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Insecticidal Activity the Mixture of Natural Oil and a Synthetic Product

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ABSTRACT

To enhance the insecticidal activity the mixture of natural oil on aphid of the green alfalfa, we conducted tests to compare with the synthetic product Malyphos most used by farmers in our area. To address this problem, we treated alfalfa plants infested by aphids with doses of this product and the mixture of natural oil. In spring-summer or there is a significant number of plant louses and after a controlled time we determines the percentages dead of this parasite in order to obtaining the mortality according to time and dose of the synthetic product and of the oil mixture.

We want to compare the mortality of aphids between the Malyphos product and the mixture of natural oil to highlight the role of this mixture on the limitation of these parasites. Then see the possible use the mixture as a natural insecticide with no effect on human health and the environment.

The tests are performed in the month of April to July on aphid's green alfalfa fields to determine the percentage mortality of aphids depending on the dose of 0.5 % and 1 % of these products and the time 3, 5 and 7 hours after treatment. The results showed that the mixture of natural oil and synthetic products have almost the same insecticidal activity.

Keywords : Alfalfa, Aphid, Insecticide, Malyphos, Mixture, Mortality, Synthetic.

I. INTRODUCTION

Through field of green alfalfa, pests such as aphids cause damage, in particular to the leaves, which cause discoloration. They attack the young shoots and the buds. A severe attack led to the fall of the leaves. In our region, some aphid species have been found in large quantities in the culture of green alfalfa.

The ruins caused by aphids can be direct or indirect. Direct damage to plants occurs from the feeding activity of aphid nymphs and adults. Aphids pierce the plant tissue and extract sap, which results in a variety of symptoms giving death of the plant. Indirect damage is also caused by the ability of some aphid species to serve as virus vectors. However, the viruses transmitted by aphids can cause severe losses. Under favorable conditions, these viruses can cause a high rate of crop failure and severe economic losses (Barbercheck, 2011).

We know that pesticides synthetics have contributed to increased crop yields in particular the fight against pests, but the side effects of pesticide use are many: effects on the health of the people, the wildlife and flora; contamination of the water, soil and air. The World Health Organization advance the impressive figure of 3 million poisonings each year in the world due to pesticides (Bouguerra, 1986).

We find that horticultural oils can be applied against aphids and aphid-transmitted viruses. These oils are useful in interfering with the transmission of viruses. They must be applied early in the growing season for crops aphids colonize plants soon after germination. Tank mixes of horticultural oils and insecticides have also been used to enhance the control of non-persistently transmitted viruses (Katis, 2007).

In organic systems, horticultural oils and soaps are effective when applied regularly with a drop nozzle (to

get the undersides of leaves) and high pressure, but these must be applied regularly and may be cost prohibitive. Neem and permethrin are other options, but care must be taken when using these broad-spectrum insecticides (Liburd and Nyoike, 2008). The growing interest in the use of pesticides based on plant extracts in the world is motivated by their effects comparable to those of chemical pesticides (Mouffok et al., 2007-2008).

This work aims to enhance the activity of the mixture of natural oil and chemical insecticide Malyphos on aphids of green alfalfa to reduce these pests damage. Besides replace this Malyphos by this natural mixture to better protect human and environmental the implications of synthetic products.

II. METHODS AND MATERIAL

A. The mixture natural insecticide

The oil mixture is formed of the oregano oil, the Thyme oil and the Neem oil. This mixture was obtained from the products and equal in percentage volumes of Thyme, Oregano and Neem in all experiments. Reagents used in this work have been provided by Herb'Atlas, supplier of natural products, organic and conventional essential oils. The Oregano essential oil (EO): Its major constituents are carvacrol (32.14 %), thymol (21.42 %), and y-terpinene (18.80 %).

The Thyme essential oil (EO): The major components of the oil are alpha-terpineol + borneol (39.23 %), camphene (9.25 %), and carvacrol (7.93 %). The Neem vegetable oil (VO): Neem oil is obtained by cold pressing and sand filtration. The active molecule is azadirachtin (0.29 %).

B. Malyphos (Synthetic Insecticide)

Lot: 35100.
Active ingredient: Malathion.
Field of action: flies, aphids, codling moth.
Dose of use: 200 ml / hl.
Product Company: Agri Chemistry (Morocco).
Nature of product: toxic insecticide and acaricide universal.

C. Alfalfa

The common name is Alfalfa (Lucerne) and latin name is Medicago sativa.This name is derived from the Greek: Medike which designated the origin of this plant, introduced of the Medes after the expedition of Darius, cited by Theophrastos in his book: Research on the plants (Remi, 2001).

Alfalfa has many environmental benefits as the subtraction of inorganic nitrogen in the process of leaching, the treatment of effluents rich in nitrogen and the positive impact on biodiversity. It is also a strategic stake in economic independence and protein for the feeding (Thiebeau et al., 2003).

D. Description and characterization of the aphids

1) Name and identification of aphid

The Latin names are Adelgides, Aphidides, Eriosomatides, Phylloxerides and the Common name is Aphids. Aphids belong to the insects, more precisely to the Homoptera order and Aphididae family. They were identified with a magnifying glass of 8x and they present the characteristics: 0.25 mm – 2.5 mm long, dark and light green head, dark and light green chest, yellow-green and light green abdomen.

2) Aphids in the alfalfa

Different species of aphids found in green alfalfa are often the following**:** The aphids in the alfalfa are the alfalfa aphid (Macrosiphum creelii), blue alfalfa aphid (Acyrthosiphon kondoi), green peach aphid (Myzus persicae), pea aphid (Acyrthosiphon pisum) and spotted alfalfa aphid (Therioaphis maculata) (Knowles, 1998).

E. Experimental Conditions and Method

1) Conditions
The experiments are carried out from April to July in the green alfalfa fields. The selected geographical area is in the area of Errachidia (Morocco). The area of fields ranged from 0.1 to 0.5 hectare. In order to carry out these experiments random plots of 1 m² were taken, mutually separated by 10 m.

2) Experiments and procedures

The testes consist of evaluating the mortality of aphids in the presence of dilute solutions of oils using a methodology inspired by the protocol of the World Health Organization (WHO, 1985). In that way, aphids parasitizing fields of 1 m² surface were taken immediately after treatment in 25×40 cm² clear plastic bags for later counting in the laboratory.

According to this, stock solutions of each oil sample were prepared in pure water, and from these solutions the final test dilutions were made at different concentration percentages (v/v) (0, 5 % and 1 % oil in pure water).

Each plot was sprayed with 100 ml of a solution (oil + water + 1 ml of liquid soap per liter of solution as an emulsifier) by use of a manual sprayer. In order to verify the reproducibility of the results each test was repeated four times. A control sample of 100 ml of pure water and emulsifier enables to measure the natural mortality at the same experimental conditions. The count of dead aphids on the last 20 cm of plants taken in a 1 m^2 surface area has been accomplished by means of a magnifying glass 8x, and this 3,5 and 7 hours after treatment. The same procedure was conducted for the other plots and concentrations (0, 5 % and 1 %).

III. RESULT AND DISCUSSION

A. Results

Each mortality percentage (m ± SEM where m is the mortality and SEM is the Standard Error of Measurement) presented in table 1 is the average of sixteen tests which have the unavoidable uncertainty of the measurement. The table 1 shows that after hours of experience the control did not exceed 10.5 % mortality in all tests.

Is observed for the dose 0.5 % mortality is almost the same for the synthetic product Malyphos that for the oil mixture. We see that by the dose 1 % mortality is low from the 7 hours for the Malyphos and it is strong for the mixture. These mortality rates are almost stabilized at the end of each test, which proves that the effect of the products is fast.

From these results, the oil mixture to be the less active in first hour. Also the mixture is still active but the Malyphos become active in the long term. It is observed that the mortality varies little even at a high dose and long duration. To evaluate more precisely the insecticide activity of these products against aphids, it was calculated the TL_{50}, the TL_{90} and the LC_{90} defined in table 2.

1) Lethal time causing 50 % and 90 % of mortality (TL_{50} and TL_{90})

The mortality of aphids reached 50 % for the dose 0.5 % of mixture from 5.75 hours and then the Malyphos products from 4.5 hours. Also for the dose 1 % of mixture from 3.75 hours then the Malyphos from 3.5 hours. For the dose 1 % we have that the mixture gives a mortality rate of over 90 % from 7.25 hours then the Malyphos from 10.5 hours.

2) Lethal concentration causing 90 % of mortality (LC_{90})

We reached a 90 % mortality of aphids after seven hours of the treatment from the dose from 2.25 % of the mixture and then the Malyphos to 1.25 %. The activity of insecticidal mixture oil seems comparable to the chemical Malyphos.

B. Discussion

It is found that the mortality of aphids increases with dose and with time in the case of the oil mixture and the synthetic product. Aphids die quickly with the high dose and reached a value of almost 85 % in the green alfalfa, but still slower than the low-dose intake witness.

It can be assumed that the mortality is mainly due to the various active compounds containing in these products, the dose used and the processing time of aphids. The increase in dose makes the oil mixture very active against aphids; this can lead to dilution and a modification of the metabolism. This is demonstrated by the assumption of Isman (Isman, 1999).

By comparing the LC_{90}, TL_{50} and TL_{90}, the insecticidal activity of the oil mixture is closer to the synthetic

product Malyphos often used by farmers in our country. These results are found proven by Butler and Henneberry (Butler and Hennberry, 1990) who tested a solution of 5 to 10 % of the oil from cotton seeds on aphids of the cabbage and the legionnaire in the beet shows that the oil from the seeds of cotton has reduced up to 91 % the number of larval legionaries on the bette to carde.

TABLE 1

APHID MORTALITY PERCENTAGE (%)

Dose	Time (h)	Mixture	Malyphos	Control
0.5 % (v /v)	3	22.4±1.4	39.0±0.8	5.2 ±1.0
	5	35.4±1.0	55.9±1.1	8.6 ±0.9
	7	70 .1 ±1.1	70.3±1.0	10.5 ±1.0
1 % (v /v)	3	31.4 ±0.5	42.7±0.7	4.6 ± 1.5
	5	70.1 ±0.6	66.1±0.9	7.5 ±0.8
	7	85.6 ±0.4	71.4±0.9	10.1 ± 1.2

TABLE 2

TL_{50}, TL_{90} AND LC_{90}

		Mixture	Malyphos
TL_{50}	0.5 %	5.75h	4.5 h
	1 %	3.75 h	3.5 h
TL_{90}	0.5 %	10.25 h	10.75 h
	1 %	7.25 h	10.5 h
LC_{90}	After 7 hours	2.25 %	1.25 %

IV. CONCLUSION

Mortality resulting from the oil mixture on aphids of green alfalfa gives the same insecticidal activity that the chemical Malyphos. This shows that the oil mixture used with concentrations were sufficient to cause death of the insect can replace the chemical product. The oils of Oregano, Basil, Marjoram, Thyme, Sage, Laurier, Rosemary, Mint, Celery, Cumin, Coriander and Fennel have been tested and several have caused up to 100 % of mortality in the small borer of cereals (Shaaya et al., 1991).

Were obtained in our study, the results have to say that the 0.5 and 1 % doses of the products applied to aphids have many insecticide activity in both cases studied. So the natural insecticide will have great importance on human, animal health and the environment. The high dose of 1 %, all samples showed an interesting activity on aphids for the two cases studied.

Hour after hour, the extract of oil mixture in the green alfalfa being the most effective sample and reaches a mortality rate of over 85 % for the high dose in less time. These results are consistent with Isman, natural plant extracts are a true wealth and can give many substances used insecticides in the fight against parasites (Isman, 2001). It follows that the use of natural molecules ecological and economic interest to the insecticidal properties of lesser toxicity in humans, proves to be an alternative approach to the use of synthetic insecticides.

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