Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2018; 6(5): 1030-1033

Received: 25-07-2018
Accepted: 26-08-2018

G Rajeshwari
College of Horticulture, UHS Campus, GKVK Post, Bengaluru, Karnataka, India

KRM Bhanu
Bio Control Research Laborotories, Sriramanahalli, Rajanukunte, Bengaluru, Karnataka, India

AK Chakravarthy
Division of Entomology and Nematology, ICAR-IIHR, Hesarghatta, Bengaluru, Karnataka, India

V Sridhar
Division of Entomology and Nematology, ICAR-IIHR, Hesarghatta, Bengaluru, Karnataka, India

S Mohan Kumar
College of Horticulture, UHS Campus, GKVK Post, Bengaluru, Karnataka, India

Correspondence
G Rajeshwari
College of Horticulture, UHS Campus, GKVK Post, Bengaluru, Karnataka, India

Efficacy of Biorational compounds against red spider mites on okra and brinjal

G Rajeshwari, KRM Bhanu, AK Chakravarthy, V Sridhar and S Mohan Kumar

Abstract
Field experiments were conducted to evaluate the efficacy of Biorationals against red spider mites on okra and brinjal at different spray schedule. Altogether eight treatments, i.e. Azadirachtin 10,000 ppm @1ml/l, *Lecanicillium lecanii* @2g/l, Neem soap @10g/l, Organic salt 30 WS @4 ml/l, Organic salt 30 WS @ 5ml/l, Spinosad 45 SC @0.2 ml/l, Dimethoate 30 EC @1.6 ml/l and one control (no spray) were selected for the experiment. Cumulative mean efficacy on population reduction after 3, 7 and 15 days after spraying indicated that among the different treatments, Organic salt 30 WS @ 5 ml/l was significantly superior and recorded lower mite population (2.59 mites/cm^2 leaf on okra and 1.98 mites/cm^2 leaf on brinjal) than other treatments. Whereas, the highest number of mites was recorded in neem soap (5.83 mites/cm^2 leaf on okra and 4.17 mites/cm^2 leaf on brinjal).

Keywords: Okra, Brinjal, Mites, Biorationals, Organic salt

Introduction
Red spider mite (*Tetranychus sp.*) is highly polyphagous pest attacking many field and horticultural crops, distributed throughout the world and often severely affected under dry conditions. Okra and brinjal crops are more suffered due to the damage caused by red spider mites (Singh and Mukherjee, 1991) [11]. Mites are responsible to cause significant damage on brinjal crop (Bitton and Nakash, 1986; David and Kumarswamy, 1989; Yadav *et al*., 1987; Singh, 1989) [2, 4, 13, 11, 12]. Adults are tiny, oval, spider like creature, reddish brown with 4 pairs of legs. Eggs are globular and whitish. The first instar larvae is pinkish in colour and having only three pairs of legs. The matured larvae are greenish- red in colour but have four pairs of legs. Both nymphs and adults suck the sap from under surface of the leaves. The yield loss was estimated from Bangalore (13.64%) and Varanasi (31.09%) respectively, in brinjal due to damage of red spider mite, *Tetranychus urticae* (Koach) (Anonymous., 1998) [1] and also 46 per cent loss in okra due to red spider mite was recorded by Mohanasundharam and Sharma during 2011.

Materials and Methods
Field experiments were conducted during 2015-16 to evaluate biorationals against mites on okra and brinjal crop at Division of Entomology, ICAR-Indian Institute of Horticultural Research (ICAR-IIHR), Bangalore under field conditions. Randomized Complete Block Design was selected for study with eight treatments and three replications. The study area was situated in Eastern dry zone of Karnataka state at coordinates of 120 58´ N latitude and 770 45´E longitude with elevation of 930 m above MSL.

Treatments consisted of seven bio-rational compounds with different concentration and one control (untreated) as given in the below table. Okra (direct sowing) and brinjal (transplanted) were taken up in separate plots by following recommended package of practices of University of Horticultural Sciences, Bagalkot. The size of plot was 4 x 4 m. The first spray application was given at 30 days after sowing and transplanting of respected crops. Subsequent sprays were given at 15 days intervals. Spray application was taken up during cooler hours of the day preferably morning. The observations were taken a day before the spray, three, seven and fifteen days after the spray (Chavan *et al*., 2008) [3], Table 1. Mite populations were recorded from three leaves of each plant on top, middle and bottom leaves (Singh and Kaushik, 1990) [10] on 15 randomly selected tagged plants.

Organic salt (LASTRAW^{TM}) is specially formulated water soluble organic salt of fatty acids of vegetable oil origin developed by Pest Control (India) PVT LTD, Bengaluru for the management of soft bodied sucking pests on contact.

Table 1: Treatment details

S. No	Treatments	Concentration	Water volume (litre/ha)
T1	Azadirachtin 10,000 ppm	1 ml/l	**500**
T2	*Lecanicillium lecanii* (2x10^8 spores/g)	2 g/l	
T3	Neem soap	10 g/l	
T4	Organic salt 30 WS	4 ml/l	
T5	Organic salt 30 WS	5 ml/l	
T6	Spinosad 45 SC	0.2 ml/l	
T7	Dimethoate 30 EC	1.6 ml/l	
T8	Untreated Control	-	

Statistical Analysis

The data obtained from the experiments were subjected to ANOVA with appropriate statistical square root transformation. After analysis, data was presented in the table as per the need of objective for interpretation of results. The interpretation of data was done by using the critical difference value calculated at 0.05 level of probability.

Results and Discussion

First spray

The data presented in the table 2, revealed that all the treatment schedules were significantly superior over control throughout the entire period of study. First spray, there was no significant difference among the treatments with respect to number of mites per three leaves at one day before imposition of the treatment; it ranged from 8.18 to 8.33/cm^2 leaf. There was a significant difference among the treatments on mite population at three days after spraying. Among the different treatments organic salt 30 WS @ 5 ml/l was significantly superior and recorded lower mite population (2.96 mites/cm^2 leaf). The next best treatments are spinosad 45 SC @ 0.2 ml/l (3.38 mites/cm^2 leaf) and azadirachtin 10,000 ppm @ 1.0 ml/l (5.51 mites/cm^2 leaf). Seven days after spraying all the treatments were effective over control in reducing the population of mites. Significantly lowest population (2.48 mites/cm^2 leaf) was recorded in organic salt @ 5 ml/l. whereas, the highest number of mites was recorded in neem soap @ 10g/l (5.90 mites/cm^2 leaf). There was a significant difference among the treatments with respect to number of mites per three leaves at 15 days after imposition of the treatment. The lowest number of mite population (2.73 mites/cm^2 leaf) was recorded in organic salt 30 WS @ 5 ml/l which was found on par with spinosad 45 SC @ 0.2 ml/l (3.20 mites/cm^2 leaf).

Second spray

Significantly minimum number of mite population (2.78 and 2.10 per cm^2) was recorded in organic salt 30 WS @ 5 ml/l followed by spinosad 45 SC @ 0.2 ml/l (3.20 and 2.88 mites/cm^2 leaves) with respect to 3 and 7 days after spraying. While same trend was observed in 15 days after imposition of the treatment. Lowest number of mite population (2.52 mites/cm^2 leaf) was noticed in organic salt 30 WS @ 5 ml/l, which was on par with spinosad 45 SC @ 0.2 ml/l (2.99 mites/cm^2 leaf). While highest population was recorded in neem soap @ 10g/l (5.58 mites/cm 2 leaf) followed by organic salt 30 WS @ 4 ml/l (5.26 mites/cm^2 leaf), *L. lecanii* @ 2g/l (5.13 mites/cm 2 leaf) and were on par with each other. The mean pooled data of two sprays revealed that, organic salt 30 WS @ 5 ml/l was recorded lowest population (2.59 mites/cm^2 leaf) and was significantly superior over all the other treatments followed by spinosad 45 SC @ 0.2 ml/l (3.13 mites/cm^2 leaf), dimethoate 30 EC @1.6ml/l (4.81 mites/cm^2 leaf), respectively. The present findings are in agreement with those of Kaur and Srinivasan (2014) who reported that organic salt 30 WS @ 5 ml/l was the most effective in reducing the population of mites on sweet pepper and Gowda *et al*. (2013) [5] reported on papaya mealybug. These findings were also in conformation with Pandey *et al*., 2014 [9]; Kalawate and Dethe, 2012 [6], who reported that spinosad was highly effective in reducing the population of sucking pests.

Table 2: Evaluation of biorationals against *T. urticae* on okra during 2015-16

Treatments	No. of mites/cm^2 leaf (n=15 plants)										Pooled mean
	I Spray					II Spray					
	DBS	3 DAS	7 DAS	15 DAS	Mean	DBS	3 DAS	7 DAS	15 DAS	Mean	
T1 - Azadirachtin (10,000 ppm) @ 1ml/l	8.18 (2.95)	5.51 (2.45)	4.70 (2.28)	4.89 (2.32)	5.03	7.82 (2.88)	5.10 (2.37)	4.56 (2.25)	4.73 (2.29)	4.79	4.91
T2 - *Lecanicillium lecanii* @ 2 g/l	8.24 (2.96)	5.69 (2.49)	5.36 (2.42)	5.42 (2.43)	5.59	8.01 (2.92)	5.40 (2.43)	4.93 (2.33)	5.13 (2.37)	5.15	4.87
T3 - Neem soap @ 10 g/l	8.28 (2.96)	6.20 (2.59)	5.90 (2.53)	6.08 (2.56)	6.06	7.95 (2.90)	5.80 (2.51)	5.42 (2.43)	5.58 (2.47)	5.60	5.83
T4 - Organic salt 30 WS @ 4 ml/l	8.31 (2.97)	5.94 (2.54)	5.53 (2.46)	5.72 (2.49)	5.73	8.38 (2.98)	5.49 (2.45)	5.20 (2.39)	5.26 (2.40)	5.31	5.52
T5 - Organic salt 30 WS @ 5 ml/l	8.26 (2.96)	2.96 (1.86)	2.48 (1.73)	2.73 (1.80)	2.72	8.33 (2.97)	2.78 (1.81)	2.10 (1.61)	2.52 (1.73)	2.46	2.59
T6 - Spinosad 45 SC @ 0.2 ml/l	8.33 (2.97)	3.38 (1.94)	3.15 (1.91)	3.20 (1.92)	3.24	8.08 (2.93)	3.20 (1.92)	2.88 (1.83)	2.99 (1.87)	3.02	3.13
T7 - Dimethoate 30 EC @ 1.6 ml/l	8.15 (2.94)	5.27 (2.40)	5.01 (2.35)	5.12 (2.36)	5.13	8.07 (2.93)	4.78 (2.30)	4.50 (2.24)	4.17 (2.16)	4.48	4.81
T8 - Untreated control	8.30 (2.97)	8.44 (2.99)	8.61 (3.02)	8.81 (3.05)	8.62	8.31 (2.97)	8.48 (3.00)	8.59 (3.01)	8.69 (3.03)	8.58	8.60
CD at 5%	NS	1.10	0.35	0.89	-	NS	0.30	0.41	0.55	-	-
SEm±	-	0.36	0.11	0.29	-	-	0.10	0.13	0.18	-	-

DBS - Day before spraying, DAS - Days after spraying

Figures in parentheses are $\sqrt{X + 0.5}$ transformed value

Table 3: Evaluation of biorationals against *T. cinnabarinus* on brinjal during 2015-16

Treatments	No. of mites/cm² leaf (n=15 plants)										Pooled mean
	I Spray					II Spray					
	DBS	3 DAS	7 DAS	15 DAS	Mean	DBS	3 DAS	7 DAS	15 DAS	Mean	
T1 - Azadirachtin (10,000 ppm) @ 1ml/l	7.47 (2.82)	3.60 (2.02)	3.05 (1.88)	3.24 (1.93)	3.29	7.10 (2.76)	3.70 (2.05)	3.37 (1.97)	3.68 (2.04)	3.58	3.44
T2 - *Lecanicillium lecanii* @ 2 g/l	7.40 (2.81)	3.81 (2.08)	3.44 (1.98)	3.57 (2.02)	3.60	7.21 (2.78)	3.97 (2.11)	3.57 (2.02)	3.85 (2.08)	3.79	3.70
T3 - Neem soap @ 10 g/l	7.75 (2.87)	4.22 (2.17)	3.92 (2.10)	4.16 (2.16)	4.10	7.11 (2.76)	4.36 (2.20)	4.07 (2.14)	4.29 (2.19)	4.24	4.17
T4 - Organic salt 30 WS @ 4 ml/l	7.65 (2.85)	3.90 (2.10)	3.58 (2.02)	3.65 (2.04)	3.71	7.26 (2.79)	4.22 (2.17)	3.91 (2.10)	4.34 (2.20)	4.15	3.93
T5 - Organic salt 30 WS @ 5 ml/l	7.59 (2.84)	2.08 (1.61)	1.57 (1.44)	1.86 (1.51)	1.83	7.14 (2.76)	2.29 (1.67)	1.94 (1.56)	2.16 (1.63)	2.13	1.98
T6 - Spinosad 45 SC @ 0.2 ml/l	7.59 (2.84)	2.54 (1.74)	1.84 (1.53)	1.90 (1.55)	2.09	7.26 (2.78)	2.41 (1.71)	2.31 (1.68)	2.20 (1.64)	2.30	2.20
T7 - Dimethoate 30 EC @ 1.6 ml/l	7.69 (2.86)	3.11 (1.90)	2.45 (1.72)	2.30 (1.67)	2.62	7.14 (2.76)	3.55 (2.01)	3.25 (1.94)	3.34 (1.96)	3.38	3.00
T8 - Untreated control	7.61 (2.85)	7.76 (2.87)	7.89 (2.90)	8.21 (2.95)	7.95	7.28 (2.79)	7.40 (2.81)	7.59 (2.84)	7.76 (2.87)	7.58	7.77
CD at 5%	NS	0.40	0.25	0.79	-	NS	0.38	0.40	0.31	-	
SEm±	-	0.13	0.08	0.26	-	-	0.12	0.13	0.10	-	

DBS - Day before spraying, DAS - Days after spraying

Figures in parentheses are $\sqrt{X + 0.5}$ transformed values

***T. cinnabarinus* on brinjal**

Data recorded on population of mites at different days after treatments are presented in Table3.

First spray

Observations recorded on number of mites one day before spraying indicates uniform distribution of mites in all the treatments. However, it ranged from 7.40 to 7.75/ cm² leaf.

Observations recorded on mite population at three days after spraying indicated significant differences among different treatments. The minimum number of mites (2.08 mites/cm² leaf) was recorded in organic salt 30 WS@ 5 ml/l followed by spinosad 45 SC @ 0.2 ml/l (2.54 mites/cm² leaf). The maximum number of mites was recorded in neem soap @ 10g/l (4.22 mites/cm² leaf) followed by organic salt 30 WS @ 4 ml/l (3.90 mites/cm² leaf) and *L. lecanii* @ 2 g/l (3.81 mites/cm² leaf) and were on par with each other.

There was a significant difference among the treatments with respect to number of mites per cm² leaf at seven days after imposition of the treatment. Significantly minimum number of mite population (1.57 mites/cm² leaf) was recorded in organic salt 30 WS @ 5 ml/l which was on par with spinosad @ 0.2 ml/l (1.84 mites/cm² leaf).Whereas, maximum number of mites was recorded in neem soap @ 10g/l (3.92 mites/cm² leaf) followed by organic salt 30 WS @ 4ml/l (3.58 mites/cm² leaf) and *L. lecanii* (3.44 mites/cm² leaf), respectively.

After 15 days of the treatment imposition, least number of mites was recorded in organic salt 30 WS @ 5 ml/l (1.86 mites/cm² leaf) which was on par with spinosad 45 SC @ 0.2 ml/l (1.90 mites/cm² leaf). The next best treatment was dimethoate 30 EC @1.6ml/l (2.30 mites/cm² leaf) followed by azadirachtin 10,000 ppm@ 1.0 ml/l (3.24 mites/cm² leaf) and *L. lecanii* @ 2 g/l (3.57 mites/cm² leaf), respectively.

Second spray

Observations recorded on number of mites one day before spraying indicates uniform distribution of mites in all the treatments. However, it ranged from 7.10 to 7.28/cm²leaf.

Observations recorded on mite population at three days after spraying indicated significant differences among different treatments. Significantly minimum number of mites (2.29 mites/cm² leaf) was recorded in organic salt 30 WS @ 5 ml/l which was on par with spinosad 45 SC @ 0.2 ml/l (2.41 mites/cm² leaf).

Seven days after spraying showed that all the treatments were effective over control in reducing the population of mites. Significantly minimum number of mites (1.94 mites/cm² leaf) was recorded in organic salt 30 WS @ 5 ml/l which was found at par with rest of the treatments except spinosad 45 SC @ 0.2 ml/l (2.31 mites/cm² leaf). Whereas, maximum number of whiteflies was recorded in neem soap @ 10g/l (4.07 mites/cm² leaf) which was on par with organic salt 30 WS @ 4 ml/l (3.91 mites/cm² leaf).

Data recorded at 15 days after spraying showed that all the treatments were effective over control in reducing the population of mites. Significantly minimum number of mites (2.16 mites/cm² leaf) was recorded in organic salt 30 WS @ 5 ml/l which was on par with spinosad 45 SC @ 0.2 ml/l (2.20 mites/cm² leaf).Whereas, highest population was recorded in organic salt @ 4ml/l (4.34 mites/cm² leaf) followed by neem soap @ 10g/l (4.29 mites/cm² leaf) and were on par with each other.

The overall mean population differed significantly among treatments with respect to number of mites per cm² leaf. Among the different treatments, organic salt @ 5 ml/l (1.98 mites/cm² leaf) was significantly superior to all the other treatments. The highest population was recorded in neem soap @ 10g/l (4.17 mites/cm² leaf) which was on par with organic salt 30 WS @ 4ml/l (3.93 mites/cm² leaf).

The mean pooled data of two sprays recorded significant differences among the different treatments, the population of mites ranged from 1.98 to 4.17 mites/cm² leaf. The least number of mites were observed in organic salt 30 WS @ 5 ml/l treated plot followed by spinosad 45 SC@ 0.2 ml/l and dimethoate 30 EC @ 1.6 ml/l @ 1.98, 2.20 and 3.00 mites/cm² leaf, respectively. Kaur and Srinivasan, (2014) reported that organic salt 30 WS @ 5 ml/l was highly effective in controlling the mites.

Comment 5: Organic salt is a newly formulated chemical and there is no much work has been done. So I could not able to add more discussion.

Conclusion

Organic salt 30 WS @ 5 ml/l was the most effective in suppressing the mite incidence on okra and brinjal crops under field conditions. Organic salt 30 WS @ 5 ml/l was recorded the least incidence of mites on okra (2.59 mites/cm^2 leaf) and brinjal (1.98 mites/cm^2 leaf), respectively. On the contrary, spinosad 45 SC@ 0.2 ml/l was also recorded lowest population of mites (3.13 mites/cm^2 leaf on okra and 2.20 mites/cm^2 leaf on brinjal).

References

1. Anonymous. Progress Report for 1996-98. All India Coord. Res. Proj. Agric. Acar., Univ. Agric. Sci., GKVK, Bangalore, 1998, 136.
2. Bitton S, Nakash J. Control of red spider mite by the predaceous mite *Phytoseiulus persimilis* in open fields of egg plant and artichokes (glove). Hassadeh. 1986; 66:682-684.
3. Chavan BP, Kadam JR, Saindane YS. Bioefficacy of liquid formulation of *Verticillium lecanii* against red spider mite (*Tetranychus cinnabarinus*). Int. J. Plant Protec. 2008; 1(2):48-51.
4. David PMM, Kumarswami T. Influence of synthetic pyrethroids on the population of red spider mite *Tetranychus cinnabarinus* Boisduval in Bhindi. Indian J. Plant Prot. 1989; 17:271-274.
5. Gowda GB, Vijay Kumar L, Jagadish KS, Subhash B, Rani AT. Efficacy of insecticides against papaya mealybug, *Paracoccus marginatus*. Current Biotica. 2013; 7(3):161-173.
6. Kalawate A, Dethe MD. Bioefficacy study of biorational insecticide on brinjal. J Biopest. 2012; 5(1):75-80.
7. Mohanasundaram A, Sharma RK. Effect of newer pesticide schedules on the population of sucking pests and predators on okra. Pestic. Res. J. 2011; 23(1):55-63.
8. Naik HPR, Shekharappa. Field evaluation of different entomopathogenic fungal formulations against sucking pests of okra. Karnataka J Agri. Sci. 2009; 22(3):575-578.
9. Pandey S, Mishra RK, Upadhyay, Gupta RP. Management of onion thrips (*Thrips tabaci*) through botanicals and bio-pesticides. Hort Flora Research Spectrum. 2014; 3(1):81-84.
10. Singh G, Kaushik SK. Comparative efficacy and sampling techniques for jassid population estimation on okra., Indian J Ecol. 1990; 17:58-60.
11. Singh J, Mukherjee IN. Pest status of polyphagous mites in some Northern States of India. In: Proceedings of first Asia Pacific Conference of Entomology, Nov. 8-13, 1989. Chiangmas, Thailand. 1991; 1:192-203.
12. Singh JB. Evaluation of insecticidal schedules against some major insect pests in the brinjal crop ecosystem. 137 pp. M.Sc. (Ag.) Thesis. Sher-e-Kashmir University of Agricultural Science & Technology, Udheywala, India, 1989.
13. Yadav GS, Anand RK, Yadav PR. Bioefficacy of some chemicals against red spider mite on brinjal. Indian J Entomology. 1987; 49:582-584.