EVALUATION OF SOME PLANT OILS ACTIVITY AS ENVIRONMENTAL SAFE PESTICIDES AGAINST SOME OF VEGETABLES AND FRUIT PESTS

Submitted By

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A thesis submitted in Partial Fulfillment
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The Requirement for the Doctor of Philosophy Degree
In
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APPROVAL SHEET

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ABSTRACT

Nashwa Elsayed Mousa Diab. Evaluation of some plant oils activity as environmental safe pesticides against some of vegetables and fruit pests. University of Ain Shams, Department of Agricultural Science, Institute of Environmental Studies & Research, (2017).

Red spider *(Tetranychus urtica)* is one of many plant species feeding mites, which cause large agricultural losses. Different extracts of Seeds of linseed, neem, and garlic were prepared using hexane, ethyl acetate, ethanol and distilled water. These extracts were investigated as acaricides by evaluate of their ability to protect plants from mite injury. The red spiders were spread on green bean seedlings for one week then the plants were sprayed with different concentrations of these plant extracts (50,250,1000,2000,5000 ppm), for three times. The results showed that linseed hexane extract caused a complete mortality all red spider after 24h of treatment and followed with neem ethanolic extract and garlic ethyl acetate extract which showed an acaricidal activity against red spider in dose and time dependent manners. Also, linseed aqueous extract and neem hexane extract inhibit acetyl cholinesterase (AChE) by 46.4% and 41.6% respectively compared to control. In addition protease activity was declined due to treatment with 5000 ppm linseed ethyl acetate extract and garlic aqueous extract by 92.27% and 86.91% respectively compared to control.

On the other hand, the results clearly indicated that infection of green bean seedling with red spider mites led to a high level of electrolyte leakage 100 % and lipid peroxidation were the level of malondialdehyde increased by 131% compared to control. Treatment of infected green beans with linseed aqueous extract and neem ethyl acetate extract showed the lowest a levels of electrolyte leakage and lipid peroxidation due to their antioxidant characterists with red spider.

Phenolic compounds and proline were increased in green bean leaves due to infection with red spider by 64.6% and 59.79% respectively. All treatments caused significant reduction in phenolic contents in infected leaves. The lowest level of phenols were recorded in the leaves treated with aqueous extract of linseed and ethyl acetate extract of

garlic seeds. Foliar application of all plant extract on the green bean seedling infected with red spider caused a remarkable reduction in the proline content in there leaves.

All, reduction of phenols after treatment with different plant extracts was associated with the reduction of PAL activity in treated seedling. Treatment with ethyl acetate extract of garlic seeds was the most effective treatment in ability to reduce PAL activity and phenols contents in infected seedling.

Chlorophyll a, Chlorophyll b, and carotenoids contents in green bean leaves were dramatically decline after one week of infection with red spider mites. Application of plant extracts especially aqueous extract of garlic led to significant increase in pigment content to reach their levels in non-infected control.

The enzyme activities of Polyphenol oxidase activity (PPO), peroxidase activity (POX), and catalase activity (CAT) were increased due to infection with red spider mites by 38.4%, 136% and 101% compared to non infected control. While, treatment with plant extracts caused significant reduction of the activities of PPO, POX and CAT except the extract of linseed and neem seeds with ethyl acetate which exhibited a significant increase in PPO activity. Our results can concluded that these plant extract can be used as natural accaricide with high level of environmental safety and efficiency.

Key words: Red spider (*Tetranychus urticae)*, plant extracts, linseed, neem, garlic, enzymes.

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INTRODUCTION

Red spider mite, *Tetranychus urticae* is a polyphagous pest feed on many vegetable, fruits and ornamental plants. Red spider mite caused heavy economical losses in many crops. In recent year red spider mite consider one of the major reasons of the crop loss in many plant species. Red spider mite infests the lower surface of mature plant leaves and feed on leave tissue and affect their physiological process including photosynthesis, respiration and transpiration. In sever infestation red spider mite damages the young and older leaves and caused plant death. **Stephanie, *et al.*, (2016).**

In many crops protection of plant from red spider mite had been carried out by using synthetic chemical acaricides such as bifenthrin and abamectin. These conventional chemical acaricide has high phytotoxicity and is still different to control due to the ability of red spider mite to develop resistance against these conventional acaricide **Jahangir, (2011**). Recently, the attention to the hazard effect of the conventional acricide on human health has been increased and considered as a major cause of reduction of food safety. The conventional chemical acricides have many adverse effects an environment , human and non target organisms **Kwon, *et al.*, (2010**).

There for, new technologies and relevants showed be develop to control red spider mite and used as alternatives of traditional acaricide. One of these modern trends in the plant protect is using natural plant extract as all alternatives chemical pesticides. Many plant extract showed high level of toxicity to different species of red spider mite.

For instance **Chiasson & Beloin (2007)** found that aqueous extract of *Capparis aegyptia* (Capparaaceae) was toxic to red spider mite female. Also, crude extract of capsicum (Solanaceaie), Scutellarioidea, Shloanthoidea, Viticoideae and Nepetoideae (Lamiaceae) showed repellent and mortal effects on red spider mites (*Tetranychus urticae)* **Neves, (2006**). Also, many plant extracts exhibited ovicidal activity against red spider mites (*Tetranychus urticae)* **Candolfi, (1992)** showed that extracts of leaves and of *Datura stramonium* exhibited acaricidal activity through their ability to repel red spider femal and their ovicidal potencies.

In the present investigation, we aim to evaluate the acaricidal potencies of different solvent extracts of linseed, neem and garlic seeds in order to develop environmentally safe natural Acaricide. Also, this investigations is highlighting the effects of their plant extract on the red spider mite enzymes responsible to feeding i.e protease and movement i.e acetyl cholinesterase (AChE). In addition, the effects of these plant extracts on the plant resistance of green bean against red spider mite has been illustrated.

REVIEW OF LITERATURE

2.1. Adverse effects of Two-Spotted Spider mites (*tetranychus urticae)* on plant production:

The spotted spider mite is responsible on heavy economic losses in many horticulture and ornamental crops. The maximum infestation of red spider was recorded in the middle age of plant leaves **Anitha & Ramani (2016).** The mites were colonize in the leaf surface and the adult female showed the highest feeding activity as reported by **Roy *et al.*, (2014**). The subclass Acari, comprising mites and ticks, is one of the largest and biologically most diverse groups within the class of the Arachnida, which also includes scorpions, spiders and harvestmen. They are distributed worldwide and have successfully colonised a wide range of terrestrial and aquatic habitats. The majority of mite species living on the aerial parts of higher plants feed mainly on microflora or predate on other small arthropods living on plants. However, mite species within the order of the Prostigmata, belonging to the families of the Tetranychidae (spider mites), Tenuipalpidae (false spider mites), Tarsonemidae (tarsonemid mites) and the superfamily of the Eriophyoidea (gall and rust mites) are able to use their specialized needle-like mouthparts to feed on the plant cells and tissues. Their feeding activity can lead to severe losses in field and protected crops **Walter & Proctor 1999; Evans, (1992).**

Two spotted spider mite, *Tetranychus urticae* Koch (Acari: Tetranychidae) is important pests of many food and fiber crops and ornamentals **Dekeyser & Downer (1994).** The spider mites are also reported to cause economic losses in fruit crops like apple, citrus, pear **Chhillar *et al.*, (2007),** raspberry **Mariethoz *et al.*, (1994)** and strawberry **Congdon *et al.*, (1993).**

A major problem in controlling these species is their ability to develop resistance to many chemical acaricides. For example, there are reports of spider mite resistance to hexythiazox, abamectin, and clofentezine. **Herron *et al.*, (1993), Beers *et al.*, (1998).**

Also, in greenhouse *Tetranychus urticae* Koch, the two-spotted red spider mite, is probably the most important pest mite throughout the world, and may also severely damage field crops especial in arid area. Two spotted red spider mites *Tetranychus urticae* is one of the most polyphagous species of the tetranychid family. Nearly 200

plant species have been recorded as hosts of *T.urticae*, including a number of economically crops such as green bean, cucumber, tomatoes, sweet pepper, cotton, maize, many fruits and a wide range of ornamentals **Jeppson *et al.*, (1975).** Many research efforts had been made to summarize the biological effects of red spider on plant under the following headings: Two-spotted spider mite: Pest status and distribution: Two-spotted spider mite (TSSM), *T.urticae*, belongs to the group of acarines known as Acariformes, in the suborder Prostigmata and the familyTetranychidae. *T. urticae*is a major pest of vegetables in India (**Gulati, 2004; Geroh, 2007)** and also worldwide **Gatarayiha *et al.*, (2010).** *T.urticae*is the most notorious pest responsible for significant yield losses in many economic crops, vegetables and fruit trees **Salman, (2007)** and also ornamental and agronomic crops worldwide **James & Price, (2002).**

Population fluctuations of *Tetranychus urticae*as influenced by season: For any efficient pest management system, the study of pest population is of vital importance. Most of the phytophagous mites remain in the field throughout the year on one or the other host but remain at low level during rainy and winter season **Chhillar *et al.*, (2007).**

Helle & Sabelis (1985) reported that *Tetranychus urticae* is mainly active on the underside of the leaves, where it punctures the leaf cells with its cheliceral stylets and feeds on the leaking cell content. The cells immediately adjacent to these punctures collapse and dehydrate. Initially, mite activity results in a fine mottling of the upper leaf surface. As feeding progresses, the leaves become hard and almost parchment-like. During this process, mites are spinning fine webbings on and between leaves. The infestation thus can significantly reduce the photosynthetic capacity of plants and their production of nutrients, often resulting in the destruction of the plants. Upon emergence from overwintering places in spring, fertilised female mites start to feed and lay up to a 100 eggs in a period of 2–4 weeks on the lower leaf surface, attached to fine silk webbing. Eggs appear as pearl-like spheres, 0.1 mm in diameter, which are deposited singly, though commonly close together. As the eggs develop, they become reddish. The development period of the eggs varies from 3 days at 32°C to 28 days at 10°C. The six-legged flesh-coloured larva hatches from the egg and, when food supplies are adequate,