**Evaluation of bio-pesticides against aphid, *Hyadaphis coriandri* (Das) on coriander**

**Abstract**

*Hyadaphis coriandri* (Das)is the major species of aphid-infesting coriander with a globe-wide distribution. Plant products or bio-pesticides are important alternatives to minimize or replace the use of synthetic chemical pesticides. The present experiment was conducted during *Rabi,* 2023 at Pt. S.K.S. College of Agriculture and Research Station, Rajnandgaon Chhattisgarh, in RBD design with seven treatments including six bio-pesticides and a popularly used chemical insecticide along with a control (no treatment) replicated thrice. Results revealed that in the evaluation of bio-pesticides against aphids, *H. coriandri* (Das)azadirachtin 0.15% (1500ppm) @ 3 ml lt-1 was found to be the second most effective bio-pesticide after the recommended chemical insecticide on coriander after both the sprays with highest yield over control (464.33 kg ha-1) which exhibited 76.89 per cent increase over control with an avoidable loss of 24.76 per cent.

***Keywords:***Coriander, bio-pesticide, aphid (*Hyadaphis coriandri* Das), *Beauveria bassiana*

**Introduction**

*Coriandrum sativum* (L.)is an important green leafy as well as seed spice crop. In Chhattisgarh, coriander is cultivated in an area of 15795 ha with 75901 Mt production along with a productivity of 4.82 Mt ha-1. In Rajnandgaon district it is cultivated in a 562 ha area with a production of 2304 Mt, with a productivity of 4.10 Mt ha-1 (Anonymous, 2022). It attracts a large number of insects, predators, parasitoids and pollinators due to umbelliform inflorescence and the presence of huge quantities of nectar and volatile oils emitted from the plant (Gaikwad *et al*., 2020; Elango *et al*., 2017). Coriander is infested by aphids, *Hyadaphis coriandri* (Das), white fly (*Bemisia tabaci*) (Gennadius), green peach aphid (*Myzus persicae*) (Sulzer), mite (*Petrobia latens)* (Muller) and thrips (*Thrips tabaci*) (Lindeman) (Khan *et al*., 2018). The crop gets infested with a large number of insect pests which damage the crop right from germination of seed to maturity. The coriander aphid is reported as a major and regular pest, with initiation of infestation during early growth stages (15 to 25 days after germination). Aphid infestation starts on coriander during the full vegetative stage to flowering and becomes more severe at seed formation. In the absence of control measures, incurred a 40-50 % yield loss (Swami *et al*., 2018; Prajapati & Amin, 2019). In present-day agriculture, farmers are solely relying on chemical insecticides for pest management, and indiscriminate use of pesticides results in the accumulation of pesticide residues in the harvestable produce, development of resistance against insecticides, resurgence of minor pests, and mortality of non-target organisms such as natural enemies and pollinators, particularly honeybees (Khan *et al*., 2020, Moustafa *et al*., 2022). Therefore the present investigation is necessary to bridge the lacunae and to look at alternate and safer management modules. Keeping this in view, the present experiment on the evaluation of bio-pesticides against aphid, *H. coriandri* (Das) on coriander was conducted in the Rajnandgaon district of Chhattisgarh.

**Materials and Methods**

For the management of coriander aphid, *H. coriandri* (Das) by non-chemical/ bio-pesticides, the experiment was conducted during rabi 2023-24 at the Instructional farm of Pt, SKS College of Agriculture and Research Station, Rajnandgaon, Chhattisgarh. Different concentrations of non-chemical/ bio-pesticides *viz.* neem oil (crude) @ 5 ml lt-1, azadirachtin 0.15% (1500ppm) @ 3 ml lt-1, *Beauveria bassiana* 1.15 %WP(1×108 cfu/g) @ 10 ml lt-1, *Metarhizium anisopliae* 1.15% WP (1×108 cfu/g)@ 10 ml lt-1 and *Verticillium lecanii* 1.15% WP (1×108 cfu/g) @ 10 g lt-1 were applied on coriander crop (variety Chandrahasini). This experiment was laid out in randomized block design with three replications along with one insecticide imidacloprid 17.8SL @ 0.32 ml lt-1 and an untreated check for comparison. The treatments were applied twice, the first spray was given on the appearance of aphids, and the second spray was given after 15 days of the first spray. Five randomly selected plants were observed from each treatment; the number of nymphs and adults per 5cm shootswere counted by visual counting one day before application and subsequently 1, 3, 5, 7, 10, and 15 days after the treatment. The objectives of working out the economic profitability *viz.,* yield, increase in yield over control, and avoidable losses were calculated (Khosla, 1977).

$$Avoidable losses (\%)= \frac{Yield of treatment which gave the highest yield-Yield of respective treatment}{Yield of treatment which gave the highest yield}X100$$

**Results and Discussion**

The incidence of aphid (*H. coriandri*) was recorded before and post application of non-chemical/ bio-pesticides treatment based on population density at 5cm shootfromfive randomly selected plants. The aphid population in the pre-treatment observation ranged from 46.93 to 54.42 aphids per 5 cm shoot and showed a statistically non-significant difference between treatments denoting a uniform population. In post-treatment observation after 1, 3, 5, 7, 10, and 15 days of the first spray, all the tested doses of non-chemical/ bio-pesticides showed significant differences over untreated control. Among the treatments, azadirachtin 0.15% (1500ppm) @ 3 ml lt-1 was found second most effective after recommended insecticide with 32.76, 23.22, 18.96, 23.38, 27.02 and 26.89 aphids per 5 cm shoot, respectively. A similar trend of the result was found after 1, 3, 5, 7, 10, and 15 days of second spray, all the tested doses of non-chemical/ bio-pesticides showed significant differences over untreated control, azadirachtin 0.15% (1500ppm) @ 3 ml lt-1 was again found as the second most effective treatment after recommended insecticide with 22.84, 17.51, 16.24, 13.04, 14.07 and 14.60 aphids per 5 cm shoot, respectively (Table 1&2). All the treatments showed better yield over control. The highest yield over control was obtained under insecticidal treatment (imidacloprid 17.8SL @ 0.32 ml lt-1) with 617.13 kg ha-1 which depicted a 135.10 per cent increase over control. The yield of the second most effective treatment (azadirachtin 0.15% (1500ppm) @ 3 ml lt-1) after recommended insecticide was found 464.33 kg ha-1 which showed a 76.89 per cent increase over control with an avoidable loss of 24.76 per cent (Table 3). Thus, the application of azadirachtin 0.15% (1500ppm) @ 3 ml lt-1 proved to be the best non-chemical/ bio-pesticides regarding the management of aphid (*Aphis gossypii*) population on coriander.

The present results are in agreement with Chaudhary *et al*. (2015) who also found that among the six different neem-based insecticide formulations tested against coriander aphid, *H. coriandri*, azadirachtin 1500 ppm at 5 ml lt-1 was the most effective in reducing the population of aphids with the increased coriander seed yield of 1043 kg ha-1. Similarly, Megersa (2016) evaluated botanical extracts for the control of aphids in Ethiopia and revealed that garlic and neem were found superior on aphids under laboratory conditions. Thus, the present findings are in line with the reports of previous researchers.

**Conclusion**

In conclusion, the use of bio-pesticides, specifically azadirachtin 0.15% (1500ppm) at 3 ml lt-1, proved highly effective in controlling *H. coriandri* populations on coriander. This treatment was comparable to the recommended chemical insecticides in reducing aphid density and improving crop yield. The findings highlight the potential of azadirachtin as a sustainable, environmentally friendly alternative for pest control in coriander cultivation. By reducing aphid numbers and increasing yield, azadirachtin demonstrated its value in integrated pest management strategies. The results align with previous studies, further supporting the efficacy of neem-based products in pest management. Moreover, the positive impact on yield and reduced reliance on chemical pesticides emphasizes the importance of bio-pesticides in promoting more sustainable agricultural practices.

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**References**

Anonymous. (2022). Directorate Horticulture and Farm Forestry, Chhattisgarh, Department of Agriculture 2021-22, Government of Chhattisgarh, p.14

Chaudhary, H. R., Ali, M., Verma, P., Ram, B. and Jadon, C. (2015). Management of Coriander Aphid (*Hyadaphis Coriandri* Das) under Soybean–Coriander Cropping System. Int. J.Seed Spices., 5:98-99.

Elango, K., Sridharan, S., Saravanan, P.A. and Balakrishnan, S. (2017). Laboratory evaluation of insecticides and biopesticides against pomegranate aphid, *Aphis punicae Passerini*. IJCS., 5(5):1810-1812.

Gaikwad, B. B., Bhosle, B. B. and Bhede, B. V. (2020). Evaluation of different bio-pesticides against aphid on okra. Journal of Entomology and Zoology Studies, 8:339-45.

Khan, A. U., Choudhury, M. A. R., Islam, M. S., and Maleque, M. A. (2018). Abundance and Fluctuation Patterns of Insect Pests in Country Bean. J. Sylhet Agric.Univer., 5(2): 167-172.

Khan, A. U., Choudhury, M. A. R., Talucder, M. S. A., Hossain, M. S., Ali, S., Akter, T. and Ehsanullah, M. (2020). Constraints and solutions of country bean (*Lablab purpureus*L.) Production: A review. Acta Entomol. Zool., 1(2): 37-45.

Khosla, R. K. (1977). Techniques for assessment of losses due to pests and disease of rice. Indian Journal of Agricultural Science, 47(4):171-174.

Megersa, A. (2016). Botanicals extracts for control of pea aphid (*Acrythosiphon pisum*; Harris). Journal of Entomology and Zoology Studies,4(1): 623-627.

Moustafa, M.A., Amer, A., Al-Shuraym, L.A., Ibrahim, E.D., El-Hefny, D.E. and Salem, M.Z. (2022). Efficacy of chemical and bio-pesticides on cowpea aphid, *Aphis craccivora*, and their residues on the productivity of fennel plants (*Foeniculum vulgare*). Journal of King Saud University-Science, 34(3):101900.

Swami, D., Jat, B. L. and Dotasara, S. K. (2018). Population dynamics of insect pests of coriander and their correlation with biotic and abiotic factors. Journal of Entomology and Zoology Studies, 6:460-464.

Prajapati, B.G. and Amin, A.U. (2019). Field evaluation of different synthetic insecticides as well as bio-pesticides against coriander aphid, *Hydaphis coriandri* (Das). International J. Seed Spices.,(2):44-51

**Table 1: Effect of non-chemical/ bio-pesticides against coriander aphid (*H. coriandri*) on coriander after the first spray during 2023-24**

|  |  |  |  |
| --- | --- | --- | --- |
| **Nota****tion** | **Treatments** | **Dose /ha****(g or ml)** | **Mean aphid population** **(**Number of aphids/ 5cm shoot**)** |
| **Pre-****treatment** | **Post-treatment**  |
| **1 DAS** | **3 DAS** | **5 DAS** | **7 DAS** | **10 DAS** | **15 DAS** |
| **T1** | Neem oil(Crude) | 5 ml lt-1 | 54.42(7.44) | 44.42(6.74) | 32.31(5.73) | 31.29(5.65) | 32.62(5.79) | 33.00(5.83) | 33.38(5.85) |
| **T2** | Azadirachtin0.15% (1500PPM) | 3 ml lt-1 | 46.93(6.92) | 32.76(5.81) | 23.22(4.84) | 18.96(4.45) | 23.38(4.92) | 27.02(5.29) | 26.89(5.28) |
| **T3** | *Beauveria* *bassiana* 1.15 %WP1×108cfu/g | 10 ml lt-1 | 50.78(7.19) | 48.60(7.04) | 36.96(6.15) | 37.73(6.20) | 35.84(6.06) | 39.00(6.32) | 33.89(5.90) |
| **T4** | *Metarhiziumanisopliae*1.15% WP1×108cfu/g | 10 ml lt-1 | 49.27(7.08) | 43.67(6.68) | 36.11(6.07) | 35.76(6.03) | 33.00(5.81) | 36.71(6.14) | 34.40(5.95) |
| **T5** | *Verticillium lecanii*1.15% WP(1x108 CFU/gram) | 10 g lt-1 | 48.20(6.99) | 40.51(6.43) | 35.47(6.03) | 29.76(5.52) | 25.84(5.17) | 27.49(5.33) | 26.60(5.25) |
| **T6** | Imidacloprid 17.8SL | 0.32 ml lt-1 | 47.56(6.96) | 26.62(5.25) | 3.13(2.03) | 5.20(2.48) | 8.31(3.04) | 15.18(4.02) | 22.36(4.83) |
| **T7** | Untreated Control | - | 53.36(7.37) | 46.51(6.89) | 44.40(6.74) | 39.24(6.34) | 39.20(6.33) | 38.13(6.24) | 30.84(5.64) |
| **SEm ±** | **-** | **0.20** | **0.15** | **0.23** | **0.21** | **0.11** | **0.15** | **0.18** |
| **CD at 5%** | **-** | **NS** | **0.47** | **0.72** | **0.65** | **0.35** | **0.48** | **0.55** |

**Note**: Figure in parenthesis are root square transformed value, DAS= Days after spray

**Table 2:Effect of non-chemical/ bio-pesticides against coriander aphid (*H. coriandri*) on coriander after the second spray during 2023-24**

|  |  |  |  |
| --- | --- | --- | --- |
| **Nota****tion** | **Treatments** | **Dose /ha****(g or ml)** | **Mean aphid population** **(**Number of aphids/ 5cm shoot**)** |
| **Pre-****treatment** | **Post-treatment**  |
| **1 DAS** | **3 DAS** | **5 DAS** | **7 DAS** | **10 DAS** | **15 DAS** |
| **T1** | Neem oil(Crude) | 5 ml lt-1 | 32.78(5.80) | 24.76(5.08) | 19.27(4.35) | 17.91(4.50) | 14.87(3.97) | 14.84(3.97) | 15.62(4.07) |
| **T2** | Azadirachtin0.15% (1500PPM) | 3 ml lt-1 | 26.89(5.28) | 22.84(4.88) | 17.51(4.15) | 16.24(4.30) | 13.04(3.74) | 14.07(3.87) | 14.60(3.94) |
| **T3** | *Beauveria bassiana* 1.15 %WP1×108cfu/g | 10 ml lt-1 | 33.33(5.85) | 25.42(5.14) | 21.84(4.96) | 23.67(4.78) | 17.58(4.30) | 16.78(4.21) | 17.93(4.35) |
| **T4** | *Metarhiziumanisopliae*1.15% WP1×108cfu/g | 10 ml lt-1 | 34.93(5.99) | 26.02(5.20) | 21.98(4.99) | 23.93(4.79) | 17.04(4.24) | 16.76(4.21) | 18.67(4.43) |
| **T5** | *Verticillium lecanii*1.15% WP(1x108 CFU/gram) | 10 g lt-1 | 25.42(5.14) | 23.78(4.98) | 17.76(4.63) | 20.44(4.33) | 13.53(3.80) | 14.67(3.95) | 14.76(3.96) |
| **T6** | Imidacloprid 17.8SL | 0.32 ml lt-1 | 22.80(4.88) | 15.27(4.03) | 2.84(1.83) | 2.38(1.95) | 3.42(2.10) | 6.40(2.72) | 8.04(3.01) |
| **T7** | Untreated Control | - | 30.33(5.60) | 28.51(5.43) | 22.13(5.06) | 24.60(4.81) | 22.09(4.80) | 21.36(4.73) | 21.18(4.71) |
| **SEm ±** | **-** | **0.17** | **0.05** | **0.12** | **0.12** | **0.08** | **0.12** | **0.13** |
| **CD at 5%** | **-** | **NS** | **0.15** | **0.37** | **0.36** | **0.26** | **0.37** | **0.39** |

**Note**: Figure in parenthesis are root square transformed value, DAS= Days after spray

**Table3: Effect of non-chemical/ bio-pesticides on yield of coriander during 2023-24**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Notation** | **Treatments** | **Dose /ha****(g or ml)** | **Yield(kg/ha)** | **Increase in yield over control (%)** | **Avoidable losses (%)** |
| **T1** | Neem oil(Crude) | 5 ml lt-1 | 382.20 | 45.60 | 38.07 |
| **T2** | Azadirachtin0.15% (1500PPM) | 3 ml lt-1 | 464.33 | 76.89 | 24.76 |
| **T3** | *Beauveria* *bassiana* 1.15 %WP1×108cfu/g | 10 ml lt-1 | 282.47 | 7.61 | 54.23 |
| **T4** | *Metarhiziumanisopliae*1.15% WP1×108cfu/g | 10 ml lt-1 | 286.47 | 9.13 | 53.58 |
| **T5** | *Verticillium lecanii*1.15% WP(1x108 CFU/gram) | 10 g lt-1 | 428.50 | 63.24 | 30.57 |
| **T6** | Imidacloprid 17.8SL | 0.32 ml lt-1 | 617.13 | 135.10 | 0.00 |
| **T7** | Untreated Control | 5 ml lt-1 | 262.50 | 0.00 | 57.46 |
|  | **SEm ±** | **46.64** |  |  |
|  | **CD at 5%** | **145.29** |  |  |