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Integrated management of mustard aphid, *Lipaphis erysimi* Kaltenbach in mustard crop

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Abstract

Field experiment on management of aphid through bio-insecticides was conducted during *Rabi* 2010-11 and 2011-12. It was found that mustard variety Rohini applied with Dimethoate (2ml/liter) gave maximum yield (22.5 q/ha) and incremental cost benefit ratio was (ICBR) 1:14.5, followed by the same variety of crop treated and applied with *Verticillium lecanii* (5g/liter) gave 20.9 q/ha production and ICBR 1:12.0. However mustard variety Urvashi applied with *Beauveria bassiana* (2g/liter) ranked last producing 9.1 q/ha and ICBR 1:0.1. On the basis of toxicity against *Coccinella septempunctata* the order was *Beauveria bassiana* > Neemarin > *Verticillium lecanii* > Dimethoate. It may be concluded that the expression of growth, yield and net profit of mustard under the agro-climatic conditions of central plain zone of U.P. can be enhanced by application of bio-insecticides *Verticillium lecanii* at timely application.

Keywords: Bio-insecticides, efficacy, *Lipaphis erysimi*, mustard aphid, natural enemies

Introduction

Mustard aphid (*Lipaphis erysimi* Kalt.) have been reported as a major constraint responsible for this low yield level, which causes average yield losses ranging 27.3- 94.5% in Indian mustard due to aphid in U.P. (Singh and Malik, (1998)^[13], Singh *et al.*,(2000)^[10] and Malik *et al.*, (2003)^[7].

The infestation of aphid in rapeseed-mustard causes losses in seed yield along with the oil content in seeds. However, numbers of chemicals have been recommended for the management of this pest by several workers, but their indiscriminate use for suppressing the pest population increases the environmental hazards (Kumar *et al.*, 2000)^[5]. Use of insecticides for the management of insect- pests in different crops is an integral part of integrated pest management, which should be eco-friendly, economically viable and socially acceptable. A number of newer chemicals have been registered in different groups for their better efficacy against different insect-pests.

Thus, it is imperative to find out a selective molecule for the cost effective management of mustard aphid. Therefore, efforts were made to determine the efficacy and economics of some newer insecticides for the management of mustard aphid on Indian mustard in central Uttar Pradesh.

Materials and Methods

The details of integrated management of the pest in mustard crop are parameter as follows:-

Geographical situation

Geographically, Kanpur is situated in the sub tropics with semi arid climate and situated between 25° 26' – 28° 58' North and longitude 79° 31' – 80° 34' East longitude at a height of about 125.9 meter above the sea level. The mean annual rain fall is about 800 mm in this area. The experimental plot of trial consisted of alluvial soil, well drained and irrigated with tube well.

Selection of the varieties

The most popular varieties of Indian mustard in Uttar Pradesh like Varuna, Vardan, Rohini and Urvashi were selected to carry out the investigation on population dynamics of mustard aphid in other experiments executed on management of aphid.

Field experimentation

The experiments for the management of aphid on mustard were sown in the second week of November during both the years. The trial was conducted as per the treatments in 2.8 x 5m² net plot size replicated thrice with Split Plot design. Crop geometry of 45 x 10 cm was maintained by thinning and gap filling.

Observations

The mean aphid infestation indices were recorded on ten randomly selected plants, on 10 cm top shoot /inflorescence of the main shoot/plant. In management of aphid through bio-insecticides, the intensity was recorded 1, 3, 7 and 14 days after each spray, in as per techniques used by Bakheta *et al.* (1989) [2].

Management of mustard aphid through bio-insecticides application

For testing the bio-efficacy of bio-insecticides like *Beauveria bassiana* (2g/liter), *Verticillium lecanii* (5g/liter), Neem oil (3ml/liter) and Dimethoate (2 ml/liter) was sprayed twice in field condition starting from aphid appearance.

Results and Discussion

Effect of different treatments on aphid (*Lipaphis erysimi* Kalt.) after spray during 2010-11

The effect of different insecticides on population of aphid (*Lipaphis erysimi* Kalt.) on Urvashi mustard variety after first spray all the treatments *Beauveria bassiana* @ 2g/litre, *Verticillium lecanii* @ 5g/litre, Neemarin (Neem oil) @ 3ml/litre and Dimethoate @ 2.0 ml/litre were found effective on Urvashi varieties. Dimethoate @ 2.0ml/litre of water was significantly minimised up to 9.24 aphid/plant of terminal top

shoot/plant over other insecticide followed by *Verticillium lecanii* @ 5g/litre of water having 11.83 aphids/10 cm terminal shoot/plant, while Neemarin @ 3ml/litre of water having 14.28 aphids/10 cm terminal shoot/plant, *Beauveria bassiana* @ 2g/litre of water having 17.22 aphid/plant of terminal shoot/plant, than 19.9 aphids/10 cm terminal shoot/plant in control. The observation recorded after 03day after spraying on Urvashi variety proved that all treatments were better against mustard aphid. Dimethoate @ 2.0 ml/litre of water was distinctly superior with 6.81 aphid/10 cm terminal shoot/plant compared to the *Verticillium lecanii* @ 5g/litre of water having 10.43 aphids, while Neemarin @ 3ml/litre of water was having 12.46 aphid/plant, *Beauveria bassiana* @ 2g/litre of water having 14.06 aphids/10 cm terminal shoot/plant as compared to control 26.63 aphids/10 cm terminal shoot/plant. It is evident from after 07day of spray showed that Dimethoate @ 2.0 ml/litre of water was most superior with 5.15 aphid/plant terminal top shoot/plant compared to *Verticillium lecanii* @ 5g/litre of water having 8.24 aphid/plant followed by Neemarin @ 3ml/litre of water having 10.30 aphid/10 cm terminal shoot/plant, *Beauveria bassiana* @ 2g/litre of water having 11.49 aphids/10 cm terminal shoot/plant and 65.12 aphids/10 cm terminal shoot/plant in control. (Table: 1 & Fig. 1)After 14 day of spray the treatment Dimethoate @ 2.0 ml/litre of water was found more superior with 8.70 aphid/plant followed by *Verticillium lecanii* @ 5g/litre of water having 11.76 aphids/10 cm terminal shoot/plant. Neemarin @ 3ml/litre of water with 13.91 aphid. The *Beauveria bassiana* @ 2g/litre of water had 17.06 aphid/10 cm terminal shoot/plants compared to 118.8 aphid/10 cm terminal shoot/plants in control during 2010-11.

Table 1: Management of mustard aphid (*Lipaphis erysimi* Kalt.) through bio-insecticides

| Treatments | Year 2010-11 | | | | | | | | Year 2011-12 | | | | | | | |
|-----------------------------|-----------------------|-----------------|-----------------|-----------------|-----------------------|-----------------|------------------|------------------|-----------------------|-----------------|-----------------|------------------|-----------------------|-----------------|------------------|------------------|
| | 1 st Spray | | | | 2 nd Spray | | | | 1 st Spray | | | | 2 nd Spray | | | |
| | 01Day | 03Day | 07Day | 14Day | 01Day | 03Day | 07Day | 14Day | 01Day | 03Day | 07Day | 14Day | 01Day | 03Day | 07Day | 14Day |
| <i>Beauveria bassiana</i> | 17.22 (4.15) | 14.06 (3.75) | 11.49 (3.39) | 17.06 (4.13) | 14.89 (3.86) | 13.24 (3.64) | 11.62 (3.41) | 9.92 (3.15) | 19.36 (4.40) | 15.76 (3.97) | 12.89 (3.59) | 17.22 (4.15) | 14.82 (3.85) | 12.82 (3.58) | 11.36 (3.37) | 9.73 (3.12) |
| <i>Verticillium lecanii</i> | 11.83 (3.44) | 10.43 (3.23) | 8.24 (2.87) | 11.76 (3.43) | 10.95 (3.31) | 10.04 (3.17) | 9.06 (3.01) | 7.62 (2.77) | 13.32 (3.65) | 11.63 (3.41) | 9.49 (3.08) | 12.11 (3.48) | 10.37 (3.22) | 8.88 (2.98) | 7.78 (2.79) | 6.55 (2.56) |
| Neemarin (Neem oil) | 14.28 (3.78) | 12.46 (3.53) | 10.30 (3.21) | 13.91 (3.73) | 12.81 (3.58) | 11.49 (3.39) | 10.37 (3.22) | 9.00 (3.00) | 15.76 (3.97) | 13.18 (3.63) | 10.76 (3.28) | 13.99 (3.74) | 11.83 (3.44) | 10.56 (3.25) | 9.24 (3.04) | 8.12 (2.85) |
| Dimethoate | 9.24 (3.04) | 6.81 (2.61) | 5.15 (2.27) | 8.70 (2.95) | 4.58 (2.14) | 4.41 (2.10) | 3.61 (1.90) | 2.72 (1.65) | 8.94 (2.99) | 6.92 (2.63) | 4.41 (2.10) | 8.88 (2.98) | 6.60 (2.57) | 5.15 (2.27) | 4.12 (2.03) | 3.13 (1.77) |
| Control (Untreated) | 19.9 (4.47) | 26.63 (5.16) | 65.12 (8.07) | 118.8 (10.9) | 156.2 (12.5) | 193.2 (13.9) | 286.6 (16.93) | 344.4 (18.47) | 36.60 (6.50) | 80.10 (8.95) | 106.0 (10.3) | 150.0 (12.25) | 176.8 (13.3) | 210.6 (14.2) | 272.25 (16.5) | 390.0 (19.75) |
| SE(d) | 0.14 | 0.12 | 0.11 | 0.14 | 0.12 | 0.13 | 0.12 | 0.11 | 0.15 | 0.14 | 0.13 | 0.15 | 0.12 | 0.1 | 0.1 | 0.06 |
| CD (P=0.05) | 0.29 | 0.24 | 0.22 | 0.29 | 0.25 | 0.28 | 0.25 | 0.23 | 0.31 | 0.29 | 0.26 | 0.32 | 0.25 | 0.21 | 0.22 | 0.12 |

NB: T₁– *Beauveria bassiana* 2g/l, T₂– *Verticillium lecanii* 5g/l, T₃– Neemarin, 3ml/l, T₄– Dimethoate, 2ml/l, and Figures in parentheses are square root

transformed values $\sqrt{x} + 0.5$

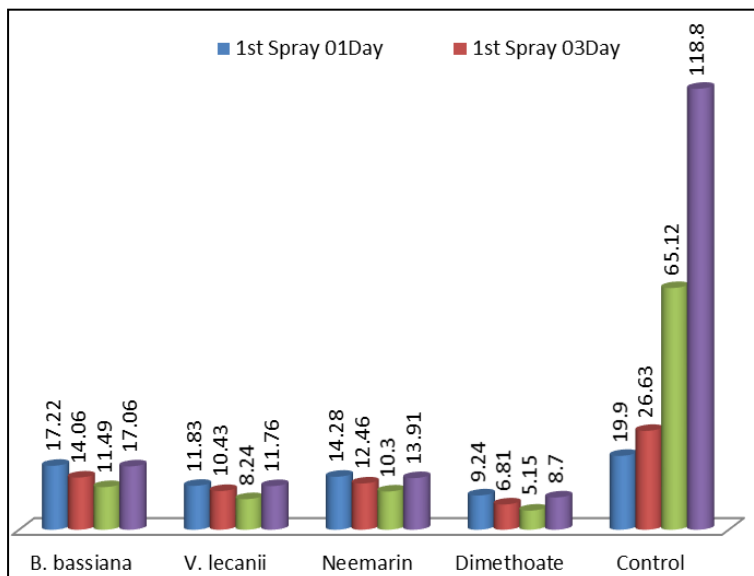


Fig 1: Management of mustard aphid through bio-insecticides 1st spray during 2010-11

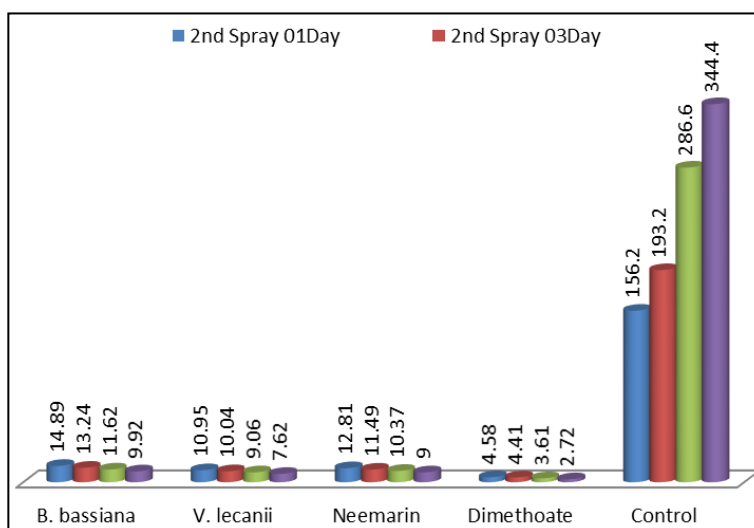


Fig 2: Management of mustard aphid through bio-insecticides 2nd spray during 2010-11

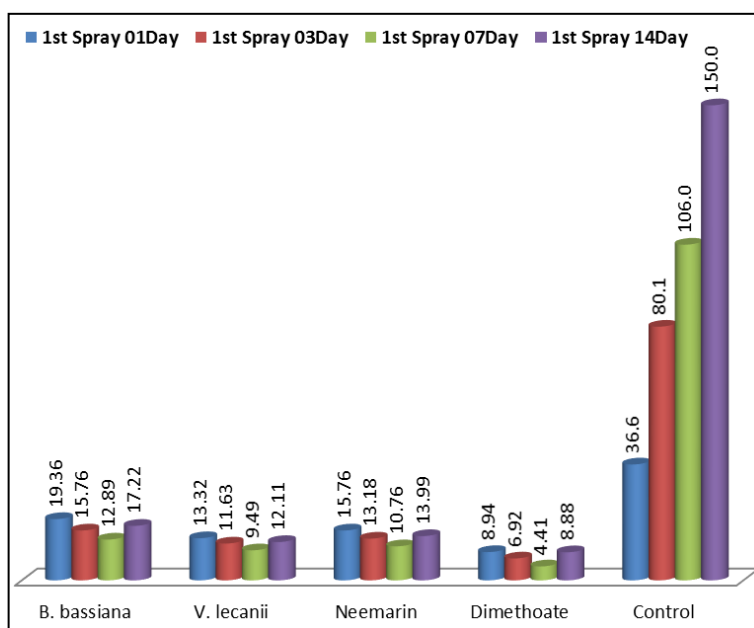


Fig 3: Management of mustard aphid through bio-insecticides 1st spray during 2011-12

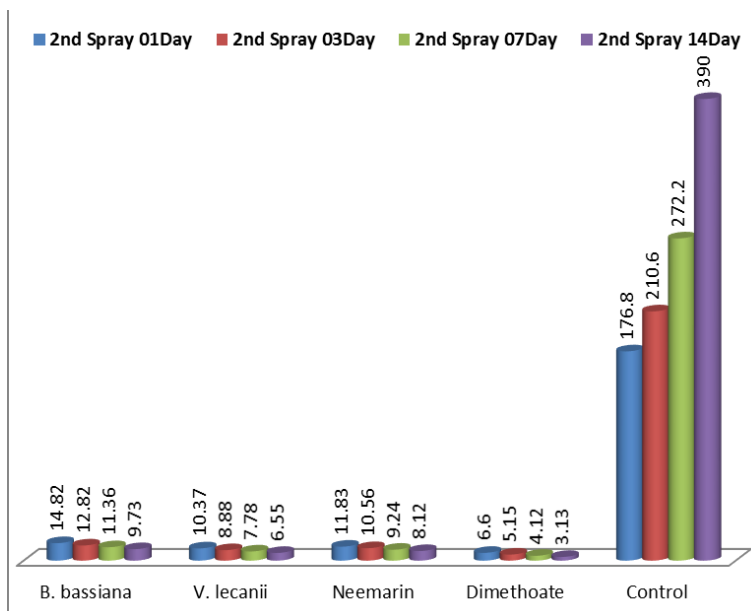


Fig 4: Management of mustard aphid through bio insecticides 2nd spray during 2011-12

Effect of different treatments on aphid (*Lipaphis erysimi*) after spray during 2011-12

The effect of different bio-pesticide were compared with insecticide on population of aphid (*Lipaphis erysimi* Kalt.) after first spray (01day after spray) on Urvashi variety, showed that *Beauveria bassiana* @ 2g/litre, *Verticillium lecanii* @ 5g/litre, Neemarin (Neem oil) @ 3ml/litre and Dimethoate @ 2.0 ml/litre. Dimethoate @ 2.0ml/litre of water was found maximum effective with 8.94 aphid/plant, followed by *Verticillium lecanii* @ 5g/litre of water having 13.32 aphids/10 cm terminal shoot/plant, Neemarin @ 3ml/litre of water with 15.76 aphids/plant, *Beauveria bassiana* @ 2g/litre of water having 19.36 aphid/plant terminal top shoot/plant compared control with 36.60 aphids/10 cm terminal shoot/plant. The data recorded after 03 day after spray showed that Dimethoate @ 2.0 ml/litre of water was found with lowest population of 6.92 aphids/plant followed by *Verticillium lecanii* @ 5g/litre of water having 11.63 aphid/10 cm twig shoot/plant Neemarin @ 3ml/litre of water having 13.81 aphids/plant, *Beauveria bassiana* @ 2g/litre of water having 15.76 aphid/plant terminal top shoot/plant comp 80.10 aphids/10 cm terminal shoot/plant in control. (Table: 2 & Fig. 3) showed that after 07 day after spray Dimethoate (@ 2.0 ml/litre of water) was most effective with 4.41 aphids/plant followed by *Verticillium lecanii* @ 5g/litre of water having 9.49 aphids/plant, Neemarin @ 3ml/litre of water having 10.76 aphids/plant and *Beauveria bassiana* @ 2g/litre of water having 12.89 aphids/10 cm terminal shoot/plant. In control 106.0 aphids/10 cm twig shoot/plant were recorded. indicated that after 14 day after spray Dimethoate @ 2.0 ml/litre of water was better with 8.88 aphids/plant followed by *Verticillium lecanii* @ 5g/litre of with water having 12.11 aphids/plant, Neemarin @ 3 ml/litre of water having 13.99 aphid/plant and *Beauveria bassiana* (@ 2g/litre of water) having 17.22 aphids/plant terminal top shoot/plant compared 150.0 aphids/10 cm terminal shoot/plant in control. Significantly maximum mean aphid population on *Beauveria bassiana* 1.15%WP treated crop with 9.92-17.22 and 9.73-19.36 aphids/10 cm twig shoot/plant during both the years proved to be the least combination as it received significantly highest aphid population. This provided seed yield of 12.69 and 11.77 q/ha during both the years, respectively. Maximum incremental net return of Rs 22749.6/ha with cost benefit ratio of 1:14.5 was gained from the Dimethoate 30 EC treated mustard crop both the years, respectively. Lowest minimum incremental net return of Rs 234.8/ha and cost benefit ratio of 1:0.1 was obtained from the application of *Beauveria bassiana* 1.15% WP treated mustard crop in both the years, respectively.

Conclusion

Among Dimethoate 30EC, *Verticillium lecanii* 1.15%, Neemarin 0.15% and *Beauveria bassiana* 1.15% WP, in Dimethoate 30EC was

superior in controlling aphid population. *Beauveria bassiana* 1.15% WP found lesser effective against mustard aphid.

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