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Field evaluation of botanical pesticides and entomopathogens against leafhopper, *Amrasca biguttula biguttula* (Ishida) on bhendi

S. SOWMIYA* and M. PAZHANISAMY

Department of Entomology, Faculty of Agriculture, Annamalai University, Chidambaram- 608002, Tamilnadu, India

E-mail*: sowmiyasivanesan22@gmail.com

ABSTRACT: Field experiments were conducted to evaluate the efficacy of botanical pesticides and entomopathogens against leaf hopper, *Amrasca biguttula biguttula* (Ishida) on bhendi crop during *kharif* and *rabi* 2018. The results showed that the highest per cent reduction in leafhopper population was observed with ginger oil 3% treatment followed by NSKE @ 5% and *Verticilium lecani* (0.5%).

Keywords: Bio pesticides, entomopathogens, leaf hopper, bhendi

INTRODUCTION

Okra or bhendi (*Abelmoschus esculentus*(L.)Moench) is an important vegetable crop in India. Besides producing edible fruits, stem is also a source of fibre. Matured fruits and stem containing crude fibre are used in paper industry (Malaichattiwar *et al*., 2014). Insect pests are one of the most important constraints in profitable and safe production of bhendi. Among several pests recorded, leafhopper, *Amrasca biguttula biguttula* (Ishida), is a of major pest on okra which could cause 32.06 to 56.0% yield loss. They are more serious in the early stage of the crop which desap the plants, make them weak and reduce the yield (Krishnaiah, 1980). Often farmers resort to spray synthetic insecticides at closer intervals leading to several undesirable effects on food and environment. Besides, the use of chemical insecticides is not advisable on bhendi due to serious problem of residue in the fruits. Hence it is essential to use safer means like botanical or biopesticides. The current trends of modern society towards 'green consumerism' desiring fewer synthetic ingredients in food may favour plant-based products which are generally recognized as safe in eco-friendly management of plant pests as botanical pesticides. Considering the importance of eco-friendly approaches to manage the pests, the present study was intended to evaluate certain botanical insecticides and mycopathogens against major sucking pests of bhendi under organic farming.

MATERIALS AND METHODS

Field experiments were conducted at a farmer field in Sivapuri, Annamalainagar (Situated at 11° 24'N latitude and 79°41'E longitude and an altitude of 5.79 m above the mean sea level), Tamil Nadu, India to study the efficacy of eight plant based insecticides and three entomofungus based biopesticides during *kharif* and *rabi* of 2018. The popular bhendi variety (cultivar: Arka Anamika) was to sown at spacing of 45×30 cm. The earmarked crop area was divided into three blocks and each block was considered as a replication.

For the assessment of sucking insect pests of bhendi, a diagonal method was used. Data were recorded early in the morning by counting leafhoppers with the help of magnifying lens on five randomly selected plants per treatment. Three leaves per plant were observed randomly from top, middle and lower portion of the plants. The first spray was given at 30 days after sowing and second and third spray were carried out at 15 days interval. Pre-treatment data was recorded 24 hours before spray and post treatment data were recorded 24h, 48h and 72 h and 7 days after spray to determine the effect of treatments. The mean populations of sucking pests from sprayed plots were considered to be an indirect reflection of different botanicals and entomopathogens.

RESULTS AND DISCUSSION

First Season *(kharif 2018)*

Data presented in table 1 showed that all the treatments were significantly superior over control. Among all the treatment, the spray of ginger oil @ 3% recorded the highest per cent reduction in leafhopper population with the mean of 9.43, 7.84, 5.10, 4.54, 3.32, 2.46 at 3, 7 and 10 days after first and second spray respectively. The next effective treatment was spray of NSKE @ 5% which gave 12.35, 8.94, 4.89, 3.41, 2.11, 1.53 reduction in leaf hopper population followed by *V. lecani* @ 0.5% (12.07, 9.11, 6.98, 3.91, 2.18, 3.78) at 3, 7 and 10 days after first and second spray respectively. The results of field trial indicated that the highest per cent reduction

Table 1. Bio-efficacy of bio-pesticides against leafhopper on bhendi under field condition during *kharif* 2018

Treatment	Dose per litre	Number of leafhoppers/ 3 leaves							Overall mean	Reduction over control %
		First spray				Second spray				
		Precount	3DAS	7DAS	10DAS	3DAS	7DAS	10DAS		
Neem seed kernel extract	5%	20.31 (4.62)	12.35 (3.65)^{c}	8.94 (3.15)^{b}	4.89 (2.43)^{a}	3.41 (2.09)^{a}	2.11 (1.76)^{a}	1.53 (1.59)^{a}	5.54	77.67
Bakain extract	5%	22.93 (4.89)	14.29 (3.91)^{e}	11.95 (3.60)^{d}	7.26 (2.87)^{d}	5.06 (2.46)^{d}	3.14 (2.03)^{b}	4.01 (2.24)^{cd}	7.62	69.29
Garlic + Chilli extract	5%	23.23 (4.92)	10.82 (3.43)^{b}	7.92 (2.99)^{a}	6.43 (2.72)^{b}	5.93 (2.63)^{e}	3.51 (2.12)^{c}	4.18 (2.27)^{d}	6.47	73.92
Bitter gourd extract	5%	21.94 (4.79)	18.73 (4.44)^{h}	12.91 (3.73)^{e}	10.43 (3.38)^{fg}	9.83 (3.29)^{g}	4.67 (2.38)^{e}	5.46 (2.54)^{e}	10.34	58.32
Lemon oil	3%	22.96 (4.89)	10.42 (3.38)^{b}	8.14 (3.02)^{ab}	6.91 (2.81)^{c}	5.91 (2.63)^{e}	4.21 (2.28)^{d}	3.98 (2.23)^{cd}	6.60	73.39
Garlic oil	3%	22.03 (4.80)	13.14 (3.76)^{d}	9.3 (3.21)^{bc}	7.39 (2.90)^{d}	4.16 (2.27)^{b}	2.19 (1.79)^{a}	2.11 (1.76)^{b}	6.38	74.28
Ginger oil	3%	24.73 (5.07)	9.43 (3.23)^{a}	7.84 (2.97)^{a}	5.10 (2.47)^{a}	4.54 (2.35)^{c}	3.32 (2.07) ^{bc}	2.46 (1.86)^{bc}	5.45	78.03
Eucalyptus oil	3%	21.92 (4.79)	16.21 (4.15)^{g}	11.42 (3.52)^{cd}	10.14 (3.34)^{f}	5.09 (2.47)^{d}	4.17 (2.27)^{d}	4.13 (2.26)^{d}	8.53	65.62
Calamus oil	3%	24.66 (5.06)	19.82 (4.56)^{i}	15.87 (4.11)^{f}	11.03 (3.47)^{g}	6.50 (2.74)^{f}	5.60 (2.57)^{f}	6.17 (2.68)^{f}	10.83	56.35
Verticillium lecani	0.5%	21.91 (4.79)	12.07 (3.61)^{c}	9.11 (3.18)^{bc}	6.98 (2.82)^{c}	3.91 (2.22) ^{ab}	2.18 (1.78)^{a}	3.78 (2.19)^{c}	6.34	74.44
Bacillus thuringiensis	0.3%	23.73 (4.97)	15.65 (4.08)^{f}	10.26 (3.35)^{c}	8.91 (3.15)^{e}	4.93 (2.43) ^{cd}	3.18 (2.04)^{b}	2.11 (1.76)^{b}	7.51	69.73
Metarhizium anisopliae	0.5%	20.33 (4.61)	17.29 (4.28) $^{g\ h}$	14.95 (3.99)^{g}	12.13 (3.62)^{h}	5.67 (2.58) ^{de}	3.33 (2.08) ^{bc}	3.83 (2.20)^{c}	9.53	61.59
Beauvaria bassiana	0.3%	25.66 (5.16)	21.98 (4.79)^{k}	16.91 (4.23)^{h}	10.84 (3.44)^{g}	6.7 (2.77)^{f}	5.87 (2.62)^{f}	6.93 (2.82)^{g}	11.54	53.49
Untreated check	-	21.91 (4.78)	20.94 (4.68)^{j}	22.74 (4.87)^{i}	24.47 (5.04)^{i}	25.41 (5.14)^{h}	27.19 (5.31)^{g}	28.11 (5.39)^{h}	24.81	0.00
SE (d)		0.096	0.077	0.069	0.062	0.054	0.048	0.049	0.061	
CD (0.05%)		0.198	0.160	0.142	0.129	0.111	0.099	0.102	0.126	

PTC = Pre – treatment Count, HAT = Days after treatment

* Mean of three replications, Figures in parentheses are arcsine (x + 0.5) transformed values, means in column followed by a common letter are not significantly different at the 5 per cent level (DMRT)

Table 2. Bio-efficacy of bio-pesticides against leaf hopper on bhendi under field condition during *rabi* 2018

Treatment	Dose per litre	Number of leafhoppers/ 3 leaves							Overall mean	Reduction over control (%)
		First spray				Second spray				
		PTC	3HAT	7HAT	10HAT	3HAT	7HAT	10HAT		
Neem seed kernel extract	5%	20.49 (4.63)	10.44 (3.38)^{a}	6.77 (2.79)^{b}	5.01 (2.45)^{a}	5.67 (2.58)^{c}	6.97 (2.82)^{d}	7.68 (2.95)^{e}	7.09	76.45
Bakain extract	5%	23.19 (4.92)	16.93 (4.23)^{h}	9.53 (3.24)^{f}	5.21 (2.49)^{ab}	7.06 (2.84)^{d}	5.43 (2.53)^{b}	6.84 (2.80)^{c}	8.50	71.77
Garlic + Chilli extract	5%	22.21 (4.82)	10.65 (3.41)^{a}	7.76 (2.96)^{c}	7.28 (2.88)^{c}	7.64 (2.94)^{e}	8.33 (3.05)^{f}	7.43 (2.90)^{d}	8.18	72.83
Bitter gourd extract	5%	22.66 (4.86)	14.67 (3.96)^{e}	10.44 (3.38)^{g}	11.77 (3.57)^{h}	10.67 (3.42)^{j}	9.97 (3.31)^{h}	8.64 (3.10)^{h}	11.03	63.37
Lemon oil	3%	25.33 (5.13)	12.67 (3.70)^{bc}	10.67 (3.42)^{gh}	7.67 (2.94)^{cd}	8.91 (3.15)^{g}	7.75 (2.96)^{e}	8.41 (3.07)^{g}	9.35	68.95
Garlic oil	3%	23.33 (4.93)	15.53 (4.06)^{fg}	8.65 (3.10)^{e}	7.26 (2.87)^{c}	5.06 (2.46)^{b}	4.93 (2.43)^{a}	5.92 (2.63)^{b}	7.89	73.79
Ginger oil	3%	23.66 (4.96)	13.18 (3.76)^{c}	7.93 (2.99)^{cd}	5.53 (2.55)^{b}	3.21 (2.05)^{a}	5.06 (2.46)^{ab}	5.43 (2.53)^{a}	6.72	77.68
Eucalyptus oil	3%	20.97 (4.69)	15.95 (4.11)^{g}	10.36 (3.37)^{g}	12.91 (3.73)^{j}	10.19 (3.34)^{i}	7.98 (2.99)^{ef}	8.60 (3.10)^{gh}	11.00	63.47
Calamus oil	3%	24.33 (5.03)	14.33 (3.91)^{d}	11.67 (3.56)^{h}	12.41 (3.66)^{i}	10.33 (3.36)^{i}	8.67 (3.11)^{g}	10.67 (3.42)^{i}	11.35	62.3
Verticillium lecani	0.5%	21.65 (4.76)	13.07 (3.75)^{c}	4.67 (2.38)^{a}	9.23 (3.20)^{e}	5.01 (2.45)^{b}	5.67 (2.58)^{bc}	6.97 (2.82)^{cd}	7.44	75.29
Bacillus thuringiensis	0.3%	18.33 (4.40)	12.21 (3.63)^{b}	10.65 (3.41)^{gh}	7.76 (2.96)^{d}	7.28 (2.88)^{de}	7.64 (2.94)^{e}	8.33 (3.05)^{f}	8.98	70.17
Metarhizium anisopliae	0.5%	19.24 (4.50)	15.11 (4.01)^{f}	12.95 (3.73)^{i}	9.98 (3.31)^{f}	7.75 (2.96)^{e}	6.26 (2.69)^{cd}	7.39 (2.90)^{de}	9.91	67.08
Beauvaria bassiana	0.3%	22.93 (4.89)	21.65 (4.76)^{i}	16.75 (4.21)^{j}	10.93 (3.45)^{g}	9.24 (3.20)^{h}	6.14 (2.67)^{c}	7.50 (2.92)^{e}	12.04	60.01
Untreated check	-	22.35 (4.83)	24.19 (5.02)^{j}	26.93 (5.28)^{k}	28.25 (5.41)^{k}	31.21 (5.67)^{k}	33.44 (5.87)^{i}	36.64 (6.13)^{j}	30.11	0.00
SE (d)		0.094	0.078	0.068	0.065	0.062	0.062	0.064	0.067	
CD (0.05%)		0.195	0.161	0.141	0.134	0.129	0.128	0.133	0.138	

PTC = Pre – treatment Count, HAT = Days after treatment

* Mean of three replications, Figures in parentheses are arcsine (x + 0.5) transformed values, means in column followed by a common letter are not significantly different at the 5 per cent level (DMRT)

in leafhopper population was observed in ginger oil 3% followed by NSKE @ 5% and *V.lecani* @ 0.5% during rabi and kharif 2018. The results indicated that toxic substance was more in ginger oil 3% as reflected by maximum per cent reduction in leafhopper population.

Second Season (*rabi* 2018)

Data presented in table 2 showed that all the treatments were significantly superior over control. Among all the treatment, the spray of ginger oil @ 3% recorded the highest per cent reduction in leafhopper population with the mean of 13.18, 7.93, 5.53, 3.21, 5.06, 5.43 at 3, 7 and 10 days after first and second spray respectively. The next effective treatment was spray of NSKE @ 5% which gave 10.44, 6.77, 5.01, 5.67, 6.97, 7.68 reduction in leaf hopper population followed by *V. lecani* @ 0.5% (13.07, 4.67, 9.23, 5.01, 5.67, 6.97) at 3, 7 and 10 days after first and second spray respectively.

Zobayer and Hasan (2013) tested the efficacy of extracts of neem, garlic, ginger, eucalyptus and papaya and found that neem, garlic and ginger based biopesticides were highly effective in suppressing the insect pest infestation. Iqbal *et al.* (2017) who reported ginger extracts were effective and showed highest mortality on jassid on okra. The present findings are in concordance with Vinodhini and Malaikozhundan (2011) who reported that neem seed kernel extract (5%) was found to be effective due to its easy availability and simplicity in preparation against the leafhoppers of cotton. The results are also in conformity with Khattak*et al.* (2006) who highlighted the effectiveness of NSKE 5% in controlling the jassid population. Similar results were reported by Dhanalakshmi (2006) in jassids on bhendi. These observations support the findings of present study and it is evident that non chemical means of hopper management is possible in okra to reap a residue free produce.

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