

Efficacy of the Aqueous Extract of *Ferula Assafoetida* Root Exudate against Mustard Aphid *Lipaphis Erysimi* Kaltenbach and Its Natural Predator *Coccinella Septempunctata* (Linn).

Hridayesh Arya* & Babu Ram Singh**

*Department of Zoology, NREC College, Khurja.

**Department of Zoology, CCS University, Meerut.

Abstract: The use of plant extracts 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. Present experiment was conducted to examine the efficacy of aqueous extract of *Ferula assafoetida* root exudate 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 distilled water only. 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 37, 43 and 52% mortality in 3rd instar nymphs and 38, 43 and 50% mortality in adult apterous viviparous females in 48, 72 and 96 hours respectively. The root exudates of *Ferula asafoetida* was however, found to be non toxic for the natural predator of aphid *Coccinella septempunctata* in the present study.

INTRODUCTION

Ferula assafoetida is a member of family Umbelliferae, locally known as Hing in Hindi. It is stimulant, carminative and antispasmodic, expectorant, slightly laxative, anthelmintic, diuretic and emmenagogue (Nadkarni and Nadkarni, 1954). 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 root exudates of *Ferula asafoetida* were dissolved in water. A stock solution of 8% concentration was prepared in distilled water. The control consisted of 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. LT₅₀ 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 $20 \pm 5^{\circ}\text{C}$; 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 emulsion. Before spraying the plant with a devilbiss atomizer, the insects that had

dropped off the plants were removed from the paper disc and water in the enamel trays. Concentration response test with different concentrations of petroleum ether extract castor seeds 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 *Ferula assafoetida* root 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. 37, 43 and 52% in third instar nymphs and 38, 43 and 50% in adults after 48, 72 and 96 hours 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.

Table.1 Efficacy of aqueous extract of *Ferula assafoetida* against adult apterous viviparous females of mustard aphid *L. erysimi*

Conc. (%)	Corrected Percentage of Mortality After					LT_{50} * Value	Fiducial Limit	Regression Equation
	12h	24h	48h	72h	96h			
Control	0.00	0.00	0.66	1.34	2.00			
2.0	0.00	1.34	6.04	14.86	22.45	213.81	0.034-0.146	0.097X+45.23
3.0	6.66	18.66	25.51	32.44	41.49	115.69	0.165-0.335	0.066X+47.13
4.0	14.00	27.34	38.25	43.24	49.65	96.68	0.256-0.444	0.061X+47.61

*Time required for 50% mortality

Table.2 Efficacy of aqueous extract of *Ferula assafoetida* against 3rd instar nymphs of mustard aphid *L. erysimi*

Conc. (%)	Corrected Percentage of Mortality After					LT_{50} * value	Fiducial Limit	Regression Equation
	12h	24h	48h	72h	96h			
Control	0.66	0.66	0.66	1.34	2.00			
2.0	0.00	2.70	10.07	16.89	21.08	227.76	0.041-0.159	0.108X+44.78
3.0	5.38	17.46	24.84	31.75	36.75	130.61	0.147-0.313	0.071X+46.90
4.0	12.08	27.52	36.92	43.24	52.39	87.44	0.247-0.433	0.054X+47.85

*Time required for 50% mortality

Table.3 Efficacy of *Ferula assafoetida* root exudates on the fecundity of adult apterous viviparous females of *L. erysimi*.

Concentration (%)	Fecundity After Treatment			
	24h	48h	72h	96h
2.0	21.67	40.33	59.33	84.33
3.0	18.67	38.67	55.67	75.33
4.0	13.00	30.33	46.33	59.67
Control	21.00	41.00	67.00	104.00
SE±	3.05	4.34	5.34	6.36
CD at 5%	6.59	9.37	11.53	13.74

The root exudate of *Ferula assafoetida* dissolved in distilled water was screened for its aphidicidal activity and the perusal of literature revealed a number of findings supporting the present work with the biological activity of *Thymus kotschyianus*, *Ferula assa-foetida* and *Eucalyptus* under laboratory conditions against *Varroa destructor* (Acari varroidae) (Ghasemi *et al.* 2011). In this experiment the acaricidal activity of *Ferula assa-foetida* was found (LC50) = 2.46, 95%CL=2.10-2.81µl/l air. The dichloromethane fraction of *Ferula ferulaeoides* was analyzed by Liu., *et al* (2013) and thirty four compounds were identified as insecticide, the main compound in the fraction guaiol (37.0%) was separated by chromatographic methods. It showed good contact activities against the 4th instar larvae of *Mythimna separate* 3rd instar larvae of *Plutella xylostella*. With LD50 value of .07 and 8.9 mg/larva as well as fumigation activity against the 4th instar larvae of *M. separate* and adult *Musca domestica* with LC50 values of 3.5µl/l and 16.9µl/l respectively. Kim *et al* (2011) isolated galbanic acid from *Ferula assafoetida* exerts anti tumor activity in association with antiangiogenesis and antiproliferation. Zia-Ul-Haq *et al.*, (2012) screened the biological activity of methanolic extracts of different parts of five medicinal plants, *Ferula assfoetida* L. resin, *Grewia asiatica*L. Leaves, *Ipomoea hederacea* Jacq. Seeds, *Lepidium sativum* seeds and *Terminatia chebula* Retz. Fruits were tested in vitro for their cytotoxic, insecticidal, nematocidal and anthelmintic activities. In these investigations *Ferula assafoetida* showed moderate to bioactive compound that may be responsible for its toxic potential. 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*. 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. The insecticidal activities of materials derived from the fruits of fennel (*Foeniculum vulgare*) against adults of *Sitophilus oryzae*, *Callosobruchus chinensis* and *Lasioderma serricorn* using direct contact application and fumigation methods are examined by Kim and Ahn (2001) and found as naturally occurring insect controlling agents for managing field population of *S. oryzae*, *C. chinensis* and *L. serricorn*. In the present investigations *Ferula assafoetida* exhibited an excellent aphidicidal activity against mustard aphid. The present findings suggest the feasibility of exploiting the potential of *Ferula assafoetida* root exudate for protecting the mustard crop against mustard aphid *L. erysimi*. The root exudate of *Ferula assafoetida* 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 root exudate can be used as an effective aphidicidal agent for the control of *L. erysimi*.

The root exudates of *F. assafoetida* although did not cause any harmful effect in the population of natural predator of aphids *Coccinella septempunctata*, it showed a limited use in controlling mustard aphid *L. erysimi* infesting rape seed crop.

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