J. Cotton Res. Dev. **34** (2) 267-271 (July, 2020) **ISSN No. 0972-8619**

Evaluation of insect herbal repellent for sucking pests of cotton

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ABSTRACT : Field experiments were carried out at Tamil Nadu Agricultural University, Cotton Research Station, Srivilliputtur to evaluate the insect herbal repellent activity against sucking pests of cotton (variety SVPR 4) under irrigated condition. The result revealed that spraying of organic insecticides *viz.*, 3G extract (10%), *Neem* oil (2%) and herbal insect repellent (10%), at 15 days interval was able to reduce the infestation of sucking insect pests like leaf hopper, thrips and whitefly during 2017-2018 and 2018-2019. The effect of application of 3 G extract (10%), *neem* oil (2%) and herbal insect repellent (10%) produced taller plants and more bolls / plant and these three treatments were comparable and significantly higher than untreated check. The mean, highest cotton *kapas* yield was recorded in 3G extract (10%) (16.6(5%)), *neem* oil (2%) (16.43%) and herbal insect repellent (10%) (16.31 q/ha) and were significantly higher than the untreated check (10.56 q/ha). The economic analysis revealed that highest total income (Rs. 67130/ha), Net income (Rs. 25330/ha) and Benefit cost ratio (1.60) were also associated with application of 3G extract (10%) which was *on par* with *neem* oil (2%).

Key words : BC ratio, cotton variety (SVPR 4), organic insecticide, sucking pests

Cotton, *Gossypium hirsutum*, a high value crop, occupies about 5 per cent of the total area under cultivation in India and consumes more than 40 per cent of the pesticides produced. This tendency of injudicious use of pesticides on cotton has culminated in pest outbreaks, development of resistance to insecticides by the insects and ultimately total crop failure. Cotton plant is ravaged by multitude of sucking pests and there is a constant change in pest scenario. Sucking pests like leafhopper (*Amrasca devastans*), aphid (*Aphis gossypii*), thrips (*Thrips tabaci)* and whiteflies (*Bemisia tabaci*) etc., are responsible for the major threat and destruction of cotton crop. Hence, the present study will be carried out the evaluation of insect herbal repellence against sucking pest in cotton.

MATERIALS AND METHODS

Field experiments were carried out at Tamil Nadu Agricultural University, Cotton Research Station, Srivilliputtur to evaluate the insect herbal repellent activity against sucking pests of cotton variety (SVPR 4) under irrigated condition (August to January) during 2017-2018 and 2018-2019. Untreated cotton seeds (SVPR 4) were sown. The crop was grown with recommended package of practices excluding plant protection. The five leaf herbal extract consists the leaves of the following *Neem*, *Azhadiracta indica* (1kg), Notchi, *vitex negundo* (1kg),Adathoda,*Adathoda viscosa* (1 kg), Ailanthus, *Ailanthus excelsa* (1kg), Zatropha, Zatropha *curcus* (1kg). The herbal plant leaves were collected, ground separately with cow urine @ 2 l/kg, mixed

together, kept in a 50 l. plastic container and allowed for fermentation for 15 days and then filtered and used for the study. Organic treatment was imposed when the leafhopper population crossed the economic threshold level, with a high volume knapsack sprayer using 500 l of spray fluid/ha. Second and third spraying was given at 15 days interval. The untreated check plot was sprayed with water only. The 3G extract consists of the following, ginger, *zingiber officinale* fresh rhizome (1kg), garlic, *Allium sativum* bulb (1kg) and green chillies, *Capsicum annum* (1 kg). The ginger, garlic and green chillies were purchased from the vegetable market, Coimbatore, ground separately with cow urine @ 2 l / kg, mixed together, kept in a 25 l plastic container and allowed for fermentation for 15 days and then filtered and used for the study. The treatment herbal insect repellent (5%), Herbal insect repellent (10%), 3 G extract (5%), 3 G extract (10%), Mahua oil (2%), Pungam oil (2%), *neem* oil (2%), NSKE (5%), *Beauveria bassiana* @10g/l and Untreated check. Observations were made from ten randomly selected plants in each plot. The population of sucking insect pests were recorded from three leaves / plant *i.e.*, nymphs and adults of leafhoppers, thrips and aphids from one leaf on top, middle and bottom of the plant and whitefly adults at weekly interval and expressed as per three leaves. The plant height during harvest, sympodia, monopodia and bolls / plant were recorded. Seed cotton yield (q/ha) was also recorded. The economics parameters like total cost of cultivation, total income and benefit of cost ratio were worked out.

RESULTS AND DISCUSSION

With regard to leaf hopper, the mean population of leafhopper observations showed that the leafhoppers ranged from 2.39 to 5.53/3 leaves. The lowest pest population was recorded in plots treated with 3 G extract (10%) (2.39/3 leaves). It was followed by *neem* oil (2%) (2.53/ 3leaves), herbal insect repellent (10%) (2.70/3 leaves) and statistically *on par* with other treatment when compared to untreated check (5.53/3leaves) (Table 1). With regard to whitefly, the mean population of whitefly showed that the whitefly ranged from 1.10 to 2.99/3 leaves. The lowest pest population was recorded in plots treated with 3 G extract (10%) (1.10/3 leaves). It was followed by *neem* oil (2%) (1.12/3leaves), herbal insect repellent (10%) (1.12/3 leaves) and statistically *on par* with other treatment when compared to untreated check (2.99/3leaves) (Table 1).With regard to thrips, the mean population of thrips showed that the thrips ranged from 1.35 to 3.56/3 leaves. The lowest pest population was recorded in plots treated with 3 G extract (10%) (1.35/3 leaves). It was followed by *neem* oil (2%) (1.32/3leaves), herbal insect repellent (10%) (1.35/3 leaves) and statistically *on par* with other treatment when compared to untreated check (3.56/3leaves) (Table 1).

The influence of organic insecticides application on the production of sympodia and monopodia though not significant but plant height and bolls / plant was significantly affected by the application of organic insecticides (Table 2). The effect of application of 3 G extract (10%), *neem* oil (2%) and herbal insect repellent

Table 1. To study the organic insecticides against sucking pests in cotton ecosystem

Treat-ment	Dose Formulation (ml/l)	Leaf hopper/3 leaves#			Whitefly/3 leaves#			Thrips/3 leaves#			Yield (q/ha)		
		2017	2018	**Mean**	2017	2018	**Mean**	2017	2018	**Mean**	2017	2018	**Mean**
T1	50	4.88ef(2.20)	4.01c(2.00)	**4.45**	1.69bc(1.30)	1.37abc(1.17)	**1.53**	2.41d(1.55)	2.25b(1.50)	**2.33**	10.10cd(3.17)	19.07cd	**14.59**
T2	100	3.09abc(1.75)	2.31ab(1.52)	**2.70**	1.28ab(1.13)	0.86a(0.93)	**1.12**	1.38ab(1.17)	1.31a(1.15)	**1.35**	11.70ab(3.50)	20.92ab	**16.31**
T3	50	4.76ef(2.18)	3.40bc(1.84)	**4.08**	1.68bc(1.29)	1.22ab(1.10)	**1.58**	1.93abcd(1.38)	1.75ab(1.32)	**1.84**	10.00cd(3.12)	19.20cd	**14.60**
T4	100	3.01ab(1.73)	1.76a(1.33)	**2.39**	1.32abc(1.14)	0.76a(0.87)	**1.10**	1.44abc(1.2)	1.26a(1.12)	**1.35**	11.40abc(3.40)	21.89a	**16.65**
T5	20	4.03cde(2.00)	3.73c (1.93)	**3.88**	1.51ab(1.22)	1.39ab(1.18)	**1.81**	2.23cd(1.49)	2.38b(1.54)	**2.31**	10.20cd(3.13)	18.26d	**14.23**
T6	20	3.37abcd(1.83)	4.41cd(2.10)	**3.89**	1.82cd(1.34)	1.70bc(1.30)	**1.95**	2.20cd(1.48)	2.32b(1.52)	**2.26**	10.15bcd(3.18)	18.88d	**14.49**
T7	20	2.83(1.68)	2.23ab(1.49)	**2.53**	1.04a(1.01)	1.22abc(1.10)	**1.12**	1.01a(1.00)	1.63ab(1.28)	**1.32**	12.90a(3.59)	19.95bc	**16.43**
T8	50	4.20adef(2.04)	3.46bc(1.86)	**3.83**	1.48abc(1.21)	2.23cd (1.49)	**2.27**	2.30bcd(1.51)	2.60bc(1.61)	**2.45**	10.30bcd(3.20)	20.41b	**15.36**
T9	10	3.90bcdef(1.97)	4.59cd(2.14)	**4.25**	2.05cd(1.43)	1.82bc (1.39)	**2.13**	2.44cd(1.56)	2.35b(1.53)	**2.40**	9.90cd(3.14)	18.53d	**14.22**
T10		5.17(2.7)	5.89d(2.43)	**5.53**	2.45d(1.56)	2.90d(1.70)	**2.99**	3.08d(1.75)	4.03c	**3.56**	8.60d(2.93)	17.06e	**12.83**
SEd		0.1153	0.1857		0.116	0.1701		0.224	0.1861		0.153	0.0537	
CD (p=0.5)		0.24**	0.3902		0.24**	0.3574		0.47**	0.3910 **		0.32**	0.1129	
CV (%)		7.21	12.25		11.64	17.27		19.60	15.77		5.80	1.49	

mean of three spraying

Table 2. Effect of organic insecticide application on growth and yield attributes of cotton

TreatmentNo.	Plant height (cm)			Sympodia/plant			Monopodia/plant			Bolls/plant		
	2017	2018	**Mean**	2017	2018	**Mean**	2017	2018	**Mean**	2017	2018	**Mean**
T1	77.80	96.70	**87.25**	14.13	16.46	**15.30**	0.27	1.40	**0.84**	17.11	19.07	**18.09**
T2.	84.13	104.30	**94.22**	14.60	17.62	**16.11**	0.40	1.52	**0.96**	19.17	20.92	**20.05**
T3.	80.67	98.90	**89.79**	14.13	17.25	**15.69**	0.33	1.31	**0.82**	17.03	19.20	**18.12**
T4.	79.07	98.10	**88.59**	14.27	17.22	**15.75**	0.40	1.56	**0.98**	19.13	21.89	**20.51**
T5	78.40	97.40	**87.90**	13.33	16.56	**14.95**	0.27	1.46	**0.87**	17.17	18.26	**17.72**
T6.	78.20	97.80	**88.00**	14.40	17.20	**15.80**	0.27	1.38	**0.83**	17.48	18.88	**18.18**
T7	84.27	103.80	**94.04**	14.00	17.08	**15.54**	0.40	1.39	**0.90**	19.60	19.95	**19.78**
T8.	83.93	102.10	**93.02**	13.67	17.17	**15.42**	0.33	1.51	**0.92**	17.66	20.41	**19.04**
T9	75.87	94.50	**85.19**	13.93	16.81	**15.37**	0.20	1.49	**0.85**	16.13	18.53	**17.33**
T10	72.73	91.60	**82.17**	13.30	16.39	**14.85**	0.13	1.56	**0.85**	15.17	17.06	**16.12**
SEd	3.868	4.15		-	-			-		1.404	1.53	
CD (p=0.5)	8.134	8.67		NS	NS			NS		2.952	3.19	

Table 3. Effect of organic insecticide application on economics of cotton

Treatment	Cost of cultivation(Rs/ha)			Total income (Rs/ha)			Net income (Rs/ha)			Benefit cost ratio		
No.	2017	2018	**Mean**	2017	2018	**Mean**	2017	2018	**Mean**	2017	2018	**Mean**
T1	36900	41900	**39400**	52520	68448	**60484**	15620	26548	**21084**	1.42	1.63	**1.52**
T2.	37300	42300	**39800**	60840	75946	**68393**	23540	33646	**28593**	1.63	1.8	**1.71**
T3.	37900	42900	**40400**	52000	62330	**57165**	14100	19430	**16765**	1.37	1.45	**1.41**
T4.	39300	44300	**41800**	59280	74980	**67130**	19980	30680	**25330**	1.51	1.69	**1.60**
T5	37400	41300	**39350**	53040	63158	**58099**	15640	21858	**18749**	1.42	1.53	**1.475**
T6.	37250	42250	**39750**	52780	61686	**57233**	15530	19436	**17483**	1.42	1.46	**1.44**
T7	37400	42400	**39900**	67080	74152	**70616**	29680	31752	**30716**	1.79	1.75	**1.77**
T8.	36700	40700	**38700**	53560	64906	**59233**	16860	24206	**20533**	1.46	1.59	**1.52**
T9	37150	42150	**39650**	51480	60766	**56123**	14330	18616	**16473**	1.39	1.44	**1.41**
T10	35000	40000	**37500**	44720	57638	**51179**	9720	17638	**13679**	1.28	1.44	**1.36**

(10%), produced taller plants and more bolls / plant and these three treatments were comparable and significantly higher than untreated check (Table 2).

The mean, highest cotton *kapas* yield was recorded in 3G extract (10%) (16.65%), *neem* oil (2%) (16.43%) and herbal insect repellent (10%) (16.31 q/ha) and were significantly higher than the untreated check (10.56 q/ha). The economic analysis revealed that highest total income (Rs. 67130/ha), net income (Rs. 25330/ ha) and benefit cost ratio (1.60) were also associated with application of 3G extract (10%) which was *on par* with *neem* oil (2%) (Table 3).Possession of antifeedent property by *neem* and pungam leaf was proved earlier by several workers (Chocklingam *et al.,* 1983 and Devakumar *et al.,* 1986) reported moderate efficacy of *neem* products against the cotton whitefly, *Bemisia tabaci*. Though different botanical pesticides used were less effective, they are safer and less costly alternatives to chemical control. Similar results were reported by many earlier workers (Mastoli *et al.,* 1995; Hofte, 1999). Thus utilization of botanical pesticides possess the advantages of reducing the pollution burden of the environment occurring due to toxic pesticides and also protect the beneficial fauna and biodiversity in the cotton agro-ecosystem.

CONCLUSION

Spraying of organic insecticide, 3G extract (10%), *neem* oil (2%) and herbal insect repellent (10%) was found to be significantly effective against the sucking pests (leaf hopper, whitefly and thrips) in cotton and also produced significantly taller plants, bolls / plant and also higher seed cotton yield besides higher economic returns.

ACKNOWLEDGEMENT

The authors are very much thankful to the Professor and Head, Cotton Research Station, Srivilliputtur of the institution for their kind support in performing the research work.

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Received for publication : January 10, 2020
Accepted for publication : April 25, 2020