Int.J.Curr.Microbiol.App.Sci (2018) Special Issue-6: 1676-1681

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 Special Issue-6 pp. 1676-1681
Journal homepage: http://www.ijcmas.com

Original Research Article

Management of Whitefly, *Bemisia tabaci* and Whitefly Transmitted *Okra Yellow Vein Mosaic Virus* (OYVMV) in Okra

K.P. Manju[1*], K. Vijaya Lakshmi[1], B. Sarath Babu[2] and K. Anitha[2]

[1]Department of Entomology, College of Agriculture, Rajendranagar, Professor Jayashankar Telangana State Agricultural University (PJTSAU), Hyderabad- 500 030, Telangana, India
[2]National Bureau of Plant Genetic Resources Regional Station, Rajendranagar, Hyderabad- 500 030, Telangana, India
**Corresponding author*

Keywords

Bemisia tabaci, Okra yellow vein mosaic virus, Sequential spray

A B S T R A C T

A field experiment was conducted to evaluate the efficacy of certain vegetable oils and novel chemicals as sequential spray against whitefly, *Bemisia tabaci* Gennadius and whitefly transmitted Okra yellow vein mosaic virus (OYVMV) during summer seasons of 2015 and 2016 at National Bureau of Plant Genetic Resources (NBPGR), Regional Station, Rajendranagar, Hyderabad. Results revealed that, among the treatments, spinosad 45 SC was found to be the best treatment against whiteflies followed by acetamiprid 20 SP and sequential spray of neem oil @ 2% and buprofezin 25 SC. The lowest OYVMV incidence was reported in thiamethoxam 70 WS (16.56%) followed by imidacloprid 70 WS (16.90 %) and spinosad 45 SC (19.43%). Maximum marketable fruit yield of 122 q/ha was recorded in thiamethoxam 70 WS followed by Imidacloprid 70 WS (115 q/ha).

Introduction

Okra (*Abelmoschus esculentus* L.), commonly known as bhendi, belonging to the family Malvaceae is one of the important vegetable crops cultivated throughout India. The production and quality of okra fruits are affected by an array of sucking and fruit boring pests from sowing until harvest. The key sucking pests of okra are whiteflies, aphids, jassids, thrips and mites. Among the sucking pests, whitefly, *Bemisia tabaci* Gennadius causes economic damage to okra by feeding on phloem sap, there by contaminating leaves and fruits with honey dew that causes sooty mould formation (Oliveira *et al.*, 2001). Besides causing direct damage, it also transmits an economically important viral disease caused by *Okra yellow vein mosaic virus* (OYVMV) resulting in significant yield losses especially when it occurs in the early stages of crop growth. As compared to healthy plants, diseased plants showed a reduction of 24.9% in plant height, 15.5% decrease in root length, and 32.1% in number of fruits per plant, whereas stem girth was reduced by 16.3% (Sheikh *et al.*, 2013). OYVMV belongs to the genus *Begomovirus* of the family Geminiviridae. Geminiviruses make up a large diverse family of plant viruses and cause heavy crop losses worldwide. The disease is characterized by different degrees of chlorosis and yellowing of veins and veinlets, smaller leaves, fewer and smaller fruits and stunting (Venkataravanappa *et al.*, 2012).

A roving survey conducted in the okra growing areas of Karnataka, Andhra Pradesh, Tamil Nadu, Kerala, Maharashtra, Haryana, Uttar Pradesh, Delhi, Chandigarh and Rajasthan revealed that the disease incidence caused by OYVMV ranged from 23.00 to 67.78 per cent (Venkataravanappa *et al.*, 2011). Moreover, OYVMV disease is wide spread in the subtropical regions in the rainy season crop and in tropical regions in spring summer crop in India. Therefore, an attempt have been made to evaluate various vegetable oils and insecticide schedules in newer combinations aganist the against okra whitefly *Bemisia tabaci* Gennadius and OYVMV.

Materials and Methods

The field trial was carried out at NBPGR Regional station, Rajendranagar during summer seasons of 2015 and 2016 on variety Arka Anamika in a randomized block design with three replications. Popular variety, Arka Anamika was sown with a spacing of size of 60 X 30 cm in a plot size of 4.8 X 3 m. Arka Anamika seeds were properly treated with imidacloprid 70 WS and thiamethoxam 70 WS@ 5 g /kg seed and later shade dried and sown for seed treatment experiments. The crop was raised as per the guidelines of package of practices (Anon., 2002). Based on ETL the spray foliar treatments were imposed. Two sprays were imposed on 15 days interval. These treatments were compared with untreated control. Observations on whiteflies and YVMV were recorded one day before and 3, 7, 10 days after spraying, on five randomly selected plants covering three leaves, one each from top, middle and bottom portion of the plant. Fruit yield was also recorded. The data were subjected to statistical analysis.

Results and Discussion

Whitefly population ranged from 3.1 to 3.8 per 3 leaves, on one day before first spray (Table 1). At 3 and 7 DAS spraying crop treated with spinosad 45 SC (0.13 and 1.00 whitefles/3 leaves, respectively) recorded significantly lowest whitefly population followed by acetamiprid 20 SP (0.2 and 2.00 whitefles/3 leaves, respectively).

Similar trend was followed in 10 DAS as well. On the third day after second spray, less number of whiteflies were observed in spinosad 45 SC (0.2) followed by acetamiprid 20 SP (0.26) followed by buprofezin 25 SC (0.63). On seventh and tenth DAS spinosad 45 SC was clearly the superior treatment followed by acetamiprid 20 SP.

Among the treatments Sequential spray of spinosad 45SC excelled over other foliar treatments by recording the lowest whitefly population population of 1.51 whiteflies per five plants followed by acetamiprid 20 SP (1.79) and sequential spray of neem oil @ 2% and buprofezin 25 SC (2.19).

Highest percent protection of 91.95 % was shown by spinosad 45 SC followed by acetamiprid 20 SP (90.22%) followed by sequential spray of neem oil @ 2% and buprofezin 25 SC (89.08 %). Sequential spray of sesame oil @ 5% followed by spiromesifen 240 SC reported the lowest percent protection (77.50 %).

Table.1 Effect of various vegetable oils and insecticide schedules on population of *Bemisia tabaci* on Okra (Whiteflies/ 3 leaves)

Treatments	1DBS	3 DAS	7DAS	10 DAS	1 DBS	3 DAS	7 DAS	10 DAS	Mean	Percent protection
T1 - Imidacloprid 70 WS @ 5 g/kg seed	0.5	1.2	1.4	1.8	2.5	2.6	3.2	3.6	2.10	79.30
T2 -Thiamethoxam 70 WS@ 5 g/kg seed	0.2	1	1.5	2	2.4	2.7	3	3.4	2.05	80.45
T3 -First spray neem oil @ 2% + second spray buprofezin 25 SC@ 0.4%	3.5	0.33	2.4	3	4.8	0.63	1	1.9	2.19	89.08
T4 - First spray of mustard oil @ 5% + second spray pyriproxifen 0.5 GR @ 0.5%	3.4	2.4	3.4	4.7	7.72	2.2	3.2	3.8	3.27	78.10
T5- First spray of sesame oil @ 5% + second spray spiromesifen 240 SC @ 0.2%	3.8	2.7	3.8	4.96	8.00	2.9	3.4	3.9	3.65	77.50
T6- First spray of bifenthrin 10 EC @ 0.4 % + second spray imidacloprid 200 SL @ 0.2 %	3.2	0.46	2.8	3.4	4	0.7	1.3	2.2	2.25	87.30
T7- First spray of lambda cyhalothrin 5 EC@0.5% + second spray of thiamethoxam 25 WG @ 0.2%	3.1	0.33	3.2	4	5.2	0.86	1.6	2.5	2.59	85.60
T8- 2 sprays of acetamiprid 20 SP @ 0.2 %	3.4	0.2	2	2.8	3.2	0.26	0.8	1.7	1.79	90.22
T9- 2 sprays of spinosad 45 SC @ 0.015%	3.8	0.13	1	2.2	2.9	0.20	0.5	1.4	1.51	91.95
T10- Untreated check	3.5	8.1	10.2	12.2	14.4	14.33	15.2	17.4	11.91	-
SE(m)	0.03	0.08	0.02	0.03	0.04	0.03	0.05	0.03	-	-
C.D.	0.11	0.14	0.07	0.10	0.12	0.11	0.14	0.10	-	-

Table.2 Effect of various vegetable oils and insecticide schedules on OYVMV incidence on Okra

Treatments	1DBS	20 days after first spray	20 days after second spray	Mean	Percent protection
T1 - Imidacloprid 70 WS @ 5 g/kg seed	6.1	18.1	26.5	16.90	72.14
T2 -Thiamethoxam 70 WS @ 5 g/kg seed	5.7	17.9	26.1	16.56	72.56
T3 -First spray neem oil @ 2% + second spray buprofezin 25 SC @ 0.4%	11.56	20	34.3	21.95	63.94
T4 - First spray of mustard oil @ 5% + second spray pyriproxifen 0.5 GR @ 0.5%	12.2	42.7	55.8	36.90	41.30
T5- First spray of sesame oil @ 5% + second spray spiromesifen 240 SC @ 0.2%	12.00	50.4	64.9	42.43	31.17
T6- First spray of bifenthrin 10 EC @ 0.4 % + second spray imidacloprid 200 SL @ 0.2 %	11.46	26.2	38.4	25.35	59.60
T7- First spray of lambda cyhalothrin 5 EC @ 0.5% + second spray of thiamethoxam 25 WG @ 0.2%	12.40	30.5	40.7	27.86	57.22
T8- 2 sprays of acetamiprid 20 SP @ 0.2 %	11.36	19.4	31.1	20.62	67.31
T9- 2 sprays of spinosad 45 SC @ 0.015%	12.50	18.8	27.00	19.43	71.62
T10- Untreated check	12.20	70.18	95.14	59.17	-
SE(m)	0.12	0.17	0.09	-	-
C.D.	0.38	0.52	0.28	-	-

Table.3 Effect of various vegetable oils and insecticide schedules on yield and economics of okra

Treatments	Yield (q/ha)	Total Cost of cultivation (Rs/ha)	Gross returns (Rs/ha)	Net returns (Rs/ha)	Cost: Benefit ratio
T1 - Imidacloprid 70 WS @ 5 g/kg seed	115	31883	345000	313117	1:10.8
T2 -Thiamethoxam 70 WS @ 5 g/kg seed	122	32070	366000	333930	1:11.4
T3 -First spray neem oil @ 2% + second spray buprofezin 25 SC@ 0.4%	94	33556	282000	248444	1:8.4
T4 - First spray of mustard oil @ 5% + second spray pyriproxifen 0.5 GR @ 0.5%	60	32935	180000	147065	1:5.4
T5- First spray of sesame oil @ 5% + second spray spiromesifen 240 SC @ 0.2%	52	32436	156000	123564	1:4.8
T6- First spray of bifenthrin 10EC @ 0.4 % + second spray imidacloprid 200 SL @ 0.2 %	72	32177	216000	183823	1:6.7
T7- First spray of lambda cyhalothrin 5 EC @ 0.5% + second spray of thiamethoxam 25 WG @ 0.2%	64	32600	192000	159400	1:5.8
T8- 2 sprays of acetamiprid 20 SP @ 0.2 %	100	32560	300000	267440	1:9.2
T9- 2 sprays of spinosad 45 SC @ 0.015%	107	34600	321000	286400	1:9.3
T10- Untreated check	43	30000	129000	99000	1:4.3
SE(m)	0.14	-	-	-	-
C.D.	0.44	-	-	-	-

The disease incidence at 20 days after first spray was significantly less in thiamethoxam 70 WS (26.1 %) treatment followed by Imidacloprid 70 WS (26.5 %) and spinosad 45 SC (27 %). Similar trend was followed till 20 days after second spray (Table 2). Highest percent protection of 72.56 % was shown by thiamethoxam 70 WS followed by imidacloprid 70 WS (72.14 %). Sequential spray of mustard oil @ 5% followed by pyriproxifen 0.5 GR reported the lowest percent protection (31.17 %).

Among the treatments, maximum marketable fruit yield of 122 q/ha was recorded in thiamethoxam 70 WS treatment followed by imidacloprid 70 WS (115 q/ha) followed by spinosad 45 SC (107 q/ha) as against the untreated control (43 q/ha) (Table 3). The best C: B ratio of 1:11.4 achieved in thiamethoxam 70 WS treatment followed by imidacloprid 70 WS (1:10.8) and spinosad 45 SC (1:9.3).

These results proved that imidacloprid 70 WS and thiamethoxam 75 WS were effective in controlling whitefly as well as incidence of yellow mosaic virus and registered higher yields with best cost: benefit ratio. Crop age influences the disease intensity and yield loss (Sastri and Singh, 1974; Ali *et al.*, 2005). If the disease occurs in the first 20 days of crop growth, the total yield loss may reach up to 94 % (Sastri and Singh, 1974). Plants of 50 and 65 days age suffer a yield loss as high as 84 and 49 %, respectively (Ali *et al.,* 2005). Hence the seed treatment imposed plots escaped the vector infestation in the early stages of crop growth resulting in less OYVMV incidence and yield loss in the respective plots.

The results are in agreement with findings of Day *et al.*, (2005) who revealed that all the dosages of imidacloprid 70 WS *viz.*, 5, 7.5 and 10 g/kg seed provided excellent protection against, whiteflies upto 45 days after sowing in okra and their efficiencies were significantly superior to carbosulfan @ 50 g/kg of seed. According to Kale *et al.*, (2005) seed treatment with thiamethoxam @5 g a.i./ha was the most effective treatment in reducing and whitefly populations in okra with higher yield and cost benefit ratio. Dhar and Bhattacharya (2015) also reported that single application of imidacloprid 17.8% SL followed by twice applications of Spinosad 45% SC gave maximum reduction in infestation of whitefly both in okra and tomato. This treatment was also effective against reduction of disease incidence of Yellow Vein Mosaic and Leaf Curl virus in okra & tomato respectively due to effective management of whitefly acting as vector.

Similar results on neonicotinoids were reported by Raghuraman and Gupta (2005) that acetamiprid 40 g a.i/ha and imidaclopird 100 g a.i./ha were the most effective treatments against *B. tabaci* and 48 and 45% increase in seed cotton yield over control, respectively. Saha *et al.,* (2011) also reported that some neonicotinoids were better that for control of various insect pests with higher C: B ratio.

Based on the results from the present study, we suggest neonicotinoids *viz.*, thiamethoxam 70 WS, imidacloprid 70 WS as seed treatment and spinosad 45 SC as foliar spray over conventional insecticides for formulating a successful management strategy for whitefly vector and OYVMV in okra.

References

Ali, S., Khan, M. A., Habib, A., Rasheed, S and Iftikhar, Y. 2005. Correlation of environmental conditions with *Okra yellow vein mosaic virus* and *Bemisia* *tabaci* population density. *International Journal of Agriculture and Biology*.7: 142-144.

Anonymous, 2002. *Package of Practices of for Higher Yields*. University of Agricultural Sciences, Dharwad. pp. 234-235.

Day, P. K., Jana, S. K., Chakraborty, G. and Somuchoudhury, A. K. 2005. Evaluation of imidacloprid (70 WS and 20 SL) against sucking pest complex of okra. *Journal of Entomological Research*, 29(3): 215-218.

Dhar, T and Bhattacharya, S. 2015. Efficacy of imidacloprid and spinosad against pest complex of okra and tomato. *International journal of bio-resource, environment and agricultural sciences*. Vol. 1(3): 126-131.

Kale, J. V., Wadnerkar, D. W., Zanwar, P. R. and Sangle, P. D., 2005. Bioefficacy of newer inseticides against inset pests of okra. *Pestology*. 29: 9-12.

Oliveira, M.R.V., Henneberry, T.J., Anderson, P. 2001. History, current status, and collaborative research projects for *Bemisia tabaci*. *Crop Protection*. 20: 709-723.

Raghuraman, M. and Gupta, G.P. 2005. Field evaluation of neonicotinoids against whitefly, *Bemisia tabaci* Genn. In cotton. *Indian Journal of Entomology*, 67 (1): 29-33.

Saha, T., Patil, R.K., Basavanna, K., Shekhrappa and Nithya, C. 2011. Evaluation of insecticides against Apion amplum under laboratory and field conditions. *Annals of Plant Protection Science*, 19: 10-14

Sastry, K.S. M and Singh, S. J. 1974. Effect of *yellow vein mosaic virus* infection on growth and yield of okra crop. *Indian Phytopathology*. 27: 294-297.

Sheikh, M.A., Safiuddin, Z. K and Mahmood, I. 2013. Effect of *bhendi yellow vein mosaic virus* on yield components of okra plants. *Journal of Plant Pathology*. 95 (2): 391-393.

Venkataravanappa, V., Reddy, C.N.L., Swaranalatha, P., Jalali, S., Briddon, R.W, Reddy, M.R. 2011. Diversity and phylogeography of begomovirus-associated beta satellites of okra in India. *Virology journal*. 8:555.

Venkataravanappa, V., Reddy, C.N.L., Swaranalatha, P., Jalali, S., Briddon, R.W, Reddy, M.R. Molecular characterization of distinct bipartite begomovirus infecting bhendi (*Abelmoschus esculentus L*) in India. Virus Genes 44: 555