BIOLOGICAL ACTIVITIES OF *EUPHORBIA HIRTA* L. (EUPHORBIACEAE) TREATED ARMYWORM, *SPODOPTERA LITURA* FAB. (LEPIDOPTERA: NOCTUIDAE)

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ABSTRACT

Toxic effect of crude seed extracts of *Euphorbia hirta* from Kanchipuram, Tamil Nadu, India, was evaluated against the armyworm, *Spodoptera litura* (Lepidoptera: Noctuidae) using different solvent extracts. All the four different *viz*., Hexane, Chloroform, ethyl acetate and water extracts were subjected to preliminary phytochemical assay. All the extracts showed insecticidal activity with dose dependent manner with four different concentrations (0.625, 1.25, 2.5 and 5%). High insecticidal activities were observed in 5 percent concentrations of chloroform extract and showed 65.33% mortality of *S.litura*. Chloroform extract showed lowest value of lethal concentration values *i.e*., gave LC_{50} value 358.59 % *S. litura*. Effective and active extract (chloroform) further tested growth inhibitory activity was tested against *S. litura*. Larval weight, pupal weight and adult durations were inhibited with increasing concentrations of treatments. Further glutathione S-transferase and monooxygenase enzymes were inhibited when increasing concentrations of treatments. Our results indicate that *E. hirta* had potential for development as botanical insecticides, especially for local use.

KEYWORDS: *Euphorbia hirta,* solvent extract, *Spodoptera litura,* insecticidal activity, Growth inhibitory, detoxification enzyme

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INTRODUCTION

In recent technology, pesticide manufacture have focused research in develop plant related compound pesticide Despite all the efforts exerted in protecting crops from noxious pests all over the world, losses due to these causes can annually reach 10–20% (Ferry et al., 2004), still remaining a challenge to be resolved. Currently, synthetic insecticides are the most used mechanisms to control pests. However, concerns over the development of resistance, toxicity and

environmental pollution associated with conventional synthetic insecticides compel us to look for new compounds. Attention is being directed towards plants that can be an alternative to synthetic insecticides because they have evolved together with herbivorous insects, developing mechanisms to interact and defend themselves. In this respect, plants are able to synthesize a broad range of different chemical compounds called secondary metabolites, many of them providing new sources of natural pesticides.

Spodoptera litura infest tomatoes, cotton, millets, maize, groundnuts, potatoes, soybeans, barley, sweet potatoes, and several horticultural crops worldwide (Ramzan et al., 2019). Medicinal plant extracts have undergone testing to determine whether they have any insecticidal, antifeedant, or repellant properties against field crop pests and storage pests (Lingathurai et al., 2013 and Tharamak et al., 2020). *Euphorbia hirta* (Euphorbiaceae) is a small annual herb. The plant is commonly called pill bearing spurge and asthma herb and the stem is slender. The leaves are oppositely arranged, lanceolate and are usually greenish or reddish underneath measuring about 5cm long. The plant leaves are used to treat colic troubles, dysentery, cough, asthma, worms and vomiting. The white latex is used as eye drops to cure conjunctivitis. Paste of leaf is applied externally (twice daily) on the place of scorpion bite. Therefore present study was planned to evaluate laboratory expriments of leaf extract of *E. hirta* Linn.

MATERIALS AND METHODS

Fresh leaves of *Euphorbia hirta* leaf powder (500 gm) and soaked with hexane, chloroform, ethyl acetate solvent and water extracts was prepared (Plate 1). Phytochemical analysis of *E. hirta* extracts was done by Horborne, 1984. The test insect *Spodoptera litura* is cultured and tested by extract of *E. hirta*. The insecticidal activity and growth inhibtory activity (Isman et al., 2001) experiments were conducted using the third instar larvae of *S. litura* (Singh & Bapatla, 2022). The effective extract was studied by detoxifying enzymes (Glutathione –S transferase and monooxygensase) activity (Oppenoorth et al., 1979). Field bio-efficacy and GC-MS studied were conducted with effective extract.

RESULTS AND DISCUSSION

The extract showed a greater yield for chloroform (3. 68gm) then followed by hexane, water and ethyl acetate extracts, that yielded 2.54, 1.82 and 1.25 gm (Table 1). Hexane extract contains tannins and terpenoids. Chloroform showed alkaloids, steroids, flavonoids and terpenoids. Ethyl acetate and water extracts resulted with alkaloids, anthraquinones, phenolics and saponins, flavonoids and phenolics (Table 2). Among different solvent extracts, chloroform extract was found to be more active and potential followed by ethyl acetate, hexane and water extracts. According to Situngkir (2018), *Euphorbia hirta*, which contains tannins, saponins, flavonoids, alkaloids, and steroids compositions can control *S. litura*. He tested these secondary metabolites can be toxic to the stomach or contact poison to the insect pest.

At 5% concentration of treatment chloroform extract exhibited maximum and significant larvicidal activity towards *Spodoptera litura*. Significant and dose dependent mortality was observed in all the treatment groups. Mortality of larvae was calculated with different concentrations as variable revealed significant difference in larval mortality ($P \leq 0.05$ level) (Table 3 and 4). Moawad and Sadek (2018) reported similar results about the mortality of pests.

Growth inhibitory activity was assayed with an effective extract chloroform extract (Table 5) with increasing concentration of treatment showed decreased level of larval and pupal weights. All the treatments showed concentration dependent activity. At 5% concentration level of treatment, larval and pupal weight reduced significantly. Adult durations also decreased significantly with increased concentration of treatment.

In the present study two detoxification enzyme levels (Glutathione S-transferase and Monooxygenase) was estimated in the larvae of *S. litura* in chloroform treated (Table 6). When increasing concentration of these enzyme levels were reduced, all the treatments showed dose depended activity. Malformed insect were developed with all the treatments (Plate 2). As this plant has a high potential source of phytochemicals, it is useful to protect our crops from herbivorous insects, with interesting perspectives on ecological systems of food production.

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Plate 1. *Euphorbia hirta* plant

Table 1. Yield of *Euphorbia hirta* crude extracts

Solvent	Quantity of Yield (gm)
Hexane	2.54
Chloroform	3.68
Ethyl acetate	1.25
Water	1.82

Table 2. Preliminary phytochemical analysis of *Euphorbia hirta* extracts

Extracts	**Phytochemicals**									
	Alk	**Ste**	**Sap**	**Tan**	**Fla**	**Ter**	**Ant**	**Qui**	**Phe**	**Cou**
Hexane	-	-	-	+	-	+	-	-	-	-
Chloroform	+	+	-	-	+	+	-	-	-	-
Ethyl acetate	+	-	-	-	-	-	+	-	+	-
Water	-	-	+	-	+	-	-	-	+	-

(**Alk:** Alkaloids, **Ste**: Steroids, **Sap**: Saponins, **Tan**: Tannins, **Fla**: Flavonoids, **Ter**: Terpenoids, **Ant**: Anthraquinones, **Qui**: Quinones, **Phe**: Phenolics and **Cou**: Coumarines) (+ present and - absent)

Table 3. Insecticidal activity of *Euphorbia hirta* against *Spodoptera litura* larvae

Extract	**Concentration (ppm)**			
	0.625	**1.25**	**2.50**	**5**
Hexane	$0.0\pm0.00_{a}$	$3.33\pm0.72_{b}$	$12.00\pm1.77_{b}$	$26.67\pm2.36_{c}$
Chloroform	$0.0\pm0.00_{a}$	$16.67\pm3.59_{c}$	$30.00\pm3.20_{c}$	$65.33\pm4.00_{e}$
Ethyl acetate	$0.0\pm0.00_{a}$	$20.00\pm2.19_{d}$	$36.67\pm2.07_{d}$	$48.67\pm2.18_{d}$
Water	$0.0\pm0.00_{a}$	$0.0\pm0.00_{a}$	$0.0\pm0.00_{a}$	$10.00\pm1.53_{b}$
Control	$0.00\pm0.00_{a}$			

within columns, means (± SD) followed by a same letter do not differ significantly (Turkey's test, $P < 0.05$ level)

Table 4. Lethal concentrations of *Euphorbia hirta* treated larval mortality towards *Spodoptera litura*

Extracts	LC_{50} (%)	95% Fiducial limit		LC_{90} (%)	95% Fiducial limit		Chi-square
		Lower	Upper		Lower	Upper	
Hexane	929.18	669.461	1705.553	3599.41	1896.22	12687.34	0.855*
Chloroform	358.59	215.906	1687.638	1079.93	513.43	15144.79	6.037
Ethyl acetate	578.18	414.560	1030.516	5693.13	2450.37	29199.05	1.800*
Water	-	-	-	-	-	-	-

5202

*$\chi 2$ values are significant at $P<0.05$ level

Table 5. Growth inhibitory activity of chloroform extract of *Euphorbia hirta* treated *Spodoptera litura*

Concentrations (%)	Larval weight (mg)	Pupal weight (mg)	Adult duration (days)
0.625	$127.38\pm2.96_{b}$	$94.17\pm2.80_{b}$	$5.65\pm1.02_{a}$
1.25	$107.22\pm2.46_{c}$	$78.14\pm2.27_{c}$	$4.62\pm0.36_{ab}$
2.5	$86.20\pm2.15_{d}$	$59.80\pm1.22_{de}$	$3.92\pm0.33_{b}$
5	$62.49\pm1.58_{e}$	$57.44\pm1.44_{de}$	$3.64\pm0.18_{bc}$
Control	$150.70\pm4.66_{a}$	$103.24\pm3.28_{a}$	$6.20\pm0.84_{a}$

within columns, means (± SD) followed by a same letter do not differ significantly (Turkey's test, $P < 0.05$ level)

Table 6. Detoxifying enzyme activities of chloroform extract of *Euphorbia hirta* treated *Spodoptera litura*

Concentrations (%)	Detoxifying enzyme activity	
	Glutathione S-transferase (nM/min/mg of protein)	**Monooxygenase** mOD/min/mg proteins
0.625	$2.176\pm0.52_{b}$	$8.715\pm1.30_{b}$
1.25	$1.894\pm0.33_{c}$	$2.937\pm1.12_{c}$
2.5	$0.299\pm0.37_{d}$	$0.145\pm0.83_{d}$
5	$0.232\pm0.14_{e}$	$0.128\pm0.42_{e}$
Control	$4.380\pm0.42_{a}$	$11.232\pm 1.61_{a}$

within columns, means (± SD) followed by a same letter do not differ significantly (Turkey's test, $P < 0.05$ level)

Plate 2. Abnormal pupae and adult after the treatment

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