



EFFECT OF NEEM EXTRACT ON LEAFHOPPER OF POTATO CROP AT QUETTA, BALOCHISTAN, PAKISTAN

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Author's contribution

N.M is the principle contributor I.K analyzed the material, M.A.R identified the samples, R.B collected the insects, S.A.T compiled the data and G.M.N finalized the data for submission.

Key words:

Leafhopper, Neem extract,
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ABSTRACT

Field studies on efficacy of neem extract against Leafhopper (*Amrasca biguttula biguttula*) on potato crop (*Solanum tuberosum* L.) were carried out at the Insect Systematic Postgraduate Laboratory, Department of Entomology, Sindh Agriculture University Tandojam and Quetta Baluchistan, during the year of 2015. The crop was shown on well prepared seed bed in a Randomized Complete Block Design keeping a net treatment plot area of 5x4 meter with 4 replications and 4 treatments. The pre-treatment observations were taken 24hrs before spray, whereas, post-treatment observations were taken at the intervals of 24hrs, 48hrs and 72hrs after the respective spray. Relative neem extract displayed greater reduction of leafhopper (*A. b. biguttula*). The results revealed that all the sprays of neem extract against potato leafhopper (*A. b. biguttula*) remained effective after the observation of leafhopper (*A. b. biguttula*) population on 24hrs, 48hrs and 72hrs after the respective spray. T4=100cc/plot, showed highest efficacy (59.31a %) trough out the three sprays followed by T3=75cc/plot(50.71b %), T2=50cc/plot (43.23c %) and T1=25cc/plot (43.23d %) respectively, with comparison to T5=Control/untreated (7.09e %).

1. INTRODUCTION

Potato (*Solanum tuberosum* L.) well known as staple food and vegetable crop. It ranked 4th position among other after cereals crops [1]. The crop relatively higher in its production capacity and per unit calories compared to wheat and rice, it produced 12-15 times more yield ha⁻¹ with 1.9 metric tons GDP compared to other cereal grains crops [2]. The crop mostly grown in summer around 03 consecutive crops can be grown per year in plains and low valleys. According to the map, there is 08 agro ecological zone of potato production includes (1) Southern Sindh, Punjab and Balochistan, (2) South East KPK, Central Punjab, (3) KPK & Northern Punjab (4) KPK irrigated areas, (5) KPK rain fed valleys & hill sides, AJK & Punjab Northern (6) KPK irrigated high valleys, Northern AJK and Waziristan, respectively. All these zones are variables in their respective climate, soil, irrigation, latitude, longitude and altitudes [3]. Nevertheless, the insect pests cause 35-40% losses that may reach up to

60-70% [4]. Potato crop (*Solanum tuberosum* L.) is attacked by different insect pests among them the potato leaf hoppers (*A. b. biguttula*) possess considerable importance. About 79 species of leaf hopper have been found infesting the potato crop, *Solanum tuberosum* L. [5]. The damage mode action relies on climatic factors and host availability. Pesticides are quick solutions for insect control and are important in increasing solutions for insect control and also important in increasing agricultural production [6]. In fruits and vegetable crops there was around 1/3 pesticides applied in the country, which prevent the damaged of crop and dramatically improved the yield [7]. Potato leafhopper (*A. b. biguttula*) 1/8 inch long, light green, sedge-shaped and slender appearance during immature and adult stages. Both adults and nymphs have piercing sucking mouthparts on the underside of the head that they insert into the plant to feed on plant juices. The wingless nymphs move quickly backwards and sideways in a crab like fashion on the leaf surface.

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Eggs are laid in plant tissue and are difficult to observe in the field. Potato leafhopper, *A. b. biguttula*. (Hemiptera: Cicadellidae), is a highly polyphagous pest, capable of successful reproduction on 200 plant species in 25 families [8]. In view of the environmental and health issues the bio-pesticides are holding attention by scientists and researchers as they are safe and environment friendly. Although, many researches carried work on neem in different aspect such as on uses [9, 10, 11]. The neem tree, *Azadirachta indica*, *A. Juss* (Meliaceae), has been found to be a promising source of natural pesticides, several constituents of its leaves and seed showing marked insect control potential. Neem seed kernel extract suppresses the feeding, growth and reproduction of insects [12, 13]. Keeping the above facts in view, an attempt was made to carry out studies on the effect of neem extract on leafhopper (*A. b. biguttula*) of potato crop (*Solanum tuberosum* L.) in agro-ecological condition of Quetta Baluchistan.

2. MATERIAL AND METHODS

An experiment was carried out to determine the efficacy of bio-pesticide (Neem extract) against leafhopper/jassid (*Amrasca biguttula biguttula*) on potato crop in the experiment area of Quetta Baluchistan, and it is divided into two parts: laboratory experiments and field trials during the year 2015.

Laboratory experiments

All trials were carried out at Entomology Department Laboratory. All experiments were done with the objective of identification and testing the efficacy of neem based products against leafhoppers (*A. b. biguttula*) in the field.

Layout: Randomized Complete Block Design.

Replication: Four.

Treatments: Four.

- T1 = Neem extract (25cc)
- T2 = Neem extract (50cc)
- T3 = Neem extract (75cc)
- T4 = Neem extract (100cc)
- T5 = Control (untreated)

Evaluation of Neem extract:

Evaluation of Neem extract was carried out at the Directorate of Agriculture Research Farm, during the period in 2015, so that the yield estimate and

recommendations for pest control could applied in the research fields of Research Farm. Healthy buds of white skin potato (varieties: Diamond, krin, Altamash and Curado) crop were buried to the well prepared ridges keeping 75cm distance between ridge/row to ridge/row and 60cm distance between plant to plant during the month of March-April.

Table-1: Bio-pesticides and their doses used against leafhopper/jassid (*A. b. biguttula*) on potato crop (*Solanum tuberosum* L.)

Treatment	Bio pesticides used	Dose/ acre	Ddose/ plot
T1	Neem extract	1liter/acre	25cc
T2	Neem extract	2liter/acre	50cc
T3	Neem extracts	3liter/acre	75cc
T4	Neem extract	4liter/acre	100cc
T5	Control/untreated	0liter/acre	00cc

The above bio pesticides were used according to the ETL level. Spray tank was carefully washed with admixture before pouring bio-pesticides. Overall, 03 sprays were applied at the interval of 1 month in potato field. Tagging was applied in five plants for each treatment for recording leafhopper population. 05 leaves were observed from top, middle and bottom for insect pest infestation. The pre-treatment observation was noted before 01 day of each spray. Post treatment observations were noted after interval of 24, 48 and 72 of sprays [14]. To see the efficacy of bio-pesticides reduction percentage was calculated according to Henderson-Tilton' s (1955) as under;

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

Where;

- Tb = Number of leafhopper/jassid in the treated plots before treatment.
- Ta = Number of leafhopper/jassid in the treated plots after treatment.
- Cb = leafhopper/Jassid population in the control plots before treatment.
- Ca = leafhopper/Jassid population in the control plots after treatment.

Statistical analysis and evaluation of the results

Collected data was interpreted in spreadsheet of Microsoft excel. Then further data analysis by ANOVA software SXW 8.0.

3. RESULTS

Table 2: Mean population of leafhopper recorded after different time intervals of 1st spray with various amounts of Neem extract on potato crop.

Treatment/Neem extract/doses/plot	Pre- Treatment	Post treatment observation			Pest Reduction	Reduction%
		24 hrs	48 hrs	72 hrs		
T1= 25cc/plot	15.13	10.23	9.6	9.1	6.03d	33.76d
T2= 50cc/plot	15.03	9.33	9.15	8.03	7.00c	41.13c
T3=75cc/plot	15.03	8.5	8.18	7.25	7.78b	46.91b
T4=100cc/plot	14.98	8.33	7.43	6.18	8.80a	54.53a
T5= Control/untreated	15.9	14.8	14.23	14.43	1.48e	9.11e
SE±	---	---	---	--	0.2847	1.5828
LSD 0.05	---	---	---	---	0.6203	3.4485
LSD 0.01	---	---	---	---	0.8696	4.8346
CV	---	---	---	---	6.48	6.04

2nd Spray

Before second spray of different dose of neem extract on potato crop (*Solanum tuberosum* L.), the pre-treatment count of leafhopper on five leaves of per plant was managed and the data Table-2 showed that the T₄ = 100cc/plot was most effective to reduced leafhopper population with highest efficacy (61.02%); where the pre-treatment leafhopper population (11.4/ 5 leaves) reduced to 7.925, 5.8 and 4.15/5 leaves after 24hrs, 48hrs and 72hrs of second spray, respectively. T₃=75cc/plot ranked 2nd by efficacy (52.16%) reducing pre-treatment Leaf

-hopper population (11.675/ 5 leaves) to 8.5, 6.55 and 5.225/ 5 leaves after 24hrs, 48hrs and 72 hrs of second spray, respectively. The neem extract dose of 50cc/plot ranked 3rd by efficacy (43.51%) reducing pre-treatment leafhopper population (11.45/ 5 leaves) to 8.8, 7.25 and 6.075/ 5 leaves after 24hrs, 48hrs and 72hrs of second spray, respectively, and dose 25cc/plot of neem extract ranked 4th by efficacy (34.50%) reducing pre-treatment leafhopper population (11.53/ 5 leaves) to 9.5, 8.25 and 7.08/ 5 leaves after 24hrs, 48hrs and 72hrs of second spray, respectively.

Table 3: Mean population of leafhopper recorded after different time intervals of 2nd spray with various amounts of Neem extract on potato crop.

Treatment/Neem extract/doses/plot	Pre- Treatment	Post treatment observation			Pest Reduction	Reduction%
		24 hrs	48 hrs	72 hrs		
T1= 25cc/plot	11.525	9.5	8.25	7.075	4.45c	34.508d
T2= 50cc/plot	11.45	8.8	7.25	6.075	5.38b	43.51c
T3=75cc/plot	11.675	8.5	6.55	5.225	6.45a	52.16b
T4=100cc/plot	11.4	7.925	5.8	4.15	7.25a	61.02a
T5= Control/untreated	12.3	11.6325	11.2075	11.525	0.78d	6.41e
SE±	---	---	---	--	0.4023	1.6498
LSD 0.05	---	---	---	---	0.8766	3.5945
LSD 0.01	---	---	---	---	1.229	5.0392
CV	---	---	---	---	11.71	5.9

3rd Spray

Before third spray of different dose of neem extract on potato crop, the pre- treatment count of leafhopper on five leaves of per plant was managed and the data Table-2 showed that the T₄ = 100cc/plot was most effective to reduced leafhopper population with highest efficacy (62.37%); where the pre-treatment leafhopper population (10.45/ 5 leaves) reduced to 7.115, 4.9 and 3.7/5 leaves after 24hrs, 48hrs and 72hrs of third spray respectively. T₃=75cc/plot ranked 2nd by efficacy (53.05%) reducing pre-treatment leafhopper population (10.675/ 5 leaves) to

7.635, 6.0325 and 4.7275/ 5 leaves after 24hrs, 48hrs and 72hrs of third spray respectively. The neem extract dose of 50cc/plot ranked 3rd by efficacy (45.05%) reducing pre-treatment jassid population (10.525/ 5 leaves) to 8.0575, 6.8325 and 5.45/ 5 leaves after 24hrs, 48hrs and 72hrs of third spray respectively, and dose 25cc/plot of neem extract ranked 4th by efficacy (34.42%) reducing pre-treatment leafhopper population (9.9875/ 5 leaves) to 8.7275, 7.6 and 6.175/ 5 leaves after 24hrs, 48hrs and 72hrs of third spray respectively.

Table 4: Mean population of leafhopper recorded after different time intervals of 3rd spray with various amounts of Neem extract on potato crop.

Treatment/Neem extract/doses/plot	Pre- Treatment	Post treatment observation			Pest Reduction	Reduction%
		24 hrs	48 hrs	72 hrs		
T1= 25cc/plot	9.9875	8.7275	7.6	6.175	3.81d	34.42d
T2= 50cc/plot	10.525	8.0575	6.8325	5.45	5.08c	45.05c
T3=75cc/plot	10.675	7.635	6.0325	4.7275	5.95b	53.05b
T4=100cc/plot	10.45	7.115	4.9	3.7	6.75a	62.37a
T5= Control/untreated	11.125	10.9775	10.525	10.475	0.65e	5.75e
SE±	---	---	---	--	0.2124	1.752
LSD 0.05	---	---	---	---	0.4629	3.8174
LSD 0.01	---	---	---	---	0.6489	5.3517
CV	---	---	---	---	6.76	6.17

After calculating the mean reduction percentage of potato leafhopper after the application of all the respective sprays i.e. 1st, 2nd and 3rd sprays, the results revealed that all the sprays of neem extract against potato *A. b. biguttula* remained effective after the observation of leafhopper population on 24hrs, 48hrs

and 72hrs after the respective spray. T4 =100cc/plot showed highest efficacy (59.31a %) trough out the three sprays followed by T3=75cc/plot (50.71b %), T2=50cc/plot (43.23c %) and T1=25cc/plot (43.23d %) respectively, with comparison to T0=Control/untreated (7.09e %).

Table 5: Mean reduction of leafhopper recorded three sprays with various amounts of bio-pesticide on potato crop.

Treatment/Neem extract/doses/plot	1st Spray	2nd Spray	3rd Spray	Mean
T1= 25cc/plot	33.76	34.508	34.42	34.23d
T2= 50cc/plot	41.13	43.51	45.05	43.23c
T3= 75cc/plot	46.91	52.16	53.05	50.71b
T4= 100cc/plot	54.53	61.02	62.37	59.31a
T5= Control/untreated	9.11	6.41	5.75	7.09e
SE±	---	---	--	1.9524
LSD 0.05	---	---	---	4.5022
LSD 0.01	---	---	---	6.551
CV	---	---	---	6.14

4. DISCUSSION

The results of present study on efficacy of bio-pesticides/neem leaves extract against leafhopper on potato crop (*Solanum tuberosum* L.). Indicated that all four levels of bio-pesticides namely Neem leaves extract applied reduced the population of leafhopper after 24hrs, 48hrs and 72hrs of their application during three sprays. However, Neem leaves extract at 100cc level found superior and caused significantly greater reduction percentage (54.53a%) of the Leafhopper population after 1st spray, closely followed by 75cc, while 50cc and 25cc when applied did not proved effective as 100cc. The results revealed that all the sprays of neem extract against potato leafhopper remained effective after the observation of leafhopper population on 24hrs, 48hrs and 72hrs after the respective spray. T4=100cc/plot, showed highest efficacy (59.31a %) trough out the three sprays followed by T3=75cc/plot (50.71b %), T2=50cc/plot (43.23c %) and T1=25cc/plot (43.23d %) respectively, with comparison to T5=Control/untreated (7.09e %). These results are supported by the finding of Akbar *et al.* [15] consid

-dering the importance of organic farming and the demand for safe food globally, evaluated the performance of bio-pesticides (neem formulation and bacterial derived Spinosad) in comparison with conventional insecticides (imidaclopride, endosulfan & profenofos) against potato leafhopper on autumn potato crop (*S. tuberosum*). All the conventional insecticides were found effective against potato leafhopper. Biosal showed moderate effectiveness (55.91%), while Spinosad exerted least effect (15.63%) reduction in potato leafhopper population. Karim [16] evaluated some plant extracts against sucking insect pests such as, aphid, whitefly and mealy bug attacking brinjal. The population of the aforementioned pests decreased with plant age. The lowest number of pests was observed in neem seed karnal extract treated plot. The number of leaves and Branches per plant, number of fruits per plant, length, diameter and weight of individual fruit were found highest in neem seed karnal extract at 20g/l treatment. The same treatment gave the highest yield (29.58t/hac) and increased (41.10%) yield over

control. The maximum net return (330071 tk/hac) and the highest benefit cost ratio (2.28) were also observed in neem seed karnal extract. Adnan *et al.*, [17] indicated that Azadirachtin based neem oil found effective against mango hopper as (48.35%), (60.15%) and (56.54%) reduction after 24hrs, 72hrs and 168hrs of the spray respectively, which was comparable with Cypermethrin. Natural enemies were also higher after 1st and 2nd spray in case of neem oil. Zaroni [3] examined that mortalities among the newly hatched nymph influenced significantly ($P < 0.05$) by the use of neem extract. Neem leaf extract had the highest mortality i.e. 17.25 per leaf (86.25%) followed by Dhatura leaf extract, Eucalyptus leaf extract and neem solutions were 16.50 (82.50%), 15.75 (78.75%) and 14.00 (70%) respectively, as compared to the lower mortality in control/untreated plot 12.25 (61.25%). The adult's activities of leafhopper showed that neem leaf extract treated adult's females had lowest fecundity, while fecundity of females prolonged to 9, 11, 14 and 18 eggs when treated with Dhatura leaf extract, Eucalyptus leaf extract, neem solution and control/untreated respectively. It is recommended that neem leaf extract and Dhatura leaf extract may preferably be used as to check and control the nymphal development of *A. devastans* and to reduce the survival of leafhopper adult on sunflower.

5. CONCLUSION

On the basis of the results of present experiment it may be concluded that all four bio-pesticides reduces the population of *A. b. biguttula* on *Solanum tuberosum* during each spray. However, neem leaves extract at 100cc was found superior in reducing the pest closely followed by neem extract at 75cc, while neem extract 50cc and 25cc level were proved less effective in decreasing the population of *A. b. biguttula* on potato crop.

6. CONFLICT OF INTEREST

All authors have declared that there is no conflict of interest regarding the publication of this article.

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