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BIO-EFFICACY OF DIFFERENT BOTANICALS AGAINST SHOOT-FEEDING INSECT PESTS OF SORGHUM

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ABSTRACT

A field experiment was carried out to evaluate some botanicals against shoot-feeding pests of sorghum in a Randomized Block Design with 3 replications at the Instructional Farm, Rajasthan College of Agriculture, Udaipur during *kharif*, 2013. Among the botanicals evaluated for the management of shoot fly (*Atherigona soccata* Rondani), neem oil (3 %) was more effective with mean egg laying 41.15 and 45.00 per cent at 1st and 3rd day after treatment. The population reduction of shoot-bug (*Peregrinus maidis* Ashmead) due to the plant oil treatments was effective for 1st and 3rd day after treatment with 40.92 and 39.31 per cent reduction due to neem oil (3%), 36.90 and 32.61 per cent due to karanj oil (3%) and 34.73 and 33.40 per cent reduction due to nirgundi oil (3%). In case of leaf folder, neem oil (3%), karanj oil (3%) and nirgundi oil (3%) were effective with percent reduction of 46.53, 44.16 and 41.75, respectively. The maximum grain yield of 32.22 q/ha and highest Cost Benefit Ratio of 1: 1.48 was recorded from neem oil (3%) treated plots.

Key words: *Atherigona soccata* Rondani, *Peregrinus maidis* (Ashmead) leaf folder, Sorghum, plant oils.

INTRODUCTION

Sorghum [*Sorghum bicolor* (L.) Moench] is an important food and fodder crop in the semi-arid tropics. It is infested by many insect pests from seedling stage to harvest. Grain yields in farmers' fields in Asia and Africa are generally low (500 to 800 kg ha-1) mainly due to insect pest damage. The sorghum shoot fly (*Atherigona soccata* Rondani) is a major pest in Asia, Africa and Mediterranean Europe (Dhillon *et al.*, 2005 and Subbarayudu and Indira, 2007) and its damage results in yield losses up to 90 per cent (Jotwani and Srivastava, 1970). Of late, the shoot bug or plant hopper (*Peregrinus maidis* Ashmead) (Delphacidae: Homoptera) has attained serious pest status due to the introduction of hybrids that mature at different times in certain parts of Andhra Pradesh, Karnataka and Tamil Nadu. Severe infestation at the boot stage results in the twisting of top leaves and preventing the emergence of panicles resulting in losses up to 41 per cent in India (Subbarayudu *et al*, 2002). The use of synthetic pesticide chemicals has been in vogue, but chemical control of shoot pests is economically unviable and indeed impractical for many resource poor and small scale farmers. Therefore, management with indigenous and locally available botanicals to contain the major pests that damage the crop during various stages of crop growth would be the most appropriate and was thus evaluated.

MATERIALS AND METHODS

An experiment was laid out in Randomized Block Design with three replications in plots of size 4.00m x 2.70m. The sorghum cultivar, CSV-23 with a spacing of 45 × 15 cm was sown on 20th July 2013 by following recommended agronomical practices. The treatments were made with hand sprayer and was done at 7th day after germination, when the shoot fly infestation initiated. The efficacy was compared among treatments and with control.

Treatments

The seed oils (3%) evaluated were:

Nirgundi (*Vitex negundo* Linn.)

Eucalyptus (*Eucalyptus* sp.)

Karanj (*Pongamia pinnata* Linn.)

Mahua (*Madhua latifolia* Linn.)

Neem (*Azadirachta indica* Linn.)

Castor (*Ricinus communis* Linn.)

An untreated check also was maintained.

Observations:

At 7th and 45th day after germination the above mentioned botanical treatments (sprays) were given to the crop of sorghum in the morning hours.

Observations on the insect pest incidence were taken one day before treatment and 1, 3 and 5 days after the application of botanicals. Ten plants were randomly selected for recording shoot fly oviposition. Observations for shoot bug were taken visually on the 5 tagged plants; while, leaf folder incidence was recorded from the 5-tagged plants and the presence of caterpillar was ensured before the visual count. Data thus observed were presented as numbers per plant.

Statistical Analysis

The population data were transformed to percentage reduction in population of shoot bug and leaf folder due to the application of botanicals using the Henderson and

$$\text{Per cent reducation} = 100 \times \left[1 - \frac{T_a \times C_b}{T_b \times C_a}\right]$$

Tilton (1952) equation as under:

Where;

Ta = Number of insects after treatment

Tb = Number of insets before treatment

Ca = Number of insects untreated check after treatment

Cb = Number of insects in untreated check before treatment

Grain Yield

Harvesting was done on maturity of the grain. The ear heads were cut off and dried by exposing them to sun for about a week. The dried heads were then threshed, and the grains were cleaned and weighed plot wise. The yield (kg.) obtained per plot was converted into yield per hectare in quintal.

Cost benefit ratio

The cost benefit ratio of different treatments was calculated by taking into consideration management expenditure in terms of cost of botanicals and labour charges. The sale price of sorghum was taken to calculate the total monetary return gained from each treatment.

RESULTS AND DISCUSSION

Relative bio-efficacy of botanicals against shoot-feeding insect pests:

(a) Shoot fly oviposition

The data (Table 1) clearly indicated that the maximum per cent oviposition was observed in the untreated check (71.56%); whereas, the minimum (41.15 %) was recorded on the plants treated with neem oil on first day after spray. Neem oil was better over the rest of the treatments followed by karanj oil (48.84%). Shrinivas *et al.* (2009) evaluated

Table 1. Relative efficacy of botanicals against sorghum shoot-fly oviposition during *kharif*, 2013

Plant Oils (3%)	PTP	Percent oviposition after spray		
		1-day	3-days	5-days
Vitex negundo	75.00 (93.30)	59.00^{cd} (73.47)	61.21^{cd} (76.81)	66.14 (83.64)
Eucalyptus spp.	71.56 (89.99)	63.43^{de} (79.99)	66.14^{de} (83.64)	77.71 (95.47)
Pongamia pinnata	81.14 (97.63)	48.84^{b} (56.68)	52.77^{b} (63.39)	61.92 (77.84)
Madhua latifolia	77.71 (95.47)	68.85^{ef} (86.98)	71.56^{ef} (89.99)	75.00 (93.30)
Azadirachta indica	66.14 (83.64)	41.15^{a} (43.31)	45.00^{a} (50.00)	59.70 (74.55)
Ricinus communis	61.92 (77.84)	52.77^{bc} (63.39)	54.98^{bc} (67.07)	59.00 (73.47)
Control	66.14 (83.64)	71.56^{f} (89.99)	77.71^{f} (95.47)	83.85 (98.85)
S. Em. ±	5.85	1.94	2.37	6.07
C. D. (5%)	NS	5.98	7.32	NS

Figures in parentheses are retransformed per cent values; figures with similar letters are statistically at par; NS-Non-significant

Table 2. Relative efficacy of botanicals against shoot-bug (*Peregrinus maidis* Ashmead) population during *kharif*, 2013

Plant Oils (3%)	PTP	Population reduction (%) after		
		1-day	3-days	5-days
Vitex negundo	10.13	34.73^{abcd} (32.46)	33.40^{ab} (30.30)	25.54 (18.58)
Eucalyptus spp.	10.20	29.93^{a} (24.89)	27.89^{a} (21.88)	23.11 (15.41)
Pongamia pinnata	11.20	36.90^{abcd} (36.05)	32.61^{ab} (29.04)	27.62 (21.49)
Madhua latifolia	10.47	28.53^{ab} (22.81)	26.96^{a} (23.30)	24.57 (17.29)
Azadirachta indica	11.00	40.92^{abcd} (42.90)	39.31^{c} (40.13)	29.76 (24.64)
Ricinus communis	10.73	30.19^{a} (25.29)	29.35^{ab} (24.02)	24.84 (17.65)
Control	10.07	N.A.	N.A.	N.A.
S. Em. $\pm$	0.40	1.50	1.66	1.93
C. D. (5%)	NS	4.71	5.22	NS

Figures in parentheses are retransformed per cent values; figures with similar letters are statistically at par; PTP: Pre-treatment population numbers per plant of shoot bug 1-day before plant oil treatments; N.A.: Not applicable

Table 3. Relative efficacy of botanicals against leaf folder population during *kharif*, 2013

Plant Oils (3%)	PTP	Population reduction (%) after		
		1-day	3-days	5-days
Vitex negundo	2.60	41.75^{b} (44.34)	38.08^{abc} (38.03)	29.14 (23.71)
Eucalyptus spp.	3.27	34.37^{a} (31.87)	27.29^{a} (21.02)	19.22 (10.84)
Pongamia pinnata	3.13	44.16^{b} (48.53)	39.22^{abc} (39.98)	26.84 (20.39)
Madhua latifolia	3.00	29.78^{a} (32.93)	28.28^{a} (22.45)	28.14 (22.24)
Azadirachta indica	2.67	46.53^{b} (52.67)	43.12^{abc} (46.72)	29.96 (24.94)
Ricinus communis	3.27	34.38^{a} (31.89)	31.60^{ab} (27.46)	22.74 (14.94)
Control	2.73	N.A.	N.A.	N.A.
S. Em. $\pm$	0.17	1.83	2.82	3.84
C. D. (5%)	NS	5.76	8.88	NS

Figures in parentheses are retransformed per cent values; figures with similar letters are statistically at par; PTP: Pre-treatment population numbers per plant of leaf folder 1-day before plant oil treatments; N.A.: Not applicable

Table 4. Effect of botanicals on grain yield of sorghum, *kharif,* 2013

Treatments Plant oils @ 3%	Grain yield (q/ha)	C: B Ratio
Vitex negundo	26.66	1:1.33
Eucalyptus spp.	24.81	1:1.11
Pongamia pinnata	30.55	1:1.38
Madhua latifolia	21.11	1:1.05
Azadirachta indica	32.22	1:1.48
Ricinus communis	28.42	1:1.23
Control (Untreated check)	18.44	
S. Em. ±	0.02	
CD (5%)	0.62	
C.V.	19.34%	

the efficacy of different plant products against sorghum shoot fly and found that NSKE (5%) treated plants recorded less numbers of eggs of shoot fly (0.40 egg/ plant). Similarly, Sable (2009) reported that neem oil (2%) proved to be the best recording 0.86 eggs per plant.

(b) Shoot-bug

It is explicit from the data (Table 2) that maximum per cent reduction (40.92 %) in shoot bug population was recorded in neem oil on first day after spray. Among the tested botanicals, neem oil (3%) was significantly better over the rest of the treatments followed by karanj oil (3%) and nirgundi oil (3%), which were statistically at par with neem oil. The minimum per cent reduction was recorded in mahua oil (3%) (28.53%)

(c) Leaf folder

The maximum per cent reduction (46.53%) in leaf folder population was recorded from neem oil (3%) treated plants on first day after spray (Table 3). Among the tested botanicals, neem oil had better repelling activity on the leaf folder as compared to the rest of the treatments followed by karanj oil (44.16%) and nirgundi oil (41.75%), which were statistically at par with neem oil. The minimum per cent reduction was recorded from plants treated with mahua oil (29.78%). These findings are in accordance with Baitha (2000), who reported 56.32 to 60.58 per cent mortality in the neem oil (2.00, 3.00 and 4.00%) treatment.

Grain yield

At harvest, grain yield per plot (kg.) in each treatment was taken and converted into quintal per hectare. All the botanical insecticides performed significantly better over untreated check (18.44 q/ha). Neem oil (32.22 q/ha) treatment gave significantly more yield over rest of the treatments with the highest Cost Benefit Ratio of 1: 1.48 followed by karanj oil 3 (1: 1.38). Mahua oil treatment resulted in lowest grain yield (21.11 q/ha) (Table 4). These results are in agreement with Sable (2009) who recorded the highest yield in neem oil (2%) treated plots (14.56 q/ ha), which was at par with plant mixture (13.89 q/ha) and NSKE (5%) (13.65 q/ha).

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