ECRONICON OPEN ACCESS

AGRICULTURE
Research Article

Effect of Sources of Supply of Organic Manure to Mustard (*Brassica juncea*) On Mustard Aphid (*Lipaphis erysimi* Kalt) Population

Mukesh K Singh* and Paras Nath

Department of Entomology and Agricultural Zoology, Institute of Agricultural Sciences, Banaras Hindu University, India

***Corresponding Author:** Mukesh K Singh, Department of Entomology and Agricultural Zoology, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, U.P, 224105, India.

Received: January 08, 2015; **Published:** May 13, 2015

Abstract

The experiment was conducted to know effects of sources of supply of organic manure to mustard (*Brassica juncea*) on mustard aphid (*Lipaphis erysimi*) population build up at research farm of Banaras Hindu University, Varanasi. The results of the experiment reveal that the maximum aphid population was developed in plots where NPK was applied at recommended rate through chemical fertilizers while minimum in the plot where green manure +50 tonnes compost ha^{-1} were applied. The average aphid population per plant (top 15 cm of central shoot) was in increasing order 22.95, 27.06, 32.23 and 39.71 in the plots applied with green manure (GM) + 50 tonnes compost ha^{-1}, green manure +25 tonnes compost ha^{-1}, green manure and NPK applied plots ha^{-1}, respectively, on seasonal average basis. The differences among the treatments were found significant. The average aphid population was found at its peak on 15th February, while minimum in the early and last stage of infestation i.e. 28th December (2.92) and 1st March (8.56), respectively. The differences among average weekly aphid population change were also found significant among each other.

Keywords: *Mustard aphid; Lipaphis erysimi; organic aphid management; effect of plant nutrition on pest*

Introduction

Groundnut, rapeseed-mustard, sunflower, soybean, safflower, sesame and Niger comprise the group of seven species yielding high grade edible oil. The non-edible oil producing species include castor and linseed.

Now India is the world's second largest producer of groundnut and rapeseed-mustard next to China [1] and held a premiere position in global oilseed production and ranked second in world oilseed production and 13th in productivity during 1997 [1]. In international trade Indian position is in both group as exporter as well as importer, it imports edible oil and exports oilseed, oil cake, castor oil, minor oil and fats, but its export value is always higher than import except in 1998-99 [2]. Among the various edible oilseed crops in India, rape seed-mustard (*Brassica sp*) could rarely find second most important place after groundnut and probably ranks first as oilseed crop of north India. In India, the states, which grow rapeseed-mustard crops grows in sizeable acreage, are Rajasthan, Uttar Pradesh, Madhya Pradesh, Punjab, West Bengal, Gujarat. In India the area under the Brassica sp oil seeds, 80% covered with *Brassica juncea* L. The share of total oilseeds crop has increased from 10 percent in 1980-81 to about 14 percent currently of total agricultural production.

Bakhetia [3] has reported from Ludhiana (Punjab) a total of 38 species of insect pests associated with rape seed and mustard crop at one or other stages of crop growth. Among them mustard aphid, *Lipaphis erysimi* (Kaltenbach) is the most serious one and cause yield loss varying from 35.4 to 73.30 percent with an average loss of 54.20 percent on all India basis. The losses due to insect pests in *Brassica* oil seed were estimated to be Rs 20,000 crore in 1996 [4]. Climatic requirement of mustard well suit the mustard aphid which being a prolific breeder, attains exponential number within a very short time span. Among the various control measures available to manage the pest,

chemical pest management tools are widely adopted. Continuous and indiscriminate use (including misuse and over use) of broad spectrum insecticides to manage the pest unknowingly leads to several ill effects. The use of hazardous chemicals has been also restricted/ banned for use in agriculture and facilitate IPM and to promote healthy and safe environment [5].

Public perception in India, about environment hazards, risk and quality food has been gaining high priority [6]. The significant role played by predators like Coccinellids, dragonflies and lacewings in suppressing the insect pest is well recognised [7]. Keeping these facts in mind this research programme was initiated.

Materials and Methods

The field experiment was conducted to fulfil the objective thereby ascertaining the effect of sources of supply of organic manure and dates of sowing on the mustard aphid population and its natural enemies at the Agricultural Research Farm of the Banaras Hindu University, Varanasi. The experiments were laid in Randomized Block Design with three replications along with two meter distance between blocks and one meter among plots. The net plot area was maintained $15m^2$ (5 x 3) with planting geometry 40 x 20 cm.

Treatments: The green manure was applied by '*dhaincha*' (*Sesbania aculeata*) sown in August and 45 days old dhaincha was turned down by soil turning plough and compost was applied 15 days before mustard sowing while NPK fertilizers were applied at the time of sowing at treatment wise requirements. The treatment details was as follows

S. No.	Treatment Index	Treatments Details	Sources of Supply
1.	T_1	Green Manure	*Dhaincha* (*Sesbania aculeata* L)
2.	T_2	Green Manure + 25 tonnes compost ha^{-1}	*Dhaincha* as green manure and decomposed cow dung as compost.
3.	T_3	Green Manure + 50 tonnes compost ha^{-1}	Dhaincha as green manure and decomposed cow dung as compost.
4.	T_4	NPK 80:60:40 ha^{-1}, respectively	Chemical fertilizers: Urea, Di-ammonium phosphate and Muriate of Potash.

Table 1: *Details of treatments and their sources of supply*

Crop culture: The experimental field was given light irrigation. The field was ploughed twice with tractor drawn disc harrow and twice with cultivator followed by planking to pulverize the soil and to level the field. The test cultivar was 'Varuna' which is commonly grown by the farmers' of the region. The crop was sown in furrow opened by *kudal* (hand shovel). The final planting geometry was maintained by thinning after 25 day of sowing and standard method of cultivation and intercultural operations were done to grow healthy crop.

Observation: The aphid population were recorded at weekly interval with the help of tally counter on randomly selected and tagged plants till harvest on top 15 cm of central shoot.

Analysis of Data: The collected population data of mustard aphid and its natural enemies were transformed as square root transformation ($\sqrt{n+1.0}$) as suggested by Heinrich., *et al*. [8]. However the seed yield data were analysed without transformations. The analysis of variance (ANOVA) was made by using Randomized Block Design and the calculated 'F' was compared with tabulated 'F' at five per cent level of significance [9] and CD was calculated.

Results and Discussion

The population of mustard aphid was recorded maximum in plots applied with NPK at recommended doses (80:60:40 kg ha-1, respectively) through chemical fertilizers, followed by green manure (GM), green manure +25 tonnes $compost^{-1}$, green manure +50 tonnes compost ha^{-1} (Table 2). The population recorded in the mustard crop having different sources of nutrients supply differed significantly. The population recorded at weekly intervals showed increasing trends during the entire cropping season up to the 17th February when it

was at its peak, while minimum population was recorded on 30th December i.e. initial stage of infestation. The population decreased after 17th February abruptly and disappeared. The population recorded at weekly intervals differed significantly except 3rd and 24th February, which was found to be at par with each other.

Weekly population	Mean aphid population (15 cm top central shoot^{-1})				
	Sources of supply of organic manure				Average
	GM	GM + Compost (25 tonnes ha^{-1})	GM + Compost (50 tonnes ha^{-1})	NPK	
30th December	2.89 (1.83)	1.78 (1.54)	1.78 (1.56)	4.09 (2.17)	2.63 (1.78)
6th January	5.71 (2.51)	4.29 (2.23)	3.91 (2.10)	8.38 (3.02)	5.57 (2.47)
13th January	9.87 (3.25)	8.02 (2.95)	7.22 (2.80)	13.84 (3.83)	9.74 (3.21)
20th January	15.47(4.04)	12.58 (3.67)	11.20 (3.47)	18.64 (4.42)	14.47 (3.90)
27th January	20.84 (4.67)	17.96 (4.35)	15.76 (4.08)	25.16 (5.10)	19.93 (4.55)
3rd February	28.33 (5.40)	24.73 (5.05)	21.89 (4.78)	34.27 (5.93)	27.31 (5.29)
10th February	50.58 (7.14)	43.60 (6.64)	37.49 (6.15)	65.40 (8.13)	49.27 (7.02)
17th February	134.93 (11.34)	120.07 (10.67)	101.82 (9.87)	158.27 (12.44)	128.77 (11.08)
24th February	28.04 (5.28)	22.38 (4.76)	16.16 (4.42)	41.02 (6.38)	26.90 (5.22)
3rd March	10.11 (3.20)	6.89 (2.63)	4.71 (2.20)	12.93 (3.54)	8.66 (2.89)
Average	30.68 (4.87)	26.23 (4.45)	22.19 (4.14)	38.20 (5.50)	
Difference between sources of supply of organic manure C.D. (P = 0.05) = 0.23 Difference between weekly population C.D. (P = 0.05) = 0.15 Interaction between sources of supply of organic manure x Weekly population C.D. (P = 0.05) = 0.30					

Table 2: *Effect of sources of supply of organic manure on the weekly population change of mustard aphid (L. erysimi) infesting Indian mustard during first cropping season. Figures in parentheses are transformed as* $\sqrt{n+1}$.

It is evident from the Table 3 that the plots applied with chemical fertilizers showed higher number of mustard aphid in comparison with the crop receiving organic manure. Maximum aphid population was recorded in plots applied with chemical fertilizers (NPK), followed by green manure, green manure +25 tonnes compost ha^{-1}, green manure +50 tonnes compost ha^{-1}. The aphid population in different treatment plots recorded differed significantly, except the plot treated with GM and NPK; GM +25 tonnes compost ha^{-1} and GM +50 tonnes compost ha^{-1} which were found at par with each other in their respective group. The population of mustard aphid observed at weekly interval differed significantly except the population observed on 3rd January and 28th February which was at par with each other. The interaction effect of sources of organic manure and weekly population was also found to have significant impact on the population build up of *L. erysimi*. The pooled data observed in two consequent cropping season exhibited the minimum aphid population in the plots applied with green manure +50 tonnes compost ha^{-1} and maximum aphid population recorded in the plots applied with chemical fertilizers (NPK) as source of nutrients. The population observed in different treatment plots varied significantly except those recorded in green manure +25 tonnes compost ha^{-1} and green manure +50 tonnes compost ha^{-1} which were found at par with each other. The population recorded at weekly intervals exhibited maximum number on 15th February and minimum on 28th December. The population recorded at weekly interval also differed significantly. The interaction effect of weekly aphid population and sources of organic manure was also found to have significant difference.

Weekly population	Mean aphid population (15 cm top central shoot^{-1})				
	Sources of supply of organic manures				Average
	GM	GM + Compost (25 tonnes ha^{-1})	GM + Compost (50 tonnes ha^{-1})	NPK	
27th December	3.47 (2.02)	2.49 (1.78)	1.56 (1.52)	5.51 (2.49)	3.26 (1.95)
3rd January	7.29 (2.84)	5.36 (2.49)	4.20 (2.24)	9.78 (3.23)	6.66 (2.70)
10th January	12.02 (3.56)	8.87 (3.11)	7.04 (2.81)	14.78 (3.92)	10.68 (3.35)
17th January	18.20 (4.42)	14.69 (3.94)	12.13 (3.60)	21.89 (4.77)	16.73 (4.18)
24th January	25.42 (5.13)	20.47 (4.62)	16.69 (4.19)	30.36 (5.59)	23.22 (4.89)
31st January	34.56 (5.96)	29.02 (5.47)	24.29 (5.13)	40.96 (6.47)	32.21 (5.76)
7th February	44.40 (6.74)	37.91 (6.24)	32.13 (5.75)	55.42 (7.50)	42.47 (6.56)
14th February	157.53 (12.17)	133.71 (11.22)	115.96 (10.45)	187.67(13.21)	148.72 (11.76)
21st February	25.36 (4.93)	20.53 (4.45)	15.53 (3.85)	30.73 (5.38)	23.04 (4.65)
28th February	9.60 (3.12)	7.47 (2.75)	5.87 (2.33)	10.71 (3.02)	8.41 (2.80)
Average	33.78 (5.09)	28.05 (4.61)	23.54 (4.19)	40.78 (5.56)	
Difference between weekly population C.D. (P = 0.05) = 0.14 Difference between sources of supply of organic manure C.D. (P = 0.05) = 0.95 Interaction between weekly population x sources of supply of organic manure C.D. (P = 0.05) = 0.29					

Table 3: *Effect of sources of supply of organic manure on weekly population change of mustard aphid (L. erysimi) infesting Indian mustard during second cropping season Figures in parentheses are transformed as* $\sqrt{n+1}$.

The aphid population showed a trend where it increased with decrease in the supply of total organic matter in the treatment plots. The study indicated that the treatment green manure + compost 50 tonnes ha^{-1} exhibited minimum aphid population while in the treatment plots where the nutrient were supplied only with the chemical fertilizers (no organic matter was supplied); the maximum aphid population was recorded.

The main reason of higher aphid population in the plots applied with NPK fertilizer is because of the luxuriant and succulent crop growth in comparison to the crop nourished totally on the organic manure. Certainly NPK fertilizer applied crop received more quantity of major nutrients only in comparison to crop nourished on organic manure. In other way, the crop nourished on organic manures received comparatively less amount of major nutrients but received all essential nutrients in balanced forms. Simultaneously, bulk organic matter also improve soil health in terms of physical conditions like aeration and mineralization of nutrients in soil, so crop plant gets balanced nutrition and hardy in nature which will provide tolerance to insect pests.

The cause of more aphids may be due to more nitrogen content in the mustard plants applied with NPK fertilizers. Helenius [10] founds four times higher aphids (*Rhopalosiphum padi*) on barley in conventional farming in comparison to organically managed field. Mena., *et al*. [11] also reported that *Myzus persicae* and other aphids are more abundant on potato in conventional system in comparison to organically managed farms. The higher aphid population is reported from conventionally managed farms than the organically managed farms by more other workers viz., Morby., *et al*. [12] and Morby and Sotheriton [13]. Kienzle Zebitz [14] also recorded more aphid population in intensively managed apple orchards in comparison to ecologically managed orchards.

Weekly population	Mean aphid population (15 cm top central shoot^{-1})				
	Sources of supply of organic manure				Average
	GM	GM + Compost (25 tonnes ha^{-1})	GM + Compost (50 tonnes ha^{-1})	NPK	
28th December	3.18 (1.94)	2.13 (1.69)	1.67 (1.57)	4.69 (2.31)	2.92 (1.87)
4th January	6.50 (2.69)	4.79 (2.36)	4.06 (2.19)	9.08 (3.13)	6.11 (2.59)
11th January	11.00 (3.42)	8.44 (3.05)	7.13 (2.81)	14.33 (3.89)	10.23 (3.29)
18th January	16.80 (4.20)	13.63 (3.81)	11.67 (3.54)	20.27 (4.60)	15.59 (4.04)
25th January	23.13 (4.91)	19.19 (4.49)	16.43 (4.17)	27.87 (5.37)	21.66 (4.73)
1st February	31.44 (5.58)	26.68 (5.26)	23.64 (4.96)	37.61 (6.21)	29.84 (5.50)
8th February	47.49 (6.77)	40.76 (6.45)	34.81 (5.98)	60.41 (7.82)	45.87 (6.76)
15th February	146.23 (11.76)	126.89 (10.96)	108.89 (10.17)	175.19 (12.84)	139.30 (11.43)
22nd February	26.68 (5.11)	20.90 (4.55)	15.84 (3.99)	35.88 (5.92)	24.83 (4.89)
1st March	9.86 (3.18)	7.18 (2.70)	5.40 (2.27)	11.81 (3.33)	8.56 (2.87)
Average	32.23 (4.96)	27.06 (4.53)	22.95 (4.17)	39.71 (5.54)	
Difference between weekly population C.D. (P = 0.05) = 0.12 Difference between sources of supply of organic manure C.D. (P = 0.05) = 0.14 Interaction between weekly population x sources of supply of organic manure C.D. (P = 0.05) = 0.24					

Table 4: *Effect of sources of supply of organic manure on weekly population change of mustard aphid (L. erysimi) infesting Indian mustard (average of two cropping seasons) Figures in parentheses are transformed* $\sqrt{n+1}$.

The aphid population recorded at weekly interval showed that the aphid infestation started from the last week of December (25-30) in late sown Indian mustard crop and reach to its peak in middle of February (12-17) and goes down there after. The presence of aphid on crop was up to the maturity of the plant and this trend was recorded in both the cropping seasons. Sonkar and Desai [15] and Kumar., *et al*. [16] had also recorded the peak incidence of aphid in mid of February. The decline in population may be attributed to maturity of the mustard plant and also because of rise in temperature and decline in humidity, due to this environmental conditions became unfavourable for aphid development and hence aphid population after attaining the peak during mid-February.

Though, the use of organic manure reduces aphids up to a certain level. Although the productivity level certainly reduce in comparison to fertilized crop and chemically pest managed crop but increasing awareness to bad impact of pesticides, these products are more preferred by quality conscious consumers because free from all types of chemical residues. Our results were suggestive that balanced nutrition through organic sources giving better crop growth with increased level of tolerance to pest up to certain level. This is also a surest way to conserve natural biodiversity and compatible to the other pest management techniques.

Bibliography

1. Hazra SK. "Agriculture policy during tenth five year plan". *Agriculture Situation in India* (2002): 229-238.
2. Hegde DM. "Oilseeds: Technology for high yields". *The Hindu: Survey of Indian Agriculture* (2000): 65-69.
3. Bakhetia DRC. "Insect pest of rapeseed-mustard and their management". In: *Plant protection of field crops* (eds.) M Veerbhadra Rao and S Stananthan. PPTI, Rajendra nagar, Hyderabad (1987): 249-259.
4. Dhaliwal GS and Arora R. "Principle of insect pest management". National Agriculture Technology Information Center, Ludhiana. (1996): 374.
5. Chandurkar PS. "Plant protection: Dynamic approach helps". *The Hindu: Survey of Indian Agriculture* (2004): 145-146.
6. Singh P. "Agricultural Policy during the Tenth Five Year Plan". *Agriculture Situation in India* 59.8 (2002b): 223-228.

Citation: Mukesh K Singh and Paras Nath. "Effect of Sources of Supply of Organic Manure to Mustard (*Brassica juncea*) On Mustard Aphid (*Lipaphis erysimi* Kalt) Population". *EC Agriculture* 1.4 (2015): 176-181.

7. Rabindra RJ. "Integrated pest management: Role of biological control". *The Hindu: survey of Indian Agriculture* (2004): 141-142.
8. Heinrichs EA., *et al*. "Statistical analysis of insect population and plant damage manual for testing insecticides on rice". IRRI Manila Philippines (1981): 73-80.
9. Gomez KA and Gomez AA. "Statistical Procedures for Agricultural Research". (1976) 2nd edition, John Wiley & Sons. Inc. New York.
10. Helenius J. "Conventional and organic cropping systems at Suitia. VI Insect populations in Barley". *Agricultural Science in Finland* 62.4 (1990): 349-353.
11. Mena J., *et al*. "Ecological management of potato cropping systems". Proceedings of 9th International Scientific Conference IFOAM: Organic Agriculture, a key to a sound development and a sustainable environment 21 (1992): 67-73.
12. Moreby SJ., *et al*. "A comparison of the flora and arthropod fauna of organically and conventionally grown winter wheat in Southern England". *Annals of Applied Biology* 125.1 (1994): 13-27.
13. Moreby SJ and Sotherton NW. "A comparison of some important chick-food insects groups found in organic and conventionally grown winter wheat fields in southern England". *Biological Agriculture and Horticulture* 15.1-4 (1997): 51-60.
14. Kienzle J and Zebitz CPW. "Extensive mulch system a contribution towards increasing the diversity of beneficial arthropods in fruit production system". Contribution to the Fourth-Scientific meeting on Ecological Agriculture, Rheinische Friedrich-Wilhelms-Universitat Bonn. Schriftenreihe-Institut-fur-Organischen-Landbau 4 (1997): 192-198.
15. Sonkar UB and Desai BD. "Effect of sowing dates on the incidence of mustard aphid, *Lipaphis erysimi* (Kalt) on mustard". *Shashpa* 6.1 (1999): 41-44.
16. Kumar A., *et al*. "Screening of different germplasm entries of mustard against *Lipaphis erysimi* Kalt". *Advances in Agriculture Research* 5 (1996): 42-46.

Volume 1 Issue 4 May 2015