BIOEFFICACY OF ATALANTIA MONOPHYLLA (L.) CORREA. AGAINST EARIAS VITTELLA FAB.

Chellaiah Muthu, Kathirvelu Baskar, Selvadurai Kingsley, Savarimuthu Ignacimuthu*

Entomology Research Institute, Loyola College, Chennai, India – 600 034
Tel: +91-44-2817 8348, Fax: +91-44-2817 5566 E-Mail Address: entolc@hotmail.com

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ABSTRACT

Hexane, chloroform and ethyl acetate extracts of the leaves of Atalantia monophylla (L.) Correa. were evaluated for their antifeedant and larvicidal activities along with their effect on pupation and adult emergence against bhendi fruit borer, Earias vittella Fab. at 5, 2.5 and 1.25% concentrations. Commercial botanical insecticide, Vijay Neem was used as positive control. Hexane extract at 5% concentration showed significant antifeedant and larvicidal activity of 70.89 and 85.33% respectively. A reduction of 16.66% in adult emergence was recorded in hexane extract followed by 25% reduction in ethyl acetate extract at 5% concentration. The results revealed that hexane extract showed significant antifeedant, and larvicidal activity and good reduction in adult emergence. This extract could be further investigated to isolate the active principles.

Key words: Atalantia monophylla, Earias vittella, Antifeedant, Larvicidal, Adult emergence

INTRODUCTION

Since the beginning of agriculture, insect control has been a challenging task for human race. With the advent of pesticides, especially the chlorinated hydrocarbons, the pest problem was controlled to certain extent and it was thought that the pest problem was solved but soon it was realized that the pests had developed resistance to these chemicals and also the chemicals polluted the ecosystem [19]. Fox et al., [8] observed that most of the chemical insecticides containing pentachlorophenol (PCP) caused the strongest inhibition for symbiotic nitrogen fixation resulting in the lowest plant yields and also affecting the seed germination. Nowadays Indian farmers use biopesticides in pest control programmes as an alternative to chemical pesticides [22].

Shoot and fruit borer of okra, E. vittella is a notorious pest causing more than 40-50 per cent losses in cotton and okra crops from various parts of India [12]. Rawat and Sahu [17] reported that it caused 69% loss in okra alone. E. vittella occurs generally as an early to mid-season pest attacking tender terminal shoots, boring into the stem and feeding on flowers and green bolls [11]. Plants from the family Rutaceae is a source of alkaloids, coumarins, flavonoids and limonoids [26]. These compounds serve as powerful toxicants and deter insects and other herbivores from feeding [9,7]. Baskar et al. [3] also reported that crude extracts of A. monophylla showed feeding deterrent activity against armyworm, Spodoptera litura. The present study was undertaken to evaluate the bioefficacy of A. monophylla against E. vittella, since there are no reports on this.

MATERIALS AND METHODS

Collection and Extraction of plant material

The leaves of A. monophylla were collected from Kancheepuram Disrict of Tamil Nadu, India and were washed with tap water, shade dried at room temperature, powdered using electric blender, extracted sequentially with organic solvents (hexane, chloroform and ethyl acetate) at the ratio of 1:3, evaporated using vacuum rotary evaporator and stored at 4°C. The plant was identified by M. Ayyanar, a taxonomist at Entomology Research Institute and the voucher specimen (ERIH 1225) is deposited at the Institute's herbarium.

Bioassay

The antifeedant activity against E. vittella was performed using bhendi fruit discs (10 mm thick) which were dipped in the respective crude extracts for 5 min. After that they were kept in a blotting paper for 10 min for drying, weighed and provided to 3rd instar larvae of E. vittella. Another set of discs of bhendi dipped in the respective crude extracts with Tween 80 and devoid of insects were also maintained to find out the weight loss due to desiccation at room temperature. Vijay Neem, a commercial botanical pesticide, was used as positive control. Five replicates were maintained for each treatment and control with 15 larvae per replicate. After 24 h, the fruit discs were weighed and the difference between initial and final weights was calculated. Real consumption was calculated as follows:

Weight loss due to desiccation (D) = initial weight – final weight

Real consumption = initial weight – (final weight + D)

Antifeedant activity was calculated using the formula [10]. After 24 h of treatment, the larvae in all the treatments were provided with untreated fresh fruit discs up to pupation. The larval mortality was recorded after 96 h of treatment and was corrected using Abbott's formula [1]. Percentage of pupation and adult emergence were also recorded.

RESULTS

The results of the present investigation related to antifeedant and larvicidal activity, effect on pupation and adult emergence of E. vittella using different solvent extracts and Vijay Neem are presented in Table 1. Hexane extract of A. monophylla at 5% concentration had significant antifeedant activity of 70.89% against E. vittella. A moderate antifeedant activity of 53.60% was observed in chloroform extract at 5% concentration. Compared to other two extracts, ethyl acetate extract showed minimum antifeedant activity of 34.84% activity at 5% concentration. The commercial pesticide, Vijay Neem which was used as positive control showed an antifeedant activity of 40.01% at 0.03% concentration.

Cent per cent larval mortality was recorded in the reference control, Vijay Neem at 0.03 % concentration (Table 1). Significant larval mortality of 85.33% was noticed in hexane extract of A. monophylla followed by 78.67 and 69.33% in ethyl acetate and chloroform extracts, respectively at 5% concentration. The highest mortality was recorded in hexane extract followed by chloroform extract. Irrespective of the concentrations of the hexane extract significant larval mortality was observed (Table 1).

With regard to pupation, all the larvae which were alive after feeding attained pupation. No larval pupal intermediate was observed. The per cent adult emergence was drastically reduced in all the treatments when compared to the control. Maximum reduction in adult emergence of 16.66% was noticed in hexane extract

Table 1 Effect of *A. monophylla* on antifeedant, larvicidal, pupation and adult emergence of 3rd instar larvae of *E. vittella* (n=5).

Extract	% Antifeedant activity (Mean ± SD)	% Larvicidal activity	% Pupation	% adult emergence
		Hexane		
1.25	35.91 ± 2.50^{bc}	49.33^{b}	50.67^{e}	39.88^{abc}
2.50	50.72 ± 4.94^{e}	64.00^{d}	36.00^{c}	29.33^{ab}
5.00	70.89 ± 3.66^{f}	85.33^{f}	14.67^{a}	16.66^{a}
		Chloroform		
1.25	32.06 ± 4.28^{bc}	38.67^{a}	61.33^{f}	60.94^{c}
2.50	45.55 ± 2.29^{de}	53.33^{bc}	46.67^{de}	45.23^{bc}
5.00	53.60 ± 4.37^{e}	69.33^{de}	30.67^{bc}	35.00^{ab}
		Ethyl acetate		
1.25	18.39 ± 5.48^{a}	45.33^{ab}	54.67^{ef}	41.90^{bc}
2.50	27.46 ± 5.30^{ab}	61.33^{cd}	38.66^{cd}	34.57^{ab}
5.00	34.84 ± 4.62^{bc}	78.67^{ef}	21.33^{ab}	25.00^{ab}
Vijay Neem (0.03%)	40.01 ± 5.83^{cd}	100^{g}	-	-
Control	-	-	100^{g}	100^{d}

Within the columns, similar alphabets do not differ significantly using Tukey 's Multiple Range Test (P≤ 0.05)

followed by ethyl acetate extract at 5% concentration. Remarkable reduction in adult emergence of 29.33% was also recorded in hexane extract followed by ethyl acetate extract (34.57%) at 2.5% concentration. Chloroform extract recorded maximum adult emergence of 60.94 and 45.23% at 1.25 and 2.5% concentrations, respectively.

DISCUSSION

In the present investigation, the hexane extract of A. monophylla at all the tested concentrations recorded maximum antifeedant activity against E. vittella when compared to the other extracts. This is in agreement with the findings of [3] who observed that the hexane extract of A. monophylla had higher antifeedant activity on S. litura. The present results also corroborate with the findings of [23] who reported that low polar solvent extract had higher activity than the high polar solvent extracts. Many researchers reported earlier that hexane extract showed antifeedant activity on S. litura [21,15,25]. Schmutterrer [20] observed that feeding deterrency was due to the action of botanicals on the centers that control gut mobility and metabolism.

In the present investigation, hexane extract of A. monophylla at 5% concentration recorded the highest per cent mortality of 85.33, 78.67, and 69.33 in hexane, ethyl acetate and chloroform extracts, respectively. Berenbaum [5] observed that the postingestive effect of plant extracts could be acute or chronic in phytophagous insects. Earlier, quite a few researchers reported that plant extracts controlled a variety of insects [14, 16]. Larval mortality was high probably due to the presence of alkaloids in this plant. Similar results were also recorded [4]. The larval mortality was 73.33% when E. vittella was treated with alkaloids present Azadirachta indica [22,24]. Arputha Sankari and Narayanasamy [2] reported that flyash waste and neem seed kernel caused 77.33% mortality on E. vittella larvae after 72 h of treatment.

Pupation and adult emergence were 14.67% and 16.66% in hexane extract followed by ethyl acetate extract of A. monophylla at 5% concentration. The present findings correlate with the earlier findings of [22] who reported that all the treatments (neem alone and in combination with pongam and sweet-flag) reduced pupation and adult emergence of E. vittella. Similar effects on pupation and adult emergence were also observed against Spodoptera frugiperda [18, 6) and S. litura [13].

CONCLUSION

The present study clearly demonstrates that hexane extract of A. monophylla showed good antifeedant and larvicidal activities and also drastically reduced pupation and adult emergence. Hexane extract could be further investigated to isolate active principles for effective management of E. vittella.

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