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Aphidicidal Activity of Calotropis Procera Leaves Against Mustard Aphid Lipaphis Erysimi (Kalt) and Its Natural Predator Coccinella Septempunctata (Linn)

KEYWORDS: Calotropis procera, Lipaphis erysimi, Coccinella septempunctata, Aphidicidal activity

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ABSTRACT *Isecticidal properties and biocidal properties of different plants are examined by several workers for controlling insect pests of different crops as they are gaining global importance due to their biodegradable and ecologically compatible nature and ill effects of synthetic and chemical pesticides such as pest resistance, pest resurgence, detrimental effects on non target organisms and environment. An experiment was conducted to examine the efficacy of ethanolic extract of Calotropis procera leaves against mustard aphid Lipaphis erysimi Kalt which is known to cause a serious damage to Brassica oil seed crop of our country and its natural predator Coccinella septempunctata (Linn.). A stock solution of 8% concentration was prepared in distilled water. The control consisted of 5% ethanol dissolved in water. Three concentrations (2, 3 and 4 percent) of test solution were prepared by its dilution with distilled water and sprayed on parts infested with counted number of 3rd instar nymphs and adults of apterous viviparous females. 4% concentration was found to be quite effective as it caused 52, 66 and 80% mortality in 3rd instar nymphs and 55, 66 and 77% mortality in adult apterous viviparous females in 48, 72 and 96 hours respectively. The leaf extract of C. procera was however, found to be non toxic for the natural predator of aphid Coccinella septempunctata in the present study.*

INTRODUCTION

The use of phytoproducts as insecticides is gaining global importance due to their biodegradable and ecologically compatible nature and ill effects of synthetic and chemical pesticides such as pest resistance, pest resurgence, detrimental effects on non target organisms and environment. The plants are known to have synthesized a diverse array of chemicals to prevent their colonization by insects and other herbivores. These chemicals to prevent repel approaching insects deter feeding and oviposition on plants, disrupt behaviour and physiology of insects in various ways and even toxic to different developmental stages of various insect species.

The present study aims to evolve an environmentally safe, economical and effective insecticide for the control of mustard aphid *Lipaphis erysimi* Kaltenbach (Homoptera; Aphididae). Mustard aphid is the most dreadful insect and found on most of the cruciferous oil seed and vegetable crops. *L. erysimi* is a soft bodied greenish yellow aphid. Females are viviparous and produce a number of young ones which attain adult stage after several moult. During the developmental period they destroy the *Brassica* oilseed crops to a great extent. They are sap suckers, suck the sap from the whole plant which results poor growth and yield from the crops. These investigations are expected to yield interesting results which may be useful for the protection of mustard crop in the country. This also enables the farmers to save their crop from the ravages of *Lipaphis erysimi*.

MATERIAL AND METHODS

The leaves of *Calotropis procera* were collected and washed thoroughly under tap water and dried in shade. After drying the leaves were powdered in an electric grinder and sieved though a fine muslin cloth. The powdered material (approx. 10 g) was extracted serially in a glass soxhlet extractor with 250 ml ethanol as a solvent. The extraction was carried out continuously for 24 h. Finally, the extracted materials were separated out in a small beaker after complete evaporation of the solvent. A stock solution of 8% concentration was prepared in distilled water. The control consisted of 5% ethanol dissolved in distilled water. The required concentrations (2, 3 and 4%) of the test solution were prepared by diluting the stock solution with distilled water. Each concentration was applied with three replications for every treatment. Observations were made after every 12 h. The corrected percentage of mortality was calculated according to Abbott's formula. The data were subjected to Probit analysis (Finney, 1952) for calculating regression equation and fiducial limits. LT_{50} values were calculated by graphical superimposition method described by Marwaha and Sarup (1978).

Experimental Bioassay:

The crop was shown in two experimental Plots A and B. Plot 'A' had mature mustard crop infested with enough number of mustard aphids, while plot 'B' contained small 9-12 cm high uninfested young plants. The plot 'B' plants were transferred to small clay pots measuring 12-15 cm in diameter and 15 cm in length. The pots were placed in natural environment (at 20 ± 5^0C; 89 ± 10 RH) away from plot 'A'. The counted number of aphids was transferred to potted plants with the help of a fine camel hair brush from the plot 'A'.

The soil of the small clay pots with one host plant each was covered with a white paper disk. To ensure that the disc fits securely at the top of the pots and around the stem, it was incised along the radius to reach the circular host. The place if any between the stem and hole was filled with cotton and pots were kept in water filled enamel trays to ensure that the apterous insect do not escape out from the potted plants.

Each of the potted plant with 48-52 apterous viviparous third instar nymph or adult apterous viviparous females of *L. erysimi* was sprayed with 5ml of extract. Before spraying the plant with a devilbiss atomizer, the insects that had dropped off the plants were removed from the paper disc

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and water in the enamel trays. Concentration response test with different concentrations of ethanolic extract of *Calotropis procera* were conducted in three replicates involving 150 insects. No visible sign of movement by the insect was accepted as a criterion for mortality.

RESULT AND DISCUSSION

The spray of all the concentrations of *Calotropis procera* leaf extract significantly reduced the number of 3rd instar nymphs and adult apterous viviparous females of *L. erysimi*, when compared with the untreated control (Table, 1 and 2). The treated with 4% extract caused highest mortality i.e. 52, 66 and 80% in third instar nymphs and 55,66 and 77 in adults after 48, 72 and 96 hrs. respectively. The toxicity values were also computed in terms of $LT_{50,}$ fiducial limits and regression equation. The fecundity was also affected significantly (Table 3) at a conc. of 4%. The complete mortality was observed after two sprays at an interval of 5-6 days.

The perusal of literature revealed a number of findings supporting the present work with the treatment of *Calotropis procera* leaves extract given to different insect species. (Moursy, L. E., 1997, Umsalama *et. al.*, 2006, Begum, N. *et. al.*, 2010, Begum, N. *et al.*, 2011 and Bakavathippan, *et al.*, 2012). Bakavathippan, *et al.*, (2012) reported maximum activity of chloroform leaf extract of *Calotropis procera* which exhibited best larvicidal activity against the *S. litura*. The result clearly indicate that the leaf extract of *Calotropisb procera* possess many useful properties to control the insect pests., Begum, N. *et al.*, (2010, 2011) examined the insecticidal activity of *Calotropis procera* and Annona squamosa against various stages of *Musca domestica*. Medicinal use of *Calotropis Gigantica* is also examined (Arti, 2014) and found leaves and aerial parts of plants are reported for its anti-diarrhoeal, anti bacterial and antioxidant properties. The efficacy of shaker aqueous extract of leaf, flower and roots of *C. procera* proved most effective in the control of *Henosepilachna elaterii* (Umsalama, *et. al.*, 2006). *C. procera* shaker extract showed strong repellent activity and thus deterred the insect from feeding. 5%extract of different plant parts of *C. procera* gave 100% protection of cucurbit leaf and no larvae survived after exposure to extract. 1% and 2.5% conc. also highly reduced the fecundity and longevity of insect. Moursey, L. E. (1997) reported the significant insecticidal activity of *Calotropis procera* extract against the flesh fly, *Sarcophaga haemorrhoidalis* fallen. The insecticidal activity of the extract of *Calotropis procera* was reported earlier against *Chilo patellus* larvae (Bhatnagar and Sharma, 1994), larvae of *Pieris brassicae* (Khan and Siddiqui, 1995) *Schistocerca gregaria*, (Al-Robai, 1997) and *Sarcophaga haemorrhoidalis* Fallen (Moursy, 1997). Kumar, 1996 reported nematicidal properties of *C. procera* extract whereas Srinivas *et al.*, (1997) showed its effectiveness in controlling the leaf spot of ground nut and in increasing itd yield. In the present investigations it exhibited an excellent aphicidal activity against *L. erysimi* against mustard aphid. The present findings suggest the feasibility of exploiting the potential of *Calotrpis* leaf extract for protecting the mustard crop against mustard aphid *L. erysimi*. The leaf extract of *C. procera* was, however, found to be non toxic for the natural predator of aphid *Coccinella septempunctata* in the present study. It may be therefore, be concluded that this leaf extract can be used as an effective aphidicidal agent for the control of *L. erysimi*.

Table.1 Insecticidal activity of *Calotropis procera* leaves against 3rd instar nymphs of *L. erysimi*

Conc.	Corrected Percentage of Mortality After					LT_{50}*	Fiducial	Regression
(%)	12h	24h	48h	72h	96h	Value	Limit	Equation
Control	0.00	0.00	0.00	1.34	1.34			
2.0	6.66	20.66	32.00	39.19	45.94	104.48	0.201-0.379	0.055X+47.64
3.0	21.34	32.66	42.00	48.65	57.43	78.79	0.304-0.496	0.065X+47.68
4.0	32.00	42.00	52.00	66.21	79.73	37.36	0.442-0.638	0.051X+48.44
*Time required for 50% mortality								

Table.2 Insecticidal activity of *Calotropid procera* leaves against adult apterous viviparous females of *L. erysimi*

Conc.	Corrected Percentage of Mortality After					LT_{50}*	Fiducial	Regression
(%)	12h	24h	48h	72h	96h	value	Limit	Equation
Control	0.00	0.00	0.66	1.34	2.00			
2.0	0.66	12.00	19.47	24.33	29.94	160.32	0.096-0.244	0.071X+46.69
3.0	16.66	25.34	37.59	46.62	55.10	82.17	0.266-0.454	0.058X+47.77
4.0	31.34	41.34	55.04	66.23	76.88	36.32	0.452-0.648	0.051X+48.45
*Time required for 50% mortality								

Table. 3 Insecticidal activity of *Calotropis procera* leaves on the fecundity of adult apterous viviparous females of *L. erysimi*.

Concentration	Fecundity After Treatment			
(%)	24h	48h	72h	96h
2.0	29.00	46.33	63.00	84.67
3.0	21.33	40.33	53.67	74.00
4.0	18.00	27.33	34.33	40.67
Control	29.67	54.00	79.00	104.00
SE±	4.30	4.58	5.35	6.16
CD at 5%	9.29	9.89	11.56	13.31
*All treated females died				

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