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EVALUATION OF MARINE MANGROVE PLANT *AVICENNIA MARINA* AGAINST TOBACCO CUT WORM *SPODOPTERA LITURA* FAB

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ABSTRACT

The present study provides a test of the behavioral activity of the tobacco cut worm Spodoptera litura Fab. (Lepidoptera: Noctuidae) with the different solvent extracts of marine mangrove plant Avicennia marina. The development of resistance to existing conventional synthetic pesticides and the increasing public concern over environmental pollution and health hazards created by synthetic pesticides, generate a great need for new types of pest management agent's advantage with higher activity against the target pests, and lower impact on humans and environmental quality. One of the approaches to overcome the above constraints is to use botanical based pesticides for the management of insect pest. By keeping this thought in our mind, experiments were carried out to determine the repellency of Avicennia marina against third instar Spodoptera litura larvae by Y- shape olfactometer. Results revealed that the extract showed more repellent property in dose dependent manner. Crude Acetone and methanol extracts of A. marina highly repel S. litura at the concentration of 3% (API = -1), hexane (API = -0.6) and water (API = -0.33) extract. Hence, the marine mangrove A. marina can be a viable option for inclusion in bio-intensive insect pest management (IPM) strategies for the management of agricultural pest S. litura.

KEY WORDS : avicennia marina, repellent activity, mangrove, spodoptera litura,pest management

INTRODUCTION

Agriculture has lead to dependence on various synthetic agrochemicals which are highly hazardous and not only the mortality of pests, but also lead to development of resistance, residue in harvested produce and adverse effect on other non target organisms in the ecosystem including human beings. Bio-control has been viewed as a sound alternative to the chemical control (Ali, et al., 2007; Hem saxena, 2009). There has been increasing interest in using more eco-friendly management methods of pest control as part of the Integrated Pest Management (IPM) approach in our country (Ganga Visalakshy and Krisnamoorthy, 2009). Misuse and excessive use of synthetic pesticides and also the hazards associated with these chemicals forced the scientists to explore the alternative and ecofriendly means of crop protection (Chitra Srivastava and Srinivasan Reddy, 2006).

Agricultural pests are mainly controlled with synthetic insecticides over the last 50 years causing development of pesticide resistance by pest, pest outbreak, negative effects on non-target organisms, including humans and also to cause adverse environmental effects by harming beneficial organisms like natural enemies and pollinators (Anjan Bhattacharyya *et al.,* 2009; Ahmed *et al.,* 2011; Sahayaraj, 2011; Sakthivel *et al.,* 2012). Chemical insecticides provide an excellent control against various pests in agricultural field but use of chemical insecticides in agro-ecosystems target the insect pests along with beneficial insects (Martin *et al.,* 1964; Michael Graing *et al.,* 1977; Venugopal, 1994; Ambrose, 2001; Sundararaj, 2012).

The widespread use of chemical pesticides has resulted in health hazards to human being and domestic animals. Hence alternative options like botanicals, natural enemies and microbial insecticides are subjected as well as practicing by farmers world-wide. Naturally occurring biological compounds, which is considered as a part of ecofriendly management methods in Integrated Pest Management (IPM) approach has been used by humans (Anjan Bhattacharyya *et al.,* 2009; Ganga Visalakshy and Krisnamoorthy, 2009;).

Mangroves are widespread in tropical and subtropical regions, growing in the saline intertidal zones of sheltered coast lines (Chelliah *et al.,* 2001; Marium Tariq *et al.,* 2007). Mangrove species are woody, seed bearing and highly specialized plants (Duke *et al.,* 1998)

found along the coast lines of estuaries and lagoons (Kamaruzzaman, 2011). Because of their unique adaptations mangroves thrive well in the environment where other plants cannot grow (Shanmugapriya *et al.,* 2012). Mangroves are salt tolerant plants. The specific regions where plants occur are termed as mangrove ecosystem (Kathiresan *et al.,* 2001; Chelliah, 2001). There are seven species of true mangroves have been identified are also recorded. Mangrove plants also have been also used as traditional medicine in India (Dhayanithi *et al.,* 2012; Bharathi *et al.,* 2011).

MTERIALS AND METHOD

COLLECTION AND EXTRACTION OF TESTED PLANT MATERIAL

The fresh leaves of mangrove plant, *Avicennia marina* was collected from the estuarine region of Roche park of Thoothukudi, South East coast of Tamil Nadu, India. The leaves were washed thoroughly thrice with tap water and once with sterile distilled water to remove salt and sand. Then they were shade-dried for two weeks and were partially powdered using domestic blender.

Extraction was carried out using Cold Percolation Extraction Method. 100 gm of partially powdered leaves packed in 1000 ml conical flask with Acetone, Hexane, Methanol and Water individually and kept on a rotary shaker at 120 rpm for 24 hrs. After shaking it was filtered using filter paper. Extraction solvent was evaporated and dried over Sodium Sulphate in dessicator under vacuum. The crude extracts were stored at -20^{o} C until further use.

PREPRATION OF *A.MARINA* EXTRACT

Test concentrations (0.5, 1, 1.5, 2, 2.5 and 3%) of different solvent (Acetone, Hexane, Methanol and Water) extracts of *Avicennia marina* were initially diluted with Dimethyl Sulphoxide (DMSO) (500 µL). Then they were diluted with distilled water to which an emulsifier (Tween 80) was added at 0.05 % and mixed well.

COLLECTION AND REARING OF PESTS

Different larval stages of *S. litura* were collected in and around from castor fields of Pavoorchatram, Tirunelveli district, Tamil Nadu, India. The collected larva were maintained in the insectory under laboratory conditions (28±2˚C; 70-75% RH; 11L and 13D hour

photoperiod) and fed with castor leaves. The third instar larvae emerged during second generation were used for the laboratory experiment.

REPELLENT ACTIVITY OF BIOASSAY

This bioassay was carried out according to the method described by Nchu et al. (2009). For this assay uniform sized pre starved third instar larvae of *S. litura* were used and the repellent bioassay was conducted in a customized Y- shaped glass olfactometer. The olfactometer was clamped on to a tripod in a horizontal position. An activated charcoal filtered air stream was supplied to each arm of the olfactometer by using an electric pump. Each air stream was then passed through a glass chamber containing test matter.

Avicennia marina crude extracts concentrations (0.5, 1, 1.5, 2, 2.5 and 3%) were impregnated with Whatman No. 1 filter paper (3cm diameter) and placed into the test chamber of Y- shape olfactometer. At the other end a filter paper with distilled water containing 500 µL of DMSO. Six third instar larvae of *S. litura* were released one after another into the release chamber. Number of larvae found on the treated and untreated chamber was recorded after 10, 30, 60, 90, 120, 150 and 180 minutes continuously. The experiment was repeated ten times with different insects. The olfactometer was rinsed with 70% ethanol and dried at 40^0C for 10 minutes after each assay. The larvae preferred either control or treated filter paper or neither. If the larvae chose neither of the chambers then it was considered that insect made no choice. From the observation recorded the Access Proportion Index (API) was performed using the following formula.

Access Proportion Index = NS-NC/NS+NC

Where NS = Number of larvae choosing the sample side and

NC = Number of larvae choosing the control side.

RESULT AND DISCUSSION

Results of the present study revealed that the crude extracts of marine mangrove *Avicennia marina* have more repellent property in a dose dependent manner (Table 1). Crude Acetone extract highly repel the *S. litura* after 30 minutes level to 150 minutes exposure. (API = -1.00 at 30 min after exposure) followed by at the concentration of 1.5% (API = -0.87 at 30 after exposure), hexane at 2.5% concentration (API = -0.73 at 1 hr after exposure) and water at 2% concentration (API = -0.33 at 2hrs after exposure) extract. It was also confirmed by Access Proportion Index (API) values.

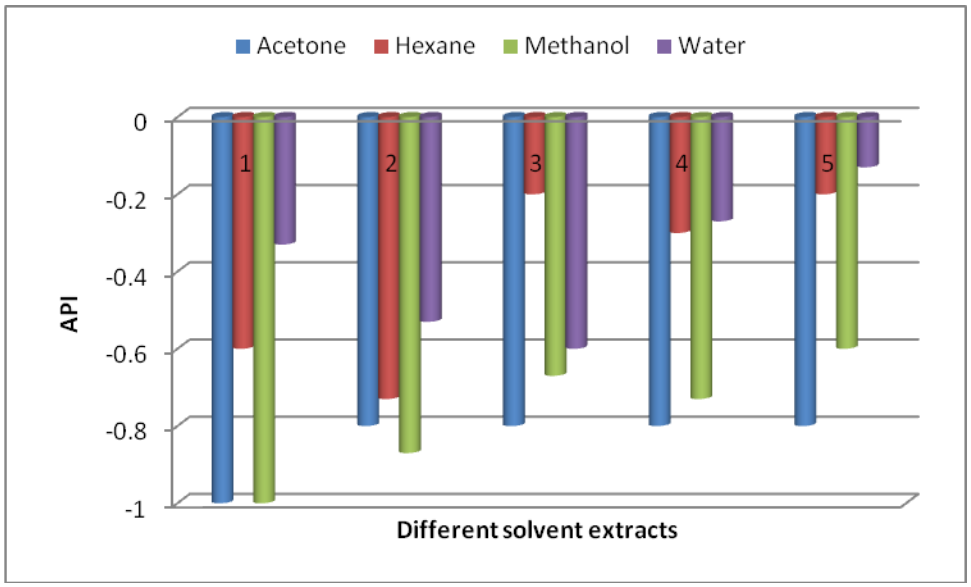
Research on the marine mangrove for the management of insect pest is very scanty. Previously, it was reported that, marine plants have insecticidal and repellent activities against mosquito in India (Thangum and Kathiresan, 1996). However, No attempts were made in this study to identify the compound (s) responsible for repellent activity. In this present study we recommend the crude extract of marine mangrove *A. marina* can be utilized for the management of *S. litura*.

Table 1. Access Proportion Index (API) of different solvent (Acetone, Hexane, Methanol and Water) crude extracts of *Avicennia marina* leaf extract on *Spodoptera litura*

Solvent	Concentration (%)	Access proportion index (API)				
		30 min	1 hour	2 hours	3 hours	24 hours
Acetone	0.5	-0.30	-0.33	-0.40	-0.47	-0.53
	1	-0.63	-0.73	-0.73	-0.87	-0.73
	1.5	-0.60	-0.60	-0.73	-0.63	-0.66
	2	-1.0	-0.87	-0.73	-0.73	-0.40
	2.5	-1.0	-1.0	-0.53	-0.60	-0.53
	3	-1.0	-0.80	-0.80	-0.80	-0.80
Hexane	0.5	-0.07	-0.07	-0.00	-0.07	0.17
	1	-0.53	-0.63	-0.53	-0.73	-0.80
	1.5	-0.47	-0.53	-0.63	-0.66	-0.80
	2	-0.63	-0.40	-0.53	-0.80	-0.87
	2.5	-0.73	-0.53	-0.67	-0.60	-0.33
	3	-0.60	-0.73	-0.20	-0.30	-0.20
Methanol	0.5	-0.30	-0.33	-0.37	-0.40	-0.47
	1	-0.47	-0.53	-0.63	-0.73	-0.80
	1.5	-0.87	-0.80	-0.73	-0.80	-0.73
	2	-0.53	-0.40	-0.67	-0.47	-0.47
	2.5	-0.33	-0.37	-0.30	-0.47	-0.73
	3	-1.0	-0.87	-0.67	-0.73	-0.60
Water	0.5	0.17	0.07	-0.03	-0.10	0.23
	1	-0.17	-0.47	-0.67	-0.70	-0.07
	1.5	-0.16	-0.56	-0.66	-0.47	-0.33
	2	-0.27	-0.27	-0.67	-0.60	-0.20
	2.5	-0.27	-0.47	-0.47	-0.47	-0.03
	3	-0.33	-0.53	-0.60	-0.27	0.13

Crude Acetone extract highly repel the *S. litura* after 30 minutes level to 150 minutes exposure (API = -1.00 at 30 min after exposure) followed by methanol at the concentration of 1.5% (API = -0.87 at 30 after exposure), hexane at 2.5% concentration (API = -0.73 at 1 hr after exposure) and water at 2% concentration (API = -0.33 at 2hrs after exposure) extract.

Figure 1. Repellent behavior of *Spodoptera litura* against different solvent extracts of *Avicennia marina* at highest concentration (3%) using Y-shaped olfactometer.



During the observation of repellent activity in the Y- shape olfactometer, we noticed some of the behavioral changes, *S. litura* slowly move to the opposite direction when they are exposed to the sample. The larvae turned into black colour in crude Acetone and methanol extract. After 24 hrs of exposure some of the larvae died at the concentration of 1.0 percent in acetone extract. Cetin *et al* (2010) reported the larvicidal efficacy of the acetone extract of the marine seaweed against late second to early third instars of *Culex pipiery* at 1200 ppm. Hence, A. marina crude extracts based formulation can be utilized for the management of agricultural pest like *S. litura.*

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