Biological activities of *Maduga logifolia* Plant Leaf Crude Extract Against Agricultural Insect Pest *Spodoptera litura*

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Antifeedant, larvicidal and ovicidal activites of various concentrations of crude extracts of *Maduga logifolia* leaf were studied against *S. litura* larvae. The results of the total mortality rate progressively increased in different concentrations. The antifeedant activity of *Maduga logifolia* showed significant antifeedant effect was recorded in ethyl acetate extract of 71.42, 53.11, 33.29, 21.30% and concentration at 5, 2.5, 1.25, 0.625% respectively. Ovicidal activity is higher in ethyl acetate extract than maximum egg mortality was observed in 81.21, 53.61, 38.32, 21.32% and concentration at 5, 2.5, 1.25, and 0.625% respectively. It was significant larvicidal effect was observed from ethyl acetate at 70.32, 48.41, 31.25, 19.23% and concentration at 5, 2.5, 1.25, and 0.625% respectively. Antifeedant activity, larval and egg mortality more than 70% observed from ethyl acetate crude extract of *Maduga logifolia* leaf at 5% concentration and control of agricultural vegetable field insect pest for *S. litura*.

Keywords: *Spodoptera litura, Maduga logifolia,* ovicidal activity, larvicidal activity, larvicidal activity, Antifeedant activity

Introduction

Broad spectrum of chemical insecticides used for control of *Spodoptera litura* (Fab.) has resulted in development of resistance to many of the registered pesticides for its control. *S. litura* is a dangerous polyphagous insect pest infesting more than 120 host plants and distributed all over India (Negi *et al.,* 2016), (Elumalai *et al.,* 2015). Hosts include field crops grown for fibre, food and plantation and forestry crops, as well as certain species and most work on the economic impact of *S. litura* has been conducted in India (Thakur *et al.,* 2010). Besides moths have a flight range of 1.5 to 2.0 km during (4 hrs) overnight. *S. litura* larvae attacks in to different hosts plants it also Castor, Sunflower, Cotton, Chilies, Pulses, groundnut etc (Jeyasankar *et al.,* 2012).

There is urgent need for conservation of natural enemies for maintaining the ecological balance by evaluating suitable integrated pest management (IPM). Plants are important natural sources of

biological active compounds (Rani *et al.,* 2012). The Plant secondary metabolic compound are safer to non-target organisms against effective insect pest and wide range of behavioural and physiological effects on alimentary canals and associated glands on the insect pests (Deepalakshmi *et al.,* 2017). The present communication deals with ecology and environmentally and ecofriendly attempts on the use of aromatic plants as secondary metabolites for control of integrated management of insect pest *(Spodoptera litura)*.

Plant product being biodegradable and easily catabolised in the environment and play an important role against insect pests (Roman Pavela, 2012). We report the antifeedant, larvicidal and ovicidal activity of physiological and behavioural effects of *Maduga logifolia* plant leaf extracts against *S. litura*.

Materials and Methods

The experiment was carried in zoology laboratory, Arignar Anna Government Arts College, Namakkal, Tamil Nadu in India. The *S. litura* eggs mass were collected from the castor field and reared and maintained in zoology lab and IV instars larvae and eggs were used in the present investigation and Plant *Maduga logifolia* were collected from Arignar Anna Government Arts College, Namakkal, Tamil Nadu in India. The plant 1500g powder was extracted with hexane, chloroform, ethyl acetate sequentially with increasing polarity of solvents and filtered through Whatman's No. 1 filter paper. The solvent from the crude extract were evaporated to air dryness at room temperature. After drying crude extracts were collected in clean borosil vials and stored at 4^0C for subsequent bioassay for Table 4.

Antifeedant bio-assay

Antifeedant activity was studied for leaf disc no choice method. The Fresh castor leaf on 4 cm diameter for dipped and dried in different concentration for 5, 2.5, 1.5, and 0.625% of crude extract of *Maduga logifolia.* After 5 minutes were kept in Petri dishes and single fourth instars larva of *S. litura* was introduced on each leaf of Petri dishes. Each experiment five replications were maintained. The larval feeding percentage in 24 hrs period was observed and recorded. The percentage of antifeedant values was calculated. (Abbott W.S. 1925).

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$$\text{Antifeedant activity} = \frac{C - T}{C + T} X\ 100$$

Where C = Area protected in control leaf disc; T = Area protected in treated leaf disc.

Larvicidal assays

For the larvicidal activity was studied for leaf disc no choice method followed by the experiments for fresh castor leaf 4 cm diameter for dipped and five minutes air dried in different concentration for 5, 2.5, 1.5, and 0.625% of crude extract of *Maduga logifolia.* After five minutes were inside the Petri dishes and fourth instar larvae of *S. litura* was introduced for each leaf. Then each experiment was maintained five replications. The larval mortality percentage was recorded in 24 hrs period and calculated. In each concentration 5 pre-starved fourth instar larvae were introduce for leaf dishes and five replicates were maintained each experiments. After 24h for number of dead larvae was recorded and calculated using formula (Abbott W.S. 1925).

$$\text{Corrected mortality} = \frac{\text{mortality in treatment} - \text{mortality in control}}{100 - \text{Control mortality}} \text{X } 100$$

Ovicidal activity

For ovicidal activity, the freshly laid twenty individual eggs of *S. litura* were separated and dipped in various concentrations as mentioned in antifeedant activity. Five replicates were maintained. Positive and negative control groups were maintained individually. After the exposure periods, the number of eggs hatched in control and treatments hatch rate was assessed 48h post treatment. Ovicidal activity was calculated using Abbott's formula (Abbott, 1925).

$$\%\text{OA} = \frac{\%\text{ELC} - \%\text{EHT}}{100 - \%\text{ELC}} \text{X}100$$

Where, %OA = % ovicidal activity; % EHC = % of eggs hatched in control; % EHT = % of eggs hatched in treatment.

Statistic Analysis

Data analysis was carried out using Microsoft Excel 2007. One -Way ANOVA was performed for all the experimental data from that LSD was calculated and significant differences were marked with different alphabet. LC_{50}, $LC_{70,}$ LC_{90} was using for SPSS 16.00.

Results and Discussion

The results obtained in various types of experiments as presented in the form of tables and data were analyzed with suitable statistical tools. The results of the present investigations are as follows:

Antifeedant activity of *Maduga logifolia* against *Spodotera litura.*

Antifeedant activity of different solvent extracts of *M. logifolia* against larvae of *S. litura* at different concentrations for 5, 2.5, 1.25 and 0.625% the data pertaining to the above experiments are shown in table 1. Maximum larval feeding at 5, 2.5, 1.25 and 0.625% concentration was recorded from ethyl acetate extract from 71.42, 53.11, 33.29 and 21.30% in LC_{50} (LCL-UCL), LC_{70} (LCL-UCL), LC_{90} (LCL-UCL) X^2 value was recorded as 2.8 (2.37-3.30), 4.56 (3.96-5.51), 7.11 (6.04-8.90), 3.380 respectively. Followed by chloroform extract 45.46, 30.51, 21.42 and 13.54% in LC_{50} (LCL-UCL), LC_{70} (LCL-UCL), LC_{90} (LCL-UCL) X^2 value was recorded as 5.36 (4.41-7.26), 7.90 (6.33-11.27), 11.57 (9.03-17.15), 1.241 respectively. Followed by hexane extract at 36.25, 23.29, 17.20 and 11.24 in LC_{50} (LCL-UCL), LC_{70} (LCL-UCL), LC_{90} (LCL-UCL) X^2 value was recorded as 6.81 (5.36-10.39), 9.72 (7.43-15.61), 13.92 (10.36-23.20), 0.651 respectively. Plant insecticides have been proven to be useful for the control insect pest and environmental degradation, low-toxicity to other organisms (Arnason *et al*., 2017). The Plant compound was control insect pest. Showed maximum antifeedant, larvicidal and ovicidal activities of (86.30 and 81.10%; 83.20 and 80.20%; 81.70 and 80.10%) at 1000ppm concentration observed in the nonadecanoic acid of *solonum pseudocapcicum*. The plants oils properties against antifeedant activity of *Spodoptera litura*, *Helicoverpa armigera* and *Achaea janata.* (Gokulakrishnan *et al.,* 2012) and then plant extract influence that protein and free amino acid concentration affected from morphological and physiological for insects body from mango leaf Webber (Ranjini *et al.,* 2016).

Larvicidal activity of *Maduga logifolia* against *Spodotera litura.*

Larvicidal activity of different solvents crude extracts of *M. logifolia* against fourth instar larvae of *S. litura* with different concentrations and the same are under mentioned shown in table 2. It was observed that the maximum larvicidal activity of ethyl acetate extract of *M. logifolia* for different concentrations for 5, 2.5, 1.25 and 0.625% was 70.32, 48.41, 31.25, 19.23% in LC_{50} (LCL-UCL), LC_{70} (LCL-UCL), LC_{90} (LCL-UCL) X^2 value was recorded as 3.03 (2.60-3.56), 4.76 (4.14-5.73), 7.25 (6.18-9.03), 2.087 respectively. Followed by chloroform extract at 38.26, 20.61, 14.75,

10.25 in LC_{50} (LCL-UCL), LC_{70} (LCL-UCL), LC_{90} (LCL-UCL) X^2 value was recorded as 6.38 (5.19-8.86) 8.85, (7.03-12.83), 12.41 (9.64-18.61), 0.146 respectively. Followed by hexane extract at 33.43, 21.41, 13.42, 09.14 in LC_{50} (LCL-UCL), LC_{70} (LCL-UCL), LC_{90} (LCL-UCL) X^2 value was recorded as 7.04 (5.59-10.47), 9.74 (7.53-15.17), 13.65 (10.29-22.00), 0.719 respectively. The following Larvicidal activity of citronellal and *Cymbopogon nardus* plants from essential oils against insect's pest *spodoptera litura* (Zaridah *et al.,* 2003). The effectiveness of the plants compounds against larvicidal and ovicidal activity (Arnason *et al*., 2017) and plant compound maximum antifeedant, larvicidal and ovicidal activities of (86.30 and 81.10%; 83.20 and 80.20%; 81.70 and 80.10%) at 1000ppm concentration observed in the nonadecanoic acid (Chinnamani *et al* 2020).

Ovicidal activity of *Maduga logifolia* against freshly laid eggs of *S. litura*.

The ovicidal activity of crude extracts of *M. logifolia* against freshly laid eggs of *S. litura* and the results pertaining to the above experiments with different concentrations are presented in table 3. Ethyl acetate extract caused in egg mortality % (egg hatchability %) 81.21(18.79), 53.61(46.39), 38.32 (61.68) and 21.32 (78.68) at 5, 2.5, 1.25, 0.625 % concentration in LC_{50} (LCL-UCL), LC_{70} (LCL-UCL), LC_{90} (LCL-UCL) X^2 value was recorded as 2.39 (2.03-2.78), 3.85 (3.40-4.48), 5.95 (5.18-7.13), 2.350. Similarly, hexane extract caused in egg mortality % (egg hatchability %) 46.36(53.46), 24.81(75.19), 19.56 (80.44), 10.75 (89.25) at 5, 2.5, 1.25, 0.625 % concentration in LC_{50} (LCL-UCL), LC_{70} (LCL-UCL), LC_{90} (LCL-UCL) X^2 value was recorded as 5.34 (4.49-6.88), 7.54 (6.21-10.14), 10.73, (8.63-14.90), 1.147. Similarly, chloroform extract caused in egg mortality % (egg hatchability %) 78.42 (21.85), 48.41(51.59), 25.49 (74.51), 19.46 (80.54) at 0.625% concentration in LC_{50} (LCL-UCL), LC_{70} (LCL-UCL), LC_{90} (LCL-UCL) X^2 value was recorded as 2.83 (2.48-3.23), 4.21 (3.74-4.85), 6.19 (5.43-7.32), 0.757 against *S. litura* respectively. *solonum pseudocapcicum* plant against the antifeedant, larvicidal and ovicidal activities of (86.30 and 81.10%; 83.20 and 80.20%; 81.70 and 80.10%) at 1000ppm concentration observed in the nonadecanoic acid (Chinnamani *et al* 2020).

Table .1 Antifeedant activity of different solvent extract of *Maduka longifolia* against *Sopodaptera litura* at 24hrs.

Plant extract	Con. (ppm)	Percentage of Antifeedant (%)	LC_{50} (LCL-UCL)	LC_{70} (LCL-UCL)	LC_{90} (LCL-UCL)	X^2 (df=4)
Ethyl acetate	0.625	21.30±2.29 (27.49)	2.8 (2.37-3.30)	4.56 (3.96-5.51)	7.11 (6.04-8.90)	3.380
	1.25	33.29±2.14 (35.18)				
	2.5	53.11±3.51 (46.77)				
	5	71.42±2.48 (57.67)				
Chloroform	0.625	13.54±1.00 (21.56)	5.36 (4.41-7.26)	7.90 (6.33-11.27)	11.57 (9.03-17.15)	1.241
	1.25	21.42±1.35 (27.56)				
	2.5	30.51±2.20 (33.52)				
	5	45.46±1.49 (42.36)				
Hexane	0.625	11.24±2.14 (19.55)	6.81 (5.36-10.39)	9.72 (7.43-15.61)	13.92 (10.36-23.20)	0.651
	1.25	17.20±3.51 (24.50)				
	2.5	23.29±2.20 (28.29)				
	5	36.25±3.24 (36.99)				

The value represents mean± SD with angular values of five replications. LC_{50}=Lethal Concentration brings out 50% Mortality and LC_{90} = Lethal Concentration brings out 90% mortality. LCL = Lower Confidence Limit; UCL = Upper Confidence Limit.

Table .2 Larvicidal activities for different solvent crud extract of *Maduka longifolia* plant against *Sopodaptera litura* at 24hrs

Plant extract	Con. (ppm)	Percentage of Larvicidal activity (%)	LC_{50} (LCL-UCL)	LC_{70} (LCL-UCL)	LC_{90} (LCL-UCL)	X^2 (df=4)
Ethyl acetate	0.625	19.23±4.42 (25.99)	3.03 (2.60-3.56)	4.76 (4.14-5.73)	7.25 (6.18-9.03)	2.087
	1.25	31.25±2.44 (33.96)				
	2.5	48.41±1.24 (44.80)				
	5	70.32±2.44 (56.96)				
Chloroform	0.625	10.25±1.43 (18.63)	6.38 (5.19-8.86)	8.85 (7.03-12.83)	12.41 (9.64-18.61)	0.146
	1.25	14.75±3.45 (22.40)				
	2.5	20.61±3.16 (26.99)				
	5	38.26±2.41 (38.17)				
Hexane	0.625	09.14±2.44 (17.56)	7.04 (5.59-10.47)	9.74 (7.53-15.17)	13.65 (10.29-22.00)	0.719
	1.25	13.42±3.11 (21.47)				
	2.5	21.41±1.26 (27.56)				
	5	33.43±2.24 (35.30)				

The value represents mean± SD with angular values of five replications. LC_{50}=Lethal Concentration brings out 50% Mortality and LC_{90} = Lethal Concentration brings out 90% mortality. LCL = Lower Confidence Limit; UCL = Upper Confidence Limit.

Table .2 Ovicidal activity of different solvent crud extract of *Maduka longifolia* plant against *Sopodaptera litura* at 24hrs

Plant extract	Con. (ppm)	Percentage of ovicidal activity (%)	LC_{50} (LCL-UCL)	LC_{70} (LCL-UCL)	LC_{90} (LCL-UCL)	X^2 (df=4)
Ethyl acetate	0.625	19.46±1.47 (26.13)	2.83 (2.48-3.23)	4.21 (3.74-4.85)	6.19 (5.43-7.32)	0.757
	1.25	25.49±2.24 (30.26)				
	2.5	48.41±5.28 (44.08)				
	5	78.42±7.44 (62.31)				
Chloroform	0.625	10.75±1.83 (18.81)	5.34 (4.49-6.88)	7.54 (6.21-10.14)	10.73 (8.63-14.90)	1.147
	1.25	19.56±4.15 (26.71)				
	2.5	24.81±2.16 (29.87)				
	5	46.36±6.39 (42.88)				
Hexane	0.625	21.32±3.84 (27.49)	2.39 (2.03-2.78)	3.85 (3.40-4.48)	5.95 (5.18-7.13)	2.350
	1.25	38.32±2.11 (38.23)				
	2.5	53.61±1.36 (47.60)				
	5	81.21±3.47 (64.30)				

The value represents mean± SD with angular values of five replications. LC_{50}=Lethal Concentration brings out 50% Mortality and LC_{90} = Lethal Concentration brings out 90% mortality. LCL = Lower Confidence Limit; UCL = Upper Confidence Limit.

Table 4. Physical Characteristics and Yield of Various solvent extracts of *Maduka longifolia* Plant Leaves

Solvent	Dried powder (gm)	Solvent (ml)	Sense of touch and color	Amount of extract(gm)	% of Yield (w/w)	TLC SPOT
Hexane	300	1200	Sticky (Greenish Yellow	3.20	3.2	5
Chloroform	300	1000	Sticky (Green)	4.50	4.5	7
Ethyl acetate	300	1000	Sticky (Golden Yellow)	7.80	7.8	8

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