Effect of Biopesticides Against Sucking Insect Pests of Brinjal Crop Under Field Conditions

S. Shahzad Ali[1,*], Sher Ahmad[1], S. Sohail Ahmed[1], Huma Rizwana[2], Saima Siddiqui[1], S. Shahbaz Ali[1], Irshad Ali Rattar[1] and Munawer Ali Shah[1]

[1]*Department of Entomology, Sindh Agriculture University, Tandojam, Pakistan*

[2]*Department of Livestockmanagement, Sindh Agriculture University Tandojam, Pakistan*

Abstract: A field study was carried out during 2013 at the experimental area of Entomology Section, Agriculture Research Institute, (ARI) Tando Jam to examine the effect of bio-pesticides against sucking insect pests of brinjal crop under field conditions. Five treatments with three replications were applied. The treatments were: T1=chemical control (confidor/Diamond), T2=Neem *(Azadirachta indica)*, T3= Tobacco *(Nicotiana tabacum)*, T4= Eucalyptus (*Eucalyptus globus*), T5= Untreated (Control). Three insect pests were found infesting brinjal including white flies, jassid and mites. Pre treatment- and post-treatment observations were recorded. The results revealed that against white fly, the first spray of chemical control(confidor) showed highest reduction percent (96.62%) followed by Neem extract (82.60%), Tobacco extract (75.95%), Eucalyptus extract (73.93%) and lowest for untreated control (11.07%); while in the second spray also, chemical control(Diamond) showed highest effect against white fly (78.32%); followed by Neem extract (67.53%), Tobacco extract (56.43%), Eucalyptus extract (42.25%) and least by untreated plot (5.49%). Against jassid, chemical control (confidor) showed highest effect (77.90%) as observed during 1st spray, followed by Neem extract (55.95%), Tobacco extract (53.38%), Eucalyptus extract (53.99%) and untreated control (8.00%), while after second spray also chemical control (Diamond) showed highest reduction percent (81.70%) followed by Neem extract (68.73%), Tobacco extract (55.72%), Eucalyptus extract (50.66%) and the lowest was resulted by untreated control (13.91%). Against mites population on brinjal the first spray results showed that chemical control (confidor) showed highest effect (98.19%) followed by Neem extract (96.19%), Tobacco extract (95.75%), Eucalyptus extract (86.86%) and least population was recorded in untreated control (9.96%). After second spray, chemical control (Diamond) showed highest reduction percent (99.65%), followed by Neem extract (98.33%), Tobacco extract (92.85%), Eucalyptus extract (88.93%) and the lowest reduction percent was resulted by untreated control (9.14%) respectively. Chemical control (confidor/Diamond) showed its superiority in effect to combat sucking insect pests studied in brinjal, followed by Neem extract, Tobacco extract, Eucalyptus extract and untreated control remained the least.

Keyword: Plant extract, Synthetic pesticides, Sucking pests, Brinjal.

INTRODUCTION

Brinjal, eggplant or *Aubergine, Solanum melongena* L. (Salanaceae) is one of the most consumed vegetable crops due to its relatively inexpensiveness and easy availability throughout the year. There are approximately 15-20 different varieties of eggplant. This can be grown successfully under the climatic conditions prevailing in South India and the Deccan Plateau. It comes up well even in hilly regions where the temperature does not come down below 5o C. Eggplant is believed to have been domesticated in India, China, Thailand, Burma and some place else in Southeast Asia. In Asia it is grown on a fairly wide scale in China, Japan, India and Pakistan [1].

China is the largest producer of brinjal and contributes about 68.7 per cent of the world's brinjal production. The first use of eggplant was probably medicinal rather than culinary: Its flesh still has a bitter after-taste if it is not treated, despite centuries of domestication experimentation. Brinjal contains water (92.7%) with some protein (1.1%), fiber and carbohydrates (0.02%) and no fats. It is rich in Vitamin A and B [2].

Besides its importance as a vegetable in daily life it is also subjected to attack by a number of insect pests like shoot and fruit borer, *Leucinodes orbonalis* (Guenee.), whitefly, *Bemisia tabaci* (Gennadius), jassid, *Amrasca biguttula biguttula* (Ishida), aphid, *Aphis gossipy* (Glover); Mexican bean beetle, *Epilachna varivestis* (Mulsan), red spider mite, *Tetranychus urticae* (Koch) and some non-insect pests [3]. Among these pests, major sucking pests like whitefly, jassid, aphid and thrips are big threats to brinjal growers which attack right from nursery stage till harvesting resulting in economic loss to the marketable yield [4].

Brinjal is attacked by insect and mite pests starting from seedling stage to senescence. Whitefly, *Bemicia tabaci* (Genn.), jassid, *Amrasca biguttula* biguttula (Ishida), Epilachna beetle, *Henosepilachna vigintioctopunctata* (Fab.) and non insect pest, red spider mite, *Tetranychus macfurlanei* are the major insect pests of brinjal [5]. In Himachal Pradesh, among

*Address correspondence to this author at the Department of Entomology, Sindh Agriculture University, Tandojam, Pakistan; Tel: + (+92-3360880750); E-mail: alisyedshahzad75@gmail.com

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27 different insect species and one mite species reported to be associated with brinjal crop [6]. These insect pests are known to damage shoot and fruit of brinjal in all stages of its growth. The yield loss due to these pests is to the extent of 70-92 percent. Brinjal is mainly infested by lepidopteran insect pests which cause extensive damage to the growing shoot tips and fruits, thereby drastically reducing the marketable fruit yield [7]. Synthetic pesticides are widely used to control insect pests of brinjal, which may adversely affect human health and there is need to introduce/adopt environmentally safe, effective and eco-friendly strategies to control these insect pests [8].

With the advent of chemical pesticides, this crisis was resolved to a great extent. But the over dependence on chemical pesticides and eventual uninhibited use of them has necessitated for alternatives mainly for environmental concerns. Degraded soils and groundwater pollution has resulted in nutritionally imbalanced and unproductive lands. Violative pesticide residues also sometimes raise food safety concerns among domestic consumers and pose trade impediments for export crops. Therefore, an eco-friendly alternative is the need of the hour. Bio-pesticides, a contraction of biological pesticides, include several types of pest management intervention through predatory, parasitic or chemical relationships. The term has been associated historically with biological control and by implication the manipulation of living organisms. Bio-pesticides are plant substances to control insect pests [9] and these naturally occurring substances control pests by non-toxic mechanisms [10]. Hence safer insect pest control may be possible by bio-pesticides application [11]. Generally in brinjal fruit, shoot borers, white flies, jassids and mites are major threat and application of pesticides showed effective control of these insect pests [9-11]. The bio-pesticides are effective in suppressing the larval population of borers and [12] and many other insect pests infesting vegetables [13-16].

The significance of botanical pesticides/plant extracts is highly recognized in the field of agriculture as botanical pesticides are cheap, safe and sound, hazardless, non-residual, and highly effective against various insect pests. The bio-pesticides have been used for almost all field crops and vegetables against bollworms, fruit borers, aphids, jassids, thrips, whitefly, leaf hopper, diamond back moth etc. The plant extracts act as repellant, anti-feedant and its seed contains certain chemicals, which inhibits the population of insect pests. Apart from Neem, Huing (Asfoetida), Dhatoora (Thorn apple) and Tobacco based products, Eucalyptus extracts are also effectively used for controlling the sucking complex [7]. Since, bio-pesticides have been used in the field for many years against many insect pests. The present study will be carried out to effect of plant extracts being used as bio-pesticides against sucking insect pests of Brinjal (*Solanum melongena* L.) crop under field conditions at Tando Jam, Pakistan.

MATERIAL AND METHODS

Effect of bio-pesticides against sucking insect pests of brinjal crop under field conditions was carried out during the year 2013. The experiment was laid out in a three replicated Randomized Complete Block Design in a sub-plot size of 3m x 3 ($9m^2$). A total of 15 plots were prepared and divided into three separate blocks as replications to manage for treatments.

Land Preparation

However, the land was prepared in off-season. Initially, the hard pan of the experimental soil was removed by running disc plow and left for 15 days. Later, the clods were crushed using tractor drawn clod crusher, and leveling was performed. After soaking dose, when the land came in condition, the plots were finally prepared by giving separation strips and forming feeding channels. The row to row distance was maintained at 60 cm and plant to plant distance of 30 cm.

Sowing

The nursery of brinjal variety “Pusa Purple Round” was obtained by the courtesy of Sindh Horticulture Research Institute, Mirpurkhas, Pakistan and transplanting was done on 25th April, 2013. The irrigation was applied initially just before transplanting and afterwards when felt necessary.

Treatments

T1 Chemical (Confidor20% SL (Imidacloprid) / Diamond 20% SP (Acetamiprid)

T2 Neem (Azadirachta indica)

T3 Tobacco (*Nicotiana tabacum*)

T4 Eucalyptus (*Eucalyptus globus*)

T5 Control (untreated)

Preparation of Botanical Extracts

For preparation of plant extract, 10 kg leaves each of Neem (*Azadirachta indica*), Tobacco (*Nicotiana tabacum*), and Eucalyptus (*Eucalyptus globus*) were collected and processed for getting the extract. Each treatments plant material was boiled in 10 liters of water. When water remained 5 liters, the prepared stock solution filtered through muslin cloth. The extracts of different plants material were sprayed with a knapsack hand sprayer. The two sprays were carried out, and observed their efficacy after 24, 48, 72, 96 hours 1 week and 2 weeks of spray and compared with control. Recommended pesticides for brinjal was sprayed for chemical control (Confidor20% SL (Imidacloprid) / Diamond20%SP (Acetamiprid) @ 250 ml / 125 gm */*acre) (0.56ml/0.28gm */*plot) and bio-pesticide 5liter/acre (12ml/plot) was sprayed.

The data thus collected were subjected to statistical analysis using analysis of variance to know the significance of differences in the population of various insect pests and infestation at different intervals after treatment, and LSD (Least Significance Difference) test was applied to compare different treatments for their efficacies against these insect pests.

RESULTS

Use of botanical substances for control of insect pests has been found most effective way to balance the ecosystem. The experiments were conducted during 2013 at the experimental area of Entomology Section, Agriculture Research Institute (ARI) Tando Jam, Pakistan to investigate the effect of bio-pesticides against sucking insect pests of brinjal, using of synthetic chemical **(**confidor/ Diamond**)** and plant extract Neem (*Azadirachta indica*), Tobacco (*Nicotiana tabacum*) and Eucalyptus (*Eucalyptus globus*), while their efficacy was compared with an untreated control was also maintained. Three insect pests posing threat to brinjal production (white fly, jassid and mites) were monitored and the data are shown in Tables **1** to **6**.

WHITE FLY

First Spray

The analysis of variance showed that the effect of bio-pesticides against white fly varied significantly ($P<0.05$) when monitored after 48 hours after first spray ($F=7.38$; $DF=20$; $P<0.05$), 72 hours after spray ($F=13.35$; $DF=20$; $P<0.05$); 96 hours of spray ($F=50.31$; $DF=20$; $P<0.05$); one week after spray ($F=87.45$; $DF=20$; $P<0.05$), two weeks after spray ($F=127.03$; $DF=20$; $P<0.05$); and non-significant ($P>0.05$) when monitored for pre-treatment ($F=0.28$; $DF=20$; $P>0.05$).

The data in Table **1** showed that all the bio-pesticides showed their effect throughout the observational period of two weeks after first spray against white fly in brinjal. The plots sprayed with chemical control (Confidor), the results revealed that after two weeks of spray, white fly infestation reduced from 5.92/plant to 0.19/plant and highest efficacy was 96.62%. While the Neem extract ranked 2nd which reduce the white fly infestation from 5.63/plant to 1.03/plant and efficacy was 82.60 %. Tobacco extract ranked 3rd which reduce the white fly infestation from 5.49/plant to 1.32/plant and showing efficacy of 75.95%. Similarly, Eucalyptus extract ranked 4th

Table 1: Effects of Bio-Pesticides Against White Fly Infestation on Brinjal as Compared to Chemical Control (Confidor) at Different Intervals after First Spray

Plant extracts	Pre-treatment	Post treatment observation/leaf after:					Pest Reduction /leaf	Reduction %
		48hrs	72hrs	96hrs	1week	2week		
Chemical control (confidor)	5.63	2.88	2.21	1.69	0.89	0.19	5.44	96.62
Neem extract	5.92	3.23	2.68	2.02	1.72	1.03	4.89	82.60
Tabacco extract	5.49	3.86	2.87	2.71	2.01	1.32	4.17	75.95
Eucalyptus extract	5.87	3.93	2.98	2.84	2.23	1.53	4.34	73.93
Untreated	5.96	5.03	4.92	5.00	5.71	5.30	0.66	11.07
S.E.±	0.4913	0.3608	0.3193	0.2514	0.2245	0.2092		
LSD 0.05	-	0.7861	0.6956	0.5477	0.4891	0.4558		
LSD 0.01	-	1.1060	0.9752	0.7678	0.6857	0.6390		

reducing white fly population from 5.87/plant to 1.53/plant showing efficacy of 73.93%.

Second Spray

The analysis of variance indicated that effect of bio-pesticides against white fly varied significantly (P<0.05) when monitored after 48 hours after second spray (F=4.79; DF=20; P<0.05), 72 hours after spray (F=7.61; DF=20; P<0.05); 96 hours of spray (F=10.06; DF=20; P<0.05); one week after spray (F=22.28; DF=20; P<0.05), two weeks after spray (F=71.28; DF=20; P<0.05); and non-significant (P>0.05) when insect population was monitored pre-treatment (F=0.99; DF=20; P>0.05).

The data in Table **2** showed that after second spray, the bio-pesticides remained effective by applying chemical control (Diamond), throughout the period of two weeks against white fly in brinjal. Neem extract ranked 2nd which reduced the white fly infestation from 5.92/plant to 5.63/plant and highest efficacy was recorded 67.53%. Tobacco extract ranked 3rd reducing white fly infestation from 4.82/plant to 2.10/plant and efficacy was 56.43%. Similarly, Eucalyptus extract ranked 4th reducing white fly population from 4.52/plant to 2.61/plant showing efficacy of 42.25%. Whereas, control (untreated) plot ranked 5th and white fly reduction percentage significantly lowest as compare to different bio-pesticides applied plots.

JASSID (*Amrasca devastans* Dist)

First Spray

The analysis of variance indicated that the effect of different bio-pesticides against jassid differed significantly (P<0.05), when observed after 48 hours after first spray (F=7.78; DF=20; P<0.05), 72 hours after spray (F=12.64; DF=20; P<0.05); 96 hours of spray (F=48.39; DF=20; P<0.05); one week after spray (F=69.47; DF=20; P<0.05), two weeks after spray (F=212.24; DF=20; P<0.05); and non-significant (P>0.05) when observed for pre-treatment (F=0.40; DF=20; P>0.05).

The data (Table **3**) indicated that the bio-pesticides remained effective to combat the jassid on brinjal throughout the observational period of 2 weeks after spray. The plots sprayed with chemical control (Confidor), the mites infestation reduced from 5.93/plant to 1.31/plant showing the highest effect of 77.90%. Neem extract was ranked 2nd reducing jassid infestation from 5.79/plant to 2.55/plant showing efficacy of 55.95%. The results further showed that the Tobacco extract ranked 3rd in reducing insect infestation from 6.20/plant to 2.89/plant showing efficacy of 53.38%; while Eucalyptus extract ranked 4th reducing insect population from 6.76/plant to 3.11/plant showing lower efficacy of 53.99%. However, regular sprays could keep the jassid population below economic injury level.

Second Spray

The analysis of variance showed that the effect of various bio-pesticides after second spray against jassid affected the pest population significantly (P<0.05) when monitored after 48 hours after first spray (F=3.69; DF=20; P<0.05), 72 hours after spray (F=4.80; DF=20; P<0.05); 96 hours of spray (F=19.97; DF=20; P<0.05); week after spray (F=35.57; DF=20; P<0.05), two weeks after spray (F=176.77; DF=20; P<0.05); and non-

Table 2: Effects of Different Bio-Pesticides Against White Fly Infestation on Brinjal as Compared to Chemical Control (Diamond20%SP) at Different Intervals after Second Spray

Plant extracts	Pre-treatment	Post treatment observation/ leaf after:					Pest Reduction /leaf	Reduction %
		48hrs	72hrs	96hrs	1week	2week		
Chemical control (Diamond20%SP)	4.43	3.63	3.26	2.90	2.00	0.96	3.47	78.32
Neem extract	4.62	3.89	3.51	3.00	2.96	1.50	3.12	67.53
Tabacco extract	4.82	4.06	3.86	3.59	3.00	2.10	2.72	56.43
Eucalyptus extract	4.52	4.29	4.00	3.86	3.41	2.61	1.91	42.25
Untreated	4.96	4.90	4.00	3.86	4.16	4.69	0.27	5.49
S.E.±	0.2762	0.2272	0.2089	0.2010	0.1845	0.1598	-	-
LSD 0.05	-	0.4950	0.4551	0.4379	0.4020	0.3482	-	-
LSD 0.01	-	0.6939	0.6380	0.6140	0.5635	0.4882	-	-

Table 3: Effects of Different Bio-Pesticides Against Jassid on Brinjal as Compared to Chemical Control (Confidor) at Different Intervals after First Spary

Plant extracts	Pre-treatment	Post treatment observation/leaf after:					Pest Reduction /leaf	Reduction %
		48hrs	72hrs	96hrs	1week	2week		
Chemical control (Confidor)	5.93	4.90	4.00	3.83	3.00	1.31	4.62	77.90
Neem extract	5.79	5.00	4.61	3.66	3.13	2.55	3.24	55.95
Tobacco extract	6.20	5.64	5.30	4.61	3.92	2.89	3.31	53.38
Eucalyptus extract	6.76	5.95	5.71	4.83	4.00	3.11	3.65	53.99
Untreated	7.25	7.00	6.93	6.71	6.51	6.67	0.58	8.00
S.E.±	0.4366	0.3546	0.3381	0.2598	0.2311	0.1830		
LSD 0.05	-	0.7727	0.7367	0.5661	0.5035	0.3987		
LSD 0.01	-	1.0832	1.0328	0.7936	0.7059	0.5589		

significant (P>0.05) when observed for pre-treatment (F=1.16; DF=20; P>0.05).

The data (Table **4**) showed that the botanical pesticides as well as synthetic pesticide showed remarkable effect against the jassid and kept the target pest under control throughout the period of two weeks after spray. The jassid population on brinjal plants sprayed with chemical control reduced from 5.74/plant to 1.05/plant showing the highest effect of 81.70%; and Neem extract ranked 2nd reducing jassid infestation from 5.79/plant to 1.81/plant showing efficacy of 68.73%. The results further showed that the Tobacco extract ranked 3rd, reducing insect infestation from 5.85plant to 2.59/plant showing efficacy of 55.72% while Eucalyptus extract ranked 4th reducing insect population from 6.00/plant to 3.05/plant showing efficacy of 50.66%. Moreover, the untreated (control) ranked least among different treatments.

Mites *Tetranychus sp*.

First Spray

The analysis of variance indicated that the effect of different bio-pesticides against mite as compared to chemical control affected the mite infestation on brinjal significantly (P<0.05). when examined after 48 hours after first spray (F=3.76; DF=20; P<0.05), 72 hours after spray (F=5.89; DF=20; P<0.05); 96 hours of spray (F=10.00; DF=20; P<0.05); week after spray (F=209.51; DF=20; P<0.05), two weeks after spray (F=140.90; DF=20; P<0.05); and non-significant (P>0.05) when observed for pre-treatment (F=0.79; DF=20; P>0.05) .

Table 4: Effects of Different Bio-Pesticides Against Jassid on Brinjal as Compared to Chemical Control (Diamond 20% SP) at Different Intervals after Second Spray

Plant extracts	Pre-treatment	Post treatment observation/leaf after:					Pest Reduction /leaf	Reduction %
		48hrs	72hrs	96hrs	1week	2week		
Chemical Control (Diamond20%SP)	5.74	4.97	4.77	3.49	2.87	1.05	4.69	81.70
Neem extract	5.79	5.33	5.20	3.85	2.86	1.81	3.98	68.73
Tobacco extract	5.85	5.47	5.43	4.06	3.69	2.59	3.26	55.72
Eucalyptus extract	6.00	5.61	5.40	5.00	4.11	3.05	3.04	50.66
Untreated	6.97	6.73	6.26	6.11	5.96	6.00	0.97	13.91
S.E.±	0.4257	0.3828	0.3725	0.2601	0.2206	0.1395	-	-
LSD 0.05	-	0.8341	0.8117	0.5668	0.4807	0.3039	-	-
LSD 0.01	-	1.1694	1.1379	0.7946	0.6739	0.4260	-	-

Table 5: Effects of Different Bio-Pesticides Against Mites Infestation on Brinjal as Compared to Chemical Control (Confidor) at Different Intervals after First Spray

Plant extracts	Pre-treatment	Post treatment observation/leaf after:					Pest Reduction /leaf	Reduction %
		48hrs	72hrs	96hrs	1week	2week		
Chemical Control (Confidor)	45.86	37.83	33.98	31.09	8.52	0.83	45.03	98.19
Neem extract	41.78	36.51	33.45	28.31	12.61	1.59	40.19	96.19
Tobacco extract	41.69	38.50	36.12	31.04	3.99	1.77	39.92	95.75
Eucalyptus extract	42.71	43.84	41.41	37.2	18.39	5.61	37.1	86.96
Untreated	42.85	44.23	41.07	40.63	39.44	38.58	4.27	9.96
S.E.±	2.4095	2.1183	2.0490	1.8383	1.1174	1.6750		
LSD 0.05	-	4.6155	4.4644	4.0053	2.4347	3.6494		
LSD 0.01	-	6.4706	6.2588	5.6152	3.4133	5.1162		

The results (Table **5**) indicated that the bio-pesticides and synthetic pesticide produced remarkable effect against mites and the mites remained under control throughout the period of two weeks after spray. The mites infestation on brinjal plants sprayed with chemical control reduced from 45.86/plant to 0.83/plant showing the highest effect of 98.19%; and Neem extract ranked 2nd reducing mite infestation from 41.78/plant to 1.59/plant showing reduction percentage of 96.19%. The data further indicated that the Tobacco extract ranked 3rd in efficacy reducing mite infestation from 41.69/plant to 1.77/plant showing efficacy of 95.75%, while Eucalyptus extract ranked 4th reducing mite population from 42.71/plant to 5.61/plant showing efficacy of 86.96%. However, untreated (Control) ranked least among different treatments.

Second Spray

The analysis of variance showed that the effect of various bio-pesticides against mites compared to chemical control to combat mite population on brinjal was significant ($P<0.05$) when examined after 48 hours after second spray ($F=5.62$; $DF=20$; $P<0.05$), 72 hours after spray ($F=7.08$; $DF=20$; $P<0.05$); 96 hours of spray ($F=9.26$; $DF=20$; $P<0.05$); one week after spray ($F=322.89$; $DF=20$; $P<0.05$) and two weeks after spray ($F=314.54$; $DF=20$; $P<0.05$); against pre-treatment count ($F=2.15$; $DF=20$; $P>0.05$).

The data (Table **6**) showed that the bio-pesticides were highly effective to control mites (*Tetranychus* sp.) population in brinjal plants sprayed with chemical control. Diamond reduced mite population from 35.18/plant to 0.12/plant showing the highest reduction

Table 6: Effects of Different Bio-Pesticides Against Mites Infestation on Brinjal as Compared to Chemical Control (Diamond20%SP) at Different Intervals after Second Spray

Plant extracts	Pre-treatment	Post treatment observation/leaf after					Pest Reduction /leaf	Reduction %
		48hrs	72hrs	96hrs	1week	2week		
Chemical Control (Diamond20%SP)	35.18	25.94	24.60	21.01	2.1	0.12	35.06	99.65
Neem extract	33.63	28.14	27.26	25.87	4.73	0.56	33.07	98.33
Tobacco extract	29.95	24.76	25.50	23.69	5.63	2.14	27.81	92.85
Eucalyptus extract	34.90	33.48	32.13	30.72	5.84	3.86	31.04	88.93
Untreated	37.72	36.36	35.06	33.18	32.40	32.27	3.45	9.14
S.E.±	2.5197	2.3610	2.3184	2.1110	0.8533	0.9502		
LSD 0.05	-	5.1441	5.0514	4.5995	1.8593	2.0703		
LSD 0.01	-	7.2117	7.0816	6.4482	2.6066	2.9025		

percent of 99.65%; and Neem extract ranked 2nd reducing mites (*Tetranychus* sp.) infestation from 33.63/plant to 0.56/plant showing 98.36 reduction percent. The data further indicated that the Tobacco extract ranked 3rd in reducing mites (*Tetranychus* sp.) infestation from 29.95/plant to 2.14/plant, showing reduction percent of 92.85%, while Eucalyptus extract ranked 4th reducing mite population from 34.90/plant to 3.86/plant showing efficacy of 88.93%. However, untreated (Control) ranked least among different treatments.

DISCUSSION

Mostly the vegetables are harvested frequently and the picked vegetables are marketed for human consumption immediately without any analysis for residual effects of the pesticides. However, toxic effects of synthetic pesticides are a real threat to human health. The bio-pesticides are safe and their application not only suppresses the insect pests effectively, but there is no risk of residual effects for the consumers. Hence, the study was carried out to examine the effect of various bio-pesticides against sucking insect pests of brinjal.

The present study showed that against white fly the first spray of chemical control (confidor) showed highest reduction percent 96.62%, followed by Neem extract 82.60%, Tobacco extract 75.95%, Eucalyptus extract 73.93%, and lowest for untreated (control) 11.07%; while in the second spray also, chemical control (Diamond) showed highest effect against white fly 78.32%; followed by Neem extract 67.53%, Tobacco extract 56.43%, Eucalyptus extract 42.25 % and least by untreated (control) 5.49%. Against jassid, chemical control (confidor) showed highest efficacy 77.90% as observed after 1st spray, followed Neem extract 55.95%, Tobacco extract 53.38%, Eucalyptus extract 53.99% and least reduction percent was recorded in untreated (control); while after second spray chemical control (Diamond) also showed highest reduction percent i.e 81.70%, followed by Neem extract 68.73%, Tobacco extract 55.72%, Eucalyptus extract 50.66%, and the lowest reduction percent was resulted by untreated (control). Against mite population on brinjal the first spray results showed that chemical control (confidor) showed highest effect 98.19%, Neem extract 96.19%, Tobacco extract 95.75%, Eucalyptus extract86.96%. Second spray results showed that chemical control (Diamond) showed highest 99.65% followed by Neem extrac 98.33%, Tobacco extract92.85%, Eucalyptus extract 88.93%. Regardless the bio-pesticides, the highest efficacy was observed against white fly during both the sprays. Mites persisted more than white fly and jassid to remain in the brinjal fields. For effective and safe control of brinjal insect pests in the field, the crop may be preferably be sprayed with Neem extract followed by Tobacco and Eucalyptus extract; and at least one spray monthly is essential to keep the insect pests below economic injury level. There is no need to apply chemical control, because Neem extract resulted better than the chemical control. The results of the present study are further confirmed by those of [17] who found that effect of Neem based pesticides against white fly and jassid was higher than other treatments and Achook and NSKE (3%) were the most effective in controlling the white fly and jassid. It was [18] found that different Neem products (botanical pesticides) proved to be effective to control Jassid under field conditions. The results supported by the findings of the earlier workers [19] they reported that Neem based products gave significant control of jassids (*Amrasca devastans*). It is also in agreement with [20] who used Neem oil at 2% and Neem seed water extract at 3% which significantly reduced the population of jassids and white fly. Dutt [21] reported that Neem and dhatura controlled the sucking insect pests effectively. Bardin [10] examined the effect of bio-pesticides and their efficacy to control insect pests of tomato. The bio-pesticides appear to be a promising biological control agent against whiteflies. The use of these products in a context of integrated protection of tomato requires that their efficacy is not altered when applied together. Noonari [22] examined the effect of bio-pesticides against jassid on brinjal having four treatments (including Control) with four replications. Neem oil, Tobacco leaves, Neem powder, Neem oil + B.M. Beneficial micro-organism were sprayed twice. The pre-treatment counts of the pest were recorded one day before spray. The post-treatment observations were taken after 48, 72 hours one week two weeks. In first spray against jassid Neem oil was most effective bio-pesticides and showed highest mortality (71.97%) followed by Neem oil + B.M. Beneficial micro-organism (65.48%) Neem powder (61.56%) and Tobacco leaves (54.75%). In the first spray against jassid Tobacco leave has showed highest reduction percentage (85.90%) and followed by Neem oil (80.00%) Neem oil + B.M. Beneficial micro-organism (75.70%) and Neem powder (70.70%). In second spray against jassid Neem oil has showed good highest mortality (72.30%) followed by Neem oil + B.M. Beneficial micro-organism (63.68%). Yadav [23] revealed that treatment of Neem formulation with

azadirachtin-endosulfan at 15 days interval brought down the jassids population up to 0.68/5 plants. Ahmed [24] conducted field experiment to determine the effect of six plant extracts (sweetsop, chilli pepper, garlic, ginger, Neem and Tobacco) against the insect pests of cowpea. All the plant extract treatments were significantly better than control treatments. Results of the present finding therefore, suggest the use of all the tested plant extracts particularly Tobacco, sweetsop and garlic as they have been found to be very promising bio-pesticides in the control of insect pests. Arain [25] found that Tobacco extract resulted highest mortality (98.60%) of mealy bug, Neem oil was most effective after Tobacco extract causing 89.32% pest mortality, Neem extract ranked third in relation to efficacy against mealy bug with insect mortality of 80.37%, while garlic extract was least effective against mealy bug with mortality of 75.82% after 72 hours treatment. Rukhsana [26] reported that among the plant material, best antifungal activity was achieved by extracts of *Azadirachta indica* (Neem), and *Allium sativum* (garlic) at the concentration of 0.015%. Soto [5] reported that only plants sprayed with Neem (31.1 mg a.i./l) showed symptoms of phytotoxicity. Lime sulphur and Neem based products, applied in appropriate concentrations and formulations, bear out as a viable alternative to control *T. evansi* on tomato plants. Ghananand [27] reported that the toxic effect of the insecticides and bio-pesticides decreased after 7 days of treatment application. Abdalraheem and Elshafie [28] used three bio-pesticides (Bt, NeemAzal and Spinosad) as alternatives to manage important tomatoes insect pests, and reported that NeemAzal was effective against all test insects pests. The chemical pesticides demonstrated the highest effects in controlling the tested insects but they reduced significantly the population of the beneficial insects. The bio-pesticides seem to be less hazardous to the beneficial insects.

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