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EVALUATION OF DIFFERENT BOTANICAL INSECTICIDES AGAINST MUSTARD APHID, *Lipaphis erysimi* (KALTENBACH) INFESTING MUSTARD

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ABSTRACT

Investigation on evaluation of some botanicals for their efficacy against aphid, *Lipaphis erysimi* (Kaltenbach) infesting mustard was carried out at Anand Agricultural University, Anand (Gujarat) during 2010-11. Among the various botanicals, tobacco decoction (2%) extracted either with cold or hot water, neem oil (0.5%), NSKE (5%) and neem leaf extract (10%) performed better and protected the mustard crop. Ardusa leaf extract (10%) as well as azadirachtin (0.0006% and 0.0008%) (ready to use neem based formulation) found inferior. Various botanicals were also evaluated for their safety to the natural enemies associated with aphid, *L. erysimi*. Ardusa leaf extract (10%) found to be safer to the natural enemies of aphid *viz.,* coccinellids (grubs and adults), chrysopids (eggs), syrphid fly (larvae) and *Diaeretiella rapae* (parasite) and honey bees followed by azadirachtin (0.0006 and 0.0008%), neem leaf extract (10%), NSKE (5%) and neem oil (0.5%). The effectiveness of various botanicals against aphid was also reflected on number of grains per pod, test weight and seed yield of mustard. The highest number of grains (12.01), test weight (5.72 g) and seed yield (13.95 q/ha) was recorded from the plots treated with tobacco decoction cold water extraction (51.32% increase in yield over control) followed by tobacco decoction hot water extraction (51.25%), Neem oil (50.36%), NSKE (47.11%) and neem leaf extract (41.21%) as compared to plots treated with 10% ardusa leaf extract and azadirachtin (0.0006 and 0.0008%).

KEY WORDS: Mustard, Aphid, Botanical insecticides

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INTRODUCTION

Mustard, *Brassica juncea* (Linnaeus) Czern and Coss belongs to family cruciferae and originated in China and later on it was introduced into North Eastern India. It is important oil seed crop of India which occupies an area of 6.30 million hectares with total production of 7.20 million tonnes and productivity of 1143 kg/ha during 2008-2009 (Anon., 2010a). It is also important *rabi* oil seed crop of Gujarat cultivated in about 0.29 million hectares of area with total production of about 0.33 million tonnes and average productivity of 1636 kg/ha (Anon., 2010b). Among various biotic factors responsible for reducing the yield of mustard, insect pests are the major one. According to Bakhetia and Sekhon (1989), 38 insect pests are known to be associated with rapeseed-mustard crop in India. On the basis of their economic importance, the insect pests of mustard crop may be grouped into, key pest: aphid, *Lipaphis erysimi* (Kaltenbach), major pests: sawfly, *Athalia lugens proxima* (Klug); painted bug, *Bagrada cruciferarum* Kirkaldy and leaf miner, *Chromatomyia horticola* Goureau, minor pests: Bihar hairy caterpillar, *Diacrisia abliqua* Walker; cabbage butterfly, *Pieris brassicae* Linnaeus; flea beetle, *Phyllotreta cruciferae* Goeze and green aphid, *Myzus persicae* Seltzer, new pests: leaf webber, *Crocidolomia binotalis* Zeller; borer, *Hellula undalis* Fabricius and whitefly, *Bemisia tabaci* Gennadius. Among these, aphid, *L. erysimi* is the key pest in all the mustard growing regions of the country. The nymphs and adults of the aphid suck the cell sap from the inflorescence, terminal twig, siliqua (pod), leaves and branches. On severe infestation, plant gets poor pod formation, leaves get curled, shrivel and plants become completely dried. On the other hand, aphid produces a good amount of honeydew which facilitates the growth of the fungus that makes the leaves appear dirty black (Awasthi, 2002). *L. erysimi* caused 35.4 to 73.3 per cent yield loss, 30.09 per cent seed weight loss and 2.75 per cent oil loss as reported by Bakhetia and Sekhon (1989), Singh and Premchand (1995) and Sharma and Kashyap (1998). Farmers generally depend on the synthetic insecticides to control this pest which leads several problems such as development of resistance, resurgence of the pest, residues and destroy the eco-system. Under these circumstances,

botanical insecticides may play an important role. The present study was carried out to evaluate the different botanical insecticides against aphid, *L. erysimi* to avoid the yield losses in mustard.

MATERIALS AND METHODS

Mustard variety GM-2 was sown during *Rabi* season 2010 with spacing of 45 x 15 cm and raised following recommended agronomical practices in separate plots each of 3.6 × 4.0 m area at Agronomy farm, B. A. College of Agriculture, Anand Agricultural University, Anand. First spray application of respective botanicals was given on the appearance of the pest and subsequently two sprays were given at 15 days interval using manually operated knapsack sprayer having duromist nozzle with slight runoff stage. Spray solutions were prepared fresh a day before spray application and various extract diluted with water just before spraying. Aphid population was recorded in terms of aphid index (0-5) from randomly selected 10 plants before first spray and 3, 5, 7 and 10 day(s) after first, second and third spray applications. Number of natural enemies *i.e*., coccinellids (grubs and adults), chrysopids (eggs) and syrphid fly (larvae) were recorded on the randomly selected five plants. The population of *Diaeretiella rapae* was recorded by observing number of live and mummified (parasitized) aphids on 10 cm terminal twig of randomly selected 10 plants. Number of grains/pod, weight of 1000 grains and grain yield was also recorded. The yield of seed from each net plot was weighed separately.

RESULTS AND DISCUSSION

The data on aphid population was pooled over periods and sprays and presented in Table 1. All botanical treatments recorded significantly lower aphid population than control. Tobacco decoction extracted either with cold or hot water and Neem oil found to be the more effective botanicals against aphid and recorded significantly lower (0.54, 0.60 and 0.67, respectively) aphid index. The chronological order of various botanical treatments based on aphid index (0-5) given in bracket was: Tobacco decoction cold water extract (0.54) > tobacco decoction hot water

treatment (0.60) > Neem oil (0.67) > neem seed kernel extract (1.11) > neem leaf extract (1.28) > azadirachtin 0.0006% (1.69) = azadirachtin 0.0008% (1.69) > ardusa leaf extract (1.72) > control (2.39). Thus, Tobacco decoction extracted either by hot or cold water followed by neem oil and NSKE were found more effective botanicals against aphid, *L. erysimi* in mustard ecosystem. The interaction between treatments and periods (T x P) and treatments, periods and sprays (T x P x S) was found to be non-significant which indicated that treatment effect was consistent in their behaviour over the periods and sprays.

Baraskar (2007), tobacco decoction 5 per cent was the most effective and recorded 62.73 per cent aphid mortality followed by leaf decoctions of tobacco (2%), neem (5%), neem (2%), tulsi (5%) and tulsi (2%). In another trial, neem seed kernel extract (5%), neem oil (2%) and neem leaf extract (5%) found effective and recorded 53.88, 52.13 and 35.65 per cent aphid reduction over control, respectively (Chanchal and Lal, 2009).

Natural Enemies:

The data on coccinellids population over periods and sprays showed that ardusa leaf extract recorded the highest population and proved to be more safe botanical treatments against coccinellids. However, it was at par with azadirachtin (0.0006%) and neem leaf extract. Tobacco decoction extracted either with cold or hot water, neem oil, NSKE, azadirachtin (0.0006 and 0.0008%) and neem leaf extract were found more or less equally safe as they were at par with each other.

The ardusa leaf extract recorded higher (0.40 eggs/plant) population of chrysopids eggs than rest of the botanicals and proved to be safer botanical treatments. The two concentrations of azadirachtin, neem leaf extract, NSKE and neem oil were equally safe to chrysopids. Tobacco decoctions extracted either with cold or hot water were found less safer and were at par with neem oil and proved to be more toxic to chrysopids.

Larval population of syrphid fly over periods and sprays presented in table revealed that ardusa leaf extract recorded significantly higher (1.11) larval population of syrphid fly and proved to be most safe botanicals. Azadirachtin at 0.0006 and 0.0008%, neem leaf extracts and neem oil was at par with each other and thus proved safer botanicals to

this predator. Tobacco decoction extracted by cold water recorded the lowest population of syrphid fly and was at par with the tobacco decoction extracted by hot water as well as NSKE. Thus, these botanicals showed some adverse effect on the larval population of syrphid fly.

No parasitized aphids were found before and up to 10 days after the first spray. The periodical data on population of parasitized aphids due to *D. rapae* before spray and 3, 5, 7 and 10 days as well as pooled over periods after second spray are presented in Table-1, clearly indicated that all botanicals recorded significantly lower parasitism of aphid due to *D. rapae* than untreated control. Among the botanicals, ardusa leaf extract recorded the highest number of parasitized aphids and proved to be the safest botanical. The two concentration of azadirachtin (0.0006 and 0.0008%) and neem leaf extract also found safe to *D. rapae* followed by NSKE, tobacco decoction hot water extraction and neem oil. Tobacco decoction cold water extraction recorded the lowest population of parasitized aphids and proved to be least safe botanical. According to Rathod *et al.* (2002), significant less mummification due to *D. rapae* was recorded in plots treated with NSE (5%) followed by neem oil (1%) and tobacco leaf extract (2%) and were found toxic to *D. rapae*.

All botanical treatments recorded significantly lower honey bee population than untreated control. Among the botanicals under investigation, ardusa leaf extract recorded significantly the highest (6.68) number of honey bees visits and proved to be safe plant material as it was at par with control. According to Singh (2006), the lowest numbers of foraging bees were recorded in the plots treated with neem oil mixed with conventional insecticides as compared to plots treated with neem oil and control.

Impact of various botanicals on yield attributing characters:

The data on yield attributing characters of mustard presented in Table 2. The highest number of grain, test weight, seed yield and per cent increase in seed yield was recorded from the plots treated with tobacco decoction cold and hot water extractions followed by Neem oil, NSKE and neem leaf extract. The mustard plots having ardusa leaf extract recorded the lowest number of grain, test weight and seed yield followed by azadirachtin (0.0008%) and azadirachtin (0.0006%). As such, ardusa leaf

extract proved to be least effective botanical as there was minimum per cent increase in seed yield over control.

Singh (1999) reported that Chetak (botanical insecticide) was the most effective treatment as it recorded higher yield and yield contributing parameters *viz.,* siliquae/plant (204.0), seed weight/plant (21.3 g), 1000 seed weight (7.3 g), per cent oil content (41.3%) and seed yield (17.0 q/ha) followed by neem seed kernel, Neemoline and Nimbecidine.

CONCLUSION

Among the various botanicals tested against aphid, *L. erysimi*, tobacco decoction (2%) extracted either with cold or hot water, neem oil, NSKE and neem leaf extract found effective. Ardusa leaf extract found to be safer to the natural enemies of aphid *viz.,* coccinellids, chrysopids, syrphid fly and *Diaeretiella rapae* and honey bees followed by azadirachtin, neem leaf extract, NSKE and neem oil. The highest seed yield was recorded from the plots treated with tobacco decoction cold water extraction followed by tobacco decoction hot water extraction, Neem oil, NSKE and neem leaf extract as compare to other treatments.

REFERENCES

Anonymous (2010a). http://faostat.fao.org

Anonymous (2010b). http://http://dacnet.nic.in/eands/latest_2009.htm

Awasti, V. B. (2002). Introduction to general and applied entomology. Scientific Publisher, Jodhpur (India) pp. 266-271.

Bakhetia, D. R. C. and Sekhon, B. S. (1989). Insect pests and their management rapeseed-mustard. *J. Oilseeds Res.,* **6**: 269-273.

Baraskar, D. K. (2007). Bio-efficacy of green pesticides against mustard aphid, *Lipaphis erysimi* (Kalt.) and its parasitoid, *Diaeretiella rapae* (Macintosh). *M. Sc. Ag. Thesis,* JNKVV., Jabalpur (M.P.): p 38.

Chanchal S. and Lal, M. N (2009). Bio-efficacy of plant extracts against mustard aphid, *Lipaphis erysimi* (Kalt.) in *Brassica* oilseed crop. *Crop Research*, **37**: 203-206.

Rathod, A. T., Tandale, M. B., Aherkar, S. K. and Lande, G. K. (2002). Bio-efficacy of herbal products against mustard aphid, *Lipaphis erysimi* Kalt. and its parasite *Diaeretiella rapae. Pestology,* **6**: 17-19.

Sharma, P. K. and Kashyap, N. P. (1998). Estimation of losses in three different oil seed *Brassica* crops due to aphid complex in Himachal Pradesh (India). *J. Ent. Res.,* **22**: 22-25.

Singh, C. P. (1999). Bio-efficacy of Chetak vis-à-vis other neem formulations against *Lipaphis erysimi* (Kaltenbach) on Mustard. *Pestology,* **23** (9): 54-56.

Singh, P. K. and Premchand (1995). Yield loss due to the mustard aphid *Lipaphis erysimi* (Kalt) in Eastern Bihar Plateau. *J. Appl. Zoological Res.,* **6**: 97-100.

Singh, P. K. (2006). Control of mustard aphid, *Lipaphis erysimi* (Kalt.) with combination of insecticides and neem oil and their safety to foraging bee. *Ind. J. Ent.,* **68** (4): 329-333.

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Table 1: Bio-efficacy of different botanicals against aphid, *L. erysimi* and its natural enemies in mustard

Treatments	Pooled over periods and sprays				Pooled over periods	
	Aphid index (0-5 scale)	No. of Predators / Plant		No. of chrysopid egg(s)/plant	Parasitized aphids/10 cm twig due to *D. rapae*	Honey bees visits/plant/3 minutes
		Coccinellids (Grubs & Adults)	Syrphid fly (Larvae)			
1	2	3	4	5	6	7
Azadirachtin 0.0006%	1.48 c (1.69)	0.92ab (0.35)	1.16c (0.85)	0.88c (0.27)	1.46b (1.63)	2.47 (5.60)
Azadirachtin 0.0008%	1.48 c (1.69)	0.89a (0.29)	1.15c (0.82)	0.87c (0.26)	1.47b (1.66)	2.55 (6.00)
NSKE 5%	1.27 b (1.11)	0.89a (0.29)	1.09ab (0.69)	0.83bc (0.19)	1.38ab (1.40)	2.62 (6.36)
Neem Leaf Extract 10%	1.28 b (1.14)	0.92ab (0.35)	1.13bc (0.78)	0.86c (0.24)	1.46b (1.63)	2.50 (5.75)
Ardusa Leaf Extract 10%	1.49 c (1.72)	0.98b (0.46)	1.27d (1.11)	0.95d (0.40)	1.64c (2.19)	2.68 (6.68)
Tobacco decoction2% (Hot water extract)	1.05 a (0.60)	0.87a (0.26)	1.07ab (0.64)	0.76a (0.08)	1.38ab (1.40)	2.62 (6.36)
Tobacco decoction2% (Cold water extract)	1.02 a (0.54)	0.86a (0.24)	1.04a (0.58)	0.77ab (0.09)	1.32a (1.24)	2.53 (5.90)
Neem oil 0.5%	1.08 a (0.67)	0.89a (0.29)	1.12bc (0.75)	0.83bc (0.19)	1.37ab (1.38)	2.50 (5.75)
Control	1.70 d (2.39)	1.07c (0.64)	1.45e (1.60)	1.09e (0.69)	1.86d (2.96)	2.55 (6.00)
Mean	1.32 (1.24)	0.92 (0.35)	1.17 (0.87)	0.87 (0.26)	1.48 (1.69)	2.56 (6.05)

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ANOVA

S. Em. ±	0.05	0.03	0.02	0.02	0.03	0.05
Treatment (T)	0.01	0.01	0.01	0.01	0.02	0.04
	0.01	0.00	0.01	0.01	-	-
Period (P)	0.02	0.01	0.02	0.02	0.05	0.13
Spray (S)	0.01	0.01	0.01	0.01	-	-
T x P	0.02	0.02	0.03	0.03	-	-
T x S P x S T x P x S	0.03	0.03	0.04	0.04	-	-
C. D. at 5%	0.16	0.08	0.06	0.06	0.10	NS
T	0.02	0.02	0.03	0.03	0.06	0.12
P	0.01	0.01	0.02	NS	-	-
S	NS	NS	NS	NS	0.15	NS
T x P	0.03	0.02	0.04	0.04	-	-
T x S	0.06	NS	NS	0.08	-	-
P x S T x P x S	NS	NS	NS	NS	-	-
C. V. %	8.19	7.04	6.79	8.08	6.03	8.98

Notes:

1. Figures in parentheses are retransformed values; those outside are $\sqrt{X + 0.5}$ value.

2. Treatment mean with letter(s) in common are not significant at 5 % level of significance within a column.

Table 2: Impact of various botanical insecticides on yield attributing characters and seed yield of mustard.

Treatments	No. of grains/pod	Test weight (g)	Seed yield (q/ha)	Increase in Yield over control (%)
1	2	3	4	5
Azadirachtin 0.0006%	10.09de	4.68bc	10.81c	37.18
Azadirachtin 0.0008%	10.14de	4.78bc	11.04bc	38.50
NSKE 5%	10.90bcd	5.21ab	12.84ab	47.11
Neem Leaf Extract 10%	10.84cd	4.81bc	11.55bc	41.21
Ardusa Leaf Extract 10%	9.56e	4.65c	9.92c	31.55
Tobacco decoction 2% (Hot water extract)	11.91ab	5.55a	13.93a	51.25
Tobacco decoction 2% (Cold water extract)	12.01a	5.72a	13.95a	51.32
Neem oil 0.5%	11.86abc	5.37a	13.68a	50.36
Control	9.28e	4.43c	6.79d	-
Mean	10.73	5.02	11.61	-
ANOVA				
S. Em. ±	0.34	0.18	0.61	-
C. D. at 5%	1.02	0.55	1.84	-
C. V. %	5.49	6.29	8.99	-

Notes:

1. Treatment mean with letter(s) in common are not significant at 5 % level of significance within a column

2. Increase in yield over control = (Yield of treatment – Yield of control) / Yield of treatment X 100