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EFFECT OF DIFFERENT DOSE OF SALICYLIC ACID AND INSECTICIDES AGAINST WHITEFLY (*BEMISIA TABACI*) INFESTING OKRA

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ABSTRACT

Field experiment was carried out to study the effectiveness of various dose of Salicylic acid and insecticides against whitefly, *Bemisia tabaci* infesting okra at Instructional Farm, J.A.U., Junagadh during *Summer*, 2022. Out of the different dose of Salicylic acid treatments tested, salicylic acid 200 mg /litre proved most effective against *B. tabai* after first spray. Among Insecticides treatments diafenthiuron 50 WP 0.06% and pyriproxyfen 10 EC 0.01% were proved next best treatments over untreated control. Among the treatment's combinations, (salicylic acid 200 mg /litre + diafenthurion 50WP 0.06%) was found significantly superior (4.05 whiteflies / leaf) as it has recorded lowest whitefly population. The next best interaction was salicylic acid 150 mg /litre + diafenthiuron 50 WP 0.06% (5.67 whiteflies /leaf) followed by (salicylic acid 100 mg /litre + diafenthiuron 50 WP 0.06%) (7.78).

Key words : Okra, Whitefly, *B. tabaci*, Salicylic acid, Insecticides.

Introduction

Okra (*Abelmoschus esculentus* L. Moench) belongs to the Malvaceae family, which is originally included among the Hibiscus genus. Okra is an important drought tolerant vegetable crop and can be grown in all three seasons, i.e., *kharif, rabi* and summer. It is an important constituent for balanced food due to its dietary fibres and amino-acid composition, which is rich in lysine and tryptophan (Hughes, 2009). It also contains considerable amounts of iron, calcium, manganese and magnesium, vitamins A, B, C and K, as well as folates (Aykroud, 1963). Among the different states, Gujarat comes in 2nd rank, having 0.94 lakh hectares of area with a production of 11.47 lakh tons and a productivity of 12.22 tons /ha (Anonymous, 2023). The crop is attacked by many species of insect and non-insect pests right from germination to harvest. Among them, whitefly, *Bemisia tabaci* (Gennadius) is one of the most important insects that cause economic damage to the okra crop. The lower surface of the leaves is infested with all life stages of whiteflies. The whitefly oviposited preferentially in young leaves, which are generally located on the apical parts, with the last stage nymphs customarily found in the bottom leaves (Leite *et al*., 1998).

Materials and Methods

To determine the incidence of whitefly, *B. tabaci* in okra (cv. GO-6) through seed treatment and foliar application of salicylic acid and insecticides, the crop was sown during the 1st week of March at Instructional Farm, COA, Junagadh Agricultural University, Junagadh during summer 2022. The crop was sown at a distance of 60cm and 30 cm within the row. The field experiment was conducted in Factorial Randomized Block Design (FRBD) with three replications having gross and net plot sizes of 3.6 m × 3.0 m and 2.4 m × 2.4 m, respectively. For recording observation, 10 plants were randomly selected and tagged in a plot per replication. Population of whitefly was recorded from tagged plants at a weekly

interval starting from one week after germination till harvesting of crop. According to the treatments, application of plant growth regulators *i.e.*, salicylic acid 100 mg /litre water, 150 mg/litre water 200 mg /litre water was applied as bio-priming of seeds before sowing, while subsequent application was applied 30 days after germination as foliar spray. The spraying of different insecticides, *viz*., diafenthiuron 50 WP 0.06%, fenpropathrin 30 EC 0.02%, flupyradifurone 17.09% w/ w SL 0.05%, pyriproxyfen 10 EC 0.01%, spiromesifen 22.9 EC 0.024% and an untreated check was given with the help of a knapsack sprayer after 50 days of sowing.

Results and Discussion

First spray

In okra, whitefly population reached to considerable level after 4th week of sowing. The periodical data shows effect of different dose of salicylic acid and insecticidal spray on infestation in okra due to whitefly on three, five, seven and ten days after spray (DAS). The effect of various management tactics against whitefly has been adjudged based on individual effect of salicylic acid and insecticidal spray.

Effect of different dose of salicylic acid on whitefly, *B. tabaci*

The mean whitefly counts after the first application of insecticides are summarized in Table 1 and illustrated in Fig. 1. Data indicated that among three different dose of salicylic acid, salicylic acid 200 mg /litre showed lowest (7.89 whiteflies /leaf) and it was statistically at par with salicylic acid 150 mg /litre (8.57 whiteflies /leaf) followed by salicylic acid 100 mg /litre with (8.87) whiteflies /leaf on the third day of spraying. The untreated plot with showed highest number of whiteflies (10.08). Consistent trends in the efficacy were observed on the fifth and seventh days after spraying.

Similarly, on the tenth day after spraying, the lowest whitefly population (7.23) was observed with salicylic acid 200 mg /litre water which was statistically comparable with salicylic acid 150 mg /litre water (7.76 whiteflies / leaf) and salicylic acid 100 mg /litre water with (8.10 whiteflies /leaf). This efficacy pattern was consistent across the third, fifth and seventh days after spraying, in addition to the tenth day.

Effect of insecticides on whitefly, *B. tabaci*

The data from Table 2 and Fig. 2 indicate that following the first application of insecticides, all tested treatments exhibited significantly greater efficacy compared to the control group in reducing the mean whitefly population. Among sprayed insecticides,

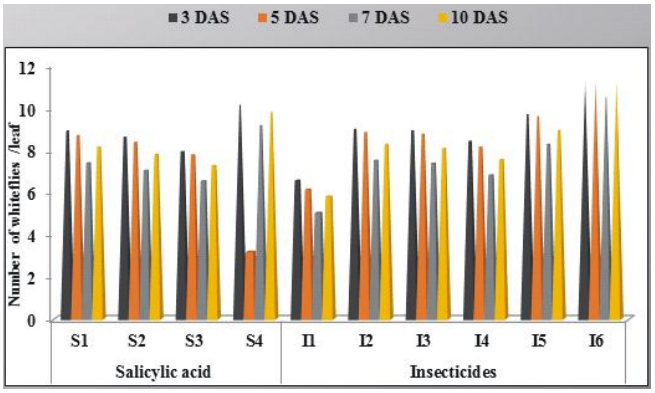

Fig. 1 : Effect of different dose of salicylic acid and insecticides against *B. tabaci* after first spray during summer 2022.

diafenthiuron 50 WP 0.06% (6.34 whiteflies /leaf) was found most effective as lowest whitefly population was observed. The next most effective treatment was pyriproxyfen 10 EC 0.01%, which resulted in a mean whitefly count of 8.38 per leaf. This was statistically comparable to flupyradifurone 17.09% SL 0.05% (8.88) and fenpropathrin 30 EC 0.02% (8.95 whiteflies /leaf).

Similarly, flupyradifurone 17.09% SL 0.05% showed no significant difference compared to fenpropathrin 30 EC 0.02% and spiromesifen 22.9 EC 0.024% (9.64 whiteflies /leaf). However, spiromesifen 24 EC 0.024% exhibited lower effectiveness compared to all other insecticides three days after spraying (DAS). Similar effect of insecticides was found after fifth; seventh and tenth DAS *i.e.*, 6.11 < 8.10 < 8.71 < 8.80 < 9.54; 5.01 < 6.79 < 7.35 < 7.48 < 8.24 and 5.78< 7.51 < 8.03 < 8.24 < 8.89, respectively. The chronological order of the effective treatments was diafenthiuron 50 WP 0.06% < pyriproxyfen 10 EC 0.01% < flupyradifurone 17.09% SL 0.05% < fenpropathrin 30 EC 0.02% < spiromesifen 22.9 EC 0.024%.

Interaction effect salicylic acid and insecticides against whitefly, *B. tabaci* before and after three, five, seven and ten days of spray

The field experiment aimed to evaluate both the individual and interactive effects of salicylic acid and various insecticides against whitefly, *B. tabaci* at Instructional farm, College of Agriculture, Junagadh Agricultural University, Junagadh during summer, 2022 and summer, 2023. During experimentations, three of dose salicylic acid (*i.e.*, 100, 150 and 200 mg /litre) and five insecticides (*i.e.*, diafenthiuron 50 WP, fenpropathrin 30 EC, flupyradifurone 17.09% SL, pyriproxyfen 10 EC, spiromesifen 22.9 EC) along with control were evaluated. The first spray was applied at the onset of pest activity *i.e.*, after 45 days after sowing. The observations on the number of whiteflies, *B. tabaci* were taken before 24

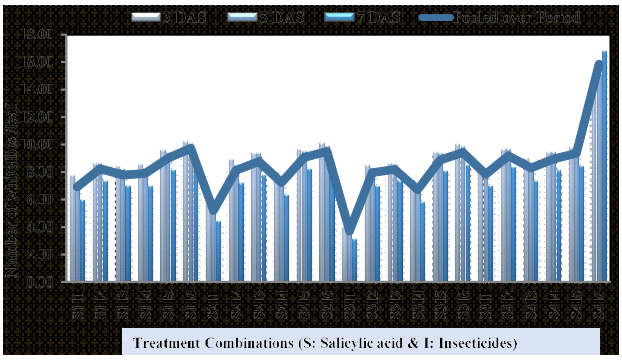

Fig. 2 : Interaction effect of salicylic acid and insecticides against whitefly, *B. tabaci* infesting okra after first spray during 2022.

presented in Table 2 and visually represented in Fig. 2. The observations showed that the population ranged from 10.07 to 12.67 whiteflies /leaf one day before spraying with no significant differences observed. This uniform distribution indicated an even initial population across all experimental plots.

The data recorded after three days of spray (3 DAS) presented in Table 2 and graphically depicted in Fig. 2 revealed that all the treatment combinations were significantly superior over control. The order of treatment interaction on the bases of whiteflies population on okra of three days after spraying (DAS) given in bracket was:

Table 1 : Effect of different dose of salicylic acid and insecticides against *B. tabaci* after first spray during summer 2022.

Treatments	3 DAS	5 DAS	7 DAS	10 DAS
Salicylic acid (S)				
S_1 Salicylic acid 100 mg /litre	2.98^{b}(8.87)	2.94^{b}(8.65)	2.71^{b}(7.36)	2.85^{ab}(8.10)
S_2 Salicylic acid 150 mg /litre	2.93^{ab}(8.57)	2.89^{ab}(8.33)	2.65^{ab}(7.01)	2.79^{ab}(7.76)
S_3 Salicylic acid 200 mg /litre	2.81^{a}(7.89)	2.78^{a}(7.74)	2.55^{a}(6.51)	2.69^{a}(7.23)
S_4 Control	3.18^{c}(10.08)	3.17^{c}(3.17)	3.02^{c}(9.12)	3.12^{c}(9.74)
ANOVA				
S. Em. ±	0.05	0.05	0.05	0.06
C.D. @ 5%	0.15	0.15	0.15	0.17
Insecticides (I)				
I_1 Diafenthiuron 50 WP 0.05%	2.52^{a}(6.34)	2.47^{a}(6.11)	2.24^{a}(5.01)	2.41^{a}(5.78)
I_2 Fenpropathrin 30 EC 0.02%	2.99^{bcd} (8.95)	2.97^{bcd}(8.80)	2.74^{bcd}(7.48)	2.87^{bcd}(8.24)
I_3 Flupyradifurone 17.09 %w/w SL 0.05%	2.98^{bc} (8.88)	2.95^{bc}(8.71)	2.71^{bc}(7.35)	2.83^{bc}(8.03)
I_4 Pyriproxyfen 10 EC 0.01%	2.89^{b}(8.38)	2.85^{b}(8.10)	2.61^{b}(6.79)	2.74^{b}(7.51)
I_5 Spiromesifen 22.9 EC 0.024%	3.10^{cd}(9.64)	3.09^{cd}(9.54)	2.87^{cd}(8.24)	2.98^{cd}(8.89)
I_6 Control	3.34^{e}(11.16)	3.34^{e}(11.17)	3.23^{e}(10.46)	3.33^{e} (11.10)
ANOVA				
S.Em. ±	0.06	0.07	0.06	0.07
C. D. @ 5%	0.18	0.19	0.18	0.21
ANOVA (S x I)				
S. Em. ±	0.13	0.13	0.13	0.14
C.D. @ 5%	0.36	0.37	0.36	0.41
C.V. %	7.45	7.67	7.94	8.70

Notes:
1. S: salicylic acid, I: Insecticides
2. Figures in parentheses are retransformed values; those outside are square root transformed value.
3. Treatment means with letter(s) in common are not significant at 5 % level of significance within a column.

hours of application as well as 3, 5, 7 and 10 days after each application. Furthermore, the efficacy of various insecticides was assessed based on pooled data across periods, as well as pooled data across periods, sprays and years.

The data on whitefly incidence on okra, both before and at 3, 5, 7 and 10 days after the first spray are

S_3I_1 < (4.05), S_2I_1 < (5.67), S_3I_4 < (7.44), S_1I_1 < (7.78), S_2I_4 < (8.04), S_4I_1 < (8.32), S_1I_3 < (8.47), S_3I_2 < (8.57), S_1I_4 < (8.61), S_3I_3 < (8.67), S_1I_2 < (8.70), S_2I_2 < (8.90), S_4I_3 < (9.04), S_2I_3 < (9.37), S_3I_5 < (9.47), S_4I_4 < (9.50), S_1I_5 < (9.55), S_4I_2 < (9.67), S_2I_5 < (9.71), S_4I_5 < (9.83) S_3I_6 < (10.04), S_2I_6 < (10.14), S_1I_6 < (10.23) S_4I_6 < (14.72).

Among the different combinations, S_3I_1 (salicylic acid 200 mg /litre + diafenthurion 50WP 0.06%) was found significantly superior (4.05 whiteflies /leaf) as it has recorded lowest whitefly population. The next best interaction was S_2I_1 (salicylic acid 150 mg /litre + diafenthiuron 50 WP 0.06%) (5.67 whiteflies /leaf); while S_3I_4 is at par with S_1I_1 (salicylic acid 100 mg /litre + diafenthiuron 50 WP 0.06%) (7.78), S_2I_4 (8.04), S_4I_1 (8.32), S_1I_3 (8.47), S_3I_2 (8.57), S_1I_4 (8.61), S_3I_3 (8.67), S_1I_2 (8.70), S_2I_2 (8.90), S_4I_3 (9.04), S_2I_3 (9.37), S_3I_5 (9.47), S_4I_4 (9.50) and S_1I_5 (9.55). The next effective interaction was S_1I_1 (salicylic acid 100 mg /litre + diafenthiuron 50 WP 0.06%) (7.78) which was at par with S_2I_4, S_4I_1, S_1I_3, S_3I_2, S_1I_4, S_3I_3, S_1I_2, S_2I_2, S_4I_3, S_2I_3, S_3I_5, S_4I_4, S_1I_5, S_4I_2, S_2I_5, S_4I_5. Treatment combination S_2I_4 (salicylic acid 150 mg /litre + pyriproxyfen 10 EC 0.01%) (8.04) was found mediocre in its effectiveness and was found at par with S_4I_1 (8.32), S_1I_3 (8.47), S_3I_2 (8.57), S_1I_4 (8.61), S_3I_3 (8.67), S_1I_2 (8.70), S_2I_2 (8.90), S_4I_3 (9.04), S_2I_3 (9.37), S_3I_5 (9.47), S_4I_4 (9.50), S_1I_5 (9.55), S_4I_2 (9.67), S_2I_5 (9.71), S_4I_5 (9.83) S_3I_6 (10.04), S_2I_6 (10.14), which were at par with each other. The least effective treatment combination was S_4I_6 (untreated check + untreated check) (14.72) which was followed in the decreasing sequence by S_1I_6 (salicylic acid 100 mg /litre + untreated check) (10.23 whiteflies / leaf), S_2I_6 (salicylic acid 150 mg/litre + untreated check) (10.14) and S_3I_6 (salicylic acid 200 mg /litre + untreated check) (10.04) and recorded maximum number of whiteflies. More or less similar results were found after three, five, seven and ten days of sprays compared to the control group in reducing the mean whitefly population. Among sprayed insecticides, diafenthiuron 50 WP 0.06% (6.34 whiteflies /leaf) was found most effective as lowest whitefly population was observed. The next most effective treatment was pyriproxyfen 10 EC 0.01%, which resulted in a mean whitefly count of 8.38 per leaf. This was statistically comparable to flupyradifurone 17.09% SL 0.05% (8.88) and fenpropathrin 30 EC 0.02% (8.95 whiteflies /leaf).

Interaction effect of salicylic acid and insecticides against whitefly, *B. tabaci* (Pooled over periods)

The data on pooled over periods after first spray are presented in Table 2 and graphically depicted in Fig. 2 revealed that the treatment combinations were significantly superior over control. The order of treatment interaction on bases of whiteflies population on okra on pooled over period given in bracket was: S_3I_1 < (3.72), S_2I_1 < (5.20), S_3I_4 < (6.71), S_1I_1 < (6.93), S_2I_4 < (7.24), S_1I_3 < (7.78), S_4I_1 < (7.84), S_1I_4 < (7.90), S_3I_2 < (7.95), S_2I_2 < (8.12), S_3I_3 < (8.18), S_1I_2 < (8.24), S_4I_3 < (8.29), S_2I_3 < (8.76), S_3I_5 < (8.88), S_4I_4 < (8.94), S_1I_5 < (9.00),

Plate 1 : Healthy plants.

Plate 2 : Damaged plants.

S_2I_5 < (9.06), S_4I_2 < (9.18), S_4I_5 < (9.36), S_3I_6 < (9.42), S_2I_6 < (9.49), S_1I_6 < (9.73) and S_4I_6 < (15.84).

The treatment combination S_3I_1 (salicylic acid 200 mg /litre + diafenthiuron 50 WP 0.06%) (3.72) stood first among different combination against whitefly and was followed by S_2I_1 (salicylic acid 150 mg /litre + diafenthiuron 50 WP 0.06%) (5.20). The next best treatment combination S_3I_4 (salicylic acid 200 mg /litre + pyriproxyfen 10 EC 0.01%) (6.71) was found statistically at par with S_1I_1 (salicylic acid 100 mg /litre + pyriproxyfen 10 EC 0.01%) (6.93) and S_2I_4 (salicylic acid 150 mg / litre + pyriproxyfen 10 EC 0.01%) (7.24). The next effective treatment combination was S_1I_3 (salicylic acid 100 mg /litre + flupyradifurone 17.09% SL 0.05%) (7.78), S_4I_1 (untreated check + diafenthiuron 50 WP 0.06%) (7.84) and S_1I_4 (salicylic acid 100 mg /litre + pyriproxyfen 10 EC 0.01%) (7.90) which were found statistically at par with S_2I_4. The treatment S_3I_2 (salicylic acid 200 mg / litre + fenpropathrin 30 EC 0.02%) (7.95) was found mediocre in their effectiveness and was statistically at par with S_2I_2 (8.12), S_3I_3 (8.18) and S_1I_2 (8.24). The lowest number of whiteflies was observed in treatment combination was S_4I_6 (untreated check+ untreated check)

Table 2 : Interaction effect of salicylic acid and insecticides against whitefly, *B. tabaci* infesting okra after first spray during 2022.

Treatments	Whiteflies /leaf					
	Before spray	3 DAS	5 DAS	7 DAS	10 DAS	Pooled over period
S_1I_1	3.38 (11.40)	2.79 (7.78)	2.69 (7.24)	2.43 (5.90)	2.59 (6.71)	2.63 (6.92)
S_1I_2	3.37 (11.33)	2.49 (6.22)	2.94 (8.64)	2.71 (7.34)	2.87 (8.24)	2.87 (8.24)
S_1I_3	3.39 (11.50)	2.91 (8.47)	2.87 (8.24)	2.64 (6.97)	2.73 (7.45)	2.79 (7.78)
S_1I_4	3.36 (11.27)	2.93 (8.61)	2.88 (8.29)	2.65 (7.02)	2.80 (7.84)	2.81 (7.90)
S_1I_5	3.33 (11.07)	3.09 (9.55)	3.08 (9.49)	2.86 (8.18)	2.97 (8.82)	3.00^{j} (9.00)
S_1I_6	3.31 (10.97)	3.19 (10.23)	3.18 (10.11)	2.98 (8.88)	3.12 (9.73)	3.12 (9.73)
S_2I_1	3.31 (10.96)	2.3 (5.67)	2.33 (5.43)	2.10 (4.41)	2.29 (5.24)	2.28 (5.20)
S_2I_2	3.29 (10.86)	2.98 (8.90)	2.93 (8.58)	2.69 (7.24)	2.82 (7.95)	2.85 (8.12)
S_2I_3	3.29 (10.81)	3.06 (9.37)	3.07 (9.42)	2.79 (7.78)	2.92 (8.53)	2.96 (8.76)
S_2I_4	3.31 (10.98)	2.83 (8.04)	2.76 (7.62)	2.51 (6.30)	2.64 (6.97)	2.69 (7.24)
S_2I_5	3.28 (10.79)	3.11 (9.71)	3.09 (9.55)	2.87 (8.24)	2.99 (8.94)	3.01 (9.06)
S_2I_6	3.34 (11.17)	3.18 (10.14)	3.15 (9.92)	2.93 (8.58)	3.05 (9.30)	3.08 (9.49)
S_3I_1	3.20 (10.24)	2.01 (4.05)	1.99 (3.96)	1.76 (3.10)	1.96 (3.84)	1.93 (3.72)
S_3I_2	3.21 (10.32)	2.92 (8.57)	2.88 (8.29)	2.65 (7.02)	2.81 (7.90)	2.82 (7.95)
S_3I_3	3.18 (10.14)	2.94 (8.67)	2.93 (8.58)	2.71 (7.34)	2.84 (8.07)	2.86 (8.18)
S_3I_4	3.17 (10.07)	2.72 (7.44)	2.67 (7.13)	2.41 (5.81)	2.56 (6.55)	2.59 (6.71)
S_3I_5	3.21 (10.28)	3.07 (9.47)	3.07 (9.42)	2.85 (8.12)	2.92 (8.53)	2.98 (8.88)
S_3I_6	3.23 (10.41)	3.17 (10.04)	3.15 (9.92)	2.92 (8.53)	3.05 (9.30)	3.07 (9.42)
S_4I_1	3.53 (12.43)	2.88 (8.32)	2.87 (8.24)	2.65 (7.02)	2.78 (7.73)	2.80 (7.84)
S_4I_2	3.52 (12.42)	3.11 (9.67)	3.12 (9.73)	2.89 (8.35)	2.99 (8.99)	3.03 (9.18)
S_4I_3	3.52 (12.39)	3.01 (9.04)	2.94 (8.64)	2.71 (7.34)	2.85 (8.12)	2.88 (8.29)
S_4I_4	3.51 (12.34)	3.08 (9.50)	3.07 (9.42)	2.86 (8.18)	2.96 (8.76)	2.99 (8.94)
S_4I_5	3.53 (12.45)	3.14 (9.83)	3.13 (9.80)	2.91 (8.47)	3.05 (9.30)	3.06 (9.36)
S_4I_6	3.55 (12.67)	3.84 (14.72)	3.89 (15.13)	4.1 (16.81)	4.11 (16.89)	3.98 (15.84)
S. Em. ± S	0.37	0.05	0.05	0.05	0.06	0.027
I	0.45	0.06	0.07	0.06	0.07	0.033
P	-	-	-	-	-	0.027
S × I	0.91	0.13	0.13	0.13	0.14	0.066
S× P	-	-	-	-	-	0.054
I × P	-	-	-	-	-	0.066
S × I × P	-	-	-	-	-	0.132
C.D. @ 5% S	1.2	0.15	0.15	0.15	0.17	0.075
I	NS	0.18	0.19	0.18	0.21	0.092
P	-	-	-	-	-	0.075
S × I	NS	0.36	0.37	0.36	0.41	0.184
S× P	-	-	-	-	-	NS
I × P	-	-	-	-	-	NS
D × I × P	-	-	-	-	-	NS
C.V. %	13.99	7.45	7.67	7.94	8.70	7.92

Notes: 1. NS: Non-significant, 2. Figures in parentheses ( ) are retransformed values; those outside are square root transformed value, 3. Treatment mean with letter(s) in common are not significant at 5 % level of significance within a column and 4. Dose of Salicylic acid: Salicylic acid 100 mg/litre (S_1), Salicylic acid 150 mg/litre (S_2), Salicylic acid 200 mg/litre (S_3) & Untreated Control (S_4) Foliar application: Diafenthurion 50 WP 0.06% (I_1), Fenpropathrin 30 EC 0.02% (I_2), Flupyradifurone 17.09% SL 0.05% (I_3), Pyriproxyfen 10 EC 0.01% (I_4), Spiromecifen 22.9 EC 0.024% (I_5) and Untreated Control (I_6)

(15.84), which was followed in the decreasing sequence by S_1I_6 (salicylic acid 100 mg /litre + untreated check) (9.73), S_2I_6 (salicylic acid 150 mg /litre + untreated check) (9.49) and S_3I_6 (salicylic acid 200 mg /litre + untreated check) (9.42) and recorded maximum number of whiteflies.

These results are in close proximity with various research scientists. Pun *et al*. (2000) reported that salicylic acid 200 ppm gave better result than other virus inhibitory chemicals on the disease infection of okra. According to Haider *et al*. (2023), among different combinations of insecticides and salicylic acid; diafenthiuran + salicylic acid (SA) gave superior result and SA enhanced plant resistance against whitefly. Pavan *et al*. (2020) observed that maximum population reduction of whitefly was in diafenthiuron 50 WP 0.05% (89.29%) and showed better efficacy than spinosad 45 SC @ 0.007% in tomato crop. In bio-efficacy of insecticides against sucking pests of chilli, Zanwar *et al*. (2022) concluded that the treatment with diafenthiuron 50 WP @ 625 g/ha was recorded superior control of whitefly, Bemisia tabaci. According to report of Halder *et al*. (2023), flupyradifurone 17.09% SL was the most promising during both years with percent population reductions of 69.90 over spiromesifen 22.90% SC and control in okra field.

Conclusion

Among the three different doses of salicylic acid and insecticides evaluated for whitefly, *B. tabaci* salicylic acid 200 mg /litre showed lowest number of whiteflies followed by salicylic acid 150 mg /litre and salicylic acid 100 mg / litre on the third day of spraying. Consistent trends in the efficacy were observed on the fifth, seventh and tenth days after spraying. While, among sprayed insecticides diafenthiuron 50 WP 0.06% was found most effective as the lowest whitefly population was observed followed by pyriproxyfen 10 EC 0.01%, flupyradifurone 17.09% SL 0.05% fenpropathrin 30 EC 0.02%. However, spiromesifen 22.9 EC 0.024% exhibited lower effectiveness compared to all other insecticides three days after spraying. The treatment combination salicylic acid 200 mg /litre + diafenthiuron 50 WP 0.06% was found superior with lowest population of whitefly followed by salicylic acid 150 mg /litre + diafenthiuron 50 WP 0.06% and salicylic acid 200 mg /litre + pyriproxyfen 10 EC 0.01%. The treatment combination of untreated check+ untreated check was found less effective in controlling the whitefly population.

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