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RESEARCH ARTICLE

STUDY OF INSECTICIDAL EFFECT OF THE SYNTHETIC PRODUCT WITH THE EXTRACTS OF OIL AND THE MIXTURE OF OIL.

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Abstract

In order to study the insecticidal effect of the synthetic product Malyphos with the essential oil (Oregano, Thyme), the vegetable oil (Neem) and the mixture of oil on the aphid in alfalfa green, we carried the tests to compare to them with the Malyphos more used by the peasants in our country. In this way, we handled seedlings of green alfalfa lived as a parasite by aphids with various doses of this product and these oils.

From June and during the summer or there is a large number of aphids and after a controlled time, we determine the death percentages of this parasite over time and dose of the synthetic product and these oils.

The study of the mortality of aphids between the product Malyphos and these oils (essential, vegetable and oil mixture) helped to highlight the role of these natural extracts on limiting these parasites and their possible use as a natural insecticide without side effects on human health and the environment.

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Introduction:-

In our area among insects, some are true parasites responsible for losses in the quality and quantity of feed or productivity. The green alfalfa aphids often occurs mainly cause leaf damage, they attack the young shoots and buds. A severe attack led to the falling leaves. In Morocco, some aphid species have been found in large quantities on the green alfalfa fields.

On the upper side there are spots, the fungus produces a fruit that is in the form of a small point raised brown, located in the centre of the spot. The affected leaves turn yellow and fall (Michel, 2002). From larva to adult aphid all stages feed on the leaves. They may affect the plant in different ways such as reducing photosynthesis and injecting phytotoxic substances.

The aphids pierce the plant tissue and extract sap, which results in a variety of symptoms causing the death of the plant. Other damage is also caused by the ability of some aphid species for use as viral vectors. However, the virus transmitted by aphids can cause a high rate of crop failure and severe economic losses (Barbercheck, 2011).

The synthetic pesticides used in our region have helped to increase crop yields in particular the fight against pests, but its side effects are numerous on the health of the population, fauna and flora. This pushes the use of horticultural oils that can be applied against aphids and virus transmitted. These oils are useful in interfering with the transmission of the virus and must be applied early in the growing season. Mixes horticultural oils and insecticidal tank were also used to strengthen the control of non-persistent virus transmitted (Katis, 2007).

Plant extracts provide natural insecticides, but their scope and specific action often led us to focus our research on the Oregano, the Thyme, the Neem and their mixture. These plants are also used for many purposes. The growing interest in the use of pesticides based on extracts of these plants in the world is motivated by their effects comparable to those of synthetic pesticides (Mouffok et al., 2007-2008).

This work has for objective to make a comparison the effect of insecticide synthetic product Malyphos with the extracts of oil (Oregano, Thyme, Neem) and the mixture of oil 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.

Material and Methods:-

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.

Substances used as natural insecticides:-

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 γ -terpinene (18.80 %).

Thyme essential oil (EO):- 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 %).

Neem vegetable oil (VO):- 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 %).

Mixture:- The mixture was obtained from the products and equal in percentage volumes of Thyme, Oregano and Neem in all experiments.

Alfalfa:-

The common name is Alfalfa (Lucerne) and latin name is *Medicago sativa*. 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).

Description and characterization of the 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.

The aphids in the alfalfa are the alfalfa aphid (*Macrosiphum creelii*), blue alfalfa aphid (*Acyrtosiphon kondoi*), green peach aphid (*Myzus persicae*), pea aphid (*Acyrtosiphon pisum*) and spotted alfalfa aphid (*Therioaphis maculata*) (Knowles, 1998).

Experimental conditions and method:-

Conditions:-

The experiments are carried out from June and during the summer 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.

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 m² 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 %).

Result:-

The application of the studied oils on the aphids at different concentrations causes mortality during the first hours after treatment as shown in table 1. Each mortality percentage ($m \pm SEM$ 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, figure 1 and figure 2 show that after hours of experience the control did not exceed 13.43 % mortality in all tests. We see that by the dose 0.5 % or 1 % mortality is low in three hours for the oil mixture and it is strong for the Oregano. After eleven hours the Oregano oil is more deadly than other products but the synthetic product Malyphos is the least deadly for different dose.

In long time, the Oregano remains active, followed by Neem, oil mixture, Thyme and finally the synthetic product Malyphos. From these results, vegetable oil, both essential oils and mixing them even have business order that the synthetic product. To evaluate more precisely the insecticide activity of these products against aphids, it was calculated the TL₅₀, TL₉₀, LC₅₀ and the LC₉₀ defined in table 2.

Lethal time causing 50 % and 90% of mortality (TL₅₀ and TL₉₀):-

The mortality of aphids reached 50 % for the dose 0.5 % of Oregano from 4.75 hours, the mixture from 5 hours and then the Malyphos products from 5.25 hours. Also for the dose 1 % of Oregano from 4.25 hours, the mixture from 4.75 hours then the Malyphos and authors products from 5 hours. For the dose 1 % we have that the Oregano gives a mortality rate of over 90 % from 6.25 hours but the latter is the Malyphos from 11.5 hours.

Lethal concentration causing 50 % and 90 % of mortality (LC₅₀ and LC₉₀):-

We reached a 90 % mortality of aphids after seven hours of the treatment from the dose from 0.75 % of the Oregano but the latter is the Malyphos to 1.2 %. The activity of insecticidal of all oils seems comparable to the chemical Malyphos.

Table 1:- Aphid mortality percentage (%)

Time (h) Oil	Concentration 0.5 % (v/v)			Concentration 1 % (v/v)		
	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
Mixture	22.4±1.4	70.1±1.1	87.21±1.22	31.4±0.5	85.6±0.4	91.3±1.4
EO Thyme	35.4±1.3	71.1±1.2	86.8±1.03	40.64±0.93	86.29±0.92	90.79±0.98
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
CO Neem	26.94±0.9	78.6±1.7	88.9±1.06	36.94±0.81	88.26±0.92	92.76±0.98
Control	5.25±1.08	09.6±0.99	12.5±1.05	6.25±1.28	11.6±0.99	13.43±1.05

Table 2:- TL₅₀, TL₉₀, LC₅₀ and LC₉₀

	TL ₅₀		TL ₉₀		LC ₅₀ After 11 hours	LC ₉₀ After 11 hours
	0.5 %	1 %	0.5 %	1 %		
Malyphos	5.25 h	5 h	11.75 h	11.5 h	0.45 %	1.2 %
Mixture	5 h	4.75 h	11.25 h	10.75 h	0.4 %	1 %
EO Thyme	5.75 h	5 h	11.5 h	10.5 h	0.4 %	0.85 %
EO Oregano	4.75 h	4.25 h	6.75 h	6.25 h	0.3 %	0.75 %
CO Neem	5.5 h	5 h	11.25 h	10.25 h	0.45 %	0.9 %

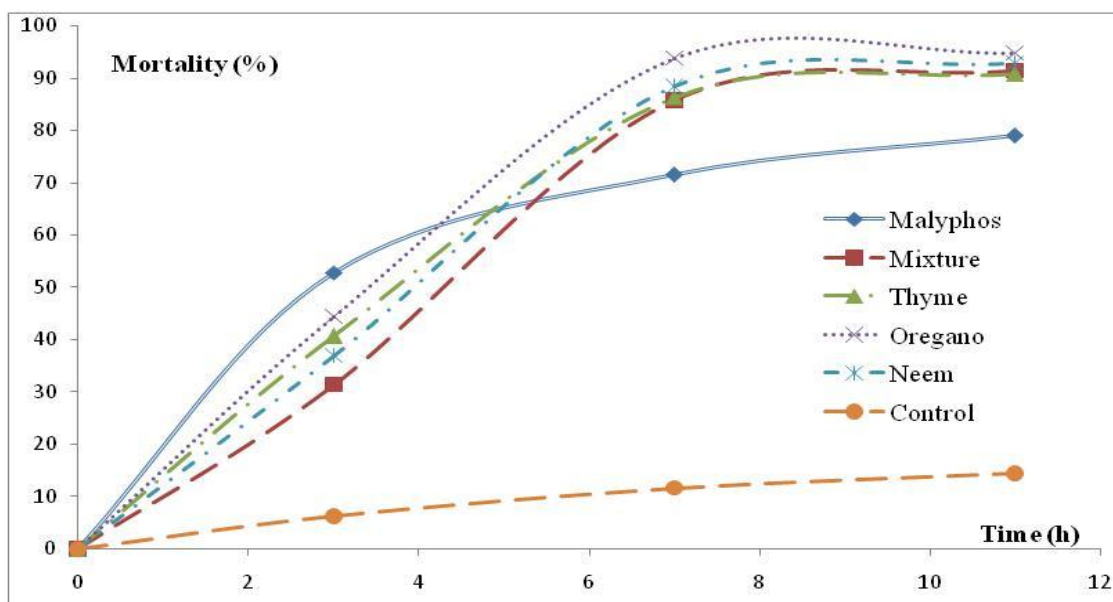


Figure 1:- Mortality of aphids in function of time for 0.5 % of product.

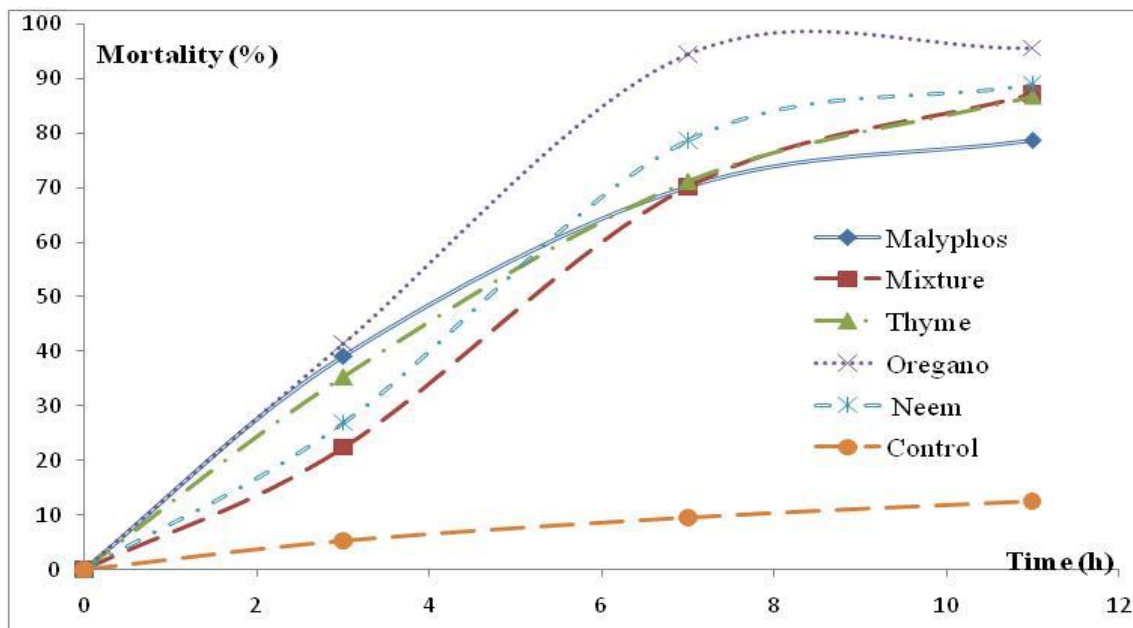


Figure 2:- Mortality of aphids in function of time for 1 % of product.

Discussion:-

It is found that Oregano oil is the most deadly of aphids in alfalfa fields, followed by the other oil products. All oils are more active than the synthetic product Malyphos. 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.

In order of insecticidal activity, treatment of aphids with Oregano, mixture, Thyme, Neem and finally the synthetic product Malyphos are most affected. Several oils such as Oregano, Basil, Marjoram, Thyme, Sage, Laurier, Rosemary, Lavender, Anise, Mint, Celery, Cumin, Citrus, Coriander and Fennel were tested and several have caused up to 100 % mortality insects and in different cultures (Shaaya et al., 1991).

Conclusion:-

We conclude even at low doses oils and their mixture, a significant insecticidal activity is obtained which is comparable to that of the synthetic product Malyphos. On observing the different changes on the quality and quantity of oil, we can estimate how long such oil can give a satisfactory performance or has an interesting activity. For different doses, all samples showed a good activity on aphids. With time, extracts of Oregano, Neem, Thyme and their mixture in green alfalfa being effective samples and reached a mortality rate of over 90 %.

In our region Mediterranean, we have a large number of aromatic plants, a rich climate in brightness and warmth, accompanied by marked seasons, demands from the adaptive plants effort supports a wealth of molecular evolution conferring multiple properties, inter alia the insecticidal effect (Pénoël, 1994). In effect, the natural extracts of plants are a true wealth and can be the cause of a large number of substances insecticides exploitable in the control of pests (Isman, 2001). In this context, the use of natural molecules of interest to the insecticidal properties of lesser toxicity in man is proving to be an alternative approach to the use of insecticides of synthesis.

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