

Efficacy of the plant products *Acorus calamus*, *Piper longum*, and Econeem against the Larvae of Tobacco Caterpillar *Spodoptera litura* Fab. (Lepidoptera: Noctuidae)

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ABSTRACT:

Larvicidal efficiency of ethanolic extracts of *Acorus calamus*, *Piper longum* and Econeem (neem product) were tested against tobacco caterpillar, *Spodoptera litura* by leaf disc assay method. The results related to *Acorus calamus* extract was more effective against all stages of larval forms (I to VI instars) followed by Econeem and *Piper longum*. Moreover, the first instar forms were quite sensitive to all the three treatments and the percentage mortality was ranged from 62.40% to 90.30% after 48 hours. Likewise, the high concentration (25%) of plant product reduced the maximum larval population density and it was 74.80% at 5% level. Low larval mortality was evident in the late stage larvae. Initial feeding inhibition, and prolonged larval period were observed in the *Acorus calamus* and Econeem treated *S. litura* larvae and deformed pupal formation were observed in the treated VI instar forms after 6 days.

Keywords:

Acorus calamus, Econeem, Larval mortality, *Piper longum*, *Spodoptera litura*.

Article Citation:

Thangapandian K, Muthusamy M and Vimal P.

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Journal of research in Biology (2011) 7: 490-493

Dates:

Received: 11 Oct 2011 / **Accepted:** 22 Oct 2011 / **Published:** 03 Nov 2011

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INTRODUCTION

Extensive uses of chemical pesticides have caused several risks and ill effects such as resistance to pesticides among insects, outbreak of secondary pests, destruction of beneficial organisms, emergence of newer pests and undesirable environmental effects (Negahban, 2006). In nature, certain plants and their derivatives have showed insecticidal activities and hence these bio pesticides have been receiving global attention and do not leave any toxic residues in the environment and selectively toxic to insects (Raghavaiah and Ramesh babu, 2011., Isman, 2006). The usage of plant products and its biologically active compounds are being considered as the best alternative to synthetic insecticides.

Out of 27,500 species of flowering plants, about 2,121 plant species are documented to possess pest management properties, 1,005 species of plants exhibiting insecticide properties, 384 with anti-feedant properties, 297 with repellent properties, 27 with attractant properties and 31 with growth inhabiting properties have been identified (Bikramiit Sinha and Indranil Biswas, 2008). India has huge variety of medicinal plants and their products have been reported for insecticidal action against variety of insect pests. *Acorus calamus* and *Piper longum* are the medicinal plants and their activities against insect pests and mosquitoes have been documented so far (Ranaweera, 1996). Piperaceae family members posses various secondary metabolites, which exhibit insecticidal and larvicidal activities against *Callosobruchus chinensis*, *Sitophilus oryzae* and *Rhyzopertha dominica* Fab. (Scott et al., 2008).

The tobacco caterpillar, *Spodoptera litura* Fab. (Lepidoptera: Noctuidae) is a polyphagous, notifiable and destructive pest of sub tropical and tropical regions and its feeding has observed on at least 150 plant species. The young ones are voracious feeders and cause severe damages in several economically important agricultural crops such as Cotton, Groundnut, Chilies, Cauliflower, Cabbage, Tobacco and Sunflower. In the present study, insecticidal efficiency of two plants extracts *A. calamus*, *P. longum* and the Neem product (Econeem) were studied against the larval forms of *Spodoptera litura*.

MATERIALS AND METHODS

The pupae of *Spodoptera litura* were obtained from the Department of Entomology, Tamil Nadu Agricultural University, Coimbatore

and reared in the plastic containers. The emerged adults were allowed to lay their eggs on muslin cloth and placed in separate cages. The newly emerged larvae were fed with fresh tender cotton leaves and maintained throughout the study period.

The ethanolic *Piper longum* extract was prepared by the method of Ikan (1969) and the extract was concentrated with 10 ml of 10% alcoholic KOH. After overnight incubation, the yellow residue was dissolved in 100 ml of ethanol and used as a stock solution. *A. calamus* extract was prepared (Harborne, 1973) with 10% of acetic acid. The extract was washed with the concentrated ammonium hydroxide and the precipitation was centrifuged and again washed with 2 ml of 1% ammonium hydroxide. The supernatant was discarded and the remaining residue was dissolved in 100 ml of ethanol and used as stock solution.

The different concentrations (5%, 10%, 15%, 20% and 25 %) of *Piper longum* and *Acorus calamus* extracts were prepared from the stock by using distilled water. Similar concentrations of Econeem were prepared by using the distilled water and the suitable emulsifying agent. The mortality rate of the different instars of *S.litura* was assessed by leaf disc assay method in the laboratory at 27°C and 72% rh. The control was maintained with the cotton leaves soaked in 1 ml of acetone and the emulsifier mixed with 10 ml of distilled water. The larval mortality of each concentration was observed after 24 hours and 48 hours. The percentage of mortality was calculated from the obtained numbers of dead larvae and corrected by using Abbots (1925) formula.

RESULTS AND DISCUSSION:

The Larvicidal action of different concentrations of plant products were compared (Fig.1). Observations indicated that high doses (25%) of extract were more effective and cause significant damage to all the instar forms. The mortality percentage was ranged from 90.3% to 69.03% after 48 hours. Among all the larval stages, I instar larva was more susceptible to the treatment when compared to other larval stages. β -asarone from rhizomes of *A. calamus* exhibits insecticidal action against the various insect pests and has been documented by Hossain et al., 2008. Nair et al. (2001) reported that the chemosterilant action of *A. calamus* on Melan fly, *Bactrocera cucurbitae*. Moreover, continuous intake of extract reduced the population density among larvae and adults. Chandel et al. (2001), have reported starvation due

Table.1. The mean mortality rate of *Spodoptera litura* treated with *Acorus calamus*, *Piper longum* extract and Econeem

S. No.	Plant Products	Concentrations (%)	Larval instars stages					
			I	II	III	IV	V	VI
1.	<i>Acorus calamus</i>	5%	74.83	68.71	62.36	64.69	60.22	56.78
		10%	80.47	72.53	66.55	68.71	65.76	61.57
		15%	85.46	76.55	70.69	73.70	66.70	63.43
		20%	85.25	78.24	72.41	74.01	72.37	66.55
		25%	90.30	82.31	79.51	76.10	72.91	69.03
2	<i>Piper longum</i>	5%	62.40	46.20	46.20	36.64	37.81	34.76
		10%	62.08	52.16	50.02	42.50	41.20	37.81
		15%	66.04	57.70	58.54	46.67	43.36	41.20
		20%	69.66	60.61	61.89	51.29	46.67	43.36
		25%	71.63	69.66	64.47	56.78	52.24	46.67
3	Econeem	5%	68.69	56.26	52.86	52.86	46.67	41.67
		10%	72.16	61.05	56.78	57.73	51.29	46.67
		15%	71.64	64.69	65.21	61.57	54.02	51.29
		20%	76.68	72.37	67.39	65.76	59.43	54.02
		25%	84.80	76.08	73.85	69.19	63.19	59.59

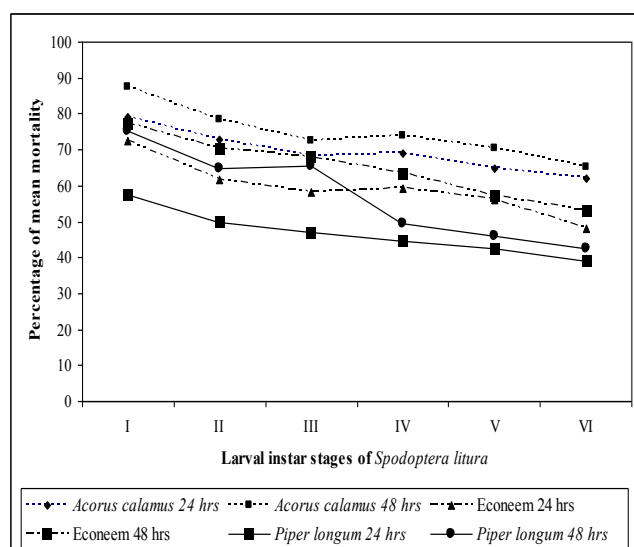


Fig.1. Percentage larval mortality of *Acorus calamus*, *Piper longum* extracts and Econeem on the different larval stages of *Spodoptera litura* after 24 hrs and 48 hrs.

to antifeedent property of *A. calamus* against *Tribolium castaneum*. The results of present study were positively correlated with the findings of Hossain et al. (2008) and Nair et al. (2001).

Larvicidal activity of *P. longum* and Econeem were more pronounced at high concentration (Fig.1). At 25% of extract concentration, the percentage larval mortality was ranged from 46.67 % to 71.63% with *P. longum* extract and it fell between 41.67 to 84.8% with

Econeem treatment. Like *A. calamus* extract, these two plant products were effective against I instar forms than other instar stages. Among them, *A. calamus* was more effective one followed by Econeem and *P. longum*. Similar results were obtained with *A. calamus* against cabbage aphid, *Brevicoryne brassicae* Linn. (Chandel et al., 2007). Senthil Kumar et al. (1997), tested acetone extract of Neem leaf exudates against V instar larvae. He concluded that the neem treatment reduced food consumption and growth efficiency and extended larval and pupal durations, reduced longevity and fecundity. The population of the larvae originally introduced was reduced due to phagodeternet and insecticidal properties of the plant extracts. Starvation of larvae was also evident with few pupal formations after 6 days of treatment on VI instar.

We concluded that, *Acorus calamus* was superior to control *Spodoptera litura* than Eco neem and *Piper longum* and the I instar stage was quite so sensitive to the treatment.

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