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Aqueous and water extracts of chosen botanicals on *Helicoverpa armigera* Hubner and *Spodoptera litura* Fab.

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Long before knowing the structure of plant naturally occuring chemicals (botanicals), plants or derivatives. These were extensively used in agriculture as insecticides. At present current botanicals in commercial use for insect control falls into four types (pyrethrum, rotenone, neem and essential oils) and a few more (ryania, nicotene, sabadilla,piperamides and isobutylamide related compounds, quassia are of limited use. Recently, juvenoids (methoprene and kinoprene), ecdysteroids (phytoecdysones) and ecdysteroid against (RH's) have also been considered as integrated pest management (IPM) compounds. However, farmer's point of view water extraction and aqueous extraction have been recommended for crop pest management. I will discuss about the use of oils, water extracts, aquous extracts, and plant powder in pest management briefly. I briefly elaborated about the impact of *Azadirachta indica* A. Jesuss., *Calotopis gigantia, Vitex negundo, Ipomea cornea, Pongiamia pinnata, Tephrosia purpuprea* (Linn.), *T. villosa, Pedalium murex, Vitex negundo* Linn., *Crystella parasitica, P. aquilinum* and *H. arifolia* Linn on selected economically important pests such as *Helicoverpa armigera* Hubner and *Spodoptera litura* Fab. Median lethal concentrations, its role in pest management and groundnut production under field conductions were recorded.

Key words: IPM, *Helicoverpa armigera,* Hubner, *Spodoptera litura*

Introduction

The proposed advandages of the biopesticides including their specificity, safety to non-target organism, particular mamals, and utilization in low, sometimes minutes, amounts have led to an intensive research programme by public and private institutions resulting in an avalanche of reports in attempts to discover and develop newer and safer pesticides, particularly in the three decades. As a consequence, increased attention and interest have followed on botanical insecticides as natural pesticides for Integrated Pest Management (IPM) strategies (Rosell *et al*., 2008). However, "natural" plant derived

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compounds may be as toxic (or more toxic). Human and many beneficial insects as many common "synthetic" insecticides are, and a "reduced risk" status is to be proved .The management of economically important as well as majar pests using synthetic chemicals has failed because of insecticide resistance, pest resurgence and environmental pollutions.

The use of conventional insecticides has raised some concern about their threat to the environment and development of insecticide resistance in insects, there is an imperative need for the development of safer, alternative crop protectants such as botanical insecticides. Plants are rich sources of natural substances that can be utilized in the development of environmentally safe methods for insect control. Crude plant extracts often consist of complex mixtures of active compounds, they may show greater overall bioactivity compared to the individual constituents and the deleterious effects of crude plant extracts on insects are manifested in several ways, including toxicity growth inhibitory activity, feeding inhibition (Hiremath *et al*., 1997) and can be used in pest management programme (Desai and Desai, 2000).

The tobacco cut worm, *Spodoptera litura* Fab. (Noctuidae: Lepidoptera) is one of the important polyphagous crop pests distributed through out south and eastern world tropical infesting 112 species of plants belonging to 44 families (Chari and Patel 1983) including groundout. In India it feeds on 74 species of cultivated crops and some wild plants (Ranga Rao *et al*., 2008). It is a strong flier, and disperses long distance annually during the summer months. It is one of the most economically important insect pests of 51 countries including India, Japan, China, and other countries of Southeast Asia. Management of this pest using synthetic chemicals has failed because tobacco cutworm has developed resistance against many insecticides (Mehrotra, 1993; Kranthi *et al.,* 2002; Kodandaram and Dhingra, 2007; Mushtaq Ahmad *et al*., 2007). Sahayaraj (1998), Sahayaraj and Paulraj (1998) reported that crude plant extracts have insecticidal activity against *S. litura* larvae. Recent studies of Raman *et al.* (2007), Sahayaraj (2002) and Sahayaraj and Ravi (2007) suggested that plant extracts (methanol, aqueous) extracts can be used for the management of this pest under groundnut field conditions. Sahayaraj and Nandagopal (2008) recommended more plant-based insecticides for the control of this pest.

Helicoverpa armigera Hubner is a polyphagous pests distributed in most of the Asian countries. The host record is diverse and few botanicals were suggested for its management (Gujar, 1997; Bajpai and Sehgal, 2000; Sundararajan and Kumuthakalavalli, 2000, 2001; Kulat *et al.,* 2001; Sahayaraj and Paulraj, 2000; Koul *et al*., 2002; Sahayaraj *et al.,* 2007). However it was developed resistance against many common synthetic insecticides (Dhingra *et al*., 1998; Patel and Koshiya, 1999). In the present investigation impact of

Azadirachta indica A. Jesuss., *Calotopis gigantia, Vitex negundo, Ipomea cornea, Pongiamia pinnata, Tephrosia purpuprea* (Linn.), *T. villosa, Pedalium murex, Vitex negundo* Linn., *Crystella parasitica, P. aquilinum* and *H. arifolia* Linn on selected economically important pests such as Helicoverpa armigera Hubner and Spodoptera litura Fab.

Materials and methods

Collection and rearing of pest

Larval stages of *Spodoptera litura* and *Helicoverpa armigera* were collected from the groundnut fields of Vickramasingapuram, Tirunelveli District, Tamil Nadu and were maintained on groundnut leaves (var. TMV 7) under laboratory conditions (29 ± 1°C temperature; 65 - 75% RH, and 11 L and 13D photoperiod) in plastic troughs (21.0×28.0×9.0 cm). Laboratory emerged adults were transferred to oviposition chamber and fed on a 5% honey fortified with vitamin mixture (multivitamin tablets) to enhance oviposition. Egg masses were collected sterilized (10% formaldehyde) and maintained in moistened plastic containers for hatching. Laboratory emerged larvae was also mainlined on groundnut leaves.

Plant material

Healthy plants of *Azadirachta indica* A. Juss., *Calotopis gigantia* Linn., *Coleus ambonicus* Lour., *Cristella parasitica (L.)* H. Lev., *Ipomea carnea* Jacq., *Hemionitis arifolia* (Brun) T., *Pedalium murex* Linn., *Pongiamia pinnata* Pierre*, Pedalium murex, Tephrosia purpuprea* (Linn.), *T. villosa, Tridax procumbens, Vitex negundo* Linn., *Crystella parasitica, P. aquilinum* and *H. arifolia* were collected from various places of Tiruneveli district, Tamil Nadu, India. The plant material was collected in the morning hours.

Water extraction of plant material

Healthy and normal plants parts were collected locally (Tirunelveli District, Tamil Nadu, India), depulped, and shade dried for 10 days. Dry parts were stored at ambient temperature indoor until needed. For extraction 550 gram of the plant part was ground using a household blender and stored in refrigerator for further use. From the stock, 250 grams of powder was extracted twice with 500 ml of water using Soxhlet apparatus for about 24 h separately. After extraction distillation was carried out, removes the solvents and extracts obtained and refrigerated for up to 4 weeks until used. These crude extracts were used for preparing stock solution. The known amount of (100 mg/ml) of crude extract obtained from the above process was serially diluted to obtain the desired concentration. A drop of emulsifier per cent Tween 80 (Himedia, Mumbai) was added with the water extracts to ensure complete solubility of the material in water.

Aqueous suspension of leaves, root and fruit of plants

An aqueous suspension of leaves, root and fruit of the tested plant was prepared by stirring 10 g of powder in a beaker containing 100 ml of distilled water for 4 – 6 h, followed by filtering through a muslin cloth. The material remaining on the cloth was squeezed into the beaker. The freshly prepared suspension thus obtained was taken as 10% stock solution, and concentrations such as 0.5, 1.0, 2.0, 4.0 and 6.0 per cent were obtained by diluting with distilled water, and an emulsifier, Tween 80 was added at 0.1% for all experiments (Senthil Nathan *et al*., 2007).

Toxicology studies

Bioassays were performed with fourth instar of *S. litura* and *H. armigera* (12 h old) larvae using contractions from 0.5 - 16.0% of water extract and 1 to 8 % for aqueous suspension. For control groundnut leaves were treated with petroleum ether, acetone, and water and a drop of Tween 80 was added as surfactant. A minimum of 5 larvae per concentration was used for all the treatment experiments and these treatments were replicated six times (n = 30). Fresh groundnut leaves (vart. TMV 7) were sprayed with different contractions of *P. murex* leaves, root and fruit extracts on both surfaces and air dried. Test material solutions were applied at a rate of 0.5 ml per groundnut leaf by a hand sprayer (Amway, USA). Each replicate was provided with 5 leaves/larvae/day. First two days the larvae were provided with plant extracts treated groundnut leaves. Every 24 h, the uneaten leaves were removed and placed with fresh treated leaves continuously for four days. Mortality was recoded every 24 h, final mortality was recorded at 96 h. Mortality was corrected using Abbot's (1925) formula if it was necessary. The median lethal concentration (LC_{50}) was to calculate using probit analysis (Finney, 1971) and values were expressed as means of lethal contractions of six replicates.

Field experiments

Field experiments were conducted at a farmer's fields in three difference places Tirunelveli District, Tamil Nadu, India. Groundnut (variety - TMV 7) was cultivated under well irrigation. The farmers were advised not to use pesticides or any other pest control practices. For each treatment, 36 × 45m field was chosen for the present study. Each plot was again divided into three subplots (130.3 m^2). The plant extracts were sprayed on the 40^{th} and 60^{th} days after the seedling emergence (DASE) in the early morning hours (6:30 A.M. to 7:30 A.M.) using a hand sprayer (Amway, India) with the flow rate of 0.1 liter/min. One plot was served as control where water alone was sprayed.

The sampling of the pest was done by visual observation and expressed in number of pests/plant. Totally 30 plants were counted randomly in each subplot and pest level was expressed as pest/10 plants. The sampling was done four days before and after the plant extracts sprayed. The mean population was recorded for each extract. After the harvest, the production of groundnut from each sub plot was estimated and expressed in $Kgha^{-1}$. The CBR was also worked according to Kalyanasundaram *et al*. (1994). Cost benefit ratio = Total gain/ Total cost of cultivation.

Results and discussion

Toxic effects of plant extracts

It is interesting to note that *S. litura* was susceptible to certain treatments like, *Calotopis gigantia* followed by *Pedalium murex* root. Least impact was noticed on *Vitex negundo* leaves extract (Table 1). Water extracts were less toxic than the aqueous extracts. For instance LC_{50} value of *Tephrosia villosa* seed was too high (10.125%) followed by *Tephrosia purpuprea* seed (5.6712 %). However least LC_{50} value was recorded for *Tephrosia purpuprea* root (0.4257 %) (Table 2). *Azadirachta indica* leaves aqueous extract was highly susceptible to *Helicoverpa armigera* (0.081 %) followed by *Calotopis gigantia* Linn. (3.244 %), *Pongiamia pinnata* Pierre (3.835%) and *Vitex negundo* Linn (4.231).

Field experiments

Higher *S. litura* population was observed in control filed and reduced 0.52 pests/10 plants when *I. cornea* was sprayed field (Table 3). But *H. armigera* population was higher in control (2.43 pests/10 plants) and reduced to 0.23 pests/10 plants in *I. cornea* sprayed field. Among the plant extracts, *V.negundo* significantly reduces both *S. litura* and *H. armigera* populations ($P < 0.05$). However *I. cornea* extracts was significant with *V.negundo*. Over all groundnut production was higher on *P. aquilinum P. aqulinum* followed by *H. arifolia* and *I. cornea* (1313 Kg/ha). In controls the production ranged from 1060.50 to l120 (Table 3). However the cost benefit ratio was equal in *P. pinnata* and *V.negundo* sprayed field (1: 1.8) (Table 4). Raman *et al*. (2007)

also reported that crude custard apple seed extracts reduce the pest incidence and increase the crop yield.

It is interesting that certain plant extracts employed in the present study possess toxicity to the lepidopteran pest species studied. It appears that these plants contain different chemicals that act upon target cells effectively. A through chemical analysis of the active plants is underway and we hope to reveal some interesting similarities between the chemicals isolated as well as their bioactivities. The activity of these extracts also suggests a future exploitation of the materials in to potential insect management chemicals with a minimum environmental impact. It is advantages, as the extracts at higher doses act as antifeedant, while the lower dilution of the same plant is oral toxicant. It also suggests that by a single application of these compounds a complete success of the insect control can be achieved. *I. cronea*, *P. pinnata* and *V.negundo* water extracts either alone or in combination can be used for the groundnut pests management and increase groundnut production.

Table 1. Impact of aqueous extracts of plants on the LC $_{50}$ values of *Spodoptera litura* fourth instar.

Plants	Family	Plant parts	LC_{50}
Azadirachta indica A. Juss.	Meliaceae	Leaves	3.898
Calotopis gigantia	Asclepiadaceae	Leaves	0.693
Vitex negundo	Verbenaceae	Leaves	1.332
Pongiamia pinnata	Papilionaceae	Leaves	4.547
Tridax procumbens		Leaves	2.833
Pedalium murex Linn	Pedaliaceae	Leaves	3.768
		Root	2.736
		Fruits	4.394

Table 2. Impact of water extracts of plants on the LC $_{50}$ values of *Spodoptera litura* fourth instar**.**

Plants	Family	Plant part	LC_{50}
Coleus ambonicus Lour.	Lamiaceaae	Aerial	3.82
Tephrosia purpuprea (Linn.)	Fabaceae	Root	0.4257
		Stem	0.5982
		seeds	5.6712
T. villosa	Fabaceae	seed	10.125
Pedalium murex Linn	Pedaliaceae	Leaves	4.058
		Root	2.574
		Fruits	4.320
Vitex negundo linn.	Verbanaceae	Leaves	1.2364
Ipomea carnea Jacq.	Convolvulaceae	Leaves	1.1933

Table 3. Various plant products water extracts on the incidence and population reduction (in %) of *S. litura* and groundnut production (Kg/ha).

Treatment	Mean population	Population reduction	Production
C. parasitica	1.45	52.51	1250
P. aquilinum	1.32	56.73	1400
H. arifolia	1.45	53.00	1370
Control	3.10	-	1120
A. indica	1.42	69.27	1260
C. gigantea	1.26	61.64	1304
P. pinnata	1.11	54.15	1154
Control	2.05	-	1177
V. negundo	0.59	77.63	1270.50
I. cornea	0.52	68.42	1312.50
Control	0.76	-	1060.50

Table 4. Water extracts of various plants on the incidence and reduction (in %) of *H. armigera* and cost benefit ratio.

Plants	Incidence	Population Reduction	Cost benefit ratio
C. parasitical	1.00	41.15	1:1.63
P. aquilinum	0.80	32.92	1:1.79
H. arifolia	0.82	33.74	1:1.76
Control	2.43	-	1:1.48
C. gigantea	1.1	55.00	1:2.0
P. pinnata	0.9	45.00	1: 1.8
V.negundo	1.0	50.00	1: 1.8
Control	2.0	-	1: 1.2
V. negundo	0.23	76.67	1:1.71
I. cornea	0.22	73.33	1:1.76
Control	0.30	-	1:1.43

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