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Insecticidal Action of Malyphos and the Essential Oil of Oregano on the Aphid

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Abstract

In order to check the insecticidal action of the essential oil (Oregano) on the aphid of certain cultures, we carried the tests to compare to them with the synthetic product Malyphos more used by the peasants. For this reason, we treated the plant louses parasitizing the pieces of culture by the doses of this product and the essential 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 this oil. The comparison of the aphid mortality between the Malyphos product and the essential oil made it possible to reveal the role of this natural extracts on the limitation of manpower of these parasites and their possible use as plant health naturalness without side-effect on the human health and the environment.

Keywords: malyphos, oregano, insecticide, aphid

1. Introduction

The aphid of alfalfa is often present. It overwinters in collar and colonized then stems leaves, inflorescences and pods. In the culture of green alfalfa, parasites such as the aphids cause especially of damage to the leaves, causing discoloration. They attack the young shoots and the buds. A severe attack led to the fall of the leaves. In Morocco, a few species of aphids have been found in large quantities on the alfalfa fields green. Of the larva to adult, all stages feed on the underside of the leaves.

The losses from aphids can be direct or indirect. They can affect the plant in different ways: reduction of photosynthesis, injection of phytotoxic substances while they are fed, accumulation of feces and paintings on the plants that can affect the appearance of plants. All of these effects have consequences for the decrease of the usable quantity of plants and therefore causes great economic losses (Johnson and Lyons, 1991). The side effects of the use of pesticides are many: effects on the health of the people, the wildlife and flora; contamination of the water, soil and air.

The plants provide natural insecticides, but their extent and their specific action often have led us to focus our research on the Oregano. This plant is also used for many uses. The growing interest in the use of pesticides based on extract plant in the world is motivated by their effects comparable to those of chemical pesticides (Mouffok et al., 2007/2008).

This work has for objective to make a comparison the effect of insecticide products Oregano and Malyphos on the aphids of alfalfa green in order to reduce the damage caused by these parasites in protecting the environment and in assessing the effect of insecticide natural products used in this study.

2. Materials and methods

2.1 Alfalfa

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 Coutin, 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).

2.2 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.

2.3 Substance used as natural insecticide

Reagents used in this work have been provided by Herb'Atlas, supplier of natural products, organic and conventional essential oils.

Oregano essential oil (EO): The Oregano used, Origanum compactum, is widely available in the North of Morocco. The method used for obtaining the essential oil of Oregano is hydro-distillation by steam distillation. Its major constituents are carvacrol (32.14 %), thymol (21.42 %) and y-terpinene (18.80 %).

2.4 Description and characterization of the aphids

2.4.1 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 are polyphagous, sucking biting insects. Aphids are usually soft body, pear-shaped. A single morphological character distinguishes them from other insects is the presence of cornicles.

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.

2.4.2 Aphids in the alfalfa

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).

2.5 Experimental conditions and method

2.5.1 Conditions

The tests have been done from early April to late June in alfalfa green fields. The geographical area chosen is near the town of Erfoud (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.

2.5.2 Experiments and procedures

The experiments 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.

Previous experiments allowed selecting a range of concentrations for the tests. 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 3,7 and 11 hours after treatment. The same procedure was conducted for the other plots and concentrations (0, 5 % and 1 %).

3. Results and Discussion

3.1 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 shows that after hours of experience the control did not exceed 12.5 % mortality in all tests.

We see that by the dose 0.5 % or 1 % mortality is low from the 7 h for the Malyphos and it is strong for the Oregano. These mortality rates are almost stabilized at the end of each test, which proves that the effect of the products is fast compared with that of other extracts such as Melia volkensii or the effect is observed on two weeks (Diop and Wilps, 1997).

From these results, the essential oil of Oregano to be the most active in first hour. Also the Oregano 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.

3.1.1 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 Oregano from 4.75 hours and then the Malyphos products from 5 hours. Also for the dose 1 % of Oregano from 4 hours then the Malyphos from 4.5 hours. For the dose 1 % we have that the Oregano gives a mortality rate of over 90 % from 8.75 hours then the Malyphos from 10.5 hours.

3.1.2 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 1 % of the Oregano and then the Malyphos to 1.25 %. The product Oregano seems more active to low dose.

3.2 Discussion

The mortality is quick, with the high dose and reached a value of close to 90 % in alfalfa green but remains less rapid for the low dose by contribution to the 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 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).

Compared the LC_{90}, TL_{50} and TL_{90}, the insecticidal activity of Oregano oil 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, , the couple, the thrips and the to legionnaire in the beet. The oil from the seeds of cotton has reduced up to 91 % the number of larval legionaries on the bette to carde.

4. Conclusion

The treatment of aphids by Oregano in alfalfa which are located most affected by contribution to the witness. These shows that the essential oil with concentrations were sufficient to cause death of the insect can replace the chemical product Malyphos. The oils of Oregano, Basil, Marjoram, Thyme, Sage, Laurier, Rosemary, Lavender, of Anise, Mint, Celery, Cumin, Citrus Fruit, 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).

We obtained in our study the results which have to say that the doses of 0.5 and 1% of products applied to aphids have a lot of impact and enough insecticide action. 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. Hour after hour, the extract of Oregano in the green alfalfa being the most effective sample and reaches a mortality rate of over 90% for the high dose in less time.

This is consistent with Isman, natural plant extracts are a true wealth and can cause a large number of substances usable 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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Table 1. Aphid mortality percentage (%) in terms of time after exposure and oil solution concentration

	Concentration 0.5% (v /v)			**Concentration 1%** (v /v)		
Time (h) / Product	**3**	**7**	**11**	**3**	**7**	**11**
Malyphos	39.04±0.8	70.31±1.02	78.68±1.04	52.77±0.7	71.49±0.95	78.88±1.05
EO Oregano	41.5±1.5	94.5±1.3	95.6±1.7	44.38 ±0.62	93.7 ±1.2	94.7 ±1.8
Control	5.25 ±1.08	09.6 ±0.99	12.5 ±1.05	8.8 ±0.41	10.89 ±0.85	12.06 ±1.01

Table 2. TL_{50} and TL_{90} for 0.5% and 1% product concentration LC_{50} and LC_{90} for 7 hours after treatment

	TL_{50}		**TL_{90}**		**LC_{50}**	**LC_{90}**
	0.5%	**1%**	**0.5%**	**1%**	**After 7 hours**	**After 7 hours**
Malyphos	5 h	4.5 h	10.75 h	10.5 h	----	1.25 %
EO Oregano	4.75 h	4 h	9.25h	8.75 h	----	1 %