

# Biopesticidal Properties of kernel extract of *Semecarpus anacardium* on growth of *Heliothis armigera* (Hub.)

<sup>1</sup>Chetankumar T. Sharma and <sup>2</sup>Geeta P. Patil

Department of Zoology, Arts, Commerce and Science College, Bodwad.

Department of Botany, Arts, Commerce and Science College, Bodwad.

## Abstract:-

The present investigation showed that different doses of kernel extract of *Semecarpus anacardium* in acetone and ethanol solvent causes retardation in the development of the life cycle stages of *Heliothis armigera* (Hub.). The toxicity of the plant extracts studied increases with the increase in its concentration on the larva and pupa. The extracts of *Semecarpus anacardium* has property to reduce the growth of the population of *H. armigera*.

Key-words- *Heliothis armigera*, *Semecarpus anacardium*, Ethanol, Acetone.

## Introduction:

*Heliothis armigera* is a highly dreaded pest of several agricultural crops i.e. cotton, tomato, chickpea, pigeon pea, maize, sorghum etc. It belongs to order- Lepidoptera and family- Noctuidae. It feeds on more than 170 species of plants belonging 41 families most notably in cotton (King, 1994). The ability to feed on various plants enables *H. armigera* populations to develop continuously during the entire cropping season as they exploit a succession of different hosts (Bhatnagar *et. al.*, 1982, Nyambo, 1988). *Semecarpus anacardium* (L) a medicinally important plant, belongs to the family Anacardiaceae. The parts of these plants are nearly everyone normally used by everyone in Ayurvedic system of medicine for various ailments, mainly alimentary tract and certain dermatologic conditions. It has potential action reported on heart, blood pressure, respiration, cancer and neurological disorders (Kurup *et. al.*, 1979; Raghunath and Mitra 1982; Sharma *et. al.*, 1995). Chemically, it contains active principal of Bhilawanol, Jeediflavone, Semecarpuflavone, Gulluflavone, Anacardoside, Biflavanone and Anacardic acid. Plants synthesize and preserve a variety of biochemical products, many of which are extractable and used for various scientific investigations. These phytochemicals that include primary and secondary metabolites have countless benefits to humans, which are exploited as natural pesticides, flavoring, fragrances, medicinal compounds, fibers and beverages. While secondary metabolites have restricted distribution, to one plant species or a taxonomically related group of species, primary metabolites are found throughout the plant kingdom (Taiz and Zeiger, 2006).

## Material and Method:

The larvae of *Heliothis armigera* were collected from the field of tur (*Cajanus cajan*) and gram (*Cicer arietinum*) etc. from field. These larvae were kept in different plastic bottles to avoid cannibalism and reared in artificial diet that was changed every day (<http://www.cicr.gov.in>).

Kernel (Seeds) of *Semecarpus anacardium*, locally called Golumbi were purchased from the market, dried and was ground to make powder. The powder was packed in filter paper and extract was extracted at the ratio of 1:10 in acetone and ethanol solvents, by using Soxhlet apparatus. After eight hours of continuous extraction the final extract was kept open to evaporate the solvent and remaining as stock solution extract was stored at 4°C in a refrigerator until use.

To find the comparative effect on the growth of the life cycle stages of *H. armigera*, concentrations of the extracts were prepared. For each concentration of acetone and ethanol extract of *Semecarpus anacardium*, ten vials were prepared and one each 1st instar larva was released. The food with the respective extract dose was changed every day. The observation was made with respect to the effect of extract on duration of the development and on their morphological characters till the emergence of the adults. The control was maintained simultaneously on food without any extract.

**Observation and Result:**

Table No.1.

Efficacy of Kernel extract of *Semecarpus anacardium* in acetone and ethanol solvents against developing stages of *Heliothis armigera*.

Extract in solvent	Dose of extract (ml/Kg food)	Mortality of larvae %	Average larval period in days	Average pupal period in days	Emergence of adults %	Activity
Acetone	Control	-	19.87±1.12	15.12±0.83	100	Actively Feeding
	2.0	10	18.88±1.05	11.28±0.75	70	Semi active
	4.0	10	19.57±1.13	12.16±0.79	60	Semi active
	6.0	20	19.95±1.26	13.83±0.56	60	Repellency
	8.0	30	20.57±1.27	14.25±0.81	40	Repellency
Ethanol	Control	-	19.87±1.12	15.12±0.83	100	Actively Feeding
	2.0	20	20.73±1.57	14.23±0.41	60	Repellency
	4.0	30	21.48±1.34	15.17±0.54	50	Repellency
	6.0	30	23.12±1.67	16.28±0.74	40	Repellency
	8.0	50	23.89±1.72	16.47±0.63	40	Antifeedency

± indicates standard deviation

Table No.1. Show the effect of kernel extract of *Semecarpus anacardium* extracted in acetone and ethanol solvents on the mortality, average larval and pupal periods, emergence of adult percent and activity of *H. armigera* at different concentrations.

At 2.0 ml/kg. concentration in acetone solvent the larvae were semi active and no marked difference were noted. In ethanol solvent the larvae were repelled and there was slight decrease in the duration of larval and pupal period as compared to control.

In 4.0ml/Kg concentration of acetone extract, the larvae were semi active and no marked differences were noted. 10% mortality was observed, while larval period lasted for 19.57±1.13 and 20.47±1.43 and pupal period 12.16±0.79 and 14.18±0.59 days respectively. In ethanol extract, the larvae were repelled and 30% mortality was observed, while larval period lasted for 21.48±1.34 days and pupal period 15.17±0.54 days.

At 6.0ml/Kg concentration, larvae showed repellency in both acetone and ethanol solvents and 20% mortality in acetone and 30% mortality in ethanol extract is observed. While larval period lasted for 19.95±1.26 and 23.12±1.67 days and pupal period 13.83±0.56 and 16.28±0.74 days respectively.

In 8.0ml/Kg concentration of acetone extract repellency and prolonged larval period for 20.57±1.27 days and pupal period 14.25±0.81 days was observed. In ethanol extract, 50% mortality and antifeedency was found while larval period lasted for 23.89±1.72 days and pupal period 16.47±0.63 days. The survived larvae in all cases pupated completely or partially but the emergence was reduced in extracts of *Semecarpus anacardium*.

At 2ml, 4ml, 6ml and 8 ml per Kg food, the percent emergence of the pupated *H. armigera* was 70, 60, 60, 40 in acetone extract and 60, 50, 40, 40 in ethanol extract respectively. Thus even at low concentration of the doses, the extracts of *Semecarpus anacardium* has property to reduce the growth of the population of *H. armigera*.



A. Effect of Acetone Extract



B. Effect of Etanol Extract

Photo shows the caterpillars of *H. armigera* after exposure to kernel extracts of *Semecarpus anacardium* in acetone and ethanol (Photo A and B) solvents. Sluggishness and cessation of feeding was observed after treatment that increased significantly while the blackening of larval body is seen. Larval Pupal intermediates were also observed indicating the effect of the plant on chitin synthesis of the insect observed. Death occurred at the time of final moulting stage of pupation with attached larval skin and ruptured abdomen is noted.

### Discussion:-

Kernel extract of *Semecarpus anacardium* prolonged larval and pupal duration, caused abnormalities and mortalities and reduced percentage emergence of adults from pupae of *H. armigera*. The growth disruption affects the inability of some of the larvae to successfully molt into the pupal stage or some of the pupae into the adult stage. Kernel of *S. anacardium* possessed maximum amount of phenols (117.33mg/gdw) than stem, leaves and roots. Plant phenols have been extensively studied because of their chemical nature and their extended occurrence in plant materials. Antioxidant phenols have potential applications in the promotion of health and prevention against damages caused by radicals. In similar studies done by Vijayvergia and Viyay (2007), phenols were higher (45 mg/gdw) in roots of *Balanites aegyptiaca*. Baskar *et. al.*, (2010) observed ethyl acetate extract of *Couroupita guianensis* showed LC50 value of 7.22% against *Helicoverpa armigera*. *Pongamia pinnata* (karanj) bark with 18 types of flavonoids has antifeedent activity against *Spodoptera litura* and other insect pests (Vishal, 2006). Tamhane *et. al.*, (2005) on feeding of *Capsicum annum* leaf extracts and two purified proteinase inhibitors in various doses to *H. armigera* larvae for two successive generations through artificial diet demonstrated their potential in inhibiting larval growth and development, delay in pupation period and dramatic reduction in fecundity and fertility.

### Conclusion:-

1. The duration of the larval and pupal period was prolonged due to the effect of kernel extract of *Semecarpus anacardium*.
2. The exposure to different extracts caused morphological alterations in the larvae and pupae.
3. The process of moulting from larva to pupa was also affected and abnormal pupae were metamorphosed.
4. The extracts also reduced the percentage of the emergence of adults from the pupae of treated larvae.
5. The toxicity of the plant extracts studied increases with the increase in its concentration on the larva and pupa.

**Acknowledgement:-**

The authors are highly grateful to the North Maharashtra University, Jalgaon and Principal of Institution to carry out the present investigation.

**References:-**

- King A. B. S. (1994): *Heliothis/Helicoverpa* (Lepidoptera: Noctuidae). In Insect Pests of Cotton, ed. GA Matthews, JP Tunstall, pp. 39–106. Wallingford: CAB Int. 593 pp.
- Bhatnagar V. S., Lateef S. S., Sithanatham S., Pawar C. S., Reed W. (1982): Research on *Heliothis* at ICRISAT. *Proc. Int. Workshop Heliothis Manage.*, ed. W Reed, V Kumble, pp. 385–96. Patancheru, Andhra Pradesh, India: Int. Crops Res. Inst. Semi-Arid Trop. 418.
- Nyambo B. T. (1988): Significance of hostplant phenology in the dynamics and pest incidence of the cotton bollworm, *Heliothis armigera* Hübner (Lepidoptera: Noctuidae), in western Tanzania. *Crop Prot.* 7:161–67.
- Kurup P.N., Ramdas V.N. and Joshi P. (1979): In Handbook of Medicinal Plants, New Delhi, Oxford & IBH Publishing Co. Pvt. Ltd. 32.
- Raghunath S. and Mitra R. (1982): Pharmacognosy of Indigenous Drugs, New Delhi, Oxford & IBH Publishing Co. Pvt. Ltd, 185.
- Sharma A., Mathur R. and Dixit V.P. (1995): Hypocholesterolemic activity of nutshell extract of *Semecarpus anacardium* (Bhilawa) in cholesterol fed rabbits, *Ind J Expt Biol.*, , 33, 444-8.
- Taiz Q. L. and Zeiger E. (2006): Plant physiology, 4th Edn. Ch. 13.pp. 315-344. Sinauer Associates, Inc. Publishers, Massachusetts.
- Vijayvergia R. and Viyay P. (2007): Quantification of primary metabolites of *Balanitis aegyptiaca*. *Asian J. Exp. Sci.* 21(2): 329-336.
- Baskar K., Maheshwaran R., Kingsley S., and Ignacimuthu S. (2010): Bioefficacy of *Couroupita guinensis* (Aubl) against *Helicoverpa armigera* (Hub.) (Lepidoptera: Noctuidae) larvae. *Spanish Journal of Agricultural Research* 8: In press.
- Vishal K. K., Chandrashekhar and Sidhu O. P. (2006): Efficacy of Karanjin and different extracts of *Pongamia pinnata* against selected insect pests. *J. Entomological. Res.*, 30(2): 103-108.
- Tamhane V.A., Chougule N.P., Giri A.P., Dixit A.R., Sainani M.N. and Gupta V.S. (2005): In vivo and in vitro effect of *Capsicum annum* proteinase inhibitors on *Helicoverpa armigera* guts proteinases. *Biochim Biophys Acta.* 1722(2):156–167.