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RB Ambad

Dept. of Agril. Entomology,
College of Agriculture, VNMKV
Parbhani, Maharashtra, India

Md. Ilyas

Associate Professor, Entomology
Sorghum Research Station,
VNMKV, Parbhani,
Maharashtra, India

DU Gosavi

Dept. of Agril. Entomology,
College of Agriculture, VNMKV
Parbhani, Maharashtra, India

SS Ajabe

Dept. of Agril. Entomology,
College of Agriculture, VNMKV
Parbhani, Maharashtra, India

Studies on efficacy of biorationals on sorghum stem borer, *Chilo partellus* and Ear head caterpillar *Helicoverpa armigera* Hubner

RB Ambad, Md. Ilyas, DU Gosavi and SS Ajabe

Abstract

A field experiment was conducted with the Efficacy of Different Plant Extract Against Sorghumstem borer, *Chilo partellus* and Ear head caterpillar *Helicoverpa armigera* Hubner. In *Kharif* season 2018 at Sorghum Research Station, VNMKV Parbhani (MS) India. The treatment T₆ [*Azadirachta indica* (Neem) leaf extract @ 5%] recorded the lowest stem borer dead hearts followed by T₈ [*Azadirachta indica* (Neem) seed extract @ 5%], T₁ [*Lantana camara* (Ghaneri) leaf extract @ 5%] and T₇ [*Ricinus communis* (castor) seed extract @ 5%] also found effective for the management of stem borer. Among Treatment T₁₁ [Cypermethrin 25EC @ 3ml/10 lit of water] was the most effective for stem borer. T₁₁ [Cypermethrin 25EC @ 3ml/10 lit of water] at milking stage recorded the lowest ear head worm population (0.66 ear head worm/5 cob). However in case of biorationals treatment T₆ [*Azadirachta indica* (Neem) leaf extract @ 5%] at milking stage recorded the lowest ear head worm population (1.02 ear head worm/5 cob). The next best treatment were T₂ [*Annona squamosa* (custard) leaf extract @ 5%] at milk stage (1.14 ear head worm/5 cob), T₉ [Dashparni ark @ 5%] (1.13 ear head worm/5 cob), and T₈ [*Azadirachta indica* (Neem) seed extract @ 5%] (1.29 ear head worm/5 cob) respectively.

Keywords: Sorghum, plant extract, stem borer, *Helicoverpa armigera*, *Azadirachta indica*

Introduction

Sorghum [*Sorghum bicolor* (L.) Monech] is the fifth most important cereal crop worldwide after wheat, rice, maize and barley (FAO, 2011) ^[5] also extensively grown in the semi-arid tropics for its nutritious food, juicy stalk and precious fodder. In India area and production under sorghum 6242 thousand ha and 2.30 (*Kharif*), 3.15 (*Rabi*) million tonnes during 2014-15. While in Maharashtra, area, production and productivity is 680.0 and 2608.0 thousand ha, 585.0 & 524.0 tonnes, 860 & 584 kg/ha in *Kharif* and *Rabi* season 2014-15, respectively (Annon. 2016) ^[2]

Stem borer, *Chilo partellus* (Order-Lepidoptera, Family-Pyralidae) infests the sorghum crop from second week till maturity. Initially, the larvae feed on the adaxial surface of the whorl leaves, leaving the lower surface intact as transparent windows. (R. A. Balikai and G. M. Sajjanar, 2012) ^[3].

Ear head caterpillar *H. armigera* Hubner (Lepidoptera; Noctuidae) is one of the serious polyphagous pest attacking more than 180 plants. The caterpillar cause major damage to the crops as it attacks reproductive parts and growing tips showing chalky appearance of ears. (Romeis *et al.*, 1999) ^[8].

The major aim of studying efficacy of different plant extract was to divert the attention of scientist of all over world to develop safe and more permanent method of pest control. In this direction, biological control is one of the best options as it is eco-friendly and can be integrated with other pest management strategies. Cultural practices have been suggested to escape the crop from stem borer and *Helicoverpa armigera* and chemical control measures are also effective to some extent under low pest population presser.

Material and Methods

The experiment was conducted during *Kharif*, 2018 at Sorghum Research Station, VNMKV, Parbhani (MS). Fresh leaves {*Lantana camera* (ghaneri), *Annona squamosa* (custard apple), *Pongamia glabra* (karanj), *Eucalyptus elongate* (Nilgiri), *Nerium oleander* (Kanhery), *Azadirachta indica* (Neem)} were collected and brought to the laboratory and washed thoroughly 3-4 times with tap water and finally with distilled water.

Correspondence**RB Ambad**

Dept. of Agril. Entomology,
College of Agriculture, VNMKV
Parbhani, Maharashtra, India

Later they were chopped into small pieces with a sharp knife. Fifty grams of chopped material was macerated in mortar and pestle and extracted with a small quantity of distilled water. The extract was squeezed through muslin cloth and made up to 1 litre, with distilled water. The filtrate was stored in a clean reagent bottles for further use. The concentration of suspension so prepared works out to be 5 per cent. And for seed extract Fifty grams of seeds (*Ricinus communis* (Castor), *Azadirachta indica* (Neem), *Annona squamosa* (custard apple)) seed extract were smashed and soaked overnight in distilled water, squeezed through muslin cloth and diluted with distilled water to get five per cent concentration of the suspension. (Ningaraj, June, 2013) [6].

The details of experiment are given below.

Experimental Design	:	Randomized Block Design (RBD)
Replications	:	Three
Treatments	:	Twelve
Spacing	:	45 cm X 15 cm
Crop	:	Sorghum
Cultivar	:	PVK-801
Plot size	:	3 m X 2.7 m
Method of sowing	:	Dibbling
Date of sowing	:	11 th July, 2018.

Table 1: Details of treatments used in experiment

Treatment No.	Name of plant extract used	Concentration (%)	Doses/ 10 lit of water
01	<i>Lantana camera</i> (Ghaneri) leaf extract	5%	500 ml
02	<i>Annona squamosa</i> (Custard apple) leaf extract	5%	500 ml
03	<i>Pongamia glabra</i> (Karanj) leaf extract	5%	500 ml
04	<i>Eucalyptus elongate</i> (Nilgiri) leaf extract	5%	500 ml
05	<i>Nerium oleander</i> (Kanhery) leaf extract	5%	500 ml
06	<i>Azadirachta indica</i> (Neem) leaf extract	5%	500 ml
07	<i>Ricinus communis</i> (Castor) seed extract	5%	500 ml
08	<i>Azadirachta indica</i> (Neem) seed extract	5%	500 ml
09	Dashparni Ark	5%	500 ml
10	Seed treatment with imidacloprid 48 FS	0.672%	14ml/kg seed
11	Cypermethrin 25 EC	0.0075%	3ml
12	Untreated control	--	--

Methods of recording observations

Stem borer (*Chilo partellus*)

The observations to assess the damage caused by stem borer larvae were recorded as dead hearts 45th and 60th day after emergence. The per cent dead hearts by stem borer were worked out.

Earhead worm (*H. armigera*)

The total numbers of larvae were recorded from randomly selected five plants in each plot. The pretreatment observation

were recorded one day before one biorationals spray at milking stage and post treatment observation were recorded at 1st, 3rd and 5th days after each spray (at milking stage). The grain yield kg/plot was recorded and expressed as quintals ha⁻¹. Data on grain yield was analyzed using analysis of variance and finally gross and net returns were worked out for each chemical.

Result and Discussion

Table 2: Bio-efficacy of different biorationals against sorghum stem borer deadhearts

Tr. No.	Treatment details	Conc. (%)	Doses/ 10 lit of water	Per cent deadhearts per plot		
				1 DBS	45 th DAE	60 th DAE
1	<i>Lantana camera</i> (Ghaneri) leaf extract	5%	500 ml	3.97 (11.49)*	4.53 (12.29)	7.00 (15.34)
2	<i>Annona squamosa</i> (Custard apple) leaf extract	5%	500 ml	5.20 (13.18)	5.97 (14.14)	9.07 (17.52)
3	<i>Pongamia glabra</i> (Karanj) leaf extract	5%	500 ml	4.40 (12.11)	5.20 (13.80)	8.08 (16.52)
4	<i>Eucalyptus elongate</i> (Nilgiri) leaf extract	5%	500 ml	4.63 (12.43)	5.47 (13.52)	8.90 (17.36)
5	<i>Nerium oleander</i> (Kanhery) leaf extract	5%	500 ml	4.33 (12.01)	5.07 (13.01)	7.69 (16.10)
6	<i>Azadirachta indica</i> (Neem) leaf extract	5%	500 ml	3.97 (11.49)	4.50 (12.25)	7.18 (15.55)
7	<i>Ricinus communis</i> (Castor) seed extract	5%	500 ml	4.20 (11.83)	4.73 (12.57)	9.28 (17.74)
8	<i>Azadirachta indica</i> (Neem) seed extract	5%	500 ml	3.48 (10.76)	4.30 (11.97)	7.33 (15.71)
9	Dashparni Ark	5%	500 ml	5.10 (13.05)	5.47 (13.52)	8.40 (16.85)
10	Seed treatment with imidacloprid 48 FS	0.672%	14ml/kg seed	5.57 (13.65)	5.70 (13.81)	8.10 (16.54)
11	Cypermethrin 25 EC	0.007%	3ml	5.30 (13.31)	3.70 (11.09)	4.10 (11.68)
12	Untreated control	--	--	8.70 (17.15)	10.07 (18.50)	16.17 (23.71)
	S.E. \pm			0.19	0.29	0.46
	C.D. at 5%			NS	0.85	1.35
	CV %			6.63	9.30	9.43

* Figures in parentheses denote angular transformed value.
DBS- Day Before Spray and DAE- Days After Emergence

The data presented in Table-2 indicated that the stem borer deadhearts at 45th, 60th days after emergence was found minimum in the treatment T₆ [*Azadirachta indica* (Neem) leaf

extract @ 5%] while T₈ [*Azadirachta indica* (Neem) seed extract @ 5%], T₁ [*Lantana camara* (Ghaneri) leaf extract @ 5%] and T₇ [*Ricinus communis* (castor) seed extract @ 5%]

also found equally good. The result of investigation indicated that the treatment T₆ [*Azadirachta indica*] (Neem) leaf extract @ 5%] was found effective for the management of stem borer.

Tekie *et al.* (2006) [10] reported that neem seed powder and neem seed extract provided protection against *C. partellus* in maize comparable to conventional insecticides.

Shekharappa and Kulkarni (2006) [9] study coincides with the

result that stem borer *Chilo partellus* in sorghum was treated with *Nimbecidine* and NSKE (5%) caused highest percentage reduction in stem borer incidence. Number of eggs laid per month was also least in these cases.

Deepthi (2007) [4] observed NSKE (5%) and *Nimbecidine* (5%) reducing deadhearts caused by *C. partellus* and tunneling by the pest was least in NSKE (5%) which in conformity with present result.

Table 3: Bio-efficacy of different biorational against ear head worm (*H. armigera*) of sorghum at milking stage

Tr. No	Treatment details	Conc. (%)	Doses/ 10 lit of water	No. of ear head worm/5 cob				
				1 DBS	1 DAS	3 DAS	5 DAS	Mean
1	<i>Lantana camera</i> (Ghaneri) leaf extract	5%	500 ml	3.20 (1.92)	2.43 (1.71)	2.27 (1.66)	2.50 (1.73)	2.40 (1.57)
2	<i>Annona squamosa</i> (Custard apple) leaf extract	5%	500 ml	2.03 (1.59)	1.17 (1.29)	1.03 (1.24)	1.23 (1.32)	1.14 (1.09)
3	<i>Pongamia glabra</i> (Karanj) leaf extract	5%	500 ml	2.27 (1.66)	1.63 (1.46)	1.40 (1.38)	1.60 (1.45)	1.54 (1.26)
4	<i>Eucalyptus elongate</i> (Nilgiri) leaf extract	5%	500 ml	3.00 (1.87)	1.70 (1.48)	1.43 (1.39)	1.80 (1.52)	1.64 (1.30)
5	<i>Nerium oleander</i> (Kanhery) leaf extract	5%	500 ml	3.70 (2.05)	2.67 (1.78)	2.23 (1.65)	2.47 (1.72)	2.46 (1.58)
6	<i>Azadirachta indica</i> (Neem) leaf extract	5%	500 ml	1.80 (1.52)	1.03 (1.24)	0.87 (1.17)	1.17 (1.29)	1.02 (1.04)
7	<i>Ricinus communis</i> (Castor) seed extract	5%	500 ml	7.13 (2.76)	8.10 (2.93)	8.13 (2.94)	9.10 (3.10)	8.44 (2.91)
8	<i>Azadirachta indica</i> (Neem) seed extract	5%	500 ml	1.83 (1.53)	1.30 (1.34)	1.17 (1.29)	1.40 (1.38)	1.29 (1.16)
9	Dashparni Ark	5%	500 ml	2.07 (1.60)	1.07 (1.25)	1.00 (1.22)	1.33 (1.35)	1.13 (1.09)
10	Seed treatment with imidacloprid 48 FS	0.67%	14ml/kg seed	7.13 (2.76)	8.10 (2.93)	8.13 (2.94)	9.10 (3.10)	8.44 (2.91)
11	Cypermethrin 25 EC	0.0075%	3ml	1.17 (1.29)	0.57 (1.03)	0.47 (0.98)	0.93 (1.20)	0.66 (0.84)
12	Untreated control	--	--	8.00 (2.92)	9.00 (3.08)	9.50 (3.16)	10.57 (3.33)	9.69 (3.12)
S.E. ±				0.12	0.13	0.07	0.13	0.15
C.D. at 5%				NS	0.38	0.22	0.39	0.43
CV %				6.83	8.51	5.03	7.74	9.25

* Figures in parentheses denote $\sqrt{x + 0.5}$ transformed values.
DBS- Day Before Spray and DAE- Days After Emergence

The data presented in Table-3 indicated that the Mean population of ear head worm after spray was calculated and result revealed that the treatment T₁₁ [Cypermethrin 25EC @ 3ml/10 lit of water] at milking stage recorded the lowest ear head worm population (0.66 ear head worm/5 cob). However in case of biorationals treatment T₆ [*Azadirachta indica*] (Neem) leaf extract @ 5%] at milking stage recorded the lowest ear head worm population (1.02 ear head worm/5 cob). The next best treatment were T₂ [*Annona squamosa* (custard) leaf extract @ 5%] at milk stage (1.14 ear head worm/5 cob), T₉ [Dashparni ark @ 5%] (1.13 ear head worm/5 cob), followed by treatment T₇ [*Ricinus communis* (castor) seed extract @ 5%] (8.44 ear head worm/5 cob) and T₈ [*Azadirachta indica* (Neem) seed extract @ 5%] (1.29 ear head worm/5 cob). whereas the treatments T₃ [*Pongamia glabra* (karanj) leaf extract @ 5%], T₄ [*Eucalyptus elongate* (Nilgiri) leaf extract @ 5%], T₁₀ [Seed treatment with Imidacloprid 48 FS @ 48% (14ml/kg seed)], T₁ [*Lantana camara* (Ghaneri) leaf extract @ 5%], T₅ [*Nerium oleander* (Kanhery) leaf extract @ 5%] were in next order with 1.54, 1.64, 2.40 and 2.46 ear head worm/5 cobs respectively. Raghuraman *et al.* (2008) [7] reported that the formulations of *Eucalyptus* and Neem were significantly effective in reducing the larval population of *H.armigera*.

War *et al.* (2009) [11] reported that PONEEM (neem oil + pongam oil in equal proportion) higher antifeedant activity was recorded and significantly superior over other conventional insecticidal treatment.

Ahmed *et al* (2010) [1] studied the bio efficacy of Neem (*Azadirachta indica*) seed oil, castor (*Ricinus communis*) oil, leaf extracts of custard apple (*Annona squamosa*) and revealed that the treatment of custard apple leaf extract produced the most favourable result in respect of pest control.

Conclusion

Biological control is one of the best options as it is eco-friendly and can be integrated with other pest management strategies and its effective, economical, environmentally safe and eco-friendly alternative to insecticides and more wide scope for safe and economical use of plant extract instead of chemical insecticides. The plant extract have little or no toxic effect on livestock, human being and natural enemies. Furthermore development of insect pest resistance by such biorationals insecticides has not so far been reported.

Plant extract used in the management of major pest of sorghum crop show effective result as they act as antifeedant, growth retardant, stomach poison and deterrent to them. The result revealed that the treatment T₆ [*Azadirachta indica*

(Neem) leaf extract @ 5%] was found effective for the management of stem borer. However in management of *Helicoverpa armigera* biorationals treatment T₆ [*Azadirachta indica* (Neem) leaf extract @ 5%] and T₂ [*Annona squamosa* (custard) leaf extract @ 5%] at milking stage recorded the lowest ear head worm population

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