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Research Article

ANTIFEEDANT, LARVICIDAL AND OVIPOSITION DETERGENT ACTIVITY OF *PONGAMIA PINNATA* AND *CEIBA PENTANDRA* AGAINST POD BORER LARVAE OF *HELICOVERPA ARMIGERA* (NOCTUIDAE: LEPIDOPTERA)

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ABSTRACT

To study report the different solvents of methanol, ethyl acetate, chloroform, and acetone for *Pongamia pinnata* and *Ceiba pentandra* were used the experimental analysis in pest control of most dangerous notorious lepidopteran pests of *Helicoverpa armigera.* Antifeedent activity of *P. pinnata* and *C. pentandra* against *H. armigera* to maintain the laboratory condition at different concentrations are 100, 200, 300, 400 and 500ppm respectively. Larval mortality was observed after 24 h exposure to the plant extracts. The oviposition deterrency against *H. armigera* at 100, 200, 300, 400 and 500 mg/L. The antifeedant activity of *P. pinnata* and *C. pentandra* against *H. armigera* 94.6% and 92.4% at 225 ppm, respectively. The larvicidal activity of *P. pinnata* and *C. pentandra* tested LC_{50} and LC_{90} values were 102.10 and 228.01 ppm, against *H. armigera*. The oviposition deterrent activity of *P. pinnata* and *C. pentandra* against *H. armigera* 98.8% and 96.2%. Performance of maximum antifeedant activity, lethal activity and ovipososition deterrent activity recorded in the methanol extract of *P. pinnata* than could be utilized in pest control programme.

Keywords: Notorious, *Helicoverpa armigera, Pongamia pinnata, Ceiba pentandra.*

INTRODUCTION

One possible way to reduce the high consumption of synthetic insecticides is through the application botanical pesticides commonly considered to be environmentally and medically safe (Dayan, 2009). Botanical properties are highly toxic to many insect species and more than 2000 plant verities are known to posseses some medical properties (Kaushik *et al.,* 2009). Biopesticides are alternative to synthetic pesticides because of their geneally low environmental pollution, low toxicity to humans and other applications. Essential oils and their constituents have been reported to be an effective source of botanical pesticides (Gokulakrishnan *et al.,* 2012).

Helicoverpa armigera is another devasting pest of worldwide occurrence inflicting crop damage of in india to the sum of one billion dollars end of the year attacks over 200 verity species of field crop belonging to 45 families (Jeyasankar and Chinnamani, 2014). This pest was damage potencial of great than an average infestation of single larvae can be destroyed 30-40 pods per plant in cotton field (Umamaheswari *et al.,* 2016). *H. armigera* is a cosmopolitan insect and has gained importances as a major devasting pest owing to its capacity to feed on many verities of plant species, some of which are important agricultural crops (Dissdale *et al.,* 2010). Therefore extencive studies are carried out to screen plants as insect growth control agents. Over the past decades, better attention has been focused on the bioactivity of Phytochemicals for their potential as pesticides against phtophagousinsects (Baskar *et al.,* 2010). Hence the present study of important medicinal plant extracts of *C. peruviana, N. oleander* and *M. elengi* against *S. litura* and *H. armigera* to experimental study of eco-friendly approaches of agriculture pest control.

MATERIAL AND METHODS

Collection of medicinal plant

P. pinnata and *C. pentandra* the mature flowers are collected from Naduvalur village of Salem District Tamilnadu India. The bulk plant raw material was dried with in the shade at room temperature. The dried 1eaves 150 g were extracted with hexane, ethyl acetate, chloroform and methanol (750 ml), in a soxhlet apparatus individually until exhaustion. The extract was concentrated under

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reduced pressure of 22-26 mm Hg at 45°C by 'Rotovapour' and the residue obtained was stored at 4°C by in an amber vial. Then the vials labeled with silver foil and transported to the laboratory.

Rearing of insects

The taro caterpillar *H. armigera* were collected from the field in sirkali, Nagapattinam district of Tamilnadu, India**,** and the collected larvae were reared individually in plastic container vials and fed usually Peanut leaf *Arachis hypogeal* till the larvae became pupae under the laboratory condition (27±2°C) and 75±5% relative humidity. Usually hale and healthy uniform sized fourth instars larvae, the recently emerged matured eggs and adult moths of genteel species were used in the pesticidal activity.

Antifeedant activity

Antifeedant activity of the methanol extracts are used leaf disc method. The fresh Peanut leaf plant leaf was used the experimental studies. Leaf disc of 4.0 cm diameter was punched using leaf eater and were dipped in individually 100, 200, 300, 400 and 500 ppm. The leaf disc dipped in ethanol, petroleum ether, chloroform and acetone was used to extracts. In each plastic Petridis (40 cm × 90 cm), wet filter paper was placed to avoid early drying of the tested leaves. The fourth instars larvae of were pioneered in each and jurisdiction Petridis. The consumption of leaf disc in the treated and control by *H. armigera* larvae after 48 hrs of the experience was measured using leaf area meter. Leaf discs consumed by the larvae in the test were corrected from the negative jurisdiction. Five replicates were maintained for each treatment with 25 larvae. The investigation was conducted at laboratory condition (27.0°C ± 2°C) with 14:10 hrs illumination and dark photoperiod and 75±5% relative humidity activity were calculated according to the formula (Bentley *et al.*, 1984).

Larvicidal activity

Larvicidal activity was studied using leaf no choice method. Peanut leaf disc were used; they were dipped in various concentrations of 25, 75, 125, 175 and 225 ppm plant extracts as used for the larvicidal activity. After 48h experiment the larvae *H. armigera* were continuously maintained on untreated fresh peanut and castor leaves. Diet was changed every 48 hrs. Larval mortality was recorded up to 24 hrs experiment. The No of larvae 25 replicates used and laboratory conditions was same as the percentage of larval mortality was calculated using abbot's formula (Abbott, 1925).

$$\text{Mortality\%} = \frac{\text{\% MT-MT}}{\text{100 - \% MC}} \times 100$$

Oviposition deterrent activity

25 Individuals eggs of *H. armigera* were separated and immersed in 100, 200, 300, 400 and 500 ppm concentrations. Five replicates were maintained (n=100) number of eggs hatched in the control and the treatments were recorded. The laboratory conditions were the same as the antifeedant activity treatment.

$$\text{\% OA} = \frac{\text{\%EHC - \% EHT}}{\text{\%EHC}} \times 100$$

Statistical analysis

The normal mortality information was focused to probit (Finney, 1971) investigation for ascertaining LC_{50}, LC_{90} and Chi-square values were figured by utilizing the product utilizing statistical package of social science (SPSS) rendition 16.0 for windows, significant level was set at $P< 0.05$.

RESULTS

Antifeedant activity observed against 4t instars larvae of *H. armigera* showed in table 1. The present study results showed that the antifeednat activity was assessed based on antifeedant index normally indicates decreased rate of feeding. The experiments study maintained three different most important medicinal plants and controlled the two notorious lepidopteran pests. One plant extract maintained both pest and observed the pesticidal activity, the same methods to follow another plants and pests. The maximum antifeedant activities were recorded in ethanol extract on *P. pinnata* and *C. pentandra* against *H. armigera* 94.6% and 92.4% at 225 ppm, respectively. The larvicidal activity of *P. pinnata* and *C. pentandra* tested LC_{50} and LC_{90} values were 102.10 and 228.01 ppm, against *H. armigera* (Table 2). The oviposition deterrent activity of *P. pinnata* and *C. pentandra* against *H. armigera* was 98.8 and 96.2% respectively (Table 3).

Table 1. Antifeedant activity of *P. pinnata* and *C. pentandra* against *H. armigera.*

Plants	pest	solvent	Concentration %ppm				
			25	75	125	175	225
P. pinnata	*H. armigera*	Ethanol	21.8±1.78^{ab}	35.8±1.30^{bc}	56.6±2.60^{d}	77.2±2.48^{e}	94.8±1.92^{f}
		Petroleum ether	19.4±1.01^{ab}	31.6±1.94^{b}	53.4±2.07^{cd}	70.2±1.64^{de}	89.2±3.70^{ef}
		Chloroform	17.2±1.78^{a}	30.4±2.88^{b}	48.2±2.48^{c}	64.6±1.94^{de}	87.4±2.19^{ef}
		acetone	15.4±1.78^{a}	24.2±2.68^{ab}	46.4±2.88^{c}	62.4±2.30^{de}	81.2±1.14^{ef}
C. pentandra	*H. armigera*	Ethanol	18.6±1.34^{a}	30.8±1.64^{b}	51.6±2.60^{cd}	72.6±1.94^{e}	92.4±1.51^{f}
		Petroleum ether	16.2±1.64^{a}	28.4±1.81^{b}	48.2±2.48^{c}	68.4±1.14^{de}	87.2±4.49^{ef}
		Chloroform	13.8±2.16^{a}	25.2±1.92^{ab}	42.4±1.81^{c}	66.2±1.92^{de}	85.6±1.94^{ef}
		acetone	10.4±2.88^{a}	19.4±2.19^{ab}	37.6±1.51^{bc}	48.4±2.07^{c}	70.2±2.38^{de}

Within the column, means ± SD followed by the same letter indicate different significantly (ANOVA, Tukey's HSD test, $P<0.05$ levels).

Table 2. LC_{50} and LC_{90} values of *P. pinnata* and *C. pentandra* against *H. armigera.*

Plant	Pest	Solvent	LC_{50} (ppm)	95% confidence limit		LC_{90} (ppm)	95%confidencelimit		χ^*
				LCL	UCL		LCL	UCL	
P. pinnata	*H. armigera*	Ethanol	102.10	89.240	114.05	228.01	207.73	255.85	1.366 n.s
		Petroleum ether	120.94	107.54	134.11	262.23	236.67	298.73	0.481 n.s
		Chloroform	142.75	129.35	157.28	288.33	259.06	330.92	1.951 n.s
		acetone	164.55	150.65	180.96	309.39	277.39	356.51	2.532 n.s
C. pentandra	*H. armigera*	Ethanol	121.10	108.35	133.64	254.69	231.17	287.62	1.981 n.s
		Petroleum ether	143.66	130.16	158.33	290.47	260.84	333.69	0.511 n.s
		Chloroform	163.86	149.66	180.70	312.96	279.79	362.20	0.389 n.s
		acetone	184.33	169.35	203.29	327.78	293.11	379.49	1.439 n.s

LC_{50} = Lethal concentration that kills 50% of the exposed larvae, LC_{90} = Lethal concentration that kills 50% of the exposed larvae. LCL = lower confidence limit; UCL = upper confidence limit; χ^2 = chi-square; n.s. = not significant.

Table 3. Oviposition deterrent activity of *P. pinnata* and *C. pentandra* against *H. armigera.*

Plant	Pest	Solvent	Concentration ppm				
			25	75	125	175	225
P. pinnata	*H. armigera*	Ethanol	19.2±2.48^{ab}	38.4±1.14^{c}	59.4±2.07^{d}	76.6±1.51^{e}	98.8±1.92^{f}
		Petroleum ether	17.8±2.07^{a}	35.2±1.78^{bc}	57.2±2.16^{d}	74.4±1.67^{e}	95.2±2.04^{f}
		Chloroform	15.6±1.14^{a}	32.8±1.64^{bc}	54.6±1.34^{cd}	71.8±1.92^{e}	93.4±1.51^{f}
		acetone	13.2±1.30^{a}	30.2±1.48^{b}	51.2±0.83^{cd}	69.4±1.81^{de}	91.2±2.16^{f}
C. pentandra	*H. armigera*	Ethanol	16.4±2.19^{a}	35.6±0.89^{bc}	56.4±2.30^{d}	73.2±0.83^{e}	96.2±1.64^{f}
		Petroleum ether	14.4±2.16^{a}	33.2±1.78^{bc}	54.4±1.64^{cd}	71.6±1.34^{e}	92.4±1.51^{f}
		Chloroform	12.8±2.58^{a}	29.6±1.94^{b}	52.2±2.61^{cd}	68.8±1.64^{de}	90.2±2.04^{ef}
		acetone	10.2±1.30^{a}	24.6±0.86^{ab}	45.6±1.94^{c}	63.4±1.51^{de}	83.6±1.94^{e}

Values are expressed as mean ± S.D of five replications. Within each row, different letters indicate significant differences (ANOVA, Tukey's HSD test, $P<0.05$).

DISCUSSION

The maximum larvicidal activity was recorded from the highest concentration of methanol extract of *Abrus precatorius* at 500 ppm and the least larvicidal activity was recorded from the 100 ppm concentration of hexane extract. Furthermore, the antifeendant activity of phytol compound from *Pongamia pinnata* was 100% on treated leaf disc against *S. litura* at 2.5 ppm, concentration. The LC_{50} and LC_{90} values are Phytol compound were 24.51 and 42.40 ppm, respectively (Mahesh Babu *et al.*, 2016). The larval mortality observed from the100, 200, 300, 400 and 500 ppm concentrations extracts showed 67.414±2.26, 78.73±2.63, 95.28±2.49, 100.00±0.00 and 100.00±0.00. Lethal concentration observed against fourth Instar larvae of *S. litura* with various solvent extracts are LC_{50} value of hexane, diethyl ether, dichloromethane, ethyl acetate and methanol extract of *Abrus precatorius* were 255.91, 266.21, 265.98, 251.84 and 225.76 ppm respectively. The methanol extract was responsible for strong lethal activity observed against selected pest species (Mathivanan *et al.*, 2015).

The results of the antifeedant potential of the solvent crude extracts of *Duranta erecta* investigated against *S. litura* and *H. armigera* larvae. Antifeedant activity was assessed based on antifeedant index. Higher antifeedant index normally indicates decreased rate of feeding. In the current year report, irrespective of concentration and solvents used for extraction the antifeedant activity varied significantly Data pertaining to the above experiment clearly revealed that maximum antifeedant activity was recorded in ethyl acetate extract on *S. litura* 80.37% and *H. armigera* 78.18% at 5% concentration, High larval mortality normally indicates potential larvicidal activity of plant extracts. Irrespective of concentration and solvents used for extraction, the insecticidal activity varied significantly. Insecticidal activity data revealed clearly that maximum insecticidal activity was recorded in ethyl acetate extract on *S. litura* 69.88% and *H. armigera* 63.2%. Followed by chloroform extract and petroleum ether extract at the same concentration. One-way analysis of variance followed by LSD test showed statistical significance P<0.05 (Chennaiyan *et al.*, 2016). The previous experiment report that the toxicity of different extracts of *Tinospora crispa* and *Psidium guajava* were tested against *S. litur*a. The antifeedant activity of *T. crispa* and *P. guajava* tested against *S. litura* fourth instar larvae was liable during a 24 hours test period. All extracts are showed moderate antifeedant activitiy; however, very least antifeedant

activity was noted in benzene and significant antifeedant activity was observed in methanol extract. Methanol extract of *Tinospora crispa* and *Psidium guajava* showed 100% and 98.38% feeding deterrency against the fourth instar larvae of *S. litura* at 500 ppm concentration value of benzene, diethyl ether, ethyl acetate and methanol leaf extracts of *Tinospora crispa* were 92.64, 96.25, 94.67 and 84.94 ppm, respectively and *Psidium guajava* shows the LC_{50} values of 144.95, 164.22, 135.64 and 121.86 ppm, respectively. The chi-square values are significant at p=0.05 level. Among five solvent extracts, the methanol extract was responsible for vigorous lethal activity observed against selected pest species (Elanchezhiyan *et al.*, 2015). The report showed that feeding deterrent activity of solvent extracts of *Caesalphenia bonducella* methanol extract of *Caesalphenia bonducella* showed 19.67±1.93% feeding deterrency against the fourth instar larvae of *H. armigera* at 100 mg/l concentration, where as 29.3 ±1.53% and 78.52±2.86% of antifeedent activity was recorded in methanol extract of *Caesalphenia bonducella* at 200 and 300 mg/l respectively. Similarly at higher concentration of such as 400 and 500 mg/l 86.87±2.82% and 96.73±2.36% antifeedant activity were recorded respectively. The maximum larvicidal activity was recorded from the highest concentration of methanol extract at 1000 mg/l and the least larvicidal activity was recorded from 125 mg/l concentration of ethyl acetate extract. Furthermore, the larval mortality of the methanol extract at the concentration of 1000 mg/l is 98.4±1.55% respectively (Backiyaraj *et al.*, 2015).

The report showed that the antifeedant activity of flindersine against *H. armigera* and *S. litura.* The maximum antifeedant activity of 84.24 and 78.07% was noted at 1000 ppm concentrations respectively. All the experiment concentrations showed more than 50%antifeedant activity against both insects. Flindesines showed concentrations dependant activity against dual pests. Report the flindersines the maximum larvicidal activity of 79.11 and 69.33% at 1000 ppm concentration against *H. armigera* and *S. litura* respectively. At 125ppm concentration, flindersine exhibited 24.88 and 22.44% larvicidal activity against *H. armigera* and *S. litura,* respectively. Flindesine showed different kind of growth inhibitory activities against *H. armigera* and *S. litura.* It exhibited maximum larval duration of 14.66 and 15.10 days for *H. armigera* and *S. litura* respectively at 1000 ppm concentration. At 125 ppm concentration, it also significantly increased the larval duration to 10.87 and 10.49 for *H. armigera* and *S. litura* (Duraipandiyan *et al.*, 2015). The results showed that Leaf extract of *Catharanthus roseus* was less effective in inhibiting feeding in fourth instar larvae of *S. litura*, both in choice and no-choice conditions, when compared to *Ocimum sanctum.* In choice experiment feeding was 45.06 percent at the highest concentration of 5% extract differentiate to 82.47 percent in control. Feeding was not affected at lower concentration of 1%. At 2, 3 and 4% extract, percent feeding reported on treated leaves was 73.40, 62.81 and 60.03 respectively. Antifeedant index was highest of 48.42 percent at 5% extract and lowest of 12.84 percent at 1%. At 2, 3 and 4% extract antifeedant indices were 18.76, 28.44 and 31.06 percent respectively. Feeding on untreated cabbage leaves was higher in choice situation differentiate to feeding in control experiments. At 1, 2 and 3% extract, percent feeding observed on untreated leaf disc was 95.46, 92.99 and 85.27 percent. At 4% and 5% extract percent feeding was 80.33 and 74.04 respectively. Antifeedant index was highest of 18.19 percent at 5% and lowest of 2.78 percent at 1% extract. In no-choice situation where only treated cabbage leaf disc was provided as food to larvae, it was observed that at 5% extract percent feeding was reduced to 47.77 compared to 82.47 in control. Percent feeding at 1, 2, 3 and 4% extract was 79.77, 75.47, 66.71 and 56.52 respectively. Antifeedant index at highest concentration of 5% was 44.89 percent and lowest of 13.71 percent at 1% extract. At 2, 3 and 4% extract, antifeedant indices were 17.02, 24.57 and 34.71 percent respectively (Sudha and Jyotsana, 2015).

CONCLUSION

In conclusion it is proof that methanol extract of *P. pinnata* and *C. pentandra* plant flower extracts was most effective insecticidal activity of pod borer larvae of *H. armigera.* The flower extract experimented in present study showed the oviposition deterrent activity. The three different plants are useful to the active principles for the management of field crop pest and protection of agricultural ecosystem.

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