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Insecticidal Effect of Product Malyphos Chemical and the Thyme Natural Extract

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Abstract

The search for natural products with insecticidal properties has contributed to the discovery of new substances that have important uses in agriculture. To check the essential oil of Thyme insecticidal action on aphids of watermelon, we performed mortality tests for comparing the synthetic product Malyphos most used by farmers. To this reason, we treated aphids parasitizing the culture of watermelon by doses of this product and this essential oil. During the summer-autumn when there are a large number of aphids and after a controlled time we calculate the mortality percentages of the parasite over time and the dose of this product and of this oil. This study demonstrated the role of the natural extract in the limitation of this parasite and their possible use as a natural insecticide with no side effects on human health and the environment. These results obtained in this study justify the use of this plant in the traditional medicine and give tracks which could be more explored for the development of new powerful insecticides.

Keywords: Malyphos; Thyme; Insecticide; Aphid; Watermelon.

1. Introduction

In many countries the use of synthetic product has been banned due to the non-biodegradability, residual toxicity, pollutative nature. In order to have safe methods for plant disease control in sustainable agriculture there is a need for reducing the use of synthetics chemicals product there by replacing it with biocides with plant origin. Plants are known to produce a variety of compounds to protect themselves against a variety of pathogens.

In our region, some aphid species were found in large quantities on the watermelon fields. The aphid of watermelon is often present in the stems, leaves and pods inflorescences and cause particular damage to the leaves, causing discoloration. Of the larva to the adult, all stages feed on the underside of the leaves. A severe attack led to the falling leaves of the fields of watermelon. All these effects have implications for reducing the usable quantity of plants and thus cause large economic losses (Johnson and Lyons, 1991).

The plant extracts and metabolites of M. fragrans have been shown to have hypolipidemic, hypocholesterolemic, hepatoprotective, antidepressant, anti-bacterial, aphrodisiac, memory enhancer, property, anticarcinogenic, and anti-inflammatory activities (Sonavane et al., 2002; Zaidi et al., 2009; Hussain et al., 1991; Ozaki et al., 1989).

The plants provide natural insecticides, but their extent and their specific action often led us to focus our research on the Thyme. This plant is also used for many applications. 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).

The plants are rich sources of numerous bioactive secondary metabolites such as alkaloid, flavonoids, terpenoids, saponins, tannins and phenolic compounds which are the important sources of microbiocides,

pesticides, antifungal activity and many pharmaceutical compound (Mahesh et al., 2008; Arif et al,. 2009).The plant extracts which is a source of natural pesticides can be developed into new biocidal pesticides (Brindha et al., 2008; Gangadevi et al., 2009).

This work aims to make a comparison of the insecticide effect of the oil extract of Thyme and synthetic product Malyphos on the aphids of watermelon to reduce the damage caused by these parasites maintaining protection environment and to evaluate the insecticidal effect of the natural extract used in this study.

2. Materials and Methods

2.1 Culture of watermelon

The common name is watermelon. The Latin name is Citrullus Lanatus (Thunberg) Matsumara & Nakai (also called C. vulgaris) and the family name is Cucurbitaceae (David, 2008). The watermelon is a fruit with seeds or the arrangement of the plants is 2 m x 1 m between hills. Its varieties are the Sugar Belle and Royal Jubilee. Its duration of culture is from 70 to 95 days. The potential returns to high productivity of this fruit are of 5 to 12 kg. The watermelon prefers warmer temperatures and a long growing season.

2.2 Description and characterization of the aphids

The Common name is aphids and the Latin name of aphids is Adelgides, Aphidides, Eriosomatides and Phylloxerides. There are the aphids of the cotton (aphid of melon), Aphis gossypii Glover on all cucurbits. It is an aphid-green blackish, about 1 to 2 mm long. The siphunculi and the cauda venenum' as the tail are black in color. There are also the aphids green of the fish, Myzus than (Sulz.) The adult aptere measure 1.5 to 2.6 mm long. It is a matte color olive green or light green, sometimes mixed with yellow. The antennas are as long as the body and the cornicules are green.

The adult wing has the head and thorax black in color. The length of its body is of 2.0 to 2.5 mm. It is a vector of cucumber mosaic and other viruses that can attack the cucurbits. To combat these aphids we used a spray of extracts of Neem, spraying of extracts of Tobacco or use of ashes of wood (Bijlmakers and Verhoek, 1995). The aphids were identified with a magnifying glass of 8x and they present the following characteristics: 0.25 mm – 2.5 mm long, dark and light green head, dark and light green chest, yellow-green and light green abdomen.

2.3 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.

2.4 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.

Thyme essential oil: The species used in this work is Thymus satureoides (Moroccan red Thyme), an endemic plant found in forest clearings, scrub and matorrals of low and medium mountains. The Thyme essential oil is obtained by hydro-distillation by steam distillation. The major components of the oil are alpha-terpineol + borneol (39.23 %), camphene (9.25 %), carvacrol (7.93 %) and terpinen-4-ol + beta-caryophyllene (7.06 %).

2.5 Experimental conditions and method

- Conditions

The tests were carried out from early July to late September in the fields of watermelon. The selected geographic area is near Erfoud (Morocco). The surface areas ranged from 0.1 to 0.5 hectare. In order to conduct these experiments the random plots of 1 m² were taken.

- Experiments and procedures

The experiments are to assess the mortality of aphids in the presence of dilute solutions of oil and product Malyphos using a methodology inspired by the protocol of the World Health Organization (WHO, 1985). This way, aphids parasitizing the fields of 1m² were taken immediately after treatment in transparent plastic bags of 25 × 40 cm² for counting later in the laboratory.

According to this, stock solutions of each 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 long leaves 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.

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.

Table 1: Aphid mortality percentage (%)

	Concentration 0.5 % (v /v)			**Concentration 1 % (v /v)**		
Time (h) / Product	3	7	11	3	7	11
Malyphos	17.98±2.8	41.89±3.01	64.09±3.9	21.01±3.1	44.32±2.8	68.71±3.3
Thyme	22.13 ±2.5	34.02 ±3.69	39.08 ±4.1	37.34 ±2.49	43.47 ±2.04	45.94 ±2.3
Control	2.65 ±0.41	4.64 ±0.61	5.3 ±0.82	1.22 ±0.12	2.13 ±0.3	2.44 ±0.35

It is observed that the control sample does not exceed the 5.3 % mortality and for the dose 0.5% or 1 % mortality remains low even for the long term with Malyphos product and Thyme oil. Mortality rates are almost stabilized at the end of each test, there is a high rate of 45.94 % for Thyme less than the Malyphos.

From these results, the essential oil of Thyme is less active than the Malyphos product in the early hours. But this chemical product becomes more active in the long term. It is found that mortality varies little even at a high dose and long term, which proves that the effect is fast compared to other extracts such as Melia volkensii or effect is observed over two weeks (Diop and Wilps , 1997).

To give great importance to the values found and to further assess the insecticidal activity of the chemical with the oil of Thyme against aphids, we calculated the lethal time TL_{50}, TL_{90}, the lethal concentration LC_{50} and LC_{90} defined in table 2.

Table 2: TL_{50}, TL_{90}, LC_{50} and LC_{90}

	TL_{50}		**TL_{90}**		**LC_{50}**	**LC_{90}**
	0.5 %	1 %	0.5 %	1 %	After 11 hours	After 11 hours
Malyphos	8.4 h	7.6 h	15.2 h	14.2 h	0.6 %	1.1 %
Thyme	10.75 h	9.75 h	25 h	21 h	1 %	1.8 %

- 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 Thyme from 10.75 hours and then the Malyphos products from 8.4 hours. Also for the dose 1 % of Thyme from 9.75 hours then the Malyphos from 7.6 hours. For the dose 1 % we have that the Thyme gives a mortality rate of over 90 % from 21 hours then the Malyphos from 14.2 hours.

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

We reached a 90 % mortality of aphids after 11 hours of the treatment from the dose from 1.8 % of the Thyme and then the Malyphos to 1.1 %. The product Thyme seems less active at low dose.

3.2 Discussion

It is found that the mortality of aphids is fast month even with the high dose is reached a value of almost 45.94% in watermelon for Thyme and value of 68.71 % for the chemical product. But mortality is low for the low dose of Thyme contribution to Malyphos. Presumably mortality is mainly due to the various active compounds containing these products, the dose used and the processing time of aphids.

Comparing to the LC_{90}, TL_{50} and TL_{90}, the insecticidal activity of Thyme oil is close to the synthetic product Malyphos often used by farmers in our country. These results are proved by Butler and Henneberry (Butler et Hennberry, 1990) who tested a solution of 5 to 10 % of cottonseed oil seeds on aphids cabbage, torque, thrips and Legionnaire in beet.

When the dose of Thyme oil increases, the treatment of aphids in the cultivation of watermelon is most affected by the control. Increasing the dose makes the oil more active against aphids, this can lead to a dilution and altered metabolism. This is demonstrated by the hypothesis of Isman (Isman, 1999).

4. Conclusion

We obtained in our study results that mean that the 0.5 % and 1% Thyme doses applied on aphids have an insecticidal effect. So the natural insecticide will be very important in health and the environment. For the high dose of 1 %, all samples showed a good activity on aphids. Hour after hour, the extract of Thyme in the culture of watermelon is becoming more efficient and reached a mortality rate greater than 45 %.

The high dose of essential oil of Thyme was sufficient to cause the death of the insect, which shows that it can replace the chemical Malyphos. The oils of Oregano, Basil, Marjoram, Thyme, Sage, Laurier, Rosemary, Lavender, Anise, Mint, Celery, Cumin and Citrus were tested and caused up to 100 % mortality in the small grain borer (Shaaya et al., 1991).

This is consistent with Isman, the natural plant extracts are a true wealth and can cause a number of substances used insecticides in the fight against parasites (Isman, 2001). It follows that the use of natural molecules ecological and economic interest with insecticidal properties of lesser toxicity in humans, proves to be an alternative approach to the use of synthetic insecticides.

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