
BIO-EFFICACY OF *PONGAMIA PINNATA* ON LARVAL GROWTH AND MORTALITY OF TOBACCO CATERPILLAR, *SPODOPTERA LITURA* FABRICIUS

M .K. Rathod*, V.K. Sangode and M. M. Rai

Centre for Sericulture and Biological Pest Management Research (C.S.B.R.)

R.T.M.Nagpur University, Amba Vihar, Nagpur -440 022, INDIA

*Corresponding Author, Email: mrathod111@rediffmail.com

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ABSTRACT: A methanolic extract from the leaves of *Pongamia pinnata* (L.) was tested for its insecticidal property on the third instar larvae of *Spodoptera litura* (F.) under laboratory conditions. Different concentration of the plant extract were used for leaf disc test to observe the effect on feeding, growth and the survival rate of the test insect at different stages of the development. The maximum mean percent mortality was observed in 50% dose concentration. The present results showed that single application of 50% solution caused up to 96.66% mortality. This concentration is the highest limit dosage, especially in order to observe possible phytotoxicity shows a potential biopesticide to check the mortality of polyphagous pest *Spodoptera litura*.

KEY WORDS: *Pongamia pinnata*, leaf extract, *Spodoptera litura*, survivability

INTRODUCTION

Spodoptera litura Fabr. (Lepidoptera: Noctuidae) is polyphagous pest and has about 120 host species belonging to 44 families. In India, it feed on 74 species of cultivated crops and some wild plants. It has been reported as an increasingly important pest during the rainy seasons causing heavy yield loss throughout India². It is an indigenous pest of a variety of crops in South Asia and was found to cause 26-100 per cent yield loss in ground nut³. Among the polyphagous pests, the tobacco caterpillar, *S. litura* has emerged as a serious and dominant pest causing enormous losses to crops like pulses, cotton, oil seeds, vegetables, tobacco, cauliflower, castor, banana, groundnut, mulberry, etc. The fully grown caterpillars of the tobacco cutworm, *S. litura* are most voracious feeders.

The widespread use of chemical pesticides has resulted in problems including health hazards to human being and domestic animals, development of pesticide resistance by pest, pest outbreak, etc. The broad spectrum action of many synthetic pesticides may also cause adverse environmental effects by harming beneficial organisms such as natural enemies and pollinators. Plants are known to possess toxins including phytotoxins. The phytotoxins protect the economically important crops from pests and pathogens all over the world. Plant derived insecticides are reported to have the ability to influence the proportion of various biochemical components (carbohydrates, lipids, proteins etc.) in the body of insects, disturbing the internal metabolism of the insect, causing their reduced activity or mortality.

Pongamia pinnata Linnaeus (Fabaceae) is a medium-sized glabrous tree distributed along the coasts and river banks in India and Myanmar. Locally known as Karanja, is a mangrove plant belonging to the family, Fabaceae. It is a medium size glabrous tree with a short bole and attaining a height of round 18 m and its habitat is in the littoral regions of South East Asia, Australia and Fiji. The leaves, flowers, seeds and stem bark of *P. pinnata* are known to have karanjin^{6,7}. Literature shows presence of flavonoids, especially furano flavonoids, quercetin, amino acids, fatty acids and triterpenoids in *P. pinnata*^{8,9}. Hence, the present investigation was conducted to study the effect of leaf extract of *P. pinnata* against the larval growth, development and survivability of tobacco caterpillar, *Spodoptera litura*.

MATERIALS AND METHODS

Maintenance of insect culture

The egg masses were collected from the field, brought to the laboratory and incubated. On hatching the first instars were released on host the plant castor, *Ricinus communis* in the laboratory and reared at the temperature 25 - 28°C and 70% relative humidity.

Plant Extract

The leaf of *P. pinnata* were collected from the premises of Centre for Sericulture and Biological Pest Management Research, and brought to the laboratory and shed dried and further grinded in mixer to make powder. The methanolic extracts were

obtained by using Sauxlet Extraction Method.

Preparation of doses

The four different concentrations were prepared from the stock. The stock solution was considered 1% solution and other concentrations were prepared by diluting the stock solution with distilled water such as 0.50%, 0.25% and 0.125%. Distilled water considered as Control for all the respective four concentrations.

Treatment

The 500 third instars larvae were selected and collected from the stock culture for each concentration. The larvae was kept in individually in plastic cups for the treatment, such three replicate was done. The larvae were treated with extract of *Pongamia pinnata* 1%, 0.5%, 0.25%, 0.125%, and control (distilled water) were spread by smearing 1ul solution on the piece of leaf of host plant and fed to the larvae individually in the plastic cup. The larval weight, growth and mortality were recorded and calculated by using Abbott's formula.

RESULTS AND DISCUSSION

During the present study all the treated group of larvae showed the symptoms like inhibiting growth, slow feeding activity, oozing of fluid from the mouth and blackening of thorax, reduction in mobility due to retraction of legs and inhibition of moulting. The larvae treated with 1% concentration could not reach up to the pupal stage and though larvae treated with lower concentrations reached up to pupal stage and

transformed into malformed pupae. Similar results were found when larvae of *S. litura* treated with extract of azadirachtin reported by¹⁵.

Sahayaraj and Nirupa in (2006) also observed the mortality, root extract of *Pongamia murex* highly reduced the pupal weight compared to the leaves and fruit extracts. When they compared to the control pupal weight, the treated pupal weight was less than the control, which suggested that *P. murex* has a unique phyto-chemical profile. The reduction of weight and shriveling of pupa in all the treatments might be related to the loss of large quantities of body fluids before pupation. Crude extracts also affect the detoxification enzyme levels of *S. litura*¹⁷, which might be the reason for the reduced pupal weight observed. This finding directly supports the present results that with

increasing dose concentration, occurs reduction in weight of treated larvae and metamorphic changes also get disturbed. It was observed that there appears to be a biologically significant interaction between dose various dose concentration with the percent larval mortality.

In the present study the effect of extract of *Pongamia pinnata* was also recorded reduced in the growth of the larvae, resulting decreased body weight after an interval of 24 hours of the treatment. The larvae treated with 1% concentrations died and larvae treated with 0.50 and 0.25 and 0.125 % concentration showed weight reduction within 48 hours as compared to control. Significant reduction in body weight observed with 0.50% treated larvae. Though all the treated larvae reached up to fifth instar stage and formed malformed pupa (Table 1).

Table 1. Effect of *Pongamia pinnata* extract on larval weight *Spodoptera litura*

<i>P. pinnata</i> extract Conc.	Weight of Larva (g)						
	Initial	24 hrs	48 hrs	72 hrs	96 hrs	120 hrs	144 hrs
1%	0.055±0.042	0.042 ±0.01	All dead	-	-	-	-
0.50%	0.056±0.035	0.042±0.02	0.174±0.014	0.35±0.043	0.549±0.060	0.595±0.034	0.654±0.048
0.25%	0.052±0.001	0.040±0.01	0.213±0.008	0.386±0.021	0.773±0.036	0.807±0.039	1.023±0.022
0.125%	0.058±0.002	0.052±0.02	0.209±0.014	0.447±0.035	0.773±0.049	0.831±0.048	1.065±0.068
Control	0.045±0.001	0.049±0.02	0.236±0.010	0.453±0.028	0.782±0.035	0.864±0.035	1.134±0.042

Table 2. Effect of *Pongamia extract* on larval mortality of *Spodoptera litura*

<i>P. pinnata</i> extract Conc.	No. of larvae dead / (%)							
	No. of larvae taken	24hrs	48hrs	72hrs	96hrs	120hrs	Adults	Total Mortality (%)
1%	30	28/ (93.33)	2/ (100)	-	-	-	0	100
0.50%	30	26/ (86.66)	2 / (93.33)	1/ (96.66)	-	1/ (100)	0	100
0.25%	30	16/ (53.33)	3/ (63.33)	-	-	-	11	63.33
0.125%	30	07/ (23.33)	1/ (26.66)	-	-	-	22	26.66
Control	30	-	-	-	-	-	30	-

In (1998) Sahayaraj and Paulraj evaluated the effect of relative toxicity of some plant extracts to *Spodoptera litura* such as antifeedent action of Neem seed kernel extracts and its commercial formulation have been found to be effective insecticide against many insect pests and can be integrate them in Integrated Pest Management programme (Schmutterer., 1990, 1988; Gupta and Sharma., 1998). In the present study also showed that single application of high dosage (1% solution) of *P. pinnata*, caused up to 100% mortality after 48 hrs of treatment due the toxicity of *P. pinnata*, increases the dose of extracts concentration, it increases the rate of mortality (Table 2).

The results obtained from the present finding clearly indicates that the application methanolic extract of *P. pinnata* reduce the population of *S. litura* and minimize the infestation to crop. The eco-friendly active principle present in this plant, therefore it will be recommended to farmers used as integrated pest management in the field.

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