Impact of Different Oils as Biopesticide against Sucking Insect Pests in Cotton

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Abstract: The study was conducted to evaluate the effect of various botanical products on population of sucking complex on cotton crop. The study was conducted at the experimental area of Entomology section, Agriculture Research Institute, Tando Jam during the Kharif Season-2004. Five bio-pesticides i.e. neem oil (500ml/acre), cooking oil (750 ml/acre), linseed oil (750ml/acre), hing (290gm/acre) and cotton oil (750ml/acre) were applied twice against sucking complex (jassid, thrip and whitefly) and compared with an untreated control. It was observed that the efficacy of different bio-pesticides against sucking complex (jassid, whitefly and thrips) varied significantly. All products reduced pest population during both sprays. On an average, neem oil (63.27%) and cotton oil (62.01%) were found to be superior in reducing sucking pest, followed by hing (58.25%), cooking oil (57.18%) and linseed oil (55.24%) respectively.

Keywords: Cotton, Biopesticides, Sucking pests, Oils.

INTODUCTION

Cotton, *Gossypium hirsutum* (L.) is attacked by a number of pests from germination till harvesting. Particularly sucking pests *viz.,* whitefly, *Bemisia tabaci* (Gennadius), jassid, *Amrasca biguttula biguttula* (Ishida), aphid, *Aphis gossypii* (Glover) and thrips, *Thrips tabaci* (Linnman) cause significant losses to cotton [1]. Cotton bollworms and sucking insect pests caused up to 50-60% reduction to cotton production [2]. Farmers mostly rely on chemical control measures to manage the populations of cotton pests. However, available commercial pesticides not only they destroy human health and environment but also created the resistance in the pests, contaminated the food chain and reported dangerous for beneficial insects [3, 4].

To reduce the problem associated with insecticide, different substitute methods of pest control are being experienced in many countries of the world. Many scientists and researchers are now using the plant based pesticides, generally known as botanical pesticides, biopesticides, natural pesticides and phytopesticides [5-11]. Nowadays, botanical pesticides are used against many crop pests mainly because they are less hazardous to the applicator than many other synthetic pesticides. Due to their quick breakdown, most of the botanical pesticides are used when control is required even at the time of harvest as other synthetic chemicals may not be applied because of PHI limitations. Quick degradation also proves that they are less likely to become environmental problems [12].

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Varieties of oils have been used for the control of different insect and mite pests. These oils are important tools to control certain pest problems (e.g. Aphids, Scales and Mites) on a wide range of different crops. Oils block the spiracles, through which insects breathe, causing death in insects. Botanical oils are derivative of different plant's parts such as leaves, flowers, fruits and wood. These oils are used as pesticides to keep away certain insects.

Therefore, the present research was conducted to evaluate essential oils as biopesticides against the population of sucking complex of cotton i.e. jassid, *Amrasca biguttula biguttula*, Thrips, *Thrips tabaci*, whitefly, *Bemisia tabaci*.

MATERIALS AND METHODS

The experiment on the efficacy of various botanical compounds on a population of sucking pests of cotton crop was carried out at the experimental area of Entomology Section, Agriculture Research Institute, Tandojam.

A homogenous seed of a standard commercial cotton variety Niab-78 was sown in a RCBD. The experiment consisted of six treatments and each treatments was replicated four times (Table **1**).

Each spray was done at economic threshold levels of individual sucking pest of cotton, whereas a repeated spray was done at an interval of one month after the first spray. Pre-treatment observation was recorded one day before each spray, while post treatment observation was recorded after 24, 72 hours, one week and two weeks of each spray of respective

ISSN: 1814-8085 / E-ISSN: 1927-5129/17

Table 1: Mean Reduction % Age of Jassid, Thrip and Whitefly after Various Time Interval of 1st Spray with Different Bio-Pesticides on Cotton Crop

Bio-Pesticides	Time Interval of 1ST spray for Jassid				Mean	Time Interval of 1st spray for Thrip				Mean	Time Interval of 1st spray for White fly				Mean
	24 Hours	72 Hours	One Week	Two Weeks		24 Hours	72 Hours	One Week	Two Weeks		24 Hours	72 Hours	One Week	Two Weeks	
Neem oil @ 500ml/acre	64.52	73.40	76.34	67.18	70.36	65.15	71.56	69.44	63.67	67.45	56.04	65.27	56.19	53.21	57.67
Cooking oil @ 750ml/acre	58.71	67.86	67.20	60.93	63.67	55.42	61.38	60.71	54.81	58.08	53.42	63.42	53.99	48.96	54.94
Lin Seed oil @ 750ml/acre	55.35	65.92	67.47	61.45	62.54	54.50	59.36	58.82	54.11	56.69	51.51	61.33	52.72	45.25	52.70
Hing @ 250gm/acre	57.79	68.97	70.96	65.62	65.83	53.30	66.23	65.01	56.13	60.16	58.65	67.11	57.70	48.74	58.05
Cotton oil @ 750ml/acre	63.60	73.96	75.80	69.53	70.72	66.00	70.21	68.85	62.97	67.00	50.41	58.62	56.43	51.25	54.17
S.E	2.666	2.414	2.093	2.540		1.548	1.243	1.560	0.868		2.019	2.016	2.362	1.381	
L.S.D at P≤0.05	-	-	6.451	7.825		4.771	3.847	4.808	2.676		6.222	-	-	4.255	
L.S.D at P≤0.01	-	-	-	-		6.688	5.395	6.740	3.751		-	-	-	-	

insecticides. Five cotton plants were randomly selected from each replicate and tagged for the continuous recording of the population of sucking pests at the particular observation timings. Both, nymphs and adults of each pest were observed and counted from five leaves (two each from middle and bottom portion, and one leave from top) of each selected plant and their average was workout.

Reduction % age of the pest was tabulated as per the standard formula of Hinderson and Tilton (1955).

$$\text{Percentage mortality} = 1 - \frac{Ta}{Ca} \times \frac{Cb}{Tb} \times 100$$

Where

Tb = Number of pests recorded in the treated plots before treatments.

Ta = Number of pests recorded in the treated plots after treatments.

Cb = Pest population observed in the control plots before treatments.

Ca = Pest population observed in the control plots after treatment.

Analysis of variance was used to analyze collected data, whereas, means with significant difference were compared using the Least Square Difference (LSD) at 0.05 probability level.

RESULTS

Effect of Various Treatments on the Reduction Percentage of Sucking Pests after First Spray

The data on reduction percentage of jassid, thrip and white–fly were recorded after 24 hours, 72 hours, after one and two weeks of 1st spray are presented in Table **1**.

Jassid

After 24 hours of spray all bio-pesticides reduced jassid population; however, maximum reduction percentage was recorded in neem oil (66.96%). After 72 hours of spray, an increase mortality of sucking pests was recorded in all bio-pesticides. Neem oil recorded maximum mortality of pest (75.79%), after one week of spray the bio-pesticides product lost their effectiveness slightly as compared to 72 hours of spray. However, neem oil remains on top and reduced maximum jassid population (72.49%). After two weeks of spray all bio-pesticides product further lost their efficacy, however, neem oil remained on top (62.82%). The results of analysis of variance revealed that the differences in the reduction percentage of jassid after 24 and 72 hours of 1st spray were non-significant statistically. While after one and two weeks of spray the effectiveness of products tried varied significantly at 5 percent level of probability.

Thrips

The results reveal that during 24 hours of spray all the bio-pesticides reduced population of thrips. However, among the treatments tried neem oil recorded maximum mortality of pest (62.40%). After 72 hours of spray all the bio-products showed upward trend in efficacy. The maximum mortality showed in cotton oil (68.25%). During one week of spray all the bio-pesticides showed slightly reduction in their efficacy except cotton oil (70.16%) enhance their efficacy as compared to 72 hours. Further, during two weeks of spray all bio-pesticides reduced their toxicity. Among the tested bio-pesticides cotton oil recorded greater mortality of thrips (65.48%). The results of analysis of variance indicated that differences in reduction percentage between compounds tried were significant at 1 percent level during 42, 72 hours, one and two weeks of 1st spray.

Table 2: Overall Reduction Percentage of Different Sucking Pests during 1st Spray with Various Bio-Pesticides on Cotton Crop

Bio-Pesticides	Pests			Mean
	Jassid	Thrip	Whitefly	
T_1=Neem oil @ 500ml/acre	60.51	64.18	53.18	62.29
T_2=Cooking oil @ 750ml/acre	62.41	53.81	50.21	55.47
T_3=Lin Seed oil @ 750ml/acre	59.14	52.54	47.84	53.17
T_4=Hing @ 250gm/acre	59.64	52.00	53.84	55.16
T_5=Cotton oil @ 750ml/acre	64.27	66.37	49.59	60.07

Whitefly

It was observed that during 24 hours of 1st spray all products reduced pest population and among the products tried hing (55.35%) showed slight superiority over other products. However, there were no variation in the reduction percentage of pest when recorded after 72 hours and one week of spray. After two weeks of spray the performance of products showed significant trends of efficacy. Linseed oil reduced its effectiveness (39.51%) while other botanical products proved well with neem oil (47.22%), cooking oil (42.77%), hing (44.45%) and cotton oil (46.62%). The results revealed that all the bio-pesticides were effective in reducing the population of pest.

Overall Reduction of Pests during 1st Spray

The results on an overall reduction percentage of pests during 1st spray are presented in Table **2**. It may be observed from the data that all bio-pesticides reduce pest population. Among the bio-pesticides tried neem oil recorded high mortality of pest (62.27%) followed by cotton oil (60.07%), cooking oil (55.47%) and hing (55.16%). While linseed oil recorded a lowest reduction of pest (53.17%). It was further found that all products provided effective control of jassid during 1st spray when compared to thrips and whitefly.

Second Spray

The results on reduction percentage jassid, thrips and whitefly recorded after 24, 72 hours, one week and two weeks of 2nd spray are presented in Table **3**. It can be observed from the data that efficacy of different insecticides varied significantly after 24, 72 hours, one week and two weeks of spray.

Jassid

It was observed from the data that after 24 hours of spray all bio-pesticides reduce jassid population significantly. Comparatively neem oil (64.52%) and cotton oil (63.60%) were top in reducing pest population. After 72 hours of spray all products enhance their efficacy over 24 hours. Comparatively neem oil (73.40%) and cotton oil (73.96%) recorded the maximum mortality percentage of pests. After one week of spray all bio-pesticides further enhance their efficacy as compared to after 72 hours of spray. Among the products, neem oil (76.34%) and cotton oil (75.80%) proved more effective and remain on top. It was further noted that after two weeks of spray all products lost their efficacy slightly as against one week of spray. Cotton oil (69.53%) showed superiority. The results on reduction percentage of jassid recorded after 24, 72 hours, one week and two weeks of 2nd spray revealed that efficacy of different insecticides varied significantly after 24, 72 hours, one week and two weeks of spray.

Thrip

The results on efficacy of various bio-pesticides against thrips after 24, 72 hours, one week and two weeks of 2nd spray indicated that the differences in reduction percentage of thrips between treatments after each time intervals of second spray were highly significant. After 24 hours of spray all bio-pesticides reduces pests. The products, cotton oil (66.00%) and neem oil (65.15%) having high mortality percentage. After 72 hours the efficacy of all bio-products enhanced progressively as compared to 24 hours of spray. The maximum reduction percentage was recorded in case of neem oil (71.56%). After one week of spray all bio-pesticides reduced their efficacy slightly as compared to 72 hours of spray. Comparatively neem oil (69.44%) and cotton oil (68.85%), remain on top in efficacy percentage. After two weeks of spray the efficacy was further reduced, however, neem oil (63.67%) and cotton oil remain on top.

Whitefly

The results of efficacy percentage of different bio-pesticides against whitefly after 24, 72 hours, one week and two weeks of 2nd spray are shown in Table **2**. It can be seen from the data that the differences in reduction percentage among the treatment were highly significant during each interval except after one week of spray. After 24 hours of spray all bio-pesticides reduced whitefly population. Hing (58.65%) proved more effective. After 72 hours of spray the efficacy of botanical compounds reaches at their peak with the same pattern as in the case of 24 hours. The maximum reduction percentage was found in case of hing (67.11%). The results further showed that after one week of spray all the oil products started losing their efficacy against whitefly with maximum reduction percentage after one week was recorded with the spray of hing (57.70%). Further, reduction in efficacy was recorded at the end of two weeks of spray with Neem oil (53.21%) showed retain the maximum reduction percentage of whiteflies.

Overall Reduction of Pest during 2nd Spray

The results in an overall reduction of sucking pests (jassid, thrips and whitefly) during 2nd spray are shown in Table **4**. It was observed from the data that all

Table 3: Mean Reduction Percentage of Jassid, Thrips and Whitefly after Various Time Interval of 2nd Spray with Different Bio-Pesticides on Cotton Crop

Bio-Pesticides	Time Interval of 1ST spray for Jassid				Mean	Time Interval of 1st spray for Thrip				Mean	Time Interval of 1st spray for White fly				Mean
	24 Hours	72 Hours	One Week	Two Weeks		24 Hours	72 Hours	One Week	Two Weeks		24 Hours	72 Hours	One Week	Two Weeks	
Neem oil @ 500ml/acre	66.96	75.79	72.49	62.82	69.51	62.40	67.19	65.93	61.23	64.18	52.94	61.52	51.05	47.22	53.18
Cooking oil @ 750ml/acre	61.53	68.25	63.94	55.92	62.41	52.11	56.33	55.82	51.00	53.83	50.07	59.07	48.94	42.77	50.21
Lin Seed oil @ 750ml/acre	57.46	65.47	61.33	52.30	59.14	50.44	54.60	55.09	50.03	52.54	47.36	56.61	47.88	39.51	47.84
Hing @ 250gm/acre	58.82	65.07	61.71	52.96	59.64	50.00	54.37	54.51	49.13	52.00	55.35	63.71	51.85	44.45	53.84
Cotton oil @ 750ml/acre	64.25	68.65	64.68	59.53	64.27	61.61	68.25	70.16	65.48	66.37	46.00	55.25	50.52	46.62	49.59
S.E	1.396	1.115	1.424	1.340		1.548	1.249	1.560	0.868		1.792	2.103	2.190	1.719	
L.S.D at P≤0.05	4.302	3.437	4.389	4.251		4.771	3.849	4.808	2.676		5.521	6.479	-	5.297	
L.S.D at P≤0.01	6.031	4.818	6.152	5.959		6.688	5.395	6.740	3.751		-	-	-	-	

Table 4: Overall Reduction Percentage of Different Sucking Pests During 2nd Spray with Various Bio-Pesticides on Cotton Crop

Bio-Pesticides	Pests			Mean
	Jassid	Thrip	Whitefly	
T_1=Neem oil @ 500ml/acre	70.36	67.45	57.67	65.16
T_2=Cooking oil @ 750ml/acre	63.67	58.08	54.94	58.89
T_3=Lin Seed oil @ 750ml/acre	62.54	56.69	52.70	57.31
T_4=Hing @ 250gm/acre	65.83	60.16	58.05	61.34
T_5=Cotton oil @ 750ml/acre	70.72	67.00	54.17	63.96

Table 5: Overall Reduction Percentage of Different Sucking Pests during Various Sprays of Different Bio-Pesticides on Cotton Crop

Bio-Pesticides	1st Spray	2nd Spray	Mean
T_1=Neem oil @ 500ml/acre	62.29	65.16	63.27
T_2=Cooking oil @ 750ml/acre	55.47	58.89	57.18
T_3=Lin Seed oil@ 750ml/acre	53.17	57.31	55.24
T_4=Hing @ 250gm/acre	55.16	61.34	58.25
T_5=Cotton oil@ 750ml/acre	60.07	63.96	62.01

bio-pesticides products reduced the pests gradually. Among the insecticides, neem oil (65.16%) proved best against different sucking pests followed by cotton oil (63.96%), hing (61.34%) and cooking oil (58.89%). The lowest reduction percentage of sucking pests was observed with the application of linseed oil (57.31%).

Overall Reduction of Sucking Pests during Two Sprays

The data pertaining to the overall efficacy of botanical compounds against sucking pests over two sprays are presented in Table **5**. It showed that pests population checked effectively by the application of different bio-pesticides during each spray. However, neem oil (63.27%) and cotton oil (62.01%) reduced significantly more population of pests than other products.

DISCUSSION

The population recorded after 24, 72 hour, one and two weeks of spray reduced the population of jassid, thrips and whitefly significantly. The efficacy of products evaluated was cotton oil (64.27%), cooking oil (62.41%), neem oil (60.51%), hing (59.64%) and linseed oil (59.14%) for jassid, while cotton seed oil (66.37%), neem oil (64.18%), cooking oil (53.81%), hing (52.80%) and linseed oil (52.54%) for thrip and hing (53.84%), neem oil (53.18%), cooking oil (50.21%), cotton oil (49.59%) and linseed oil (47.84%) for whitefly respectively. While during second spray the reduction percentage of pest cotton oil (70.72%), neem oil (67.45%), hing (65.83%), cooking oil (63.67%), and linseed oil (62.54%) for jassid, neem oil (67.45%), cotton oil (67.00%), hing (60.16%), cooking oil (58.08%) and linseed oil (56.69%) for thrip, hing (58.05%), neem oil (57.67%), cooking oil (54.94%), cotton oil (54.17%) and linseed oil (52.70%) for whitefly respectively. On overall neem oil and cotton seed oil found to be more effective in reducing the population of sucking complex. Ahmed *et al*. (1995) found that neem oil gave encouraging control of jassid and whitefly in the cotton field. Gupta and Sherma [13] observed the neem used alone or alternatively with *Bacillus thuringiensis* or conventional synthetic insecticides failed to control bollworm complex, however no population build-up of *Bemesia tabaci*. While [14] treated various bio-pesticides against sucking complex in cotton and found that the population of jassid, thrip and whitefly after different time intervals spray indicated higher initial killing effect of all the chemicals. Gupta *et al*. [15] found that neem product lowered the population of *Bemisia tabaci* in the cotton field. Prabharkar *et al*. [16] found that neem oil when applied

as soil application produced significant mortality of immature leading to reduced immature of adult of *Bemisia argentifolli*.

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Received on 30-08-2016 Accepted on 09-11-2016 Published on 16-03-2017

https://doi.org/10.6000/1927-5129.2017.13.06