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Screening of insecticidal activity of *Origanum majorana* oil against *Tribolium castenium*

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ABSTRACT

Origanum majorana essential oil was tested for its potency as botanical pesticide to protect stored food commodities from insect infestation. The oil was found to be an effective repellent against the beetle *Tribolium castenium* (L.). An inverse relationship was observed with between concentration of oil and oviposition.Treatment of 1000 and 500 ppm found maximum mortality while 5 ppm concentration can be considered good against oviposition of insect *T. castenium.*

Key words: Post harvest insect, oil extract, mortality, repellency, oviposition.

INTRODUCTION

Severe deterioration of stored food commodities takes place due to infestation by different storage pests. Synthetic pesticides have been recommended for control of such post harvest infestations of the commodities, but due to the residual toxicities of most of the pesticides, there is need for same alternative control measures. Plants are a rich source of biologically active substances, which could be potentially harnessed to modify crop growth or protect crops against disease and pests (Mishra and Dubey, 1994; Caccioni and Guizzardi, 1994; Ghfir *et.al,* 1997). It has been shown that many aromatic plant species as well as their essential oils, present a high level of efficiency in protecting crops and stored food against insects pests (Arnason *et.al* 1989; Regnault rager and Hamroani 1993, 1995;Lamiri *et.al*,2001).This study investigates that the protective effect on oviposition, insect mortality and repellent activity against *T. Castenium.*

MATERIAL AND METHODS

Extraction of volatile oil

Fresh parts of *Origanum majorana* plant were collected at flowering stage from the Herbal Park, Maharana Pratap University of Agriculture and Technology, Udaipur, India. Fresh parts of plant were cut and segregate into small pieces and washed with sterilized water. The essential oil was isolated through the hydro distillation by Clevenger apparatus. Two distinct layers an upper oily layer and the lower aqueous layer. Both layers were separated and the essential oils were stored in clean glass vials. (Tripathi et.al, 2004)

Test insect

Tribolium castenium (Herbst)

Rearing of test insects

Insect were collected from the Department of Entomology, Institute of Agriculture, BHU, Varanasi, India. *Tribolium castenium* was maintained

on wheat flour at 27 ± 2 °C and 80 ± 5 % relative humidity (Babu *et. al*, 2003; Jenki *et. al*, 2003 and Mendoza *et. al*, 2004) in plastic containers. Adult insects were 3 days old used for bioassay.

Study of repellent activity of oil

The essential oil was tested for its insect repellent ability against *T. castenium* following the methods of Dubey *et. al* (1989) and Varma and Dubey (1997). A Y shaped oflactometer was used for this purpose (common arm 24-cm, each branch 14.5 cm). The repellent experiment was carried out at a light intensity of 37.3 lux and 25°C. Insect repellent ability of three concentrations of the essential oil *i.e.* 10ppm, 50 ppm and 100 ppm was assayed by keeping cotton swabs soaked in respective concentrations separately in the experimental arm. The control arm contained a cotton swab soaked in an equal amount of distilled water. Eleven adult insects of *T. castenium* were introduced in to the base of the stem of the Y arm of the oflactometer. After 30 minutes the numbers of insect in the experimental and control arms were counted. % repellency was calculated by the following formula Gundurao and Majumdar (1966).

$$\% \text{ Repellency} = C\text{-}E / T \times 100$$

Where, C = Number of insects in control arm, E = Number of insects in the experimental arm and T = Total number of insects released.

Effect of essential oil on mortality and oviposition

In vivo effect *O. majorana* oil on *T. Castenium* mortality and oviposition was assayed by exposing the insects to different concentrations i.e. 10, 50, 100, 500, 1000 ppm of oil. Requisite control samples were kept for each treatment group. Observations were taken after 3 and 5 hours. All insects (live plus dead) were removed and total count of live and dead insects was made to find out mortality. Adults showing any movement of legs and antennae were considered alive. For oviposition studies, ten insect were placed with twenty five cow pea seeds mixed with respective concentrations of oil. Number of eggs laid by insects was counted with the help of a magnifier after three days. Suitable control was maintained.

RESULTS

O.majorana oil showed a dose dependent insect repellent activity. Repellency was enhanced with increasing doses depicted in table1.84 %

Table 1: Insect repellant activity of *O. majorana* oil

S. No.	Concentration of oil in ppm	No. of insects	Control Arm	Experimental Arm	% Repelency
1.	0	25	25	25	100
2.	10	25	17	8	68
3.	50	25	19	6	76
4.	100	25	21	4	84

Table 2: Effect of *O. majorana* oil on adult mortality at 3 h interval

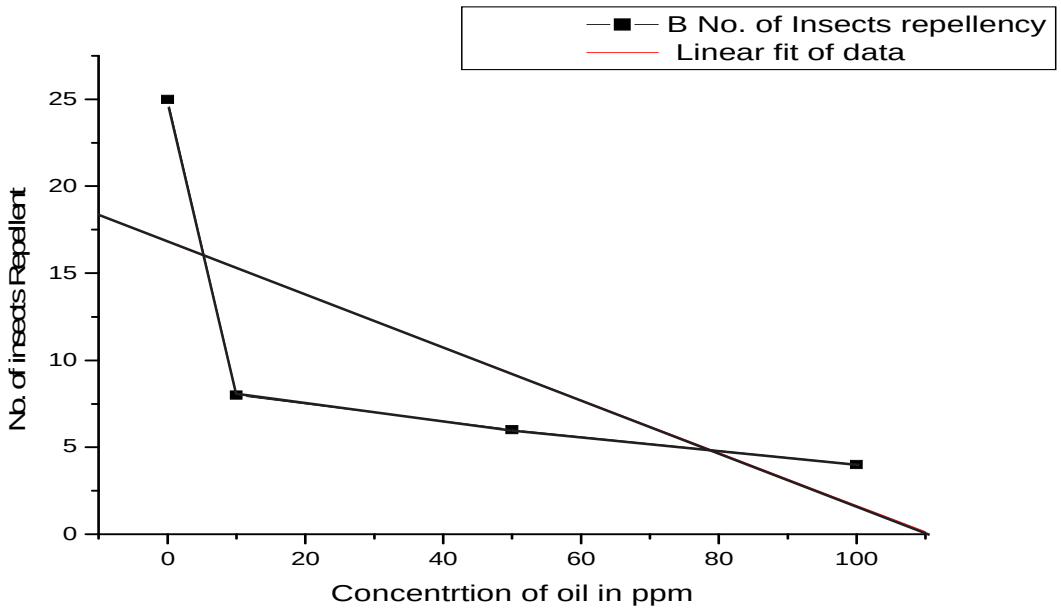
S. No.	Concentration oil in ppm	No. of insects Mortality	Mortaility	% Mortaility
1	10	11	4	36.36
2	50	11	7	63.63
3	100	11	9	81.81
4	500	11	11	100
5	1000	11	11	100

Table 3: Effect of *O. majorana* oil on adult mortality at 5h interval

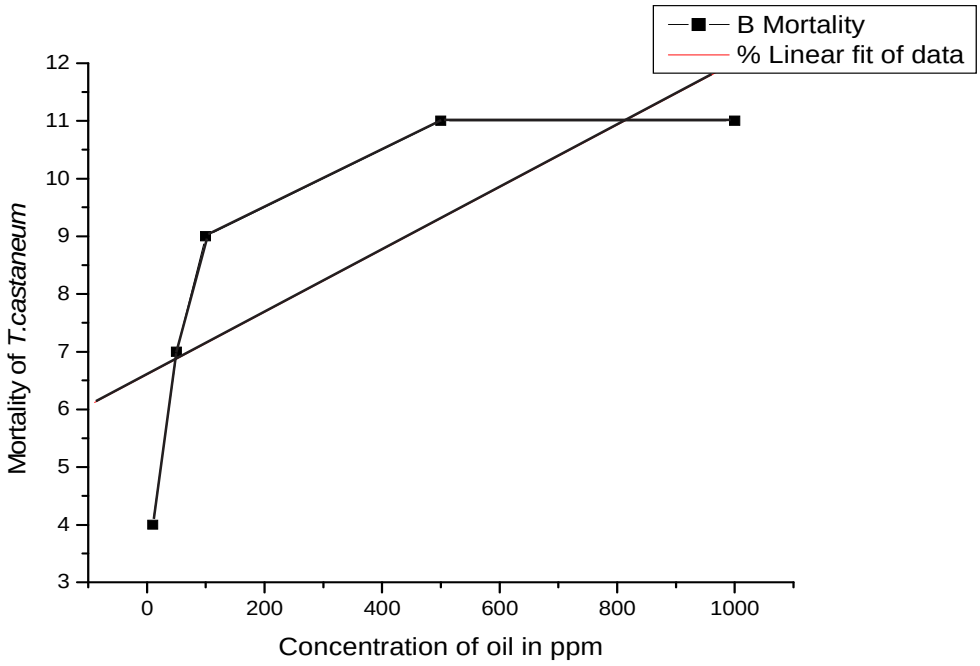
S. No.	Concentration oil in ppm	No. of insects Mortality	Mortaility	% Mortaility
1	10	11	6	54.54
2	50	11	8	72.72
3	100	11	11	100
4	500	11	11	100
5	1000	11	11	100

Table 4: Effects of *O. majorana* extract oil on oviposition of *Tribolium castenium*

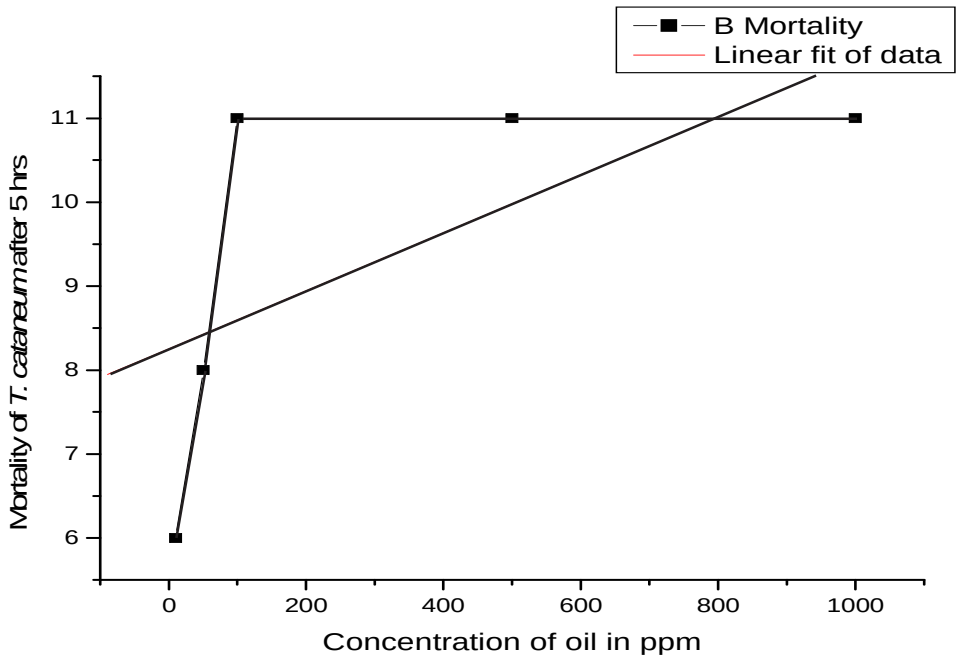
S. No.	Concentration of oil in ppm	No. of eggs laid on cow pea	No. of cow pea seeds	No. of Insects	% eggs laid on cow pea
1	0	96	25	10	100
2	5	23	25	10	23.95
3	1	35	25	10	36.45
4	0.5	42	25	10	43.75
5	0.1	67	25	10	69.79
6	0.05	78	25	10	81.25



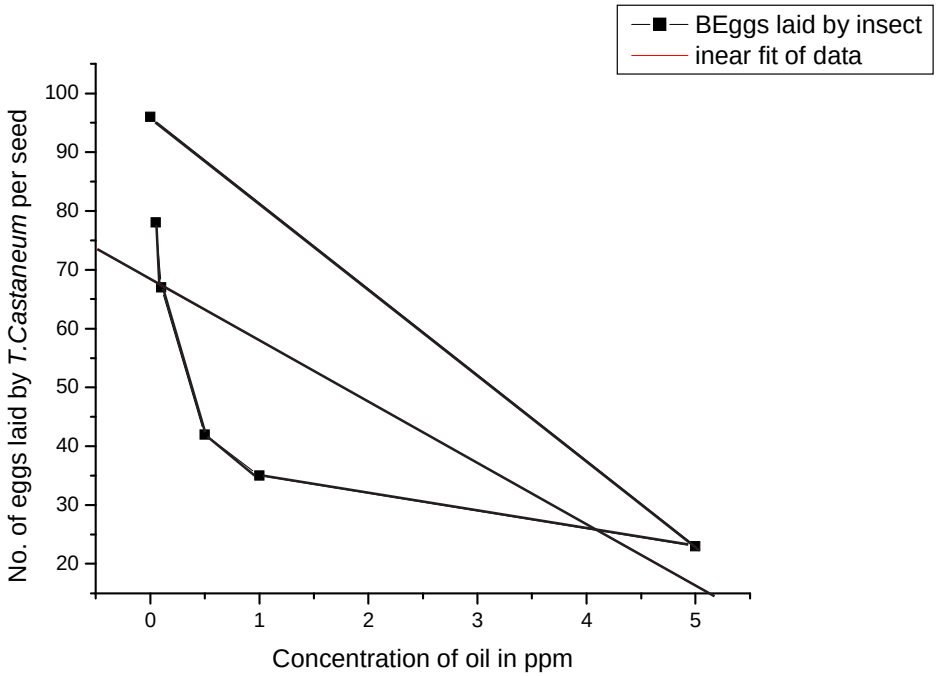
Graph 1: Showed the proportional ratio between concentration of oil and insect repellent



Graph 2: Showed that the increasing concentration of oil, the adult mortality was also increase after 3 hrs



Graph 3: Showed that the increasing concentration of oil, the adult mortality was also increase after 5 hrs



Graph 4: Showed that the concentration of oil increased, the number of eggs laid increase

repellent activity was observed against *T. castenium* at 100 ppm. The effect of *Origanum majorana* oil on mortality of insects during different time interval is shown in (tables 2 & 3). 100 % mortality of insect was observed with 1000 and 500 ppm concentration of oil for t 3 and 5 hrs respectively. At 5ppm concentration of oil, the number of eggs laid decreases on cowpea seed. Similarly oviposition by *T. castenium* decreased with increasing the concentration of oil (table 4).

DISCUSSION

O. majorana oil was effective in reducing *T. castenium* infestation in cowpea and wheat respectively. The insecticidal and repellent activity was found to be concentration of oil dependent. Reduction in oviposition suggests that the oil may have successfully inhibited the larval penetration into the seeds. Insect repellent activity of the oil indicates that it can be used as a protective agent to prevent infestation of stored grains and seeds by insect pests. *T. castenium* was found to be more susceptible to the oil. Differential susceptibility of insects to different botanical pesticides has been reported previously (Belmain *et al*., 2001). The development stage of the particular insect species may be important in determining resistance or susceptibility to chemical used as pesticides. Newly emerged beetles have been reported to be more susceptible then older beetles (Vayias *et al.,* 2004). Semiochemicals are generally considered to be safer and more environmentally acceptable than conventional pesticides. Some other plants such as *Mentha arvensis*, *Caesulia axillaris* (Varma *et al*., 1997, 2007) and *Securidaca longepedunculata* (Jayasekara *et al.,* 2005) have also been studied the efficacy of oil against pests of stored grains.

It can be recommended that *O. majorana oil* can be developed as a botanical pesticide for the management of the insect's infestations in stored food commodities after suitable toxicity and clinical trials.

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