from the saliva (Humă R. *et al.*, 2010). The attacked trees have weak growth, leaves are glassy, crops are reduced and fruits are stained and deformed (English L.M. 2007). Over time, they wither from top to bottom. The young trees may wither in 2 to 3 years of strong attack (Humă R. *et al.*, 2010).

To control the San José scale populations, the use of chemicals is required and the major objective in chemical control is to develop and

use products with the lowest toxicity and phytotoxicity possible, and also some selective insecticides.

Due to the damages, a proper control, using the most effective insecticides, has a particular importance.

To determine the products with high efficiency in the San José scale control a series of studies were conducted, both in Romania and abroad. Thus, from the research conducted in our country the following products resulted as the best insecticides: Calypso 480 SC (0.4 l/ha), Reldan 40 EC (2 l/ha), Ekalux S (2 l/ha) (Ghizdavu I., *et al.*, 1997), Fyfanon and Novadim (Navrozidis E. *et al.*, 1999).

Navrozidis *et al.*, following some observations effected in Greece, concluded that application during spring and summer of insecticides based on fenoxycarb (Insegar 25 WP), buprofezin (Applaud 25 WP) and diofenolan (Aware), produced a successful control of the scale. The

authors also noted that parasitism with *Encarsia formosa* was barely reduced (Reding E. *et al.*, 2003).

In Bulgaria, the paper of Kristeva, published in 2010 mentioned that the application of winter treatments is the basic element in the control of *Quadraspidotus perniciosus* Comst. pest. Thus, in winter the use of DNC 50% (Dinozol) 1.5% product and the use of insecticides based on oil and phosphorothioate are recommended.

The products containing methyl parathion (Oleovofatox) had a certain efficiency only when were used on warmer weather and even after budding. In summer treatments the Tower product is recommended (Krišteva L., 2010).

American researchers from Utah State University considered that the most effective insecticides are: Oil Superior or Oil Supreme mixed with Supracide (methidathion) or Lorsban (chlorpyrifos) for winter treatments (not recommended on apricot), Lorsban and Diazinon for spring and summer treatments (used only on apple, pear and cherry) (Deligeorgidis P.N., *et al.*, 2012). The same results obtained the product English in 2012 (Beşleagă R., *et al.* 2009). Deligeorgidis observed that Dursban product reduced significantly the *Quadraspidotus perniciosus* Comst. populations (Paşol P, *et al.*, 2011).

2. MATERIAL AND METHOD

Research were conducted at the Research Institute for Fruit Growing Piteşti – Mărăcineni, in laboratory and field conditions during 2010 - 2012 with the objective of testing the efficacy of some insecticides in the San José scale control.

Experiments were effected in a research field of the agrotechnics laboratory and two fields of production farm no. 1, on Stanley plum cultivar, on Golden Delicious apple variety and on "mixed" varieties of apple cultivars.

The plum plantation was created in 1986, using the so called system "lanes with technological traffic alleys" with a density of 1,000 trees/ha. The soil type is sloppy pseudogley vertic. The rootstock used is *Prunus cerasifera*.

Apple trees in the fields have an age of 12-29 years and a density of 700 trees/ha. The planting distance was 4.0 m between rows and 3.5 m between trees. The rootstock used was M4.

In order to control the pest, insecticide products based on mineral oil, imidacloprid, chlorpyrifos methyl, diflubenzuron, thiamethoxam, acetamiprid, pyriproxyfen, thiacloprid, deltamethrin and deltamethrin + chlorpyrifos were tested.

To establish the efficacy of the experimental products, observations were made using the binocular magnifier, counting differentially the viable and the dead shapes. Results were presented as a percentage, as mortality or efficacy.

Efficacy was calculated using the Schneider-Orelli formula (Schneider O., 1947):

$$E\% = \frac{(T - M)}{100 - M} \times 100$$

where:

T% = larvae mortality using treated variant (after treatment);

M% = larvae mortality using untreated variant.

Results were compared with the standard chemical used and with the untreated control.

3. RESULTS AND DISCUSSIONS

Obtained results for the chemical control of the pest in dormancy are presented in Tables 1 and 2.

Analyzing the data in Table 1 one can see that mortality of overwintered larvae of San José scale, ranged between 52.6 and 96.8, depending on product, concentration used and biological resistance of the pest.

It is noted that the Confidor Oil SC 004 product in a concentration of 1.5% produced a mortality of overwintered larvae of 73.4% in 2011 and 96.8% in 2012 for the stone fruit species.

Table 1. Mortality of overwintered larvae of San José scale

Year of study	Specification	Insecticide product	Concentration (%)	Mortality of overwintered larvae (%)
2010	<i>Pomaceae</i>	Mospilan (0.45 Kg) + Toil	0.5	70.1
		Ovipron Top	1.5	57.1
	<i>Drupaceae</i>	Mospilan (0.45 Kg) + Toil	0.1	65.4
2011	<i>Pomaceae</i>	Nuprid Oil 004 CE	1.25	85.9
	<i>Drupaceae</i>	Confidor Oil SC 004	1.5	73.4
2012	<i>Pomaceae</i>	Nuprid Oil 004 CE (first treatment)	1.25	79.0
		Nuprid Oil 004 CE (second treatment)	1.5	86.9
	<i>Drupaceae</i>	Confidor Oil SC 004	1.5	96.8
		Mospilan (0.45 Kg) + Toil	0.5	72.5
		Ovipron Top	1.5	52.6

The 004 Oil Nuprid product produced a mortality of overwintered larvae of 79.0-85.9% in a concentration of 1.25% and 86.9% in a concentration of 2.0% for the pome fruit species.

Also, in the control of overwintered larvae of the pest, experiments were effected using the Reldan 40 EC product. This has the effect of a juvenile hormone which, by its action, protects the useful fauna, the active substance being chlorpyrifos methyl, and was compared with the standard product Confidor Oil SC 004 - 1.5%.

Tests were effected on plum species, Stanley cultivar, treatment being applied on March 15, 2011, when the trees were in the phenophase 75% unfolded buds (“green button”). Obtained results are shown in Table 2.

Table 2. ECOQ product efficacy in the overwintered larvae control of San José scale – Stanley variety, 2011

Variant	Insecticide product	Concentration (%)	Total number of examined individuals	Mortality (%)	Efficacy (%)
V ₁	Reldan 40 EC	0.1	518	91.31	90.70
V ₂	Reldan 40 EC	0.125	547	96.16	95.89
V ₃	Reldan 40 EC	0.15	517	99.03	98.86
V ₄	Confidor Oil SC 004	1.5	519	98.84	98.70
V ₅	Untreated control	-	560	8.36	

Analyzing these data it appears that Reldan 40 EC product was tested in three concentrations (0.1, 0.125 and 0.15%). Results showed that the best efficacy (98.86%) was recorded for a concentration of 0.15%. Thus it is recommended to use the Reldan 40 EC product to control the overwintered larvae of San José scale, in concentrations from 0.125% to 0.15%, depending on the biological resistance of the pest.

With regard to the efficacy of used insecticides against the first generation larvae of San José scale, results are shown in Tables 3, 4 and 5.

A total of six variants were established for the plum species, Stanley cultivar. Treatments were applied from June 12 to June 21, 2010.

For the experiments, some different concentrations of Mospilan 20 SP/SG product and the biological product Actara 25 WG, with 25% thiamethoxam as active ingredient, were used. Results were compared with standard products Reldan 22 EC (chlorpyrifos methyl 400g /l) 0.15% and Mospilan 20 SP/SG 0.025% (Table 3).

Analysing these results one can see that the Actara 25 WG product in a concentration of 0.01% provided a very good efficacy, therefore

we recommend it to control the summer generations larvae of the pest.

Table 3. Efficacy of tested insecticides in San José scale larvae control – Stanley variety, 2010

Variant no.	Insecticide product	Concentration (%)	Total number of examined individuals	Mortality (%)	Efficacy (%)
V ₁	Actara 25 WG	0.01	500	98.6	98.5
V ₂	Reldan 22 EC	0.15	500	98.8	98.7
V ₃	Mospilan 20 SP/SG	0.025	500	96.0	95.6
V ₄	Mospilan 20 SP/SG	0.002	500	60.0	57.0
V ₅	Mospilan 20 SP/SG	0.015	500	32.7	27.4
V ₆	Untreated control	-	500	7.2	-

Table 4. Efficacy of Calypso 480 EC insecticide in San José scale larvae control – Stanley variety, 2011

Variant no.	Insecticide product	Concentration (%)	Mortality (%)	Efficacy (%)
V ₁	Calypso 480 EC	0.015	86.43	80.75
V ₂	Calypso 480 EC	0.02	90.79	86.93
V ₃	Dimilin 48 SC	0.2	96.95	95.67
V ₄	Calypso 480 EC	0.025	94.88	92.73
V ₅	Untreated control	-	29.48	-

Regarding the Mospilan 20 SP/SG product, it is noticed that its effect in the San José scale larvae control at low concentrations of 0.002%

and 0.015% was quite weak, of 57.0% and 27.4%.

The efficacy of Calypso 480 EC product in San José scale larvae control is presented in Table 4. Three verification concentrations were proposed: 0.015%, 0.02% and 0.025%. For comparison, as standard product was used Dimilin 48 SC in a concentration of 0.02%.

Very good results were obtained with the Calypso 480 EC insecticide in concentration of 0.025%, ensuring an efficacy of 92.37%. The Calypso 480 EC product is recommended in a concentration of 0.025% to control the summer larvae generations of San José scale.

Treatments were applied from June 14 to June 24, 2011 and the date of observations was July 19, 2011.

The results obtained on the efficacy of Decis 25 WG pyrethroid used in *Quadraspidiotus perniciosus* Comst. pest control are shown in Table 5.

Table 5. Efficacy of Decis 25 WG synthetic pyrethroid against the larvae of San José scale - Golden Delicious variety, 2012

Variant no.	Insecticide product	Concentration (%)	Mortality (%)	Efficacy (%)
V ₁	Decis 25 WG	0,003	92,4	87,6
V ₂	Decis 25 WG	0,0045	92,4	87,7
V ₃	Pyrinex Quick	0,1	96,1	93,8
V ₄	Dimilin 48 SC	0,02	96,4	94,2
V ₅	Untreated control	-	39,0	-

In 2012, five different experimental variants were proposed and conducted. They aimed the first generation larvae control of the San José scale scale.

The experience was placed in an experimental field for apple trees species, Golden delicious cultivar.

The obtained data showed a good efficacy of Decis 25 WG pyrethroid without major differences between the two concentrations.

As a result the product is recommended to be used in a concentration of 0.003% (E% = 87.6) in San José larvae control.

Treatments were applied from June 17, to June 30, 2012 and the date of observations was July 20, 2012.

A very good efficacy had the Pyrinex Quick product in a concentration of 0.1% (93.8%) comparable with the standard product Dimilin 48 SC 0.02% (94.2%).

4. CONCLUSIONS

Quadraspidiotus perniciosus Comst. is one of the most dangerous pests in fruit trees growing, attacking more than 200 plant species, therefore it is necessary to control it using the most effective insecticides.

During the dormancy to control the overwintered larvae at *Drupaceae* the use of the Confidor Oil 004 CE product is recommended, in a concentration of 1.5%, insecticide whose average efficacy was of 84.9% and the maximum one of 96.8%. At *Pomaceae* the best product was Nuprid Oil 004 CE, in a concentration of 1.5%.

A high efficacy against the overwintered larvae presented also the Reldan 40 EC product (E% = 98.86%) used in a concentration of 0.15% or 0.125%, depending on the pest biological resistance.

Regarding the efficacy of the insecticides used against first generation larvae, very good results were obtained for the products Actara 25 WG - 0.01% (E% = 98.50%), Calypso 480

EC - 0.025% (E% = 92.37%), Pyrinex Quick - 0.1% (E% = 93.80%) and Decis 25 WG - 0.003% (E% = 87.60%).

5. REFERENCES

- [1] Ghizdavu I., *et al.* Entomologie agricolă. Ed. Didactică și Pedagogică, R.A. București, 1997;
- [2] Pașol P., *et al.* Tratat de entomologie specială. Ed. Ceres, București, 2011;
- [3] Beșleagă R., *et al.* Control of San José scale (*Quadraspidiotus perniciosus* comst.) from apple tree plantations at the fruit growing research and development station of Iași. Cercetări Agronomice în Moldova, Vol. XLII, no. 3 (139), 2009;
- [4] Humă R. *et al.*, Rezultate privind avertizarea și combaterea păduchelui țestos din San José (*Quadraspidiotus perniciosus* Comst.) în plantațiile de măr de la S.C.D.P. Iași. Durable agriculture in the context of environmental changes. Proceedings of the 50st international scientific conference, Iași, 2010;
- [5] Navrozidis E. *et al.* Biology and control of San Jose scale, *Quadraspidiotus perniciosus* (Comstock) (Hemiptera, Diaspididae) on apricot trees in northern Greece. ISHS Acta Horticulturae 488: XI International Symposium on Apricot Culture, 1999;
- [6] Krísteva L. Winter control of *Quadraspidiotus perniciosus*. CAB Abstracts, Sofia, Bulgaria, 2010;
- [7] Reding E. *et al.* San Jose Scale *Quadraspidiotus perniciosus*. Utah State University. Orchard IPM Series HG/Orchard/16, 2003;
- [8] English L.M. San Jose Scale, (*Quadraspidiotus perniciosus*) and its control. College of Agriculture, Consumer and Environmental Sciences New Mexico State University, 2007;
- [9] Deligeorgidis P.N., *et al.* Monitoring and Control of *Quadraspidiotus perniciosus* (Comstock) Hemiptera: Diaspididae on Apple Trees in the Prefecture of Florina, Greece, Journal of Entomology, Volume: 5, 2012;
- [10] Schneider O., Entomologisches Praktikum, Aarau, 2. Auflage, 1947.