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Larvicidal activity of the flowers of *Delonix regia* (Bojer Ex Hook.) Rafin. (Fabales: Fabaceae) against the teak defoliator, *Hyblaea puera* Cramer

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Delonix regia (Bojer Ex Hook.) Rafin., is a perennial tree found in the tropics and commonly available in coastal India and other south East Asian countries. It is commonly known as Flamboyant flame tree, Gul mohr and Gold mohr. It is an ornamental medium-sized tree. It is planted in avenues and gardens in all the warmer and damper parts of India. It has a spreading crown of feathery foliage and bears flowers early in the hot season when the foliage falls and the branches are nearly bare. The flowers with panicles, varying in colour from deep crimson through scarlet orange to delicate salmon, appear in profusion in broad erect clusters along the branches, presenting a gorgeous appearance. The flowers last till June or even longer. Several natural dyes are prepared from the flowers of *D. regia*. *Hyblaea puera* Cramer is the most important defoliator pest of teak. In Kerala, *H. puera* infestation is an annual phenomenon and its defoliation is reported to cause 44% loss in the volume increment of teak (Nair *et al*., 1985). As the attack by *H. puera* significantly affects timber production, the management of this pest is very important. Hence, the present study was taken up with objective to explore the possible insecticidal property of the flowers of *D. regia* on *H. puera.*

The flowers of *D. regia* were collected from IWST (Institute of Wood Science and Technology) campus forest, Bangalore during May – June. The flowers were sprinkled with alcohol to prevent fungal infestation and then were oven dried and was powdered in a mixer. 100g of the powdered flower was dissolved in 250 ml of each of the solvent namely petroleum ether, chloroform, methanol, ethyl alcohol, ethyl acetate, acetone and water and kept in sealed round bottom flasks. After 48 hours, it was extracted in soxhlet apparatus until the respective eluting solvents turned colourless. The solvent was evaporated and the dry crude extract obtained was weighed and stored in refrigerator.

A known amount of crude extract obtained from the above process was dissolved in respective solvent in 1:1 proportion and serially diluted with water to obtain the desired concentrations of 0.25%, 0.5%, 1%, 2% and 4%. One drop of emulsifier (0.005%) (Tween 20, Sigma Chemical Company) was added to the extract to ensure complete dispersion of the active ingredient.

For bioassays to evaluate larvicidal action of crude extracts, early 3rd instar larvae of *H. puera* of uniform age and weight range (9-13 mg) obtained from laboratory culture were used. Contact toxicity was tested with 0.25%, 0.5%, 1%, 2% and 4% concentrations. Five replications with 10 individuals were used for each concentration. Larvae were introduced into sterilized plastic petriplates. The test

solution was applied on larvae, as topical spray using a TLC (Thin Layer Chromatography) sprayer. The petriplates were covered with the lid. In blank group the larvae were sprayed with water and in the control group the larvae were sprayed with respective solvent. Tween 20 also served as a control. Observations were made on the behaviour of the larvae and mortality was observed at 2hr, 4hr and 6hr.

Percentage of larval mortality was calculated. Mortality in the control was corrected using Abbott's formula (Abbott, 1925). The percentage values were transformed to ensure normality and variance homogeneity using an arcsine transformation (Zar, 1999). The data was subjected to analysis of variance (ANOVA) and the means separated using Least Significant Difference (LSD). LC 50 values were calculated using probit analysis according to calculations outlined by Finney (1971). Probit analysis was carried out using SPSS Software program version 12 and ANOVA was done with AGRES statistical package.

The larvicidal activity of the flowers of *D. regia* against the 3rd instar larvae of *H. puera* showed that there was no mortality of larvae in any of the extract tested and were on par with the control, except the methanol extract. At the lowest concentration (0.25%), the extract was ineffective causing least mortality (8%). At highest concentration (4%) the methanol extract showed highest mortality (100%), followed by mortality (96%) at 2% concentration. At 1% methanolic extract of *D. regia* flowers, mortality of 84% was exhibited (Table 1). The methanol extract proved to be very less effective at 0.5% and brought about low mortality of 18%. The LC_{50} and LT_{50} values of methanolic extracts of *D. regia* flowers are presented in tables 2 and 3. The LC_{50} value is 0.67%. The LT_{50} at the lowest concentration (0.25%) and highest concentration (4%) are 19.88 hours and 3.19 hours, respectively. Among all the extracts tested only methanol extract of *D. regia* flower showed larvicidal activity. The methanol extract might have contained the active principles which could have brought about the mortality of the larvae. Earlier reports showed that the flower extract of *D. regia* in water possess insecticidal activity against leaf eating caterpillars and beetles (Jacobson, 1975) and also antifeedant activity to the larvae and pupae of the pulse beetle, *C. maculates* (Chandrakantha, 1988). Third instar larvae of *Pericallia ricini* were more susceptible to the flower extract of *D. regia* (Chockalingham *et al*., 1992). According to Baskaran and Narayanasamy (1995) the flowers of *D. regia* have chemicals with contact insecticidal property. The present study once again confirmed the claims of earlier workers that flowers of *D. regia* possess insecticidal property.

CONCLUSION

The methanol extract of *D. regia* flowers were very effective against *H. puera* indicating the potentiality as bio-pesticide. The enormous biomass of *D. regia* flowers could be exploited to develop effective, eco-friendly and cost–effective biopesticide as component of insect pest management.

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Table 1: Percentage mortality of 3rd instar larvae of *H. puera* on contact toxicity with methanol extract of *D. regia*

Treatment	Per cent mortality				
	4%	2%	1%	0.5%	0.25%
Methanol extract	100.00±0.00 (81.86)[a]	96.00±8.94 (78.18)[ab]	84.00±18.16 (68.57)[b]	18.00±14.83 (24.15)[c]	8.00±14.83 (16.67)[c]
Blank	0.00 (9.10)	0.00 (9.10)	0.00 (9.10)	0.00 (9.10)	0.00 (9.10)
Control (Respective solvents)	0.00 (9.10)	0.00 (9.10)	0.00 (9.10)	0.00 (9.10)	0.00 (9.10)
Tween 20	0.00 (9.10)	0.00 (9.10)	0.00 (9.10)	0.00 (9.10)	0.00 (9.10)

	SED	CD (0.05)	CD(0.01)
Treatment	0.7483	1.5610	2.1293

Mean ± SD represents mean percentage mortality of 5 replicates with 10 individuals each.
Means followed by the same alphabet does not differ significantly at 5% level of significance.
Values in parentheses are arcsine transformed values.

Table 2: Dose - mortality response of *H. puera* on contact toxicity with wood of *P. marsupium*

Treatment	LC_{50}	Fiducial limits		Slope ± S.E	Intercept ± SE	Chi-square
		Lower Limit	Upper Limit			
Methanol extract	0.67214	0.58785	0.76816	4.05768 ± 0.43378	0.70012 ± 0.13889	7.637

The Chi-square value is less than 7.815 (Df=3) is not significant (P>0.05)

Table 3: LT_{50} (in hours) of methanol extract of *D. regia*

Treatment	Concentration in %				
	4	2	1	0.5	0.25
Methanol extract	3.19	3.57	3.96	9.21	19.88

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