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RESEARCH ARTICLE

Mortality of watermelon aphids by neem natural oil and a chemical synthetic product.

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Abstract

To study the mortality of vegetable oil (Neem) on watermelon aphids, we carried out tests to compare it with the chemical synthetic Malyphos most used by farmers in our region. Because of this, we treated the aphid infested watermelon leaves with doses of vegetable oil (Neem) and Malyphos.
In summer, where there is a significant number of aphids on the leaves and after a controlled time, we determine the mortality rates of this parasite in order to obtain the mortality as a function of time and of the dose of the synthetic product and of this oil.
The comparison of the mortality of the aphids between the Malyphos and the vegetable oil made it possible to highlight the role of these natural extracts on the limitation of the losses of agriculture caused by these parasites. Then the possible use of Neem oil as a natural to replace this chemical product (Malyphos) without any side effect on human health and the environment.

Introduction:-

Current methods of curative control use liquid insecticidal products whose active ingredients belong to the family of organophosphates, pyrethroids and synthetic carbamates. These preparations have proved to be both very effective but also harmful on many other species. Insecticides cause a significant accumulation of active matter in treated ecosystems; they are sensitive to human health and contribute to the development of resistant insects.

In early summer, the vast majority of watermelon fields contain a large amount of aphid that is present. They are found in the neck and then colonize the stems and leaves. In our area, all stages of aphids feed on the underside of leaves in watermelon fields. According to studies, the most important parasitic diseases leading to the development of leaf spot appear first on lower leaves. These affected leaves turn yellow and fall (Michel, 2002).

To cope with the harmful effects of these insects, the means of control are essentially oriented towards the use of synthetic chemical insecticides. However, while most of these products are effective under optimum conditions, their intensive and uncontrolled use has enormous disadvantages (Salim, 2011). These include resistant strains in insects, consumer poisoning, environmental pollution (Benayad, 2008; Camara, 2009; Gueye et al., 2011). Faced with these nuisances, the search for an alternative that is more respectful of human health and the environment is essential.

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We know that pesticides have contributed to increased crop yields, particularly pest control, but the side effects of using synthetic pesticides are numerous on the health of populations, fauna and flora. The increasing interest in the use of plant extract pesticides in the world is motivated by their effects comparable to those of chemical pesticides (Mouffok et al., 2007/2008).

Indeed, new preventive measures as well as new products are continuously sought to ensure on the one hand an effective protection of agricultural production and on the other hand to contribute to a sustainable management of the environment. From this point of view, the use of plant extracts with insecticidal effects offers certain potentialities. Already Volkonsky (1937) advocated the use of plant extracts for the control of migratory locusts. Among the most widely documented examples is the efficacy of extracts of Melia azaderach L. containing azadirachtin and from Neem on Schistocercagregaria larvae (Wilps et al., 1992, Mordue, Blackwell, 1993, Linton and al., 1997).

This research aims to make a mortality comparison between the chemical insecticide Malyphos and the vegetable oil of Neem on the aphids of watermelon fields. The aim is to reduce the damage caused by these pests by protecting the environment and by evaluating the natural insecticide used in this study.

Material and Methods:-

Synthetic insecticide (Malyphos):-

Plot: 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.

Natural insecticide (Neem oil):-

Reagents used in this work have been provided by Herb'Atlas, supplier of natural products, organic and conventional essential oils.
Neem vegetable oil: The botanical name of Neem, also known as Indian Lilac, is Azadirachta indica. Neem is an evergreen tree native to India, Burma, Java and the Lesser Sunda Islands (Mouffok et al., 2007/2008). Neem oil is obtained by cold pressing and sand filtration. The active molecule is azadirachtin (0.29 %). Its major constituents are oleic acid (46.8 %) and linoleic acid (12.8 %)

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.

Description of the aphids:-

The Common name is aphids and the latin name of aphids is Adelgides. 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 (the tail) are black in color. There is 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.

Experimental conditions and method:-

Conditions:-

The tests have been realized from the beginning of summer 2016 in watermelon fields. The geographical area chosen is near the Ziz Oasis Tafilalt in the Southeast Morocco. The area of the watermelon fields ranged from 0.1 to 0.5 hectare. In order to carry out these experiments, it was chosen randomly the plots of 1 m².

Experiments and procedures:-

Experiments were carried out to assess the mortality of aphids in the presence of dilute solutions using a methodology based on the World Health Organization protocol. Aphids parasitizing fields with a surface area of $1m^2$ were collected after treatment in white plastic bags of 25 x 40 cm^2 for subsequent laboratory counting.

Stock solutions of each product sample were prepared in pure water and from these solutions the final dilutions of the assay were carried out at different concentration percentages (v / v) (0.5 % and 1 % of product in pure water). 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 watermelon 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.

Result and Discussion:-

Results:-

The action of different products on the aphids results in mortality after the time following treatment, as shown in table 1, figure 1 and figure 2. 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	5	7	3	5	7
Malyphos	17.98±0.9	33.9±1.3	41.89±1.02	21.01±0.8	35.76±1.1	44.32±0.95
Neem	25.12 ±1.75	29.76 ±2	33.19 ±2.09	23.47 ±1.25	32.3 ±1.46	36.01 ±1.5
Control	5.25 ±1.08	07.6 ±0.99	12.5 ±1.05	6.8 ±0.41	8.89 ±0.85	12.06 ±1.01

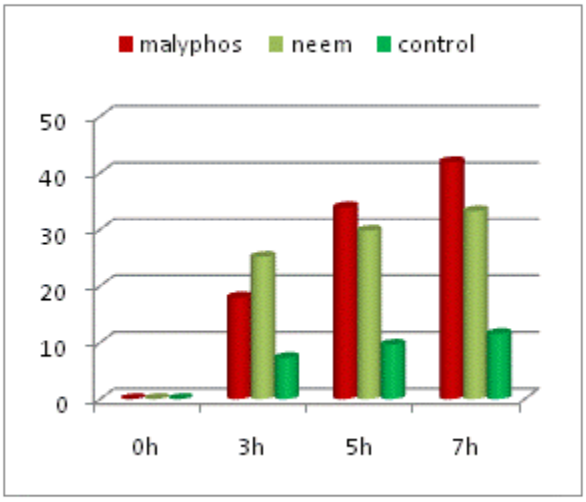

Figure 1: Case of dose 0.5 %

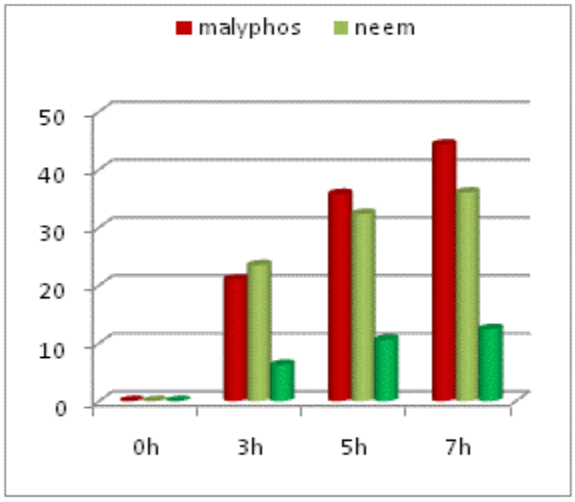

Figure 2:- Case of dose 1 %

It is observed that at the 0.5 % dose the mortality is low at 3 hours for the Malyphos than for the Neem oil. But beyond 3 hours the product Malyphos becomes more deadly than the oil of Neem. At the 1 % dose, the same is observed for both products. The natural mortality of the control is too low at all times by contribution to the products used and does not exceed 12.5 %.

These mortality rates are clear at the end of each test and do not reach high mortality values over short periods, which proves that the effect of the products is long and similar. Also the Neem is active in the short term but the Malyphos becomes active in the long term. It is observed that mortality varies little, even at a high dose and over a long period.

To more accurately evaluate the insecticidal activity of these products against aphids, lethal times were calculated for mortality of 50 % (TL_{50}) with 90 % (TL_{90}) and lethal doses for mortality of 50 % (LC_{50}) with 90 % (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 7 hours**	**After 7 hours**
Malyphos	8.2 h	7.6 h	14.6 h	13.8 h	1 %	1.9 %
Neem	9.8 h	9 h	18.2 h	16.6 h	1.25 %	2.35 %

Discussion:-

In a watermelon field, aphids die slowly even at a high dose of 1 % and after 7 hours have a mortality value of 36.01 % for oil and 44.32 % for Malyphos. These values are close for both products and are very far from the natural mortality of the low and high dose control. It can be assumed that the mortality is mainly due to the different active compounds contained in these products, the dose used and the treatment time of the aphids. At high doses the oil and Malyphos become very active against the aphids with a superiority of the last product.

It is noted for the 0.5 % dose that the time to have 50 % mortality of the aphids for oil (TL_{50} = 9.8 hours) is close to Malyphos (TL_{50} = 8.2 hours). After 7 hours, the dose necessary to have 50 % mortality for oil (LC_{50} = 1.25 %) close to Malyphos (LC_{50} = 1 %). Viewing these results obtained in table 2, the insecticidal activity of Neem oil is closer to the synthetic product Malyphos often used by farmers in our country. These results are proved by Butler and Henneberry (Butler and Hennberry, 1990) who tested a 5 to 10 % solution of cotton seed oil on cabbage aphids.
In our study, we obtained results indicating that doses of 0.5 % and 1 % of the products applied to aphids have a close impact and sufficient insecticidal action. The high dose of 1 % showed that all samples had an unattractive activity on the aphids. Hour after hour, Neem extract in watermelon fields achieved a 90 % mortality rate for the high dose 1 % in less time than 16.6 hours close to that of Malyphos by 13.8 hours.

The natural insecticide will therefore have a great importance on human, animal and environmental health and will be better than the synthetic product. These results are consistent with Isman, the natural plant extracts have a real richness and can give many substances insecticides used in the fight against the parasites (Isman, 2001).

Conclusion:-

The attack by the vegetable oil of Neem on the aphids of watermelon fields is also affected in the same way by the chemical Malyphos. This shows that vegetable oil with sufficient concentrations can cause death of the insect and replace the product Malyphos. These results show that natural plant extracts are a real wealth and can give many insecticide substances used in the control of parasites. It follows that the use of natural molecules of ecological and economic interest possessing insecticidal properties of lesser toxicity in humans proves to be an alternative approach to the use of synthetic insecticides.

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