International Journal of Zoology and Applied Biosciences **ISSN: 2455-9571**
Volume 1, Issue 2, pp: 106-110, 2016
https://doi.org/10.5281/zenodo.1309480
http://www.ijzab.com

Research Article

ANTIFEEDANT AND TOXICITY OF INDIGENOUS MEDICINAL PLANTS EXTRACTS AGAINST *SPODOPTERA LITURA* (FAB) (LEPIDOPTERA: NOCTUIDAE)

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Article History: Received 14th March 2016; Revised 22nd April 2016; Accepted 23rd April 2016

ABSTRACT

An investigation was disbursed to guage the antifeedant activity and toxicity of *Punica granatum, Cassia fistula* and *Erythrina variegata* extracts (ethyl acetate, hexane, chloroform and methanol) against the fourth arthropod larvae of *Spodoptera litura* below laboratory conditions within the Annamalai University, Chidambaram, India. The *P. granatum, C. fistula* and *E. variegata* methanol extract exhibited robust antifeedant and toxicant activity against the larvae of *S. litura* once applied either on leaf discs or incorporated into artificial diet. Below selection conditions the antifeedant index calculated over 96 hours. Consumption by, the fourth instar larvae of leaf discs swaybacked in 0.5, 1.5, 3.0 and 5.0% concentrations. Among the plants screened, *P. granatum* showed higher antifeedant activity against the larvae of *S. litura*. methanol extracts of *P. granatum* (83.8%), *C. fistula* (73.2%) and *E. variegata* (56.4%) showed higher antifeedant activity. the very best concentration of (5.0%) *P. granatum* methanol extract was found to be relatively a lot of to LC_{50} and LC_{90} values of (1.364% and 3.987%) than those of *C. fistula* (1.605% and 4.523%) and *E. variegata* (1.832% and 4.982%) at 96 hours exposure. Hence, it should recommend its use for dominant the agriculture pest, *S. litura*.

Keywords: Antifeedant activity, toxicity, *Punica granatum, Cassia fistula, Erythrina variegate, Spodoptera litura*.

INTRODUCTION

Man suffers extensively as a result of the nuisance of insect populations each in agriculture and health. In agriculture, insects have an effect on directly the growing a part of the crop and causes severe harm, leading to revenue loss. Crop loss as a result of insect pests is calculable between 10 and 30 per cent for major crops (Ferry *et al.*, 2004). Asian country is associate degree agricultural country and over 18th of the population depends on agriculture. Morbific organisms and bug pests cause tremendous crop loss worldwide and cut back the yield by 20-40%. In India, some eighteen of food grains are lost as a result of pathogens and bug pests (Yadav and Mendhulkar, 2015). As a result of these issues, a probe goes on to find new, less damaging cuss management tools. Standard artificial organic pesticides are unfit within the inexperienced context by their high toxicity, future persistence and propensity of bioaccumulation (Ignacimuthu and Jayaraj, 2003). Different chemical pesticides are accustomed management the pests as they need a fast knock down impact. However, their indiscriminate use resulted in many issues like resistance to pesticides, revivification of pests, elimination of natural enemies, toxic residues in food, water, air and soil that have an effect on human health and disrupt the system, resulting in the threat that their continued use might additional hurt the setting (Arivoli and Tennyson, 2013). These imply another to chemical pesticides through natural means that of pest management, together with vigorous explore for new sources of biology pesticides, veterinary and public health since kingdom is that the best producer of chemical compounds, synthesizing several merchandise that are utilized in defense against insects (Balaraju *et al.*, 2011).

In recent years, tries are being created to spot plants, together with herbs and weeds, for his or her insecticidal property with a read to seek out appropriate alternatives to exchange unsafe artificial pesticides utilised in massive scale in India (Elumalai *et al.*, 2010). Insecticidal activity of the many plants against many insect pests has been incontestable. The injurious effects of plant extracts or pure compounds on insects are often manifested in many manners as well as toxicity, mortality, anti-feedant growth substance, suppression of generative behavior and reduction of fecundity and fertility (Jbilou *et al.*, 2006). During this juncture, bioactive compounds of plant origin are thought of as ecologically safe different and also the plant extracts with advanced mixtures of compounds are

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wide investigated for his or her insecticidal, repellent, ovicidal, antifeedant and antioviposition properties (Mehmet and Hakki, 2003).

The castor cut worm, *S. litura* is one in the entire necessary polyphagous crop pests distributed throughout south and japanese world tropical infesting 112 species of plants happiness to forty four families (Chari and Patel, 1983) as well as groundout. In Republic of India it feeds on seventy four species of cultivated crops and a few wild plants (Ranga Rao *et al.,* 2008). *S. litura* may be a cosmopolitan and polyphagous tormenter moving many crops worldwide inflicting intensive loss of agricultural production. It's one in all the foremost economically necessary insect pests of fifty one countries as well as Republic of India, Japan, China and different countries of geographic area. Consequently, intensive efforts are created to seek out alternatives, particularly pesticides and plant origin that are safe, effective and environmentally acceptable (Suiatha *et al.,* 2010).

MATERIALS AND METHODS

Collection and rearing of pest

Larval stages of *S. litura* square measure collected from the castor leaves field of Naduvalur, Salem District, Tamil Nadu, India. *S. litura* area maintained on castor leaves beneath laboratory conditions (30 ± 1ºC temperature; 65-75 RH and eleven L and 13 D photoperiod) in plastic troughs (21.0×28.0×9.0 cm). Laboratory emerged adults were transferred to oviposition chamber and gulped up a ball honey fortified with nutrition mixture (multivitamin tablets) to spice up oviposition. Egg heaps were collected sterilized (10% formaldehyde) and maintained in moistened plastic containers for hatching. Laboratory emerged larvae was together mainlined on castor leaves.

Plant material

Different plant species, *Punica granatum, Cassia fistula* and *Erythrina variegata* were collected from in and round the Nagapattinam District, Tamil Nadu in India. Bulk samples were dry within the shade and when drying every sample was ground to a fine powder. At the time of assortment, two ironed voucher herbarium specimens were ready per species and known with the assistance of Plant taxonomy, Department of Botany, Annamalai University, whenever attainable, flowering or mature specimens were collected to facilitate compartmentalization identification.

Extraction of plant material

The plant materials were thoroughly washed with tap water and shade dried under room temperature (30ºC ± 2ºC) at Department of Zoology, Annamalai University, and Chidambaram. After complete drying the plant materials were powdered using electric blender and sieved through kitchen strainer. 500 g of plant powder was extracted with ethyl acetate, hexane, chloroform and methanol, sequentially with increasing polarity of solvents and filtered through Whatman's No. 1 filter paper. The solvents from the crude extracts were evaporated to air dryness at room temperature. The crude extract were collected in clean borosil vials and stored in the refrigerator at 4ºC for subsequent bioassay against *S. litura*.

Anti-feedant activity

Antifeedant bioassay was distributed exploitation leaf disc no alternative methodology. The crude extracts were dissolved in dissolvent and contemporary castor leaf disc of four cm diameter were punched exploitation cork borer and unfit in 0.5, 1.5, 3.5 and 5.0% concentrations. The leaf discs treated with dissolvent were used as negative management. In every plastic petridish (1.5 × 9 cm) wet paper was placed to avoid early drying of the leaf disc and single fourth arthropod larvae were introduced into every petridish. Progressive consumption of leaf space by the larvae once twenty four hrs was recorded up to speed and treated discs exploitation the leaf space meter. Leaf space consumed by the beast in plant extract treatment was corrected from the management. 5 replicates were maintained for every treatment with ten larvae per replicate and therefore the proportion of antifeedant activity was calculated exploitation the subsequent formula.

$$\text{Antifeedant activity} = \frac{\text{Leaf area consumed in control} - \text{leaf area consumed in treatment}}{\text{Leaf area consumed in control}} \times 100$$

Toxicology studies

Bioassay were performed with fourth arthropod of *S. litura* (12 h old) larvae exploitation concentrations from 0.5 - 5.0% of ethyl acetate, hexane, chloroform and methanol. For management castor leaves were treated with resolvent a drop of Twenty eight was additional as surface-active agent. A minimum of ten larvae per concentration was used for all the treatment experiments and these treatments were replicated 5 times (n=50). Recent castor leaves were sprayed with completely different contractions of *P. granatum, C. fistula* and *E. variegata* leaves extracts on each surfaces and air dried. Take a look at material solutions were applied at a rate of 0.5 cubic centimetre per castor leaf by a hand sprayer (Amway, USA). Every replicate was supplied with five leaves, ten larvae and ninety six hrs. 1st 2 days the larvae were supplied with plant extracts treated castor leaves. Every 24 h, the leftover leaves were removed and placed with recent treated leaves endlessly for 3 days. Mortality was recorded each twenty four h, final mortality was recorded at ninety six h. Mortality was corrected exploitation Abbot's (1925) formula if it absolutely was necessary.

Statistical analysis

The antifeedant and toxicity activity square measure subjected to analysis of variance (ANOVA). Important variations between treatments were determined by Tukey's multiple vary tests (P<0.05). The LC_{50} and LC_{90} values were calculated exploitation probit analysis (Finney, 1971).

RESULTS

The feeding deterrency of the crude extracts of *P. granatum, C. fistula* and *E. variegata* at completely different concentrations against the fouth arthropod larvae of *S. litura* is given in Table 1. Statistically important feeding deterrent activity (83.8%) was discovered in methanol extract of *P. granatum* at 5.0% concentration followed by ethyl acetate (69.2%), chloroform (47.8) and hexane (42.8%) extracts. The extracts (methanol, ethyl acetate, chloroform and hexane) from *C. fistula* and *E. variegata* showed (73.2%, 58.4%, 46.4%, 41.2% and 56.4%, 45.2%, 37.2%, 31.4%) minimum activity at 5.0% concentration against *S. litura*. The very best LC_{50} and LC_{90} values were obtained at 1.364% and 3.987% concentrations, severally in methanol extract of *P. granatum* for larval motality against *S. litura*. Followed by, the LC_{50} and LC_{90} values were obtained at 1.605%, 4.523% and 1.832%, 4.982% concentrations, severally in methanol extracts of *C. fistula* and *E. variegate* against *S. litura* is given in Table 2.

Table 1. Per cent antifeedant activity of three plant extracts against *Spodoptera litura*.

Plants name	Extracts	Concentrations %			
		0.5	1.5	3.0	5.0
P. granatum	Ethyl acetate	25.6±4.33^b	46.4±3.64^b	58.2±4.02^b	69.2±2.89^b
	Hexane	18.8±4.08^d	32.6±3.97^d	41.2±3.63^d	52.6±3.71^d
	Chloroform	21.4±2.96^c	38.2±3.27^c	46.2±3.34^c	57.4±3.97^c
	Methonal	30.4±3.64^a	47.6±3.28^a	68.2±3.89^a	83.8±2.68^a
C. fistula	Ethyl acetate	22.2±3.27^b	36.2±2.94^b	46.2±3.27^b	58.4±4.15^b
	Hexane	14.4±3.20^d	23.2±4.02^d	32.6±3.13^d	41.2±3.19^d
	Chloroform	17.6±3.97^c	26.2±3.42^c	37.6±2.60^c	46.4±3.91^c
	Methonal	26.2±3.49^a	42.4±4.09^a	56.4±3.64^a	73.2±4.43^a
E. variegata	Ethyl acetate	19.2±3.63^b	26.8±3.42^b	38.4±3.57^b	45.2±3.42^b
	Hexane	11.8±2.16^d	17.2±2.77^d	24.2±3.89^d	31.4±2.96^d
	Chloroform	15.6±2.19^c	22.6±3.91^c	28.8±3.19^c	37.2±3.89^c
	Methonal	23.6±4.97^a	34.4±4.77^a	47.6±4.61^a	56.4±3.13^a

Values are mean of five replications.

Within the column similar alphabets are statistically significant (*P*<0.05).

Table 2. LC_{50} and LC_{90} and χ^2- values of different plant extracts on *Spodoptera litura*.

Plant name	Extracts	LC_{50} (mg/L)	LC_{90} (mg/L)	Chi-square
P. granatum	Ethyl acetate	1.938	5.313	0.786*
	Hexane	3.417	7.963	2.051*
	Chloroform	2.696	7.191	1.975*
	Methanol	1.364	3.987	4.070*
C. fistula	Ethyl acetate	2.218	5.601	1.172*
	Hexane	3.755	8.184	1.133*
	Chloroform	3.276	7.882	1.533*
	Methanol	1.605	4.523	2.328*
E. variegata	Ethyl acetate	2.640	6.261	0.933*
	Hexane	4.325	8.799	1.495*
	Chloroform	3.889	8.632	1.184*
	Methanol	1.832	4.982	1.345*

χ^*- values are significant at *P*<0.05 levels.

DISCUSSION

In our results showed that, *P. granatum, C. fistula* and *E. variegata* plant extracts have important antifeedant and toxicity against hand-picked necessary agricultural field gadfly *S. litura.* Selvam and Ramakrishnan (2014) results noted that the antifeedant activity was noted in hexane extract and important antifeedant activity discovered in methanol extract. *Tinospora cardifolia* methanol extract may well be used effectively in ovicidal activity of agricultural field gadfly *Spodoptera litura* and *Helicoverpa armigera.* Isman and Seffrin (2014) investigated that the crude extracts from seeds, leaves, bark, twigs and fruits obtained from the plant species of custard-apple family are extensively tested in recent years for bioactivity to gadfly insects and connected arthropods worldwide. During this study, toxicity and effectiveness of 2 2-tridecanone formulations were assessed against *S. invicta*. In field path, at application rate of 5.28 mL/L and fourteen days once mound drench treatment, 100 percent management was achieved for formulation with PBO and ninetieth management for the formulation while not PBO (Chen, 2016). Krishnappa *et al.,* (2013) reported that the most antifeedant activity was noticed in *S. officinalis* (85.56±9.44%), followed by *O. basilicum* (80.55±8.64%) at 1000 ppm. Similarly, larvicidal activity was recorded most in POF6 with 70.44±3.43% mortality followed by 67.55±6.24; 55.22±3.48% mortality exhibited by POF4; POF5; POF3; POF1 and POF2 severally. Yadav and Mendhulkar (2015) investigation that the liquid extracts of *C. guianensis* leaves show high insecticidal impacts on nymphs and adult flies whereas low effect on the eggs of *B. tabaci* as compared to regulate. Farooq *et al.,* (2013) effectuality the insecticidal activity of *Allium sativum, Zingiber officinale* and *Nigella sativa* extracts against the larvae of *T. granarium*. The very best concentration of (6%), *Z. officinale* was found to be relatively a lot of cytotoxic (16.70%) than those of *A. sativum* (10.45%) and *N. sativa* (5.49%) at ninety six h exposure.

Gokulakrishnan *et al.,* (2012) rumored that the road of experiment was tried with Plant Oil Formulation (POF), showed most proportion of ovipositional repellent activity against the pregnant moths of *H. armigera* followed by *S. litura* and *E. vitella* were 84.75%, 79.90% and 76.55% severally. Sahayaraj (2011) result showed that *S. litura* was vulnerable to bound treatments like, *Calotropis gigantia* followed by *Pedalium murex* root. Least impact was noticed on *Vitex negundo* leaves extract. Pavela (2010) investigation that the many variations in antifeedant activity were found within the highest tested dose of 500 µg/cm^2, not solely among individual extracts however conjointly between each persecutor species tested. *S. littoralis* larvae were less sensitive to the extracts, once forty three extracts showed antifeedant activity below 50% - 90% was found in thirteen extracts. Out of all tested extracts, solely the extracts obtained from the plants

Angelica archangelica, Imperatoria ostruthium, Psoralea bituminosa and Vincetoxicum hirundinaria showed antifeedant activity highest than ninety fifth, and their effective doses (ED_{50}) were calculable at 44, 34, seventy two and 11 µg/cm^2, severally.

Safia Zoubiri and Aoumeur Baaliouamer, (2011) World Health Organization ascertained that alternatives to standard pesticides, essential oils extracted from aromatic plants are wide investigated. Their toxicities toward insects were of interest group throughout the last decade. Hamshou *et al.,* (2010) reported that the results of the *Rhizoctonia solani* glycoprotein on the expansion, development and survival of an economically necessary caterpillar in agriculture and agriculture, the cotton leafworm, genus *Spodoptera littoralis* were studied. Evelyn Munoz *et al.,* (2013) are reported that the extracts from *Calceolaria talcana* exhibited sturdy bio-insecticidal effects against *D. melanogaster* and *S. frugiperda*. The foremost active extract was ethyl acetate and its majority compound verbascoside. The best fatal concentration to the larvae of *S. frugiperda* and *D. melanogaster* was 20.0 µg/ml of the ethyl acetate extract with 95.8% and 67.0% of mortality, severally. Cespedes and Alarcon (2011) demonstracted that the *C. talcana* showed insecticidal activity in an exceedingly preliminary trial. supported this data and knowing that this plant incorporates a high resistance to insect and infective agent attack we've got allotted an insect grow regulative study of the aqueous, ethyl acetate, methanol and n-hexane extracts of aerial elements of this bush. Anandan *et al.,* (2011) reported that effectuality of ethyl acetate, methanol and liquid extracts of *Acrous calamus, Corchorus aestauaus, Cammelina bengalinsis, Emblica peepul* and *Lantena camera* were tested at 1000 ppm for their antifeedant activity against fourth arthropod larvae of *H. armigera* mistreatment leaf disc (no-choice) methodology. The aqueous extract of *C. collinus* was found to own most antifeedant activity followed by *E. fisheri, F. religiosa* and *C. aestauaus*.

CONCLUSION

In conclusion, ethyl acetate, hexane, chloroform and methanol extracts of leaves of *P. granatum* showed highest antifeedant and toxicity against fourth arthropod larvae of *S. litura*. Hence, it's going to be urged that the leaves extracts of *P. granatum* followed by *C. fistula* and *E. variegata* is used for dominant the insect tormenter, *S. litura*.

ACKNOWLEDGEMENTS

Authors are awesome grateful to the Dr. R. Karuppasamy, Professor and Head, Mr. Senthil and Mr. Palaniyappan, Research laboratory facility in-chargers, Department of Zoology, Annamalai University for the facilities provided to carry out the work.

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