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Effect of Seed Treatment along with Spraying of Biopesticides on Sucking Pests of Okra (*Abelmoschus esculentus* (L.) Moench)

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Abstract
The present study was carried out to evaluate various management treatments against major sucking pests of okra. In precount data of aphid and leaf hopper before first spray was significant. Because of seed treatment of thiamethoxam 35% FS to all seed before sowing except untreated control seeds it showed a significant difference in aphid and leaf hopper population in precount. The evaluation of various pesticides for their field efficacy against aphid and leaf hopper revealed that dimethoate 30% EC consistently provided the most effective and rapid reduction in sucking pest populations across all observations, maintaining the lowest pest population. The treatment dimethoate 30% EC (T_6) followed by Azadirachtin 10000 ppm @ 1ml/l (T_2) was found effective against aphids as well as leaf hopper for reducing the pest population throughout the crop growth. In order to next treatments Dashparni showed moderate and reliable control, significantly reducing sucking pest populations compared to other pesticides.

Keywords: Okra, sucking pests, biopesticides, aphids, leaf hoppers and seed treatment

Introduction

In India, vegetables are a key component of daily nutrition, offering an economical supply of essential nutrients like carbohydrates, proteins, vitamins, minerals, and fiber. Okra, *Abelmoschus esculentus* (Linn.) Moench, also known as lady's finger (family: Malvaceae), an herbaceous, often cross pollinated, annual vegetable crop is one of the most important traditional vegetables in India. Okra is originating in Africa and is currently grown all over the world, primarily in tropical and sub-tropical regions such as West Africa, Bangladesh, India, Japan, and Nepal. It is a significant vegetable crop that is grown all over the world in the *summer* and *kharif* seasons. One of the main factors limiting okra production is the rising prevalence of insect pests, which cause enormous yield losses ranging from 35 - 40 per cent. About 72 species of insects have been identified on okra (Rao and Rajendran, 2002) [11].

Among these insect pests Aphids (*Aphis gossypii* Glover), leafhoppers (*Amrasca biguttula biguttula* Ishida) and whiteflies (*Bemisia tabaci* Gennadius) are the major sucking pests that seriously harm okra crops and causes 17.46 per cent yield loss in okra (Ghosh, 1996) [6]. Although the crop is affected by the shoot and fruit borer *Earias vittella* (Fabricius) caused the most damage to fruits in terms of both quality and quantity (Papal and Bharpoda, 2009). The Homoptera: Aleurodidae cotton whitefly, *Bemisia tabaci* (Gennadius), has been identified as a significant pest of about 500 host plants and roughly 160 plant species, including okra (Costa *et al*. 1991) [5]. Okra aphid, *Aphis gossypii* Glover (Hemiptera: Aphididae), is a serious insect pest of okra. Nymphs and adults of this species are often found on the lower surface of leaves, where they feed on the phloem and cause yellowing, stunted growth, curling and crinkling of leaves. *Amrasca biguttula biguttula*, or leaf hopper, is one of the most destructive okra pests. It reduces the yield by sucking the sap from the bottom of the leaves and causing upward curling along the edge. Whiteflies, among the sucking pests that harm okra economically by feeding on phloem sap and affecting leaves and fruits with honey dew, which leads to the growth of sooty mould (Oliveira *et al*. 2001) [8].

These insect pests cause both qualitative and quantitative harm to the okra crop; infested fruits are unfit for human consumption, and affected plants produce less yield.

Although chemicals have gained a lot of attention and demonstrated their benefits in addressing food security, their continued and careless use in India and other Asian countries had a number of negative effects, including the development of insecticidal resistance in important pest species, harmful impact on beneficial organisms, pesticide residues in the food chain, deterioration of the eco-system and human health, and decreased profits (Pratap, 2003) [10]. Therefore, finding plant protection alternatives to conventional pesticides without compromising agricultural production and profitability is the main purpose. As a result, there is an increasing demand for ecologically sound control techniques to lessen the need for synthetic pesticides. Insect pests are more serious in the early stage of crop growth; thus, seed treatment is expected to give better protection to crop against these pests and help in enhancing the crop yield. Keeping this in view, the present investigation was undertaken to evaluate the effect of seed treatment and to determine the effectiveness of biopesticides against the okra sucking pest.

Material and Methods

The present investigation was carried out in Randomized Block Design during *Summer* season of 2025 under field conditions on experimental plot at Zonal Agricultural Research Station, Ganeshkhind, Pune for the management of sucking pests of okra. The seeds of okra variety "*Phule Utkarsha*" were sown during 1st fortnight of February in a plot size 4.8 m x 2.7 m. with plant spacing 30 x 15 cm. Before sowing seeds were treated with thiamethoxam 35% FS. Desired quantities of seed were taken and treated with the recommended quantity of insecticide @ 7.5 ml/kg seed. The seed was then dried in the shade and used for sowing. In management of sucking pest of okra three sprays were applied at 15 days interval and treatment details are mentioned in Table.1. In order to find out effective treatment against sucking pest of okra, five plants from each treatment plot were selected randomly and tagged for recording observations. The number of nymphs and adults of aphid and leaf hopper were recorded on three leaves (top, middle, bottom) per plant. The observations were recorded a day before treatment application as precount and then at 3,7,10 and 14 days after each spraying as post-counts.

Table 1: Treatment Details

Tr. No.	Treatments	Dose (gm or ml/lit)
Seed treatment	Thiamethoxam 35% FS	7.5 ml/ kg of seed
T_1	Azadirachtin @10000 ppm	1
T_2	Pongamia oil	1
T_3	*Metarhizium anisopliae* (1.15%WP)	5
T_4	Dashparni	25
T_5	*Lecanicillium lecanii* (1.15%WP)	5
T_6	Dimethoate 30% EC	2
T_7	Untreated Control	-

Results and Discussion

The cumulative results (Tables 2 and 3) show that all of the treatments were found to be significantly more effective than the untreated control to manage okra sucking pests.

Efficacy of biopesticides against aphid on okra

The precount of first spray before spraying, the plots treated with thiamethoxam 35% FS seed treatment showed a 39 - 49 per cent lower population of aphids as compared to untreated plots, highlighting effectiveness of seed treatment. The observations recorded after first spray, treatment dimethoate 30% EC(T_6) @ 2 ml/l (6.24 aphids/plant) was recorded most significant reduction in aphid population which was at par with Azadirachtin 10000 ppm(T_1) @1ml/l. While the treatments Pongamia oil (T_2) @ 1 ml/l and Dashparni (T_4) @ 25 ml/l were found statistically at par with each other. In second spray, treatment with spraying of dimethoate 30% EC @ 2 ml/l registered least 4.24 aphids /plant and identified as most effective. Followed by spraying of Azadirachtin (10000 ppm) @ 1 ml/l was next in order of efficacy and first best treatment among botanicals was found at par with spraying of Pongamia oil @ 1 ml/l and Dashparni @ 25ml/l. While treatment *L. lecanii* (T_5) @ 5 g/l was next in order of superiority which was at par with spraying of *M. anisopliae* (T_3) @ 5 g/l it was less effective among all the treatments.

After third spray, treatment dimethoate 30% EC @ 2 ml/l was found excelled over all the treatments (4.02 aphids /plant). Among the botanicals first best treatment was Azadirachtin 10000 ppm @1ml/l was found statistically at par with Dashparni @ 25ml/l. Followed by treatment Pongamia oil @ 1 ml/l, while the treatment *L. lecanii* 1.15% WP @ 5 g/l and *Metarhizium anisopliae* 1.15% WP @ 5 g/l were equally effective. In cumulative effect (Table 2) dimethoate 30% EC @ 2 ml/l was shown to be better than all other treatments, with a minimum mean of 4.96 aphids/plant. The three biopesticide treatments that were found to be equally efficient in lowering the incidence of aphids were Azadirachtin 10000 ppm @ 1ml/lit (7.05 aphids /plant), Dashparni @ 25 ml/lit (9.25 aphids /plant) and Pongamia oil @ 1 ml/l (9.45 aphids /plant). The next best result was 12.77 aphids / plant with the treatment *L. lecanii* @ 5 g/l which was at par with *M. anisopliae* 5g /lit (13.84 aphids /plant). The present investigation was evaluated that dimethoate 30% EC performs superior over all treatments. These findings were consistent with in respect of effectiveness of insecticide against aphid which was earlier reported by Ahmad *et al* (2021) [1] who reported that dimethoate highly controlled aphid populations from the first spray, while botanical pesticides showed effective control starting from the second spray. Bisen *et al*. (2020) [4] reported that dimethoate 30% EC effective in keeping down aphids and leaf hopper population throughout crop growth.

Followed by Azadirachtin@ 10000 ppm was effective these findings align with Uttam (2024) [13] evaluated various treatments for controlling aphids and jassids population in okra. who reported that among botanicals Azadirachtin @10000 ppm shown best result than *Lecanicillium lecanii* 1.15% WP. In respect of effectiveness next treatment was Dashparni the similar findings were reported by Akashe *et al.* (2009) [2] who reported the effectiveness of fermented Dashparni extract against sucking pest of okra.

Efficacy of biopesticides against leaf hoppers in okra.

The precount of first spray showed reduction in leaf hopper population because of seed treatment with thiamethoxam 35% FS to all seed before sowing except untreated control seeds it showed a significant difference in leaf hopper population. The seed treatment effectively lowered the leaf hopper population by 36 to 43 per cent in different treatment. The treatment dimethoate 30% EC (T_6) @ 2 ml/l treatment was shown to be superior to all other treatments in terms of recording the leaf hopper population after the first spray (10.21 leaf hoppers /plant) which found at par with Azadirachtin (T_1) (10000 ppm) @ 2 ml/l. Next effective treatment was Pongamia oil(T_2) @ 1 ml/l which was statistically on par with Dashparni (T_4) @25ml/l. After second spray, treatment dimethoate 30% EC @ 2 ml/l was found excelled over all the treatment (6.78 leaf hoppers /plant) and was found at par with Azadirachtin 10000 ppm @1ml/l. The next best treatment was Dashparni @25ml/l was on par with treatment Pongamia oil @ 1 ml/l. While the treatment *L. lecanii* 1.15% WP (T_5) @ 5 g/l was at par with treatment *M. anisopliae* 1.15% WP (T_3) @ 5 g/l.

In third spray, treatment dimethoate 30% EC @ 2 ml/l reported minimum 4.23 leaf hoppers /plant and demonstrated its superiority was at par with the treatment Azadirachtin (10000 ppm) @ 2 ml/l. While Dashparni @ 25 ml/l found at par with Pongamia oil @ 1ml/l. In cumulative effect (Table 3) a minimum mean of 5.69 leaf hoppers /plant, it was determined that dimethoate 30% EC @2 ml/l was superior to all other treatments. Azadirachtin 10000 ppm @ 1 ml/lit (8.39 leaf hoppers /plant), Dashparni @ 25 ml/lit (10.37 leaf hoppers /plant) and Pongamia oil @ 1 ml/l (7.68 leaf hoppers /plant) were the three biopesticide treatments that were shown to be equally effective in reducing the occurrence of leaf hopper. While, treatment with *L. lecanii* @ 5 g/l (20.28 leaf hoppers /plant), which was at par with *M. anisopliae* 5 g/l (19.65 leaf hoppers /plant).

The superiority of dimethoate 30% EC among the treatments in reducing leaf hopper population in the present findings corresponds with earlier findings of Shivanna *et al.* (2011). Followed by Azadirachtin 10000 ppm was next best treatment after dimethoate 30% EC, which was first effective treatment among botanicals studies by Kekan *et al.* (2022). Followed by Dashparni was effective treatment in management of leaf hopper. In order to follow Pongamia oil was next best treatment in the present findings results are in accordance with Alam *et al.* (2010) [3].

Table 2: Cumulative effect of biopesticides on leaf hoppers population. (Average of three sprays)

Tr. No	Treatments	Dose (gm or ml/L)	Avg. survival population of leaf hoppers/3 leaves/plant				
			Post count (Days after spray)				
			3	7	10	14	Mean
T_1	Azadirachtin @10000 ppm	1	9.93 (3.24)	6.33 (2.66)	7.69 (2.88)	9.61 (3.19) *	8.39 (2.98)
T_2	Pongamia oil	1	12.10 (3.55)	9.05 (3.11)	10.36 (3.31)	12.54 (3.61)	7.68 (3.39)
T_3	*Metarhizium anisopliae* (1.15%WP)	5	22.60 (4.85)	20.74 (4.65)	17.91 (4.33)	19.88 (4.55)	20.28 (4.59)
T_4	Dashparni	25	12.25 (3.57)	7.94 (2.90)	9.62 (3.18)	11.69 (3.48)	10.37 (3.28)
T_5	*Lecanicillium lecanii* (1.15%WP)	5	22.30 (4.81)	20.21 (4.59)	16.90 (4.21)	19.22 (4.48)	19.65 (4.52)
T_6	Dimethoate 30 EC	2	7.07 (2.78)	3.45 (2.06)	5.13 (2.41)	7.12 (2.81)	5.69 (2.51)
T_7	Untreated Control	-	46.33 (6.86)	48.06 (6.98)	49.35 (7.08)	50.95 (7.19)	48.67 (7.02)
	S.E.(m) ±		0.20	0.17	0.18	0.18	0.18
	C.D. @ 5%		0.61	0.58	0.56	0.56	0.57

*****Figures in parentheses are $\sqrt{X+0.5}$ transformed values those outsides are original values.

Table 3. Cumulative effect of biopesticides on leaf hoppers population. (Average of three sprays)

Tr No.	Treatments	Dose (gm or ml/L)	Avg. survival population of aphids/3 leaves/plant				
			Post count (Days after spray)				
			3	77	10	14	Mean
T_1	Azadirachtin @10000 ppm	1	7.47 (2.90)	5.21 (2.46)	6.81 (2.77)	8.72 (3.02) *	7.05 (2.78)
T_2	Pongamia oil	1	10.16 (3.32)	7.90 (2.95)	9.12 (3.15)	10.61 (3.13)	9.45 (3.14)
T_3	*Metarhizium anisopliae* (1.15%WP)	5	16.58 (4.18)	13.95 (3.85)	11.41 (3.60)	13.43 (3.74)	13.84 (3.83)
T_4	Dashparni	25	10.08 (3.30)	7.59 (2.90)	8.63 (3.07)	10.72 (3.10)	9.25 (3.09)
T_5	*Lecanicillium lecanii* (1.15%WP)	5	15.63 (4.06)	12.67 (3.67)	10.37 (3.36)	12.42 (3.64)	12.77 (3.68)

T_6	Dimethoate 30% EC	2	4.83 (2.39)	3.13 (1.99)	5.01 (2.32)	6.89 (2.57)	4.96 (2.31)
T_7	Untreated Control	-	36.79 (6.12)	38.63 (6.27)	40.05 (6.38)	41.72 (6.51)	39.20 (6.32)
	S.E.(m) ±		0.15	0.17	0.17	0.17	0.51
	C.D. @ 5%		0.49	0.53	0.52	0.51	0.16

***Figures in parentheses are √X+0.5 transformed values those outsides are original values.

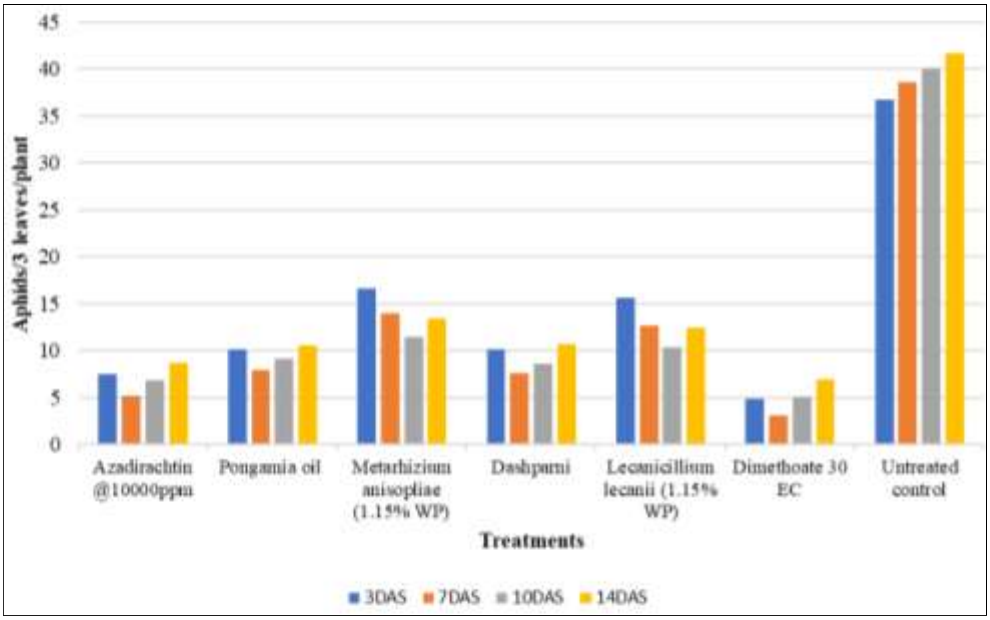

Fig 1: Cumulative effect of biopesticides on aphid population.

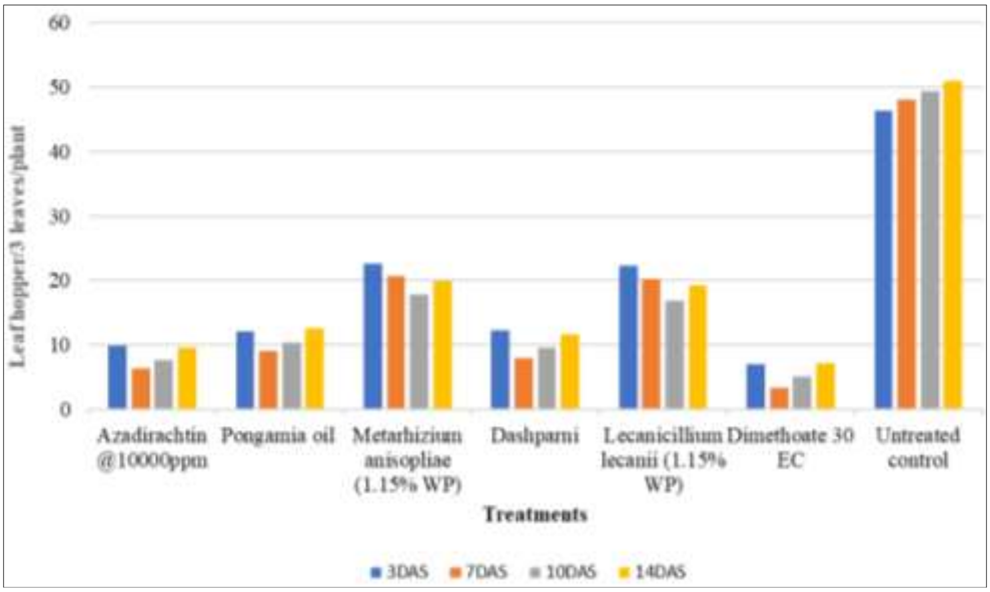

Fig 2: Cumulative effect of biopesticides on leaf hopper population.

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