

Aphidicidal Activity of Selected Plant Extracts against Mustard Aphid *Lipaphis erysimi* (Kaltenbach)



Hridayesh Arya

Assistant Professor & Head,
Deptt. of Zoology,
N. R. E. C. College,
Khurja



B. R. Singh

Designation,
Deptt. of Zoology,
C. C. S. University,
Meerut

Abstract

The aphidicidal activity of different plant extracts was tested against mustard aphid *Lipaphis erysimi*, which is causing a serious damage to *Brassica* oil seed crop of our country. Natural 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 some environmentally safe, economical and effective insecticides for the control of mustard aphid *Lipaphis erysimi* Kaltentbach (Homoptera; Aphididae). Mustard aphid is the most dreadful insect and found on most of the cruciferous oil seed and vegetable 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*.

The insecticidal as well as aphidicidal properties of seven plants viz. *Adhatoda vasica* (leaves), *Allium sativum* (bulbs), *Delphinium ajacis* (seeds and flowers), *Lycopersicon esculentum* (leaf), *Ricinus communis* (Leaves), *Ocimum sanctum* (leaves) and *Sesamum indicum* (Seeds) have been investigated. The extracts of plant materials were prepared by grinding the fresh and shade dried part and reducing it to a fine powder in a large grinder/blender. The powdered substances were extracted with suitable solvents in soxhlet extractor. Different concentrations of each extract were tested against the aphid. For bioassay studies small clay pots 10cm high and 12 cm in diameter at the top with one host plant about 5-6 cm high was used. A potted plant was infested by a known number of aphids. The biological activity of different extracts was determined by spraying 5ml of extract with an atomizer of known concentration on each potted plant.

Keywords: Aphidicidal Activity, *Lipaphis erysimi*, Plant Extracts, Mustard Aphid

Introduction

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. 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 some environmentally safe, economical and effective insecticides for the control of mustard aphid *Lipaphis erysimi* Kaltentbach (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*. The *Ocimum sanctum* (leaves), *Adhatoda vasica* (leaves), *Allium sativum* (bulbs), *Delphinium ajacis* (seeds and flowers), *Lycopersicon esculentum* (leaf), *Ricinus communis* (seeds and Leaves) and *Sesamum indicum* (seeds) have been investigated for their insecticidal properties..

Material and Methods

In the present investigations several plants and their products were examined for their aphidicidal activity against common mustard aphid *Lipaphis erysimi* Kalt. The extracts of plant materials were prepared by grinding the fresh and shade dried part and reducing it to a fine powder in a large grinder/blender. The powdered substances were extracted with suitable solvents (aqueous, ethanolic or petroleum ether) in soxhlet extractor. Different concentrations of each extract were tested against the aphid. Adult apterous viviparous females and nymphs

of mustard aphid *L. erysimi* used in the present investigations were collected and brought to the experimental plants from the field after snipping off the infested leaves and twigs of *Brassica campestris*. The adults and nymphs were transferred to experimental plants for investigation. For bioassay studies small clay pots 10cm high and 12 cm in diameter at the top with one host plant about 5-6 cm high was used. A potted plant was infested with counted number of aphids and placed in natural environment at 20±5°C Temp. and 80±10% RH for bioassay studies. The biological activity of different extracts was determined by spraying 5ml of extract with an atomizer of known concentration on each potted plant. The effect of these extracts were examined on the mortality of nymphs and adults at intervals of 12 hrs. The percentage mortality was recorded in nymphs and adult viviparous females. No visible sign of movement was accepted as criterion of mortality (Naithani.1987). All these response tests were conducted in three replicates involving approx. 150 insects. The effect of suitable control was also examined simultaneously.

Results

In all extracts of different parts of the plants were screened for their insecticidal activity. Results are given below in the form of table.

Table 1. Effect of Some Plant Extracts against Third Instar Nymph of Mustard Aphid *Lipaphis erysimi*

Plant Material	Solvent Used	Conc. used	Corrected Percentage of Mortality After				
			(%)	12 hrs.	24 hrs.	48 hrs.	72hrs.
<i>Adhatoda vasica</i> (Leaves)	Ethanol	Control	0.00	0.00	0.00	0.66	2.00
		2	6.00	26.66	40.66	52.34	59.86
		3	14.66	33.34	52.00	65.11	74.14
		4	21.34	44.66	66.00	87.26	100.0
<i>Allium sativum</i> (Bulb)	Petroleum ether	Control	0.00	1.34	1.34	1.34	2.66
		2	28.66	45.94	66.90	87.17	100.0
		3	50.66	70.95	89.86	100.0	100.0
		4	74.00	100.0	100.0	100.0	100.0
<i>Delphinium ajacis</i> (Seeds)	Petroleum ether	Control	1.34	1.34	2.00	2.66	3.34
		2	34.44	55.40	70.76	89.05	100.0
		3	47.96	67.57	89.80	100.0	100.0
		4	61.48	83.78	100.0	100.0	100.0
<i>Delphinium ajacis</i> (flowers)	Ethanol	Control	0.66	0.00	0.66	1.34	2.00
		4	3.36	22.15	40.95	52.71	59.18
		6	18.12	40.27	59.67	69.78	80.87
		8	39.60	55.71	79.20	100.0	100.0
<i>Lycopersicon esculentum</i> (Leaves)	Ethanol	Control	1.34	1.34	2.00	2.66	3.34
		4	19.58	42.57	68.02	87.67	100.0
		6	39.85	63.51	85.04	100.0	100.0
		8	59.46	82.42	96.59	100.0	100.0
<i>Ocimum sanctum</i> (Leaves)	Petroleum ether	Control	1.34	1.34	1.34	2.00	3.34
		2	11.47	48.65	69.69	89.80	100.0
		3	25.00	63.51	81.76	100.0	100.0
		4	43.24	81.76	100.0	100.0	100.0
<i>Ricinus communis</i> (Seeds)	Petroleum ether	Control	0.66	0.66	0.66	0.66	2.00
		0.5	14.78	44.98	75.18	87.92	100.0
		1.0	36.92	79.88	100.0	100.0	100.0
		1.5	66.44	100.0	100.0	100.0	100.0
<i>Ricinus communis</i> (Leaves)	Ethanol	Control	0.66	0.66	0.66	1.34	2.00
		2	2.01	19.47	32.21	39.19	46.27
		3	15.44	27.52	51.68	60.13	70.06
		4	26.85	45.64	72.48	89.20	100.0
<i>Sesamum indicum</i>		Control	0.00	0.00	0.66	2.00	2.00

(Seeds)	Petroleum ether	0.5	15.34	31.34	41.62	57.82	57.82
		1.0	27.34	59.34	84.56	100.0	100.0
		1.5	63.34	100.0	100.0	100.0	100.0

Table 2. Effect of Some Plant Extracts against Adult Apterous Viviparous Females of *Lipaphis erysimi*

Plant Material	Solvent Used	Conc. used (%)	Corrected Percentage Mortality After				
			12 hrs.	24 hrs.	48 hrs.	72hrs.	96 hrs.
<i>Adhatoda vasica</i> (Leaves)	Ethanol	Control	0.00	0.00	0.00	0.66	2.00
		2	5.34	18.66	29.34	37.57	46.94
		3	18.00	29.34	44.00	57.71	65.31
		4	27.34	50.66	66.00	85.90	100.0
<i>Allium sativum</i> (Bulb)	Petroleum ether	Control	2.00	2.00	2.00	2.66	3.34
		2	27.20	44.90	65.31	85.62	100.0
		3	48.31	68.71	88.43	100.0	100.0
		4	72.10	100.0	100.0	100.0	100.0
<i>Delphinium ajacis</i> (Seeds)	Petroleum ether	Control	0.66	1.34	1.34	1.34	2.00
		2	27.52	46.63	64.87	81.76	100.0
		3	41.62	55.40	74.32	92.56	100.0
		4	58.39	80.40	100.0	100.0	100.0
<i>Delphinium ajacis</i> (flowers)	Ethanol	Control	0.00	0.00	0.66	2.00	2.00
		4	1.34	2.00	38.94	55.10	61.23
		6	13.34	31.34	53.03	67.35	81.63
		8	26.66	54.66	75.84	95.25	100.0
<i>Lycopersicon esculentum</i> (Leaves)	Ethanol	Control	0.66	0.66	0.66	2.00	2.66
		4	10.75	39.60	58.39	70.76	79.45
		6	27.52	47.66	71.15	86.39	100.0
		8	40.27	61.08	81.88	100.0	100.0
<i>Ocimum sanctum</i> (Leaves)	Petroleum ether	Control	0.66	0.66	0.66	2.00	2.00
		2	3.36	31.55	66.44	86.39	100.0
		3	20.13	47.66	81.22	100.0	100.0
		4	40.26	79.20	100.0	100.0	100.0
<i>Ricinus communis</i> (Seeds)	Petroleum ether	Control	0.66	0.66	1.34	1.34	2.66
		0.5	14.09	42.96	75.01	83.78	100.0
		1.0	41.62	79.20	100.0	100.0	100.0
		1.5	64.43	100.0	100.0	100.0	100.0
<i>Ricinus communis</i> (Leaves)	Ethanol	Control	0.00	0.00	0.00	1.34	2.00
		2	1.34	17.34	24.66	35.80	43.53
		3	12.00	23.34	40.00	54.04	65.31
		4	23.34	43.34	62.60	81.76	100.0
<i>Sesamum indicum</i> (Seeds)	Petroleum ether	Control	1.34	1.34	1.34	1.34	3.34
		0.5	0.00	15.34	22.97	33.77	39.31
		1.0	18.91	33.10	66.21	87.84	100.0
		1.5	41.88	79.93	95.28	100.0	100.0

Review of Literature

Effectiveness of *Adulsa* leaf extract has been reported by several workers (Bhaduri et al., 1985; Srivastava et al., 1996; Bhargava et al., 1997) against different insect pests including *Callosobruchus maculatus*, *Albizia lebbeck* and *Rhesasala imparta* and found that 10% aqueous extract of *Adulsa* found to be most effective. In the present study the population of *L. erysimi* was significantly reduced on *B. capestris* plant sprayed with a single dose of *adulsa* leaf extract (4%) after one week of treatment and proved to be an effective protectant for *Brassica* oil seed crops. With the aim of selecting botanical insecticides, seven plant extracts were screened by tKhan et al., (2017) for their toxic effect against four important agricultural insect pest like pea aphid, fruit fly, red flour beetle and army worm. All the plants including *Cinnamomum camphora*, *Eucalyptus* and *tagetes minuta* showed considerable mortality in aphid.

The insecticidal properties, and repellent nature of *Allium sativum* against different insect species has already been reported by Kabir and mia (1987), Singh et al. (1996) and Murugan and Jeyabalan (1999). The petroleum ether extract of garlic bulbs was found highly effective against third instar nymph and adult apterous viviparous females against *L. erysimi* in present studies. Since the garlic is reported (Awchar et al., 1995) to be non effective against the beneficial insects associated with mustard it may be used as a potent aphidicidal agent against mustard aphid. To reduce the use of synthetic pesticides leaves of *Eucalyptus*, *Artemisia* and *Rosamarinus* were evaluated under laboratory condition for their insecticidal effect against *Myzus persicae*. Etheric extract found highly effective in comparison to alcoholic and aqueous extract (Bilal et al., 2015)

The concentrations of *Delphinium ajacis* flower extract was found to be effective higher than the concentrations of seed extract, but it was not

found to cause any significant effect on the population of natural predator (*Coccinella septempunctata*) of mustard aphid. Therefore it appeared to be safe aphidicidal agent for the control of *L. erysimi*.

During the perusal of literature some findings supporting the present study with the treatment of *L. esculentum* leaf extract given to different insects were encountered (Katiyar et al., 1997; Hongo and Karel, 1986). In the present study ethanolic leaf extract not only reduced the fecundity of *L. erysimi* but also caused 100% mortality of the insect. Mostafa et al (2012) investigated insecticidal activity of *Tamarindus*, *Azadirachta*, *Cucumis* and *eucalyptus* against *Tribolium castaneum* Herbst and found all the plants highly effective. Insecticidal activity of *Ocimum sanctum* leaf extract was also reported earlier by some workers (Pandey and Verma, 1987; Kumari et al., 1994 and Silva et al., 1997). The present investigations revealed the aphidicidal properties of the leaves of *Ocimum sanctum*. It was observed that a single spray of 4% concentration of petroleum ether extract results in Cent percent mortality within 48 hrs. among third instar nymph and adult apterous viviparous females of *L. erysimi*. Toxicity of some selected plant extracts was also tested by Bushra abid (2015) against wheat aphid and its predators

Conclusion

In present investigations the leaf and seed extract of *Ricinus communis* exhibited significant aphidicidal activity against *L. erysimi*. The perusal of literature revealed a number of findings supporting the present work with the treatment of *R. communis* extract given to different insect species (Kumar and Dutta, 1987; Nadira et al., 1994; Dhar et al., 1996 and Mateeva et al., 1997). Seeds of *Sesamum indicum* were well known for their synergistic activity with different pesticides and pyrethroids (Banerji et al., 1985; Sridevi and Dhingra, 1996). These extracts were found to be very effective as they caused 100% mortality of nymphs and adults both at different concentrations. In the present investigations the extract not only caused 100% mortality in nymphs and adults of *L. erysimi* but also reduced significantly the fecundity of aphids.

References

1. Awchar, S. L., Satpute, U. S., Sarnaik, D. N. and Sarode, D. B. (1995). Effect of certain chemical and botanical insecticides with mustard. *J. Biol. Chem.* 9: 13-15.
2. Bhaduri, N., Ram Shree and Patil, B. D. (1985). Evaluation of some plant extracts as protectants against the pulse beetle, *Callosobruchus maculatus* (Fabricius) infesting cowpea seeds. *J. Ent. Res.* 9: 183-187.
3. Bhargava, A., Srivastava, A. and Kumbhare, V. (1997). Insecticidal activity of leaf alkaloids of *Adhatoda vasica* on *Albizia lebbek* defoliator *Rhesela imparta* Wak. *Lepidoptera-Noctuidae. Pestology* 21: 16-19
4. Bilal, NIA, Naama, FRAH and Imane AZOUI (2015). Insecticidal activity of three plant extracts against *Myzus persicae* (Sulzer, 1776) and their phytochemical screening. *acta agriculturae Slovenica* 105-2: 261-267
5. Bushra Abid (2015). Toxicity of selected plant extracts against wheat aphid and its predators. *Appl. Sci. Bus. Econ.* 2: 33-39.
6. Hongo, H. and Karel, A. K. (1986). Effect of plant extract on insect pests of common beans. *J. Appl. Ent.* 102: 164-169.
7. Kabir, K. H. and Mia, M. D. (1987). Effectiveness of some indigenous plant materials as repellents against the mustard aphid. *Bangladesh J. Zool.* 15: 87-88.
8. Katiyar, O. P., Mukherjee, S. P. and Lal, L. (1997). Effect of certain natural food plants on the larval development of *D. obliqua* Wik. *Ind. J. Ent.* 38: 130-133.
9. Khan, S., Taning, C. N. T., Bonneure, E., Mangelinckx, S., Smagghe, G., and Shah, M. M. (2017). Insecticidal activity of plant derived extracts against different economically important pest insects. *Phytoparasitica* 45: 113-124.
10. Kumar, A. and Dutta, G. P. (1987). Indegenous oils as larvicidal agent against *Anopheles stephensi* mosquitoes. *Curr. Sci. India* 56: 59-69.
11. Kumari, C. P., Sharma, C. L. and Saxena, R. C. (1994). Pupicidal effect of *Ocimum sanctum* on the vector *Aedes aegypti* (Diptera: Culicidae). *J. Ecobiol.* 6: 69-70.
12. Mostafa, M., Hossain, H., Hossain, M. A., Biswas, P. K. and Haque, M. Z. (2012). Insecticidal activity of plant extracts against *Tribolium castaneum* Herbst. *J. Adv. Sci. Res.* 3: 80-84.
13. Murugan, K. and Jeyabalan, D. (1999). Effect of certain plant extracts against the mosquito, *Anopheles stephensi* (Liston). *J. Ent. Res.* 20: 137-137.
14. Pandey, U. K. and Verma, G. S. (1987). Effectiveness of some indigenous plant products against insect-pests of cruciferous vegetables, *Bagrada cruciferarum* Kirk. *Zeitschrift fur Angewandte Zoologie* 69:129-132.
15. Silva, A. C. D., Salgado, L. O., Rigitano, R. L. O. and Friqueto, R. T. S. (1997). Insecticidal activity of plant extracts on larvae of *Ascia monusteoriseis* (Latreille, 1819) (Lepidoptera: Pieridae) under laboratory conditions. *Ciencia-e-Pratica* 19: 420-424.
16. Singh, H., Mrig, K. K. and Mahla, J. C. (1996). Effect of different plant products on the fecundity and emergence of lesser grain borer, *Rhyzopertha domonica* (F.) in wheat grains. *Ann. Biol. Ludhiana* 12: 96-98.
17. Srivastava, A., Kumbhare, V., Pandey, D. K. and Srivastava, S. (1996). Preliminary phytochemical and insecticidal studies of leaf extract of *Adhatoda vasica* on *Albizia lebbek* defoliator, *Rhesela imparta*. *J. Forestry* 19: 83-84.