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RESEARCH NOTE

Efficacy of biopesticides and botanicals against *Carpomyia vesuviana* Costa on ber

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ABSTRACT: A field experiment on the relative efficacy of botanical and biopesticides against *Carpomyia vesuviana* Costa on ber was conducted in 2021-22. The results revealed that Spinosad45 SC was most effective, followed by azadirachtin 0.03 EC and NSKE (5%) whereas, *Neem* oil and *Karanj oil* were least effective. The treatment of *Beauveria bassiana* 1.15 WP and *Metarhizium anisopliae* 1.15 WP were found moderately effective against ber fruit fly.

Keywords: *Carpomyia vesuviana*, ber, biopesticides, azadirachtin, Karanj oil

The ber (*Ziziphus mauritiana* L.) also known as 'desert apple' is an important fruit crop in arid and semi-arid regions of Rajasthan, Haryana, Punjab, Gujarat, and other part of India. The low productivity of ber has been attributed to various abiotic and biotic factors the major factors that contributes towards low yield of ber is the damage done by a number of insect pests and diseases. Ber trees have been reported to be attacked by about over 100 species of insect- pests (Butani, 1979; Lakra and Singh, 1985). Among them ber fruit fly, *Carpomyia vesuviana* Costa is the most serious one (Sharma *et al.,* 1998, Lal *et al,.* 1993) and found everywhere in India where ber is grown. In serious cases, it causes severe yield loss up to 80 per cent or even up to 100 per cent damage (Sharma *et al.,* 1998; Karuppaiah, 2014). The use of botanicals and biopesticides for management of *Carpomyia vesuviana* is a part of this work for effective management of this pest and avoiding harmful effect to the predators.

A field experiment was laid out in a randomized block design (RBD) with eight treatments and replicated thrice. The ber variety 'Gola' recommended for this region was used andplant to plant distance of 8 m × 8 m. The treatments included were azadirachtin 0.03 EC, NSKE (5%), Neem oil (1%), *Metarhizium anisopliae* 1.15 WP, *Beauveria bassiana* 1.15 WP and spinosad and untreated control. Neem seed kernel extract was prepared by grinding known weight of kernel into a fine powder. The resulting powder was then socked overnight in sufficient quantity of water. The desired concentration of NSKE on kernel weight to volume (of water) basis was obtained by filtering the extract in a fine muslin cloth with repeated washing in the next morning. The volume was made up by adding the required quantity of water to get 5 per cent solution (Kumar *et al.,* 2000). Sandoval used one ml per liter of spray solution used as surfactant. The required quantity of different bio-pesticide was sprayed by using foot sprayer. Overall two sprays were done. The first spray was done at the peanut stage and second spray was done 30 days after the first spray. The fruit fly damage was recorded from each tree by observing hundred fruits randomly from bulk at each commercial picking (Patel *et al.*, 1989). Three pickings were taken during the season at ten days intervals. In all these treatments fruits were brought the laboratory and dissected with a knife and those possessing gallery, maggot or exit hole was taken as the fruit fly infestation. The yield of healthy fruits was recorded at each picking and mean fruit yield per tree was worked out.

The data as given in Table 1 indicate that the treatment of spinosad 45 SC was most effective having 11.61 per cent fruit infestation. This was followed by azadirachtin 0.03 EC having 23.72 per cent infestation. The treatment of *Beauveria bassiana* 1.15 WP and *Metarhizium anisopliae* 1.15 WP were found next effective treatments and resulted in 26.78 and 27.66 per cent infestation, respectively and at par to each other. The maximum infestation (30.86%) was recorded in *Karanj* oil followed by *Neem* oil (28.80%) treated plots which were found at par to each other. However, it was superior over control having 35.75 per cent fruit infestation. The treatments tested in the present study were not evaluated

earlier against ber fruit fly. Hence, the efficacy of these treatments tested on other crops discussed to support the present findings. In the present findings the efficacy of spinosad are conformity with that of Nehra *et al* (2019*)* and Rifat Alam *et al*. (2021) reported thet among the treatments, spinosad 45 SC performed the best based on minimum percent fruit infestation on both number and weight basis. Diksha *et al*. (2019) reported that among biopesticides, spinosad and azadirachtin though inferior over the synthetic pyrethroid, were as effective over neem and pongamia oil, *Beauveria bassiana*, clay and also over the recommended insecticide malathion. *Neem* oil, *B*. *bassiana*, Pongamia oil, clay and Neemastra treatments were not found much effective though these were superior over control. Bhowmik *et al*. (2014) reported that Neemazal and *karanj* oil were the least effective insecticide in reducing the fruit infestation by melon fruit fly.

Table 2 reveals that the maximum net profit of Rs. 625.04 per tree was recorded from the treatment of spinosad followed by azadirachtin (448/tree) and NSKE (379/tree). The lowest net profit of Rs. 193.80 per tree was obtained from *Karanj* oil which was followed by *Metarhiziumanisopliae* with net profit of Rs. 253.40 per trees. The net profit of Rs. 297.80 per trees was obtained from the treatment of *Neem*oil. The treatment of *Beauveria bassiana*, the net profit of cost of management of fruit fly was found 333.00. The highest cost benefit ratio of 1:4.03 was recorded from treatment of spinosad followed by *Beauveria bassiana,*

Table 1: Efficacy of different biopesticide against *C. vesuviana* on ber during 2021-22

Treatments	Formulation	Conc./ Dosage	Per cent fruit infestation at			Mean
	1.15 WP		10 DAT	20 DAT	30 DAT	
Beauveria bassiana		1g/l	24.60	26.78	29.00	26.78
			(29.82)	(31.12)	(32.57)	(31.14)
Karanj oil		1.5ml/l	28.00	31.80	32.80	30.86
	1.15 WP		(31.92)	(34.29)	(34.92)	(33.72)
Metarhizium anisopliae		1g/l	25.35	27.27	30.37	27.66
	Lab. prepared		(30.18)	(31.43)	(33.42)	(31.70)
NSKE		5.0%	23.37	25.80	28.00	25.72
	-		(28.86)	(30.48)	(31.93)	(30.44)
Neem oil		1 .5ml/l	25.80	29.40	31.20	28.80
	0.03 EC		(30.43)	(32.77)	(33.94)	(32.44)
Azadirachtin		5ml/l	21.38	23.50	26.30	23.72
	45 SC		(27.46)	(28.92)	(30.83)	(29.11)
Spinosad		0.01 %	10.38	11.47	13.00	11.61
	-		(18.68)	(19.71)	(21.11)	(19.90)
Untreated control		-	34.83	35.77	36.66	35.75
			(36.13)	(36.65)	(39.18)	(36.70)
S.Em.±			**0.51**	**0.61**	**0.81**	**0.26**
CD (p=0.05)			**1.57**	**1.88**	**2.50**	**0.80**

Figures in the parentheses are angular transformed value.
DAT = days after treatment

Table 2. Economics of different biopesticide applied for the management of *C. vesuviana* during 2021-22

Biopesticides	Formulation	Conc. (%)/ Dose	Marketable yield (kg/ tree)	Yield gain over control	Value of yield gain (Rs.)	Cost of treatment (Rs.)	Net profit/ tree (Rs.)	Incremental cost benefit ratio
Beauveria bassiana	1.15 WP	1 g/l	33.00	11.50	460.00	127.00	333.00	1:2.62
Karanj oil	-	1.5 ml/l	29.40	07.90	316.00	122.20	193.80	1:1.58
Metarhizium anisopliae	1.15 WP	1 g/l	31.00	09.50	380.00	126.60	253.40	1:2.0
NSKE	Lab prepared	5.0%	35.35	13.85	554.00	175.00	379.00	1:2.16
Neem oil	-	1.5 ml/l	32.00	10.50	420.50	122.20	297.80	1:2.41
Azadirachtin	0.03 EC	5 ml/l	37.00	15.50	620.00	172.00	448.00	1:2.60
Spinosad	45 SC	0.01%	41.00	19.50	780	154.96	625.04	1:4.03
Untreated			21.50	-	-			-

Market price ber: Rs. 40/kg

azadirachtin, *Neem* oil *and* NSKErecording the ratio of 1:2.62, 1:2.60 and 1:2.41 and 1:2.16 respectively. Cost benefit ratio obtained from the *Metarhizium anisopliae*was 1:2.00. The least cost benefit ratio was recorded in *Karanj* oil with 1:58. Diksha *et al*. (2019) who reported that among biopesticides, the BCR value of B. *bassiana* is 1:1.21 and Hosagoudar *et al*. (1999) reported that cost benefit ratio was maximum in Nimbicidine and NSKE with 1:3.00 and 1:3.24, respectively.

Effect of different treatments on marketable yield of ber fruits on weight basis

The data presented in Table 2 revealed that the weight of marketable fruits harvested from treated trees was recorded higher than control. Maximum weight of marketable yield of 41 kg ber per tree was recorded from the treatment of spinosad followed by azadirachtin and NSKE producing 37.00 and 35.35 kg per tree, respectively. The weight of marketable fruits in the treatments of *Beauveria bassiana*(33 kg/tree) and *Neem* oil (32kg/tree) respectively. Minimum weight of marketable fruit (29.40 kg/tree) was recorded from *Karanj* oil, followed by *Metarhiziumanisopliae* with and 31.00 kg fruits per tree, respectively. However, it was 21.50 kg per tree in untreated control. Hosagoudar *et al.* (1999) reported that lowest healthy fruit yield of ber was 12.76 and 13.53 kg/tree from Nimbicidine (0.03%) and NSKE (5%), respectively and shivbhagvan*et.al*. reported that lowest healthy fruit yield of ber was 17.20 and 18.45 kg/tree from Neem oil (1.5 ml/l) and NSKE (5%), respectively.

Effect of different treatments on loss due to ber fruit fly on weight basis

The data presented in Table 2 and revealed that the weight of fruits was also reduced due to the infestation of fruit fly *C. vesuviana*. The minimum loss in fruit weight (6.27 kg/tree) was recorded in the treatment of spinosad followed by azadirachtin, NSKE and *Neem* oil with loss of 09.92, 10.80 and 10.87 kg per tree, respectively. The loss in weight of fruit in the treatments of *Metarhizium anisopliae and Beauveria bassiana* was 10.90 and 11.00 kg per tree. The maximum loss in weight of fruits (12 kg/tree) was recorded from the treatment of *Karanj* oil. In control the loss in weight of fruits was recorded 13.50 kg per tree. Hosagoudar et al. (1999) reported that maximum fruit yield loss of 10.25 and 9.45 kg/tree as recorded from treatments of Nimbicidine (0.08%) and NSKE (5.0%), respectively. Shivbhagvan *et al*., reported that maximum fruit yield loss of 9.13 and 8.98 kg/tree as recorded from treatments of NSKE (5.0%) and Neem oil (1.5 ml/l), respectively.

The study showed that using spinosad resulted in the lowest total and percentage of avoidable losses, as well as the highest benefit-cost ratio. These results indicate that this biopesticide is effective in reducing fruit fly presence in ber fields while maintaining economic viability.

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