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Evaluation of biorationals against *Myzus persicae* Sulzer (Aphididae: Hemiptera) on broccoli under net house

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Abstract

Myzus persicae Sulzer is an important sucking pest on broccoli under net house condition. It reduces the yield and economic value of the crop. Its population build up rapidly under net house or green house due to congenial conditions like elevated temperature, relative humidity and lack of natural enemies. Use of chemical insecticides have negative impact, like toxic residues in soil, water, air and food, resurgence and resistance of insect pests, and effect on human health and non-target organisms like natural enemies, pollinators, and other beneficial organisms. To overcome these problems there is a need for alternative ecofriendly management strategies. The study was conducted to evaluate efficacy of biorationals like azadirachtin, pongamia, spinosad and Entomopathogenic fungus viz., *Lecanicillium muscarium*, *Beauveria bassiana*, *Metarhizium rileyi*, *Metarhizium anisopliae* against *M. persicae*.

Keywords: *Myzus persicae*, broccoli, net house and biorationals

Introduction

Broccoli (*Brassica oleracea* var. *italica*) is a popular and nutritious vegetable crop that belongs to the family Cruciferae. It is known for its green, flowering heads and is widely cultivated in many parts of the world. Broccoli is a particularly rich source of vitamin C and vitamin K (Nagraj *et al.*, 2020) [8]. Broccoli crop production involves several key aspects, including cultivation practices, growth requirements, and pest management. Like other cruciferous crops, insect pests cause damage to broccoli and play a major role in reducing the yield.

The peach-potato aphid, *Myzus persicae* Sulzer, is one of the most important pests of economic crops. This pest damages plants both directly, by consuming nutrients and water, and indirectly, by transmitting plant viruses. With resistance to more insecticides than any other herbivorous insect pest, it holds the unenviable title of being highly resistant. Due to the development of its resistance to chemical pesticides, it is necessary to find other control options (Ali *et al.*, 2023) [3]. Keeping in view the economic and nutritive importance of broccoli and adverse effects of synthetic insecticides on human health and environment, the non-synthetic natural pest control approaches seem to be the novel alternatives of chemical insecticides. Biorationals like azadirachtin, pongamia, *Lecanicillium muscarium*, *Beauveria bassiana*, *Metarhizium rileyi*, *M. anisopliae*, spinosad were selected as safer alternatives for effective control of *M. persicae*, in order to support sustainable production with least environmental pollution.

Material and Methods

The study was conducted in net house at Hi-tech Horticulture Unit, University of Agricultural Sciences, Dharwad following randomized block design with 8 treatments and 3 replications during Rabi season 2022-23. Raised beds of 100 cm width and 15 cm height leaving 50 cm path between the beds were prepared. Broccoli seedlings (Green magic) were procured from nursery. The seedlings of 30 days old were transplanted in zigzag manner with a spacing of 45 cm × 45 cm in two rows in plot size of 10 m length and 1 m width. All the recommended agronomic practices were carried out during the experiment including plant protection measures except for the *M. persicae*.

Treatment details: The treatments listed below were targeted against *M. persicae*. The required quantity of spray solution was calibrated and treatments were imposed using a knapsack sprayer. Need-based application was carried out when pests reached peak level or ETL.

Table 1: Treatment details

Treatments	Treatment details	Dosage
T ₁	<i>Lecanicillium muscarium</i> (2x10 ⁸ cfu/g)	2 g/l
T ₂	<i>Beauveria bassiana</i> (2x10 ⁸ cfu/g)	2 g/l
T ₃	<i>Metarhizium rileyi</i> (2x10 ⁸ cfu/g)	2 g/l
T ₄	<i>Metarhizium anisopliae</i> (2x10 ⁸ cfu/g)	2 g/l
T ₅	Azadirachtin 3000 ppm	3 ml/l
T ₆	Spinosad 45 SC	0.2 ml/l
T ₇	Pongamia oil (2%)	3 ml/l
T ₈	Untreated check	-

Observations recorded: Observations were recorded from randomly selected five plants from each treatment and replication and were tagged. Pre-treatment observation was recorded a day before treatment (DBT) imposition and post treatment observations were recorded on 1, 5, 7 and 10 days after treatment imposition (DAT), respectively. The aphid population was counted from 1 cm² leaf area from three leaves of each selected plant.

Statistical analysis: The number in reduction of pest population over control due to biorational treatments was

calculated at the different time intervals. The data so obtained were subjected to ANOVA (Randomized Block Design) after following transformation ($\sqrt{x+0.5}$) values (Square root transformation). The significance of the difference among the treatment combination means were determined by Duncan's Multiple Range Test (DMRT) at 5% level of probability. Software like Microsoft excel and WASP 2.0 were used for aforesaid analysis.

Results

The study was carried out to evaluate efficacy of different biorationals against *M. persicae* on broccoli. The observations of *M. persicae* on broccoli before and after first spray are presented in Table-2.

Aphid population was found non-significant, indicating uniform distribution of population in all the treatments at 1 day before spray (DBS). At 1 day after spray (DAS) the treatments viz., azadirachtin 3000 ppm @ 3 ml/l was found significantly superior over remaining treatments by recording least aphid count of 14.89 per cm², which was at par with spinosad 45 SC @ 0.2 ml/l and pongamia oil @ 3 ml/l recorded 14.94 and 15.00 aphids per cm² and were significantly superior over *L. muscarium*, *B. bassiana*, *M. anisopliae* and *M. rileyi* respectively. Same trend was observed at 5, 7 and 10 DAS. Azadirachtin showed 56.85% reduction over control after 10 DAS which was followed by spinosad 45 SC, pongamia oil, *L. muscarium* and others.

Table 2: Evaluation of biorationals against *Myzus persicae* Sulzer under net house-First spray

Treatments	Dosage	No. of aphids/cm ² leaf area					Per cent reduction over control
		1 DBS	1 DAS	5 DAS	7 DAS	10 DAS	
<i>Lecanicillium muscarium</i> (2x10 ⁸ cfu/g)	2 g/l	17.23 (4.21)	15.96 (4.03) ^{bc}	9.75 (3.20) ^c	6.64 (2.67) ^c	3.89 (2.10) ^c	42.43
<i>Beauveria bassiana</i> (2x10 ⁸ cfu/g)	2 g/l	18.33 (4.34)	16.10 (4.06) ^{bc}	10.33 (3.29) ^{cd}	7.57 (2.84) ^d	4.24 (2.18) ^{cd}	37.59
<i>Nomuraea rileyi</i> (2x10 ⁸ cfu/g)	2 g/l	16.78 (4.16)	16.57 (4.13) ^{bc}	14.18 (3.83) ^e	10.43 (3.31) ^f	9.67 (3.19) ^e	17.19
<i>Metarhizium anisopliae</i> (2x10 ⁸ cfu/g)	2 g/l	16.38 (4.11)	16.26 (4.09) ^{bc}	11.12 (3.41) ^d	8.76 (3.04) ^e	6.82 (2.71) ^d	31.85
Azadirachtin 3000 ppm	3 ml/l	18.11 (4.31)	14.89 (3.92) ^a	6.22 (2.59) ^a	4.24 (2.18) ^a	2.01 (1.58) ^a	56.85
Spinosad 45 SC	0.2 ml/l	17.34 (4.22)	14.94 (3.94) ^{ab}	6.84 (2.72) ^{ab}	4.63 (2.30) ^a	2.84 (1.71) ^b	52.27
Pongamia oil (2%)	3 ml/l	18.52 (4.36)	15.00 (3.94) ^{ab}	9.58 (3.17) ^c	6.57 (2.66) ^c	3.21 (1.93) ^b	44.16
Untreated check	-	16.88 (4.17)	16.73 (4.15) ^c	15.8 (4.04) ^f	14.65 (3.89) ^e	14.35 (3.85) ^f	-
S. Em±		NS	0.07	0.05	0.05	0.04	
CV (%)		11.34	10.86	10.21	9.96	9.76	

DBS=Days before Spray, DAS=Days after Spray

Figures in parentheses are in square root transformation ($\sqrt{x+0.5}$)

Means followed by a common letter are not significantly different at 5% level by DMRT

Table 3: Evaluation of biorationals against *Myzus persicae* Sulzer under net house-Second spray

Treatments	Dosage	No. of aphids/cm ² leaf area					Per cent reduction over control
		1 DBS	1 DAS	5 DAS	7 DAS	10 DAS	
<i>Lecanicillium muscarium</i> (2x10 ⁸ cfu/g)	2 g/l	13.98 (3.81) ^{bc}	13.62 (3.76) ^c	9.32 (3.13) ^{bc}	5.24 (2.40) ^c	2.37 (1.69) ^{bc}	49.25
<i>Beauveria bassiana</i> (2x10 ⁸ cfu/g)	2 g/l	14.67 (3.89) ^{bc}	13.76 (3.78) ^{cd}	11.89 (3.52) ^c	8.12 (2.94) ^d	3.05 (1.88) ^c	39.34
<i>Nomuraea rileyi</i> (2x10 ⁸ cfu/g)	2 g/l	15.32 (3.98) ^c	15.11 (3.95) ^d	14.06 (3.82) ^d	12.84 (3.65) ^e	7.13 (2.76) ^d	18.74
<i>Metarhizium anisopliae</i> (2x10 ⁸ cfu/g)	2 g/l	14.20 (3.83) ^{bc}	14 (3.81) ^{cd}	12.89 (3.66) ^{cd}	8.84 (3.06) ^d	3.46 (1.99) ^c	35.19
Azadirachtin 3000 ppm	3 ml/l	11.56 (3.47) ^a	10.00 (3.20) ^a	6.84 (2.71) ^a	3.43 (1.98) ^a	1.82 (1.52) ^a	63.92
Spinosad 45 SC	0.2 ml/l	13.85 (3.79) ^b	11.13 (3.25) ^a	7.19 (2.83) ^{ab}	3.76 (2.06) ^{ab}	1.97 (1.61) ^{ab}	58.74
Pongamia oil (2%)	3 ml/l	14.23 (3.84) ^{bc}	13.1 (3.69) ^{bc}	11.97 (3.53) ^c	5.48 (2.45) ^{cd}	2.53 (1.74) ^{bc}	45.30
Untreated check	-	16.88 (4.17) ^d	16.57 (4.13) ^c	15.38 (3.98) ^e	14.94 (3.93) ^f	13.58 (3.75) ^e	-
S. Em±		0.07	0.06	0.06	0.05	0.04	
CV (%)		11.24	10.76	10.25	9.87	9.31	

DBS=Days before Spray, DAS=Days after Spray

Figures in parentheses are in square root transformation ($\sqrt{x+0.5}$)

Means followed by a common letter are not significantly different at 5% level by DMRT

Table-3 represents the results of second spray against *M. persicae*. Highest percent reduction of 63.92% was recorded with azadirachtin 3000 ppm @ 3 ml/l and was found significantly superior over all the treatments by recording

lowest aphid population of 1.82 per cm² of leaf area at 10 DAS. Spinosad 45 SC was comparatively less effective than azadirachtin which was at par with *L. muscarium*. During second spray *L. muscarium* gave better control of *M.*

persicae and registered 49.25% reduction over pongamia oil. *L. muscarium* is potential biocontrol agent on sucking

pests and since it is fungus it requires time for establishment and multiplication.

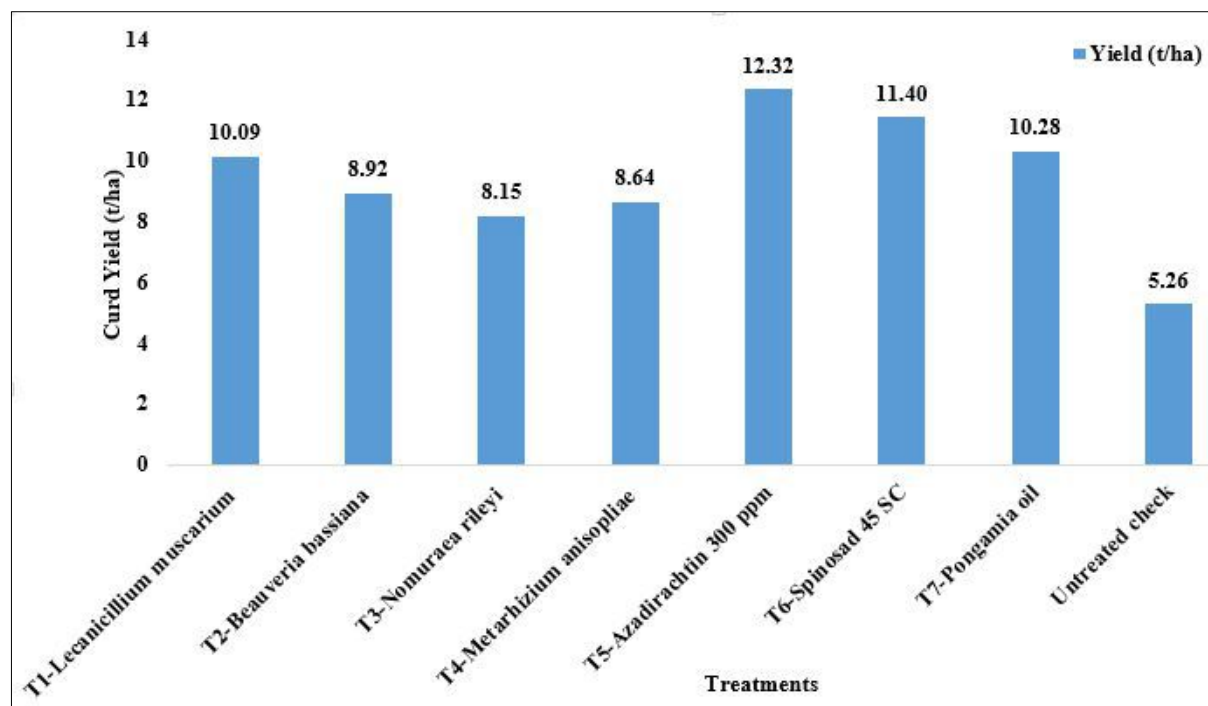


Fig 1: Yield of treatments used for management of *Myzus persicae* on broccoli

Broccoli curd yield obtained from different treatments under net house during *Rabi* 2022-23 are presented in Figure-1. All the treatments showed significant increase in yield over control. Azadirachtin 3000 ppm @ 3 ml/l recorded the highest yield of 12.32 tones per hectare and was superior over all the treatments followed by spinosad 45 SC @ 0.2 ml/l and pongamia oil @ 3 ml/l recorded 11.40 and 10.28 tones per hectare respectively. However, entomopathogens were also recorded comparable yield ranging from 8.15 to 10.09 tonnes per hectare.

Discussion

Broccoli (*Brassica oleracea* var *italica* L.) is a popular exotic and nutritious vegetable belonging to the family (Brassicaceae). Renowned for its densely packed green heads made up of compact flower buds, broccoli is grown for its consumable florets and stems, boasting a wealth of essential vitamins, minerals and dietary fiber. To cater to both domestic demands and exports, it holds significant cultivation importance, often raised in protective environments like net houses. The research aimed to develop strategies for controlling *M. persicae* using environmentally friendly approaches. The findings of this investigation are discussed and analyzed in relation to existing scholarly resources.

Among all the treatments azadirachtin 3000 ppm @ 3 ml/l was found significantly superior (63.92% reduction over control (ROC)) over remaining treatments in controlling aphid population and was at par with spinosad 45 SC (58.74% ROC). The next best treatment was *L. muscarium*, (49.25% ROC) and was found superior over other entomopathogens. Azadirachtin was highly effective in controlling aphid population under net house, it is recommended mainly for sucking pest. This compound has been shown to be an antifeedant and insect growth regulator. Azadirachtin is a complex compound and its exact mode of

action is still not fully understood. It is insect antifeedant at high concentrations and growth inhibitor at low concentrations to all the test insects if applied topically or by feeding (Mordue and Blackwell, 1993; Seymour *et al.*, 1995; Abudulai *et al.*, 2003) [7, 11, 1], due to its insecticidal nature azadirachtin was superior over all treatments in controlling aphids. Spinosad 45 SC @ 0.2 ml/l which is mainly recommended for defoliators also could control aphid population to some extent but it followed the azadirachtin. In second spray *L. muscarium* got superior over pongamia, since entomopathogens takes time to multiply and establish first and control later, hence delayed response of *L. muscarium* was observed. At 1 DAS slight reduction in pest population in treatments comprising of entomopathogens was noticed, it might be due to spray action. Research work is supported with following studies, (Shinde *et al.*, 2010) [12], found that *L. muscarium* (Zimm.) is a promising microbial biocontrol agent with a broad host range. Numerous studies have documented the natural infection of various insect pests by *L. muscarium*, with a notable prevalence among sucking insects like *M. persicae* and pests from the Homoptera, Hemiptera and Thysanoptera orders. Survival and fecundity and the effect of secondary metabolites of *L. muscarium* and *B. bassiana* on *Aphis gossypii* was evaluated by Gurulingappa (2011) [6]. *L. muscarium* and *B. bassiana* are important entomopathogens of *A. gossypii*. Their capacity to colonize crop plants is also becoming widely recognized, both fungi significantly reduced the rate and period of reproduction of *A. gossypii*. (Akbar *et al.*, 2010) [2], evaluated effect of biosal 10 EC, a neem formulation against aphid, *Myzus persicae* (Sulzer) (Aphididae: Hemiptera), on cabbage biosal performed well with 59.77% reduction. *B. bassiana* was more effective against *M. persicae* with a 40% reduction on broccoli, *B. bassiana* is also important for reducing the risk of pesticide resistance and maintaining environmental sustainability

(Dara, 2017) ^[14]. Significantly lower number of *A. gossypii* population (4.39 aphid/leaf) was recorded with the treatment of *Azadirachta indica* oil @ 3% followed by *Beauveria bassiana* (1x10⁸ cfu spores @ 8g/l) (6.01 aphid/leaf) and spinosad 45% SC @ 0.3ml/l (9.16 aphid/leaf), respectively resulting 92.89, 90.27 and 85.17 per cent reduction of *A. gossypii* population (Sankar *et al.*, 2022) ^[10].

Azadirachtin 3000 ppm @ 3 ml/l recorded the highest yield of 12.32 tons per hectare and was superior over all the treatments followed by spinosad 45 SC and pongamia oil under net house. However, entomopathogens were also recorded comparable yield ranging from 8.15 to 10.09 tons per hectare (Figure-1). Present results are in line with Dashrath (2018) ^[5] reported the curd yield of broccoli in different biopesticide treatments where the highest yield was recorded in NSKE 5% (12.10 t/ha), which was at par with treatments *Bacillus thuringiensis* (12 t/ha), Azadirachtin (11.90 t/ha), Neem oil (11.80 t/ha), *Beauveria bassiana* (11.75 t/ha) and *Metarhizium anisopliae* (11.65 t/ha).

References

1. Abudulai M, Shepard BM, Mitchell PL. Antifeedant and toxic effects of a neem (*Azadirachta indica* A. Juss) -based formulation Neemix® against *Nezara viridula* (L.) (Hemiptera: Pentatomidae). J Entomol Sci. 2003;38(3):398-408.
2. Akbar MF, Haq MA, Parveen F, Yasmin N, Khan MFU. Comparative management of cabbage aphid (*Myzus persicae* (Sulzer)) (Aphididae: Hemiptera) through bio and synthetic insecticides. Pak Entomol. 2010;32(1):12-17.
3. Ali J, Bayram A, Mukarram M, Zhou F, Karim MF, Hafez MMA, *et al.* Peach-Potato Aphid *Myzus persicae*: Current management strategies, challenges, and proposed solutions. Sustainability. 2023;15(14):11150.
4. Dara SK. Managing western flower thrips (Thysanoptera: Thripidae) on lettuce and green peach aphid and cabbage aphid (Hemiptera: Aphididae) on broccoli with chemical insecticides and the entomopathogenic fungus *Beauveria bassiana* (Hypocreales: Clavicipitaceae). Open Plant Sci J. 2017, 10(1).
5. Dasharath SM. Population dynamics and efficacy of biopesticides against major insect pests of broccoli (*Brassica oleracea* L. var. italica). M.Sc. (Agri.) Thesis, Vasantrao Naik Marathwada Krishi Vidyapeeth Parbhani, Maharashtra, India; c2018.
6. Gurulingappa P, McGee PA, Sword G. Endophytic *Lecanicillium muscarium* and *Beauveria bassiana* reduce the survival and fecundity of *Aphis gossypii* following contact with conidia and secondary metabolites. Crop Prot. 2011;30(3):349-353.
7. Mordue AJ, Blackwell A. Azadirachtin: an update. J Insect Physiol. 1993;39(11):903-924.
8. Nagraj GS, Chouksey A, Jaiswal S, Jaiswal AK. Broccoli. In: Nutritional composition and antioxidant properties of fruits and vegetables. Academic Press; c2020. p. 5-17.
9. Piper R. Extraordinary animals: An encyclopedia of curious and unusual animals. Bloomsbury Publishing USA; c2007.
10. Sankar C, Jayaraj J, Shanthi M, Chinniah C, Vellaikumar S, Rajamanickam C. Field efficacy of certain biorational pesticides against aphid, *Aphis gossypii* Glover (Hemiptera: Aphididae) on Watermelon, *Citrullus lanatus* Thunb. Matsum and Nakai. Madras Agric J. 2022;108(10-12):1.
11. Seymour J, Bowman G, Crouch M. Effects of neem seed extract on feeding frequency of *Nezara viridula* L. (Hemiptera: Pentatomidae) on pecan nuts. Aust J Entomol. 1995;34(3):221-223.
12. Shinde SV, Patel KG, Purohit MS, Pandya JR, Sabalpara AN. *Lecanicillium muscarium* (Zimm.) Zare and Games: An important biocontrol agent for the management of insect pests—a review. Agric Rev. 2010;31(4):235-252.