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RESEARCH ARTICLE

BIOEFFICACY OF CERTAIN BOTANICAL CRUDE EXTRACTS AGAINST *SPODOPTERA LITURA* ON TOMATO

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ABSTRACT

Spodoptera litura is a polyphagous and cosmopolitan pest. This generalist can grow and survive on wide range of plant species. It causes an estimated loss of 25.8 to 100% in crop production. Establishment of *S. litura* would have devastating consequences on the quantity and quality of food and fiber crops. Generally chemical pesticides are used to control the infestation of *Spodoptera litura* but the indiscriminate use of such pesticides develops pest resistance and adversely affected the non-target organisms. So, there is a need of environmentally safe pesticides. Secondary metabolites from plants play a key defensive role against the pests and act as antifeedant, oviposition deterrents and growth inhibitors. Three botanical extracts were used in this experiment. Hexane and ethyl acetate extract of*Acorus calamus, Solenum pseudocapsicum* and *Eupatoroum triplinerve* were used against the *Spodoptera litura*. These extracts were applied after 15 days interval and the efficacy of botanicals tested against th*e S.litura*. Results showed that all six crude extracts of botanicals performed well against the pest but hexane extract of *Acorus calamus* gave best results against the pest. It shows highest percentage of mortality (61.94%, 37.34%) after 1st round of treatment. Hexane extract of *Acorus calamus* performed well after the 2nd round of treatment with highest percentage of mortality (53.13%, 40.01%).

INTRODUCTION

Spodoptera litura (Lepidoptera: Noctuidae) is a polyphagous pest of many economically important crops such as cotton, groundnut, soybean tomato, sweet potato etc (*Senrung Anna et al., 2014*). *S. litura* is a general feeder on over 100 hosts, including crucifers, legumes, millets, deciduous fruit trees, and various ornamentals and vegetables. High reproductive rate, damaging potential and ability to feed on different variety of plants has made it an economically important pest (*Dhir B C et al., 1992*). Infestation by *S. litura* has largely been controlled by the use of insecticides. This resulted in selective pressure on sprayed population and development of resistance against insecticides (*Kranthi K R et al., 2001*). Over use and abuse of insecticides has resulted in ecological imbalance. Therefore, it is essential to search alternative sustainable methods for the management of this pest. Plants have evolved rich sources of natural substances for their protection against herbivores. These botanicals are not only biodegradable and environment friendly but also there is less likelihood for insects to develop resistance against these natural substances.

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Botanical insecticides are an important group of naturally occurring, often slow acting crop protectants that are usually safer to humans and the environment than conventional pesticides (*Chauhan et al., 2013; Mehta and Sood, 2010*). Therefore, the use of botanical insecticides has been recommended ever more as a suitable alternative of plant protection with minimum negative risk (*Isman, 2006; Pavela, 2007*). Use of botanicals, particularly from neem, pyrethrum, tobacco etc., for controlling insect pests in the last few decades have given promising results (*Koul et al.,2004*).

MATERIALS AND METHODS

Rearing of Test Organism

Egg masses of *Spodoptera litura* were collected from vegetable farm of Chandrashekhar Azad Agriculture University, Kanpur (India). Surface of eggs sterilized with 0.02% sodium hypoclorite solution, dried and allowed to hatch. Hatched larvae feed on castor leaves. Larvae were feed on castor leaves until they developed into 4th and 5th instar larvae. Rearing of test organism performed under controlled environmental conditions.

Treatments

T1 *Acorus calamus* (hexane extract)
T2 *Acorus calamus* (ethyl acetate extract)

T3 *Solenum pseudocapsicum* (hexane extract)
T4 *Solenum pseudocapsicum* (ethyl acetate extract)
T5 *Eupatorium triplinerve* (hexane extract)
T6 *Eupatorium triplinerve* (ethyl acetate extract)
T7 Control

Collection and Extraction of plant Material

Healthy rhizomes of *Acorus calamus*, seed of *Solenum pseudocapsicum* and leaves of *Eupatorium triplinerve* were collected from the field. Fresh plant materials were washed through the distilled water thoroughly and dried on blotting paper. All plant materials shed dried under room temperature (25°C). Plant materials were powdered by using grinder. Powder from each plant species was extracted by soaking in hexane and ethyl acetate for 48 hours (*Matharu K S, et al.2016*). Then it filtered by Whattman filter paper no.-1. All solvents the evaporated to air dryness at room temperature to give crude extract. All extracts were collected in clean borosil vials and stored at 4ºC in a refrigerator until use. The crude extracts of different plant parts obtained above were further diluted with respective solvents to make the desire concentrations and emulsifier was added to it. (*Matharu K S, et al*, 2016)

Procedure of treatment application

A field experiment was carried out during, 2016- 17 at research farm of department of zoology, A.N.D. College. The tomato variety "Ratna" was raised by transplanting method with a gross plot size of 4.0 m x 3.0 m. The experiments were laid out in Randomized Block Design with six treatments and three replications. The spray of botanicals was given at 50 days after transplanting. The spray fluid was applied after 15 days interval with the help of sprayer.

Data Collection

For recording the observation, five plants were selected randomly from net plot area of each plot and tagged. The observations on tomato fruit borer population were recorded after 7 and 14 days application of different plant extracts spray.

Infested tomato fruit by *Spodopteralitura* larva

Statistical Analysis

The data thus, obtained were statistically analyzed after suitable transformation. The reduction in population of tomato fruit borer was worked out by adopting following formula of per cent corrected mortality (*Abbott's formula*).

Abbott Corrected mortality %=

$$\frac{\left(\begin{array}{c}\%\text{ mortality} \\ \text{in treated}\end{array}\right) - \left(\begin{array}{c}\%\text{ mortality} \\ \text{in control}\end{array}\right)}{100\%-\%\text{ mortality in control}} \times 100$$

RESULTS AND DISCUSSION

During the study 6 crude extracts of three biopesticides such as *Acorus calamus, Solenum pseudocapsicum* and *Eupatorium triplinerve* were tested against the *Spodopteralitura* to control its infestation on tomato crop. Data obtained in this experiment revealed that *Spodo pteralitura* is a serious pest in tomato crop. It affects organoleptic quality of tomato fruit. Observation recorded after the 7th and 14th day of treatment.

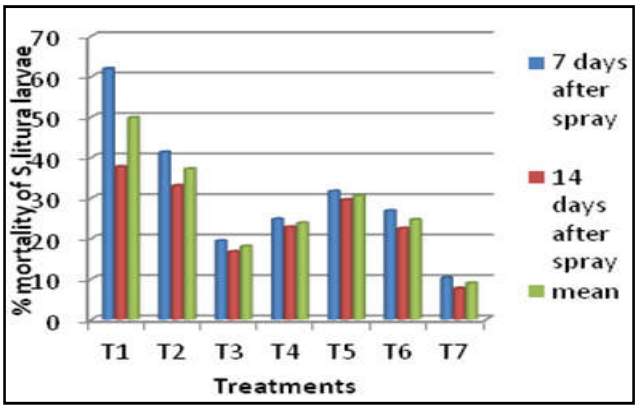

Figure 1-Efficacy of botanicals after 1st round treatment

Table 1. Percent mortality of *S.litura* larvae after 1st round treatment

Treatments	Concentration	7days after spray	14days after spray	Mean
T1	5%	61.94	37.73	49.84
T2	5%	41.31	33.04	37.18
T3	5%	19.40	16.72	18.06
T4	5%	24.80	22.81	23.81
T5	5%	31.66	29.56	30.61
T6	5%	26.83	22.48	24.66
T7		10.28	7.68	8.98

Table 2. Percent mortality of *S.litura* larvae after 2nd round treatment

Treatments	Concentration	7 days after spray	14 days after spray	Mean
T1	5%	53.13	40.01	46.57
T2	5%	35.10	38.46	36.78
T3	5%	12.60	10.38	11.49
T4	5%	18.73	14.75	16.74
T5	5%	27.74	22.83	25.285
T6	5%	23.81	19.20	21.50
T7		8.62	5.60	7.11

The screening of best pesticide was determined by the comparing treated plots with control plots. High larval mortality indicates the potential insecticidal activity of plant extracts. Data pertaining to the insecticidal activity clearly revealed thatall botanical extracts showed significant insecticidal activity against the *Spodoptera litura* larvae.

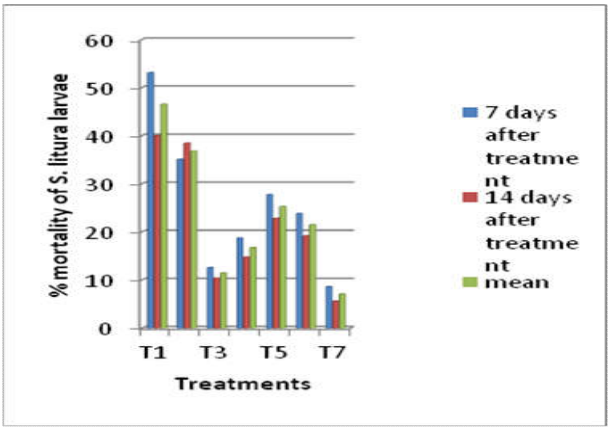

Figure 2. Efficacy of botanicals after 2nd round treatment

The results summarized in Table no. 1 and Table no. 2 clearly demonstrated that percent mortality during the larval stage of *S. litura* was highest in hexane extract of *Acorus calamus* followed by ethyl acetate extract of *Acorus calamus.* Hexane extract of *Acorus calamus* showed 61.94% mortality after 7 days of spray while after 14 days of spray it was 37.73%. These data obtained after the first round of spray. After the second-round spray, the % mortality shown by hexane extract of *Acorus calamus* was 53.13% and 40.01% respectively. The overall mean percentage mortality after first round treatment was 49.84% while after the second-round spray it was 46.54%. On the other side hexane extract of *Solenum pseudocapsicum* was least effective against the pest. In the first round, after the 7^{th} day of treatment it shown 19.40% larval mortality while after 14 days it was 16.72%. In the second round, after the 7^{th} day of treatment larval mortality was 12.60% while after 14 days it was 10.38%. Control plot shown 8.98% and 7.11% mean mortality.

Conclusion

Out of 6 crude extracts of three botanicals, hexane extract of *Acorus calamus* show significant effect against the *Spodoptera litura* larvae. At starting chemical pesticides gives good result but slowly it damages environment, pest resurgence, pest resistance to insecticide and lethal effect on non-target organism (*Abudulai et al., 2001*)

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