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TOXICITY OF SELECTED MEDICINAL PLANT WATER EXTRACTS AGAINST *SPODOPTERA LITURA* FAB. UNDER LABORATORY CONDITION

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Abstract

Phyto-insecticides offer ample scope for effective pest management with reduced toxic load on environment. Still their large scale commercial usage remain a distant dream since non availability of formulations. This could be surmounted through studies on determination of effective doses. Three medicinal plants viz., Glory lily (*Gloriosa superb* L.), Bitter guard (*Momordica charantia* L.) and papaya (*Carica papaya* L.) water extract were bioassayed and the most promising extract median lethal concentrations worked out. The water extract of bitter gourd seed and papaya latex performed better and their LC_{50} was identified as 1.560 % and 5.260% respectively.

***Key words*:** Glory lily, Bitter gourd, Papaya, $LC_{50,}$ Insecticidal action.

Introduction

Phyto-insecticides derived from plants are used in a variety of pest control situations from time immemorial (Jacobson and Crosby, 1971 and KarlMaramorsch, 1991). As most of them are relatively non-toxic to humans, animals and natural enemies they readily fit into IPM protocol and their use as an effective alternative to insecticides gain importance. They possess dose dependent varieties of action *viz.,* repellence, insecticidal, growth regulatory *etc.* However, their large-scale utilization is obstructed by non-availability of formulations. This hurdle can be surmounted through studying the properties beyond bio-assays. Studies on median effective doses may help in identifying potent extracts which may in turn used for product development after detailed investigations. Hence, the present study aimed at screening of three medicinal plants *viz.,* Glory lily (*Gloriosa superb* L.), Bitter guard (*Momordica charantia* L.) and papaya (*Carica papaya* L.) and determining their effective doses.

Materials and Methods

Test Plants and Insect

Seeds of Bitter gourd (*Momordica charantia L.*), latex of papaya fruits (*Carica papaya* L.) were collected from Chidambaram, (11^0 24'N, 79^0 44'E) Tamilnadu, India. The seeds of glory lily (*Gloriosa superb* L.) were collected from Erode (11^0 35' N, 77^0 73' E). The collected plant materials were shade dried, powdered and extracted with water. The contents were filtered through Whatman no.40 filter paper. The extract thus obtained was used for bioassays immediately. The test insect, *Spodoptera litura* Fab. egg masses were collected from the fields and were reared in castor leaves collected from unsprayed experimental farm grown plants (Arivudainambi *et al.* 2006).

Bioassay

Fresh castor leaf disc (3cm) was dipped in water extract of individual plant parts separately at different concentrations (90%, 70%, 50%, 30%, 10%, 5% and 1%) for five seconds. The dipped leaves were then air dried under room temperature and kept inside separate petriplates (6 mm dia.). Four-hour pre-starved third instar larvae @ three / Petri plate were released. The data on larval mortality was recorded 24 hours after treatment. The surviving larvae were provided with fresh leaves and maintained up to adult emergence. Per cent larval mortality was calculated. Mortality if any in pupal and adult stages were also recorded. The entire experimental set up was replicated thrice.

Determination of Median Lethal Concentration

Median lethal concentration (LC_{50}) of most promising plant extracts recording higher mortalities was worked out by following the method of Finney (1971).

A leaf disc bioassay as described earlier was carried out using third instar *S. litura* larvae. Seven to nine different concentrations depending upon the effect of most promising extracts, respective solvent and absolute control treatments were applied and each treatment was replicated three times. Data on the number of dead larvae was recorded 24 hours post

treatment. Mortality was corrected using Abbott's formula (1925). LC_{50} values and fiducial limits were worked out using probit analysis.

Results and Discussion

Glory lily seed water extract showed reduced per cent larval mortality at the highest concentration (90 % recorded 33.33 % mortality) and higher mortalities at lower concentrations (70, 50 and 30 % recorded 66.66 % mortalities). However, at much lower concentrations (10, 5 and 1 %) mortality was not recorded. Bitter gourd seed water extract at 10 and 5 per cent concentrations recorded 33.33 and 66.66 per cent larval mortality. It was also noticed that the dead larvae were having blackened cuticle. However, the data on pupal mortality showed that at 70 per cent concentration maximum mortality was recorded (100 %) followed by 90 and 1 per cent concentrations (66.66 %). Other concentrations (50, 30, 10 and 5%) were found recording 33.33 per cent mortality.

The water extract of Bitter gourd seed clearly imparted insecticidal effect through mortality at higher doses tested and through malformation and mortality at low doses tested. The effect was also much noticed at larval pupal moult and either the treated larvae died as pupa or as larval pupal intermediates. These results were confirmed by the studies of Harrison and Bonning (2010) who reported effect on midgut, haemocoel and even cuticle. Such broader sites of action might be responsible for better insecticidal action. Further, Telang *et al.* (2003) reported the effectiveness of BGPIs in inhibiting gut proteinases and the related larval, pupal mortalities and malformations. As BGPIs are known to act on protein metabolism, they might have derailed the hormone secretion which may be the reason for appearance of larval pupal intermediates.

Papaya latex water extract was found to be highly efficacious in imparting insecticidal action and that too at the larval stage itself. 90, 70, 50, 30 and 10 per cent concentrations recorded 66.66 per cent larval mortality whereas 5 and 1 per cent concentrations showed 33.33 per cent larval mortality. This clearly showed that the Papaya latex water extract possessed high level of insecticidal action even at 10 per cent concentration. Such effects are correlated with the ability to inhibit peritrophic membrane and midgut epithelia due to the presence of cysteine protease inhibitors (Table 1).

Most promising plant extracts *viz*., water extract of Bitter gourd seed and Papaya latex exhibiting potent insecticidal action against third instar larvae were further bio assayed at different concentrations for determination of respective $LC_{50's}$ and fiducial limits.

Bitter gourd seed water extract imparted higher toxicity with a LC_{50} value of 1.560 per cent followed by Papaya latex water extract (5.260%) (Table 2 & 3).

Table 1 : Insecticidal property of water extract of selected botanicals at various concentrations against third instar *Spodoptera litura* Fab.

Treatments / Concentration	Glory lily seed Water extract		Bitter gourd seed water extract		Papaya latex water extract	
	*Per cent larval mortality	*Per cent Pupal mortality	*Per cent larval mortality	*Per cent Pupal mortality	*Per cent larval mortality	*Per cent Pupal mortality
90%	33.33 (29.98)^{ab}	0 (0.00)^{b}	0 (0.00)^{c}	66.66 (59.98)^{ab}	66.66 (59.98)^{a}	0
70%	66.66 (59.98)^{a}	0 (0.00)^{b}	0 (0.00)^{c}	100 (90.00)^{a}	66.66 (59.98)^{a}	0
50%	66.66 (59.98)^{a}	0 (0.00)^{b}	0 (0.00)^{c}	33.33 (29.98)^{bc}	66.66 (59.98)^{a}	0
30%	66.66 (59.98)^{a}	0 (0.00)^{b}	0 (0.00)^{c}	33.33 (29.98)^{bc}	66.66 (59.98)^{a}	0
10%	0 (0.00)^{b}	33.33 (29.98)^{a}	33.33 (29.98)^{b}	33.33 (29.98)^{bc}	66.66 (59.98)^{a}	0
5%	0 (0.00)^{b}	0 (0.00)^{b}	66.66 (59.98)^{a}	33.33 (29.98)^{bc}	33.33 (29.98)^{ab}	0
1%	0 (0.00)^{b}	0 (0.00)^{b}	0 (0.00)^{c}	66.66 (59.98)^{ab}	33.33 (29.98)^{ab}	0
Absolute control	0 (0.00)^{b}	0 (0.00)^{b}	0 (0.00)^{c}	0 (0.00)^{c}	0 (0.00)^{b}	0
SE (d)	16.021	8.005	10.678	19.615	17.913	0
CD (p=0.05)	34.255	17.117	22.608	41.939	38.300	0

* Mean of three replications Values in parentheses are Arc sine transformed values

Value with different alphabets with columns differ significantly

Table 2 : Toxicity of Bitter gourd seed water extract against third instar *Spodopteralitura*

S. No	Concentrations	No. of insects used	Number dead	Per cent Mortality	Corrected per cent mortality
1.	20	9	8	88.88	88.89
2.	10	9	6	66.66	66.67
3.	7	9	6	66.66	66.67
4.	5	9	6	66.66	66.67
5.	3	9	6	66.66	66.67
6.	2	9	6	66.66	66.67
7.	1	9	3	33.33	33.33
8.	Absolute control	9	0	0	0

LC_{50} = 1.560 Y= 0.2.19+ 0.88x
Lower limit = 0.1622 Table χ^2 =11.0705
Upper limit= 3.2831 Calculated χ^2 = 1.9052
Variance= 0.7725

Table 3 : Toxicity of Papaya latex water extract against third instar *Spodoptera litura*

S. No	Concentrations	No. of insects used	Number dead	Per cent Mortality	Corrected per cent mortality
1.	50	9	8	88.88	88.89
2.	30	9	6	66.66	66.67
3.	20	9	6	66.66	66.67
4.	10	9	6	66.66	66.67
5.	7	9	6	66.66	66.67
6.	5	9	3	33.33	33.33
7.	3	9	3	33.33	33.33
8.	1	9	3	33.33	33.33
	Absolute control	9	0	0	0

LC_{50} = 5.2606 Y= 01.68+ 0.89x
Lower limit= 4.3856 Table χ^2 =12.5916
Upper limit= 6.1357 Calculated χ^2 = 2.9267
Variance= 0.1993

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