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The Insecticidal Activity of Petroleum Ether Extract of *Hyptis suaveolens* Poit (Labiatae) Seeds on *Plutella xylostella* (L.) (Lepidoptera:Y ponomeutidae)

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Abstract: A laboratory experiment was conducted to investigate the insecticidal activities of petroleum ether extract of *H. suaveolens* seeds on second instar larvae of the Diamond back moth, *Plutella xylostella* (L.). Four concentrations (1.25, 2.5, 5.0, and 10.0% v/v) of the seed extract diluted in 70:30 v/v petroleum ether: olive oil mixture, were prepared. Spraying was done using the Potter tower. Two millilitres of the spray solution was pipetted into the reservoir of the Potter tower and sprayed onto fresh Chinese cabbage leaves, which, were placed at the base of the Potter tower. An unsprayed Chinese cabbage leaves were included as control. Ten second instar larvae of *Plutella xylostella* were released into each container. Mortality was observed after 24 and 48h. The seed extract showed high toxicity against *P. xylostella.* LC_{50} values of 6.49 and 4.39 % were recorded *a*fter 24 h and 48 h exposure, respectively. At 24 and 48 h of exposure, mortality was significantly (p=0.05) higher (63 and 82%) at 10% concentration than at other concentrations. The regression analysis of percent concentrations of the extracts against percent mortality of *P. xylostella* indicated a high coefficient of determination (r^2 = 0.9216 and 0.9369), which indicated that 92.16 and 93.69% of the mortality was accounted for by the concentrations of the extracts.

Key words: Petroleum ether extract, *Hyptis suaveolens, Plutella xylostella,* mortality, concentrations

INTRODUCTION

The Diamondback moth, *Plutella xylostella* (L.) is the most injurious insect pest of cabbage and other cole crops throughout the world[1]. Historically, farmers have relied primarily on multiple applications of broad-spectrum insecticides for the control of this pest in Jamaica[2]. Many insecticides from the organophosphate, carbamate and pyrethroid groups are reported ineffective currently because of insecticide resistance[3,4]. In the field *P. xylostella,* has developed resistance to almost every synthetic insecticide used against it including *Bacillus thuringiensis* (Berliner (Bt) formulations[5,6]. *P. xylostella* is the first field populations resistant to *B. thuringiensis*[5]. *P. xylostella* is also a major pest for crucifers and one that is hard to get rid of with insecticides to which it has built up resistance.

The genus *Hyptis* Jacq. consist of about 400 species and is cosmopolitan in that it is found in subtropical or temperate regions of America as well as in the tropics in Africa[7]. The Labiatae family to which *Hyptis suaveolens* belongs is a rich source of compounds with anti-insect activity, which is believed to at act as a defence mechanism in the plant[8]. Twenty-three compounds were identified from *H. suaveolens*[10]. These compounds have been isolated from other sources and used against insects and they act in various ways. Some act by deterring insects from feeding, others kill on contact with the insects[11], some retard their growth and development when incorporated into the diet of the insects[12] while some of these compounds act by repelling insects[13].

There is paucity of information on suitable insecticides to control this hard insect pest hence this study was carried out to investigate the insecticidal activities of *H. suaveolens* on *P. xylostella.*

MATERIALS AND METHODS

All experiments were performed in the University of Reading, Department of Agriculture glasshouse or laboratory. The seeds of *H. suaveolens* were obtained from The Gambia and stored in airtight containers that were kept in a refrigerator at 5°C ± 2°C

The rearing of insects: *Plutella xylostella* culture was obtained from the existing stock at the Rothamstead Experimental Station, Hertfordshire. Insects were maintained at 22°C and 16:8h light: dark regime in 70 X 75 X 50 perspex cages with a 30 X 40 cm access holes covered with nylon netting secured, with 'Velcro'

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fastening. The Chinese cabbage var. Wang Bok (7-8 weeks old) was used throughout the study for culturing the second larval instars of *P. xylostella* larvae.

Seed extraction procedure: *Hyptis suaveolens* seeds were ground to fine powder using an electric grinder. The Soxflo extraction instrument (Scientific and Technical Supplies, Newmarket) was used in the extraction procedure. The sample tube of the unit was fitted with a filter disc at the bottom and filled with ground seeds, sealed with another filter disc and compressed. This was then fitted to the Soxflo unit, filled with 70 mL of petroleum ether (40-60°C) and the unit was regulated to give a slow controlled flow of the solvent through the compressed sample. The filtrate was collected in a round bottom flask, which was transferred to a rotary evaporator and placed over a lukewarm water bath to evaporate the petroleum ether. The final product was an oily yellowish crude extract.

Preparation of spray solution and spraying procedure: The extract was diluted in 70:30 v/v petroleum ether: olive oil mixture. Four concentrations (1.25, 2.5, 5.0, and 10.0% v/v) were used. Spraying was done using the Potter tower with the delivery pressure set at 0.42 kg/cm^2. Fresh Chinese cabbage leaves were collected from the main plant culture 30 minutes before spraying and were placed at the base of the Potter tower. Two millilitre of the spray solution was pipetted into the reservoir and sprayed onto the leaves. The sprayed leaves were allowed to dry before being transferred into plastic containers that had soaked cotton wool at the base and was covered with a 9mm filter paper. An untreated cabbage leaves were included to serve as control. Ten-second instar larvae of *P. xylostella* were released into each container using an aspirator. The treatments were replicated four times. Mortality was observed after 24 and 48 h by counting the number of dead insects. Genstat[15] was used to analyse the data and the concentration/mortality response curves were computed using Statspak[16] to determine the LC_{50} values. The percentage mortality for each treatment was corrected using Abbott's formula[16]. A *t*-test was carried out to compare the LC_{50} values after 24 and 48 h. Percentage mortality of *P. xylostella* was regressed against concentration of the extracts to calculate the coefficient of determination.

RESULTS AND DISCUSSION

Hyptis suaveolens extracts showed acute toxicity on the second instar larvae of *P. xylostella*. The ANOVA on the mortality showed a significant effect between the different treatments (F=35.69; df=4,15; p<0.001) after 24 h and a similar trend was observed after 48h (F=47.25; df4,15; p<0.001). The regression analysis of percent mortality against *H. suaveolens* concentrations (Fig. 1) showed high coefficient of determination at 24 h and 48 h respectively. These results indicated that 92.16 and 93.69% of the mortality was accounted for by the concentrations of the extracts of *H. suaveolens*.

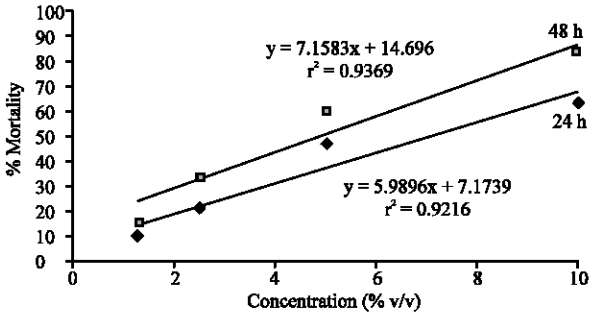

Fig.1: Effect of concentration (% v/v) of *H. suaveolens* seed extract on percent mortality of second instar larvae of *Plutella xylostella* at 24 and 48 h

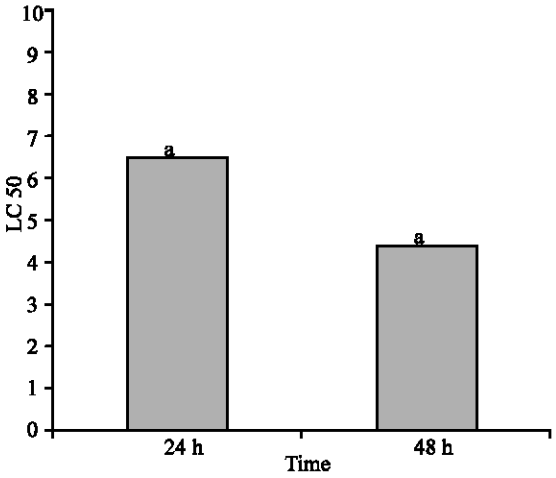

Fig. 2: *t*-test of LC_{50} values of *Hyptis suaveolens* seed extract on second instar larvae of *Plutella xylostella* at 24 and 48 h . Columns with the same letter are not significantly different at p=0.05

A *t*-test on the LC_{50} values for 24 and 48 h after the release of *P. xylostella* onto the sprayed leaves showed no significant difference (Fig. 1and 2) at p=0.05, an indication that a lower dose can be applied and the same level of control could be achieved after 48 h. Hence what needs to be ascertained is the level of damage that could occur. It was observed that the number of insects that died after 48h were moribund at 24 h. Consequently, the damage these moribund insects could cause might not be serious. Using a sublethal dose has the merit of reducing

the risk of affecting non-targeted organisms such as parasitoids and parasites. It also delays the occurrence of resistance in that susceptible strains will continue to exist and breeding could dilute any resistance that developed. The study has confirmed the insecticidal activities of extract of *H. suaveolens* as reported by[11] and has further showed that it can be used in the control of *P. xylostella* since the insect has developed resistance to other insecticides including *B. thuringiensis* as reported by some authors[2,6,17,18].

The efficacy of *H. suaveolens* on the control of *P. xylostella* could be enhanced by exposing the larvae to the extracts for longer period than the time used in this study. Such long time exposure could result to 100 % mortality enhance thus living no survival to develop resistance against subsequent applications.

Hyptis suaveolens is a common weed that is found growing in most wastelands[19] as such could be easily obtained by farmers and used for pest management.

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