International Journal of Academic Multidisciplinary Research (IJAMR)
ISSN: 2643-9670
Vol. 3 Issue 6, June – 2019, Pages: 41-48

Efficacy of Neem Product against Major Sucking Pests on Different Okra Varieties under Field Conditions

[1]Enayat Aziz
[1] Deputy Director Office (Ext), Agriculture Department Lasbela, at uthal, 90150, Pakistan

[2]Ghulam Jilani
[2]Department of Entomology, Lasbela University of Agriculture, Water and Marine Sciences (LUAWMS) Uthal, 90150, Pakistan

[3]Abdul Ghaffar Khoso
[3]Department of Entomology, Sindh Agriculture University, (SAU), Tando Jam, 70060, Pakistan
E-mail address: [3]khoso05@hotmail.com (Corresponding author)

[4]Farrukh Asghar
[4]Department of Entomology , Sindh Agriculture University, (SAU) , Tando Jam, 70060, Pakistan

[5]Ameer Uddin
[5]Horticulturist Agriculture Research, Agriculture Research Institute, (ARI), Awaran, 89300, Pakistan

[6]Nadir Ali
[6]Directorate of Pulses, Agriculture Research Institute, (ARI), Sariab, 87550, Pakistan

[7]Khalil Asghar
[7]Department of Plant Breeding and Genetics, Balochistan Agriculture College, (BAC), Quetta, 87300, Pakistan

Abstract: *Sucking Insect pest pose a heavy threat to vegetable globally. The study was carried out on Efficacy of Neem product against major sucking pests on different okra varieties under field conditions. Repellency of Neem Seed Extract was studied against whitefly on okra plants by free choice method in the green house of the Faculty of Agriculture, LUAWMS. The genotypes okra sown separately had sprayed with Neem Seed Extract against whitefly, jassid, aphid, borer and population of these insect pests and predators was compared on three varieties of okra crop separately sown in Randomized Complete Block Design (RCBD). The population was higher 6.44, 4.99 and 3.64 whiteflies / leaf on okra varieties Anamika, Rani and Rama Krishna respectively on 25th January. The Jassid population was relatively higher 4.97, 4.63 and 3.89 / leaf on Anamika, Rani and Rama Krishna varieties respectively. Similarly, the aphid population was slightly higher 10.93, 10.83 and 8.14 / leaf on Anamika, Rani and Rama Krishna varieties respectively. The predator population was comparatively higher 2.26, 1.64 and 1.76 / plant on Rama Krishna, Rani and Anamika okra varieties respectively on 30th January. Since pest population increased beyond ETL on 25th January. Therefore 2 percent neem seed extract was applied on the crop on 25th January, 09th February and 24th February. These applications kept the pest population below ETL till the last observation on 5th March. Population of predators was not affected significantly by application of 2 percent of neem seed extract because of predators are not phytophagous like other pests.*

Keywords: Efficacy; neem product, major sucking pests, okra varieties, pest population.

1. INTRODUCTION

Vegetables are the major component of human life diet and play a vital role in food security and it is a rich source of minerals, vitamins, and fiber and contains a characteristic viscous juice that can be used to thicken sauces which are essential for human health [3] and offers a wide range of health benefits. Among the vegetables, okra is an important crop of Malvaceious vegetables in many countries. In Malvaceious crops, the okra (*Abelmoschus esculentus* Monech) is a finger-shaped vegetable with a characteristic viscous juice. Warm-season vegetable and has great economic important [11]. A diet can reduce the risk of a range of health conditions, including obesity, cardiovascular disease. According to the American Heart Association (AHA), High-fiber foods lower the risk of heart disease, stroke, obesity, and diabetes. Fiber also helps to reduce appetite and also can slow heart disease in people who already have it and diabetes. In 2011, the researchers made a powder of peel and okra seeds to treat rats with diabetes. Okra collects toxins from the liver and carries them out of the body. The okra lectin was used in a study to treat human breast cancer cells. Folate is important to prevent fetal problems during pregnancy. Low folate levels can lead to pregnancy loss. Getting enough folate is especially important for women before and during pregnancy, while breastfeeding. In Asian medicine, okra extract is added to foods to protect against irritation and inflammatory gastric diseases [19]. Okra as a vegetable is renowned for its taste and status of nutritionally rich vegetable [9] liked by rich and poor alike particularly in the South Asian region [15]. Like other plants, okra has to suffer great losses in production due to numerous biotic and abiotic factors. In abiotic factors,

there are many pathogens and insects, which destroy the quality and quantity of okra production. Mostly sucking and chewing type of insects such as jassid, aphid, whitefly, spotted bollworms and pink bollworms etc, infest these plants [17]. There are few eco-friendly pest-control systems that can be used to avoid excessive rely on greatly toxic chemicals. These methods and treatments for pest control are greatly effective. They can prevent insect pests to infest the crop. All these eco-friendly pest control systems are the part of Integrated Pest Management (IPM). The judicious use of all possible methods to pest control which do not result in the disturbance of environment and no harmful side effects are produced. Therefore preservation and encouragement of the natural enemies is the central feature of the Integrated Pest Management [6]. It coordinates the use of pest biology, environmental information, and available approach to prevent unacceptable levels of pest damage by the most economical means, while posing the least possible risk to people, property, resources, and the environment. IPM provides an effective strategy for managing pests in all areas from developed residential and public areas to wild lands. IPM serves as an umbrella to provide an effective, all encompassing, low risk approach to protect resources and people from pests [18]. IPM is often mistakenly associated only with entomology and insect pests. However, in contrast to entomology, plant pathology has, since its beginning, approached plant pests through multiple, or integrated strategies [13]. The quality of chilli fruits can be obtained by the organic cultivation methods, which will result in increased export[2]. The use of trap as IPM technique improved crop quality and overall farm profitability [4]. 90% aphid mortality without use of chemicals when neem extract and ginger extract were sprayed on okra [16]. Total 5% neem seed extract showed the lowest infestation of aphids and maximum crop yield. The crop may be preferably sprayed with neem seed extract followed by tobacco and tooh 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 seed extract resulted better than the chemical control [4]. Similarly, Janjua (2015) observed that bio-pesticides, especially neem seed extract (NSE) and tobacco based products may be used against insect pests of *Lycopersicon esculentum*, because the efficacy of neem based bio-pesticides remained highest throughout the study period against all the target pests. Efficacy of synthetic pesticides alone or in combination with oil of neem against *Bemisia tabaci* did not observe a considerable impact on insect population[1]. Profenofos alone and Profenofos+ neem oil had higher efficacy against whitefly than rest of the treatments. The proposed study was carried out on the comparison of pest population and integrated pest management on different varieties of okra under field conditions with the objectives to record population of major insect pests on lady's finger, compare major insect pests on different varieties of okra and study botanical pest control material (Neem Seed Extract) against insect pests of these vegetables under field conditions.

2. MATERIALS AND METHODS

The study was carried out on comparison of pest population on different varieties of okra as affected by spray application of neem extract against key pests such as whitefly, jassid, aphid, borers and their predators. The efficacy of neem based bio-pesticide (neem seed extract) against these insect pests using three varieties of okra The experimental crops were grown an experimental field in Coconut Farm, Department of Agriculture at Uthal, District Lasbella, Balochistan.

Three varieties Okra were cultivated four replicated Randomized Complete Block Design (RCBD). The experimental area consisted of one acre of land which was divided into 4 blocks. Each block was divided into 3 plots. All experimental area was divided into 12 plots. Each plot size was 11 m x 22 m.

The land for sowing the experimental crops was adapted not in season. In the beginning, the experimental area had ploughed with running disc plough & 15 day leave. Later, the tractor had used for crushing of clods and leveling the land. Then the area came in proper condition, finally using strips for isolation of plots & preparing channel of feeding 60 cm for row to row distance & 30 cm for plant to plant distance for all experimental crops.

In this study, neem seed extract was applied for controlling the insect pests and dynamical number of the dominant pest & predators was monitored for the entire growing season of each vegetable crop by using the six plants randomly of each variety from each plot. The treatment details are as under;

2.1 Okra varieties

V1- Rama Krishna
V2- Rani
V3- Anamika.

The experimental crop was sown at recommended sowing time and all the crop production technologies were adopted from sowing view point, inputs application as well as for crop management. For controlling insect pests, the neem seed extract was prepared & sprayed when insect pest appears.

2.2 Preparation of neem seed extract

Total 2% neem seed extract was prepared from 40 gm powder of neem seed which had added of 5 gm of detergent. This was wrapped in a muslin cloth and dipped in 2 L of hot water. After 15-20 hours the concentrate was squeezed out and diluted to 2 percent by adding water. During attack of insect pests on crops, application of 2 percent neem seed extract was applied on the crops at 15 days intervals in the field. Neem seed extract spray was applied as repellent in order to keep the insect pests away from the crops.

The result that were together had observed in statistical analysed by using analysis of variance (ANOVA) know the significance differences in insect pests infestation in different treatments and LSD test was employed to compare treatment

International Journal of Academic Multidisciplinary Research (IJAMR)
ISSN: 2643-9670
Vol. 3 Issue 6, June – 2019, Pages: 41-48

means. In view of the statistical analysis, the tables containing summarized experimental results were prepared and detailed descriptions are presented.

2.3 Statistical analysis

The collected data were statistically analysed using MSTATc software and entire means were subjected to Least Significant Difference (LSD) as well as Tukey test at P< 0.05.

3. RESULTS

Repellent effect of neem seed water extract application to okra plant was initially studied against whitefly in a free choice method in a green house in the Faculty of Agriculture, LUAWMS. Further studies on population dynamics of whitefly, jassid, aphid, borers and predators were compared on different varieties of lady's finger, *Abelmoschus esculentus* (Rama Krishna, Rani, Anamika) as affected by spray application of neem seed extract. The experimental crop was grown in an experimental area of Coconut Farm, Department of Agriculture Uthal. Three varieties of okra were sown separately in Randomized Complete Block Design (RCBD).

3.1 Repellency of Neem Seed Extract against whitefly on lady's finger

Okra was used to evaluate repellent effect of neem seed extract against whitefly in green house studies by free choice method as given below. The extract was applied in 2.0, 1.0 and 0.5 per cent concentrations to vegetable plants.

3.4 Insect pest of okra varieties

3.4.1 Whitefly population on okra varieties

The result of per leaf population of whitefly on three okra varieties at different dates is presented in Table-2.1. It revealed that the highest population of whitefly was recorded on 25th January in Anamika variety. It was 3.64, 4.99 and 6.44 / leaf on Rama Krishna, Rani and Anamika varieties respectively. Therefore, Neem Seed Extract was applied at 2 percent concentrations on 25th January which was continued after 15 days intervals on 9th February and 24th February. However, the lowest number of 0.68 whitefly / leaf was recorded on 29th February in Rama Krishna variety which was significantly different from all those values. Similarly in case of Rani variety, the lowest number of 0.66 was observed on 29th February which was significantly different from all other values. In case of Anamika variety similar trend was observed, the lowest number of 0.33 whitefly / leaf was observed on 29th February which was significantly different from all other values.

A comparison of mean number of whitefly on three varieties of okra is presented in Figure 3.1. It revealed that the lowest number of 2.39 whitefly / leaf was observed in Rama Krishna variety which was not significantly different from 2.50 recorded in Rani variety. However, the highest number of 2.65 whitefly / leaf was recorded in Anamika variety.

A comparison number of whitefly on okra varieties at different dates is presented in Figure 4.28. It revealed that the lowest population of 0.55 whitefly / leaf was observed on 29th February. However, the highest population of 5.03 whitefly / leaf was recorded on 25th January.

Interaction between all the three varieties indicated that highest and significantly different whitefly population was recorded on 25th January which dropped significantly with the application of neem seed extract on 25th January and after 15 days intervals. The population of whitefly remained lower but significantly different in different varieties.

Table-3.1: Mean number of whitefly nymph / leaf on okra varieties at different observation dates.

	Okra varieties		
Obs. Dates	**V1=Rama Krishna**	**V2= Rani**	**V3= Anamika**
20-Jan	1.91^{jk}	1.98^{ij}	2.16^{gh}
25-Jan	3.64^{c}	4.99^{b}	6.44^{a}
30-Jan	2.11^{hi}	2.61^{ef}	2.31^{ef}
4-Feb	3.31^{c}	3.36^{c}	3.21^{cd}
9-Feb	2.81^{de}	2.64^{ef}	2.67^{ef}
14-Feb	1.74^{kl}	1.51^{m}	1.70^{lm}
19-Feb	2.18^{gh}	2.34^{ef}	2.59^{ef}
24-Feb	3.27^{c}	2.53^{ef}	2.58^{ef}
29 Feb	0.68^{n}	0.66^{n}	0.33^{n}
5-Mar	2.29^{ef}	2.38^{ef}	2.51^{rf}

Note: Means sharing similar letters are not significantly different by Fisher's LSD test at P = 0.05

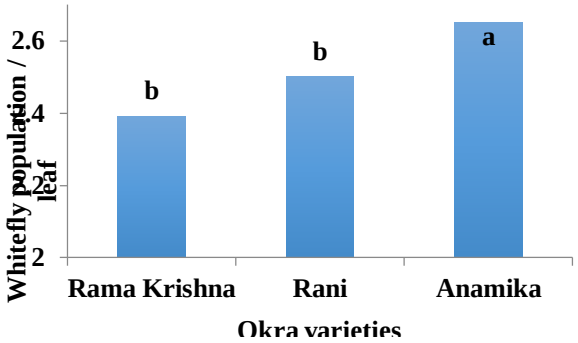

Figure-3.1: Mean number of whitefly on okra varieties.

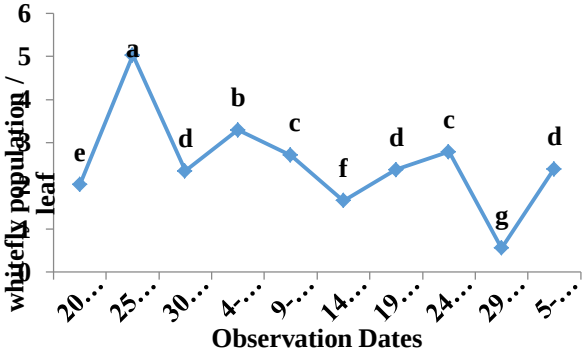

Figure 3.2: Mean number of whitefly on okra varieties at different observation dates.

International Journal of Academic Multidisciplinary Research (IJAMR)
ISSN: 2643-9670
Vol. 3 Issue 6, June – 2019, Pages: 41-48

Note: Means sharing similar letters are not significantly different by Fisher's LSD test at P = 0.05

3.4.2 Jassid population on okra varieties

The result of per leaf population of jassid on three okra varieties at different dates is presented in Table-3.2. It revealed that the highest population of jassid was recorded on 25th January in Anamika variety. It was 3.89, 4.63 and 4.97 / leaf on Rama Krishna, Rani and Anamika varieties respectively. Therefore, Neem Seed Extract was applied at 2 percent concentrations on 25th January which was continued after 15 days intervals on 9th February and 24th February. However, the lowest number of 0.22 jassid / leaf was recorded on 29th February in Rama Krishna variety which was significantly different from other values. Similarly in case of Rani variety, the lowest number of 0.41 jassid / leaf was observed on 29th February which was significantly different from other values. In case of Anamika variety similar trend was observed, the lowest number of 0.18 jassids / leaf was observed on 29th February which was significantly different from other values.

A comparison of mean number of jassid on three varieties of okra is presented in Figure-3.3. It revealed that the lowest number of 2.27 jassid / leaf was observed in Rama Krishna. However, the highest number of 2.3 and 2.34 jassids / leaf was recorded in Rani and Anamika varieties which was not significant different from each other.

A comparison of mean number of jassid on okra varieties at different dates is presented in Figure-3.4. It revealed that the lowest number of 0.27 jassid / leaf was observed on 29th February. However, the highest number of 4.5 jassid / leaf was recorded on 25th January but significantly higher than the number recorded on all other dates. The jassid population fluctuated during 30th January to 5th March.

Interaction between all the three varieties indicated that highest and significantly different jassid population was recorded on 25th January which dropped significantly with the application of neem seed extract on 25th January and after 15 days intervals. The population of jassid remained lower but significantly different in different varieties.

Table 3.2: Mean number of jassid nymph / leaf on okra varieties at different observation dates.

Obs. Dates	Okra varieties		
	V1= Rama Krishna	V2= Rani	V3= Anamika
20-Jan	3.66^{bc}	3.26^{cd}	3.36^{cd}
25-Jan	3.89^{b}	4.63^{a}	4.97^{a}
30-Jan	3.06^{de}	2.61^{fg}	3.24^{cd}
4-Feb	2.91^{de}	2.68^{fg}	2.82^{ef}
9-Feb	2.13^{ij}	2.21^{hi}	1.79^{lm}
14-Feb	1.46^{no}	1.24^{pq}	1.32^{op}
19-Feb	1.87^{kl}	1.96^{jk}	2.12^{ij}
24-Feb	1.19^{q}	1.73^{mn}	1.36^{op}
29 Feb	0.22^{r}	0.41^{r}	0.18^{r}
5-Mar	2.29^{hi}	2.44^{gh}	2.26^{hi}

Note: Means sharing similar letters are not significantly different by Fisher's LSD test at P = 0.05

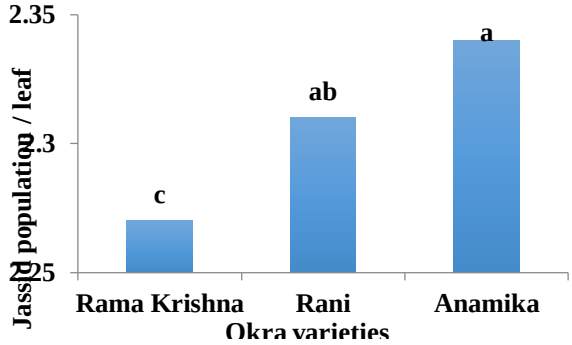

Figure 3.3: Mean number of jassid on okra varieties.

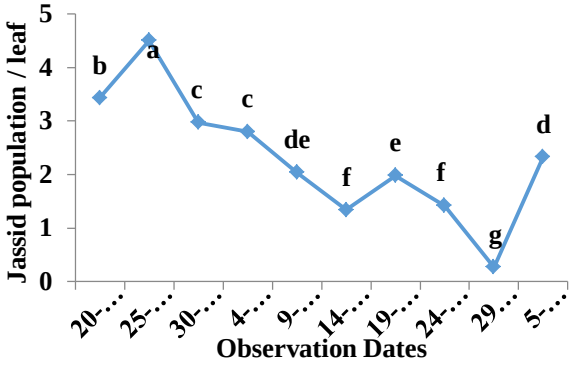

Figure- 3.4: Mean number of jassid on okra varieties at different observation dates.

Note: Means sharing similar letters are not significantly different by Fisher's LSD test at P = 0.05

3.4.3 Aphid population on okra varieties

The result of per leaf aphid population on three okra varieties at various dates is presented in Table-3-3. It revealed that the highest population of aphid was recorded on 25th Jan. in Anamika variety. It was 8.14, 10.83 and 10.93/ leaf on Rama Krishna, Rani and Anamika varieties respectively. Therefore, Neem Seed Extract was applied at 2% concentrations on 25th Jan. which was continued after 15 days intervals on 9th Feb. and 24th Feb. The lowest number of 0.04 aphid/ leaf was recorded on 29th Feb. in Rama Krishna variety which was not significantly different from 0.14 and 0.46/ leaf was recorded on 5th Mar. and 19th Feb. The lowest population of 0.06 aphid/ leaf was recorded on 29th Feb. in Rani variety which was not significantly different from 0.14 was observed on 5th Mar. respectively. Whereas, the lowest population of 0.06 aphid/ leaf was recorded on 29th Feb. in Anamika variety which was not significantly different from 0.19 was observed on 5th Mar.

A comparison of mean number of aphid on three varieties of okra is presented in Figure-3.5. It revealed that the lowest population of 2.33 aphid/ leaf was observed in Rama Krishna which was not significantly different from 2.49 and 2.52/ leaf was recorded in Rani and Anamika varieties.However, the highest population of 2.52 aphid/ leaf was observed on Anamika variety which was not significantly different from 2.33 and 2.49/ leaf on Rama Krishna and Rani varieties.

International Journal of Academic Multidisciplinary Research (IJAMR)
ISSN: 2643-9670
Vol. 3 Issue 6, June – 2019, Pages: 41-48

A comparison of mean number of aphid on okra varieties at different dates is presented in Figure-3.6. It revealed that the lowest number of 0.05 aphid/ leaf was observed on 29th Feb. which was not significantly different from 0.16 and 0.55/ leaf recorded on 5th Mar. and 19th Feb. respectively. However, the highest number of 9.96 aphid/ leaf was recorded on 25th Jan. which was significantly different from all other values was recorded from 20th Jan. to 5th Mar.

Interaction between all the three varieties indicated that highest and significantly different aphid population was recorded on 25thJanuary which dropped significantly with the application of neem seed extract on 25thJanuary and after 15 days intervals. The population of aphid remained lower but significantly different on different varieties.

Table 3.3: Mean number of aphid nymph / leaf on okra varieties at different observation dates.

Obs. Dates	Okra varieties		
	V1=Rama Krishna	V2= Rani	V3=Anamika
20-Jan	7.67^{b}	7.55^{b}	7.30^{b}
25-Jan	8.14^{b}	10.83^{a}	10.93^{a}
30-Jan	2.94^{c}	2.41^{cd}	2.33^{cd}
4-Feb	0.78^{fg}	0.59^{hi}	1.04^{ef}
9-Feb	0.81^{ef}	0.56^{hi}	0.49^{hi}
14-Feb	1.69^{de}	1.57^{de}	0.54^{de}
19-Feb	0.46^{hi}	0.61^{hi}	0.58^{hi}
24-Feb	0.68^{fg}	0.64^{gh}	0.81^{ef}
29 Feb	0.04^{i}	0.06^{i}	0.06^{i}
5-Mar	0.14^{hi}	0.14^{hi}	0.19^{hi}

Note: Means sharing similar letters are not significantly different by Fisher's LSD test at P = 0.05

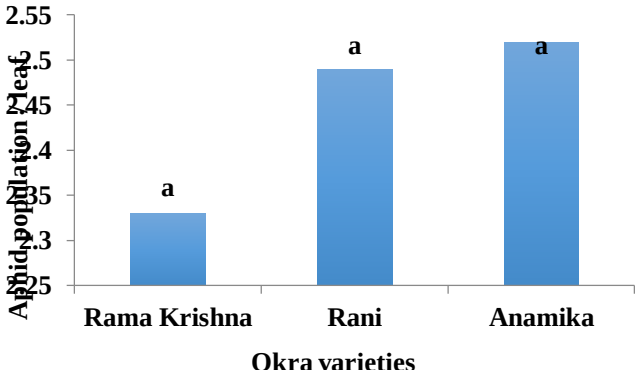

Figure 3.5: Mean number of aphid on okra varieties.

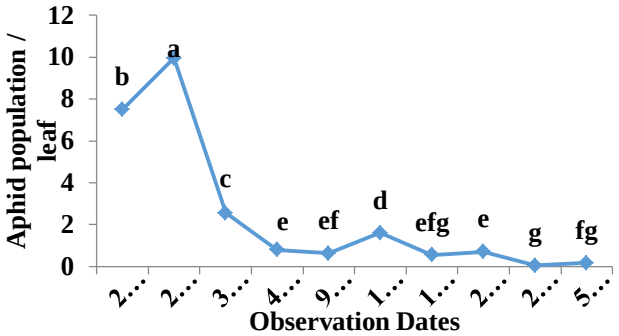

Figure-3.6: Mean number of aphid on okra varieties at different observation dates.

Note: Means sharing similar letters are not significantly different by Fisher's LSD test at P = 0.05

3.4.4 Predators population on okra varieties

The result of per plant population of ladybird beetle (*Coccinella septempunctata*) adults on three okra varieties at different dates is presented in Table-3.4. It revealed that the highest population of *C. septempunctata* was recorded on 30th January in Rama Krishna variety. It was 1.64, 1.76 and 2.26 / plant on Rani, Anamika and Rama Krishna varieties respectively. Therefore, neem seed extract was applied at 2 percent concentrations on 25th January which was continued after 15 days intervals on 9th February and 24th February. However, the lowest number of 0.03 *C. septempunctata* / plant was recorded on 20th January in Rama Krishna variety which was not significantly different from 0.04, 0.09 and 0.28 / plant recorded on 25th January, 29th February and 5th March respectively. In case of Rani variety, the lowest number of 0.01 *C. septempunctata* was observed on 20th January which was not significantly different from 0.06, 0.14 and 0.23 / plant was recorded on 25th January, 29th February and 5th March. In case of Anamika variety similar trend was observed, the lowest number of predators 0.03 / plant was observed on 20th January which was not significantly different from 0.06, 0.11 and 0.14 / plant recorded on 25th January, 29th February and 5th March respectively.

A comparison of mean number of predators on three varieties of okra is presented in Figure-3.7. It revealed that the lowest number of 0.76 *C. septempunctata* / plant was observed in Rani which was not significantly different from 0.85 and 0.79 / plant was recorded in Rama Krishna and Anamika varieties. However, the highest population of 0.85 predator / plant was observed on Rama Krishna variety which was not significant different from 0.76 and 0.79 observed on Rani and Anamika varieties.

A comparison of mean number of predators on okra varieties at different dates is presented in Figure-3.8. It revealed that the lowest number of 0.02 *C. septempunctata* / plant was observed on 20th January which was not significantly different from 0.05, 0.11 and 0.21 / plant recorded on 25th January, 29th February and 5th March respectively. However, the highest number of 1.87 *C. septempunctata* / plant was

International Journal of Academic Multidisciplinary Research (IJAMR)
ISSN: 2643-9670
Vol. 3 Issue 6, June – 2019, Pages: 41-48

recorded on 30th January which was significantly different from all other values.

Interaction between all the three varieties indicated that highest and significantly different predator population was recorded on 30th January which dropped significantly with the application on NSE on 25th January and after 15 days intervals. The population of predators remained lower but significantly different in different varieties.

Table 3.4: Mean number of predators on okra varieties at different observation dates.

Obs. Dates	Predators		
	V1=Rama Krishna	V2= Rani	V3=Anamika
20-Jan	0.03^{k}	0.01^{k}	0.03^{k}
25-Jan	0.04^{k}	0.06^{k}	0.06^{k}
30-Jan	2.26^{a}	1.59^{bc}	1.74^{b}
4-Feb	1.39^{cd}	1.41^{cd}	1.13^{ef}
9-Feb	1.24^{de}	1.13^{ef}	1.76^{b}
14-Feb	1.48^{bc}	1.64^{bc}	1.39^{cd}
19-Feb	0.78^{hi}	0.69^{hi}	0.51^{ij}
24-Feb	0.93^{gh}	0.71^{hi}	1.09^{fg}
29 Feb	0.09^{k}	0.14^{k}	0.11^{k}
5-Mar	0.28^{jk}	0.23^{jk}	0.14^{k}

Note: Means sharing similar letters are not significantly different by Fisher's LSD test at P = 0.05

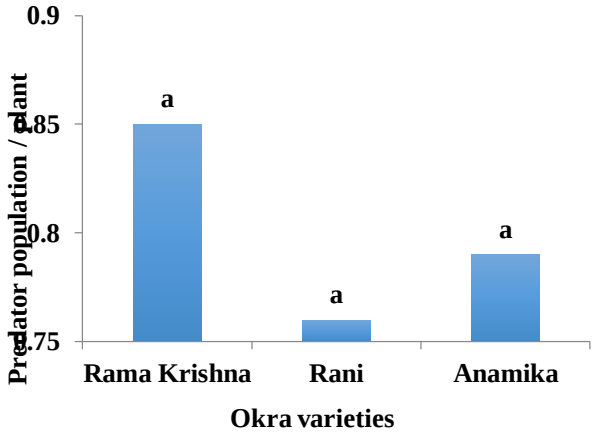

Figure-3.7: Mean number of predators on okra varieties.

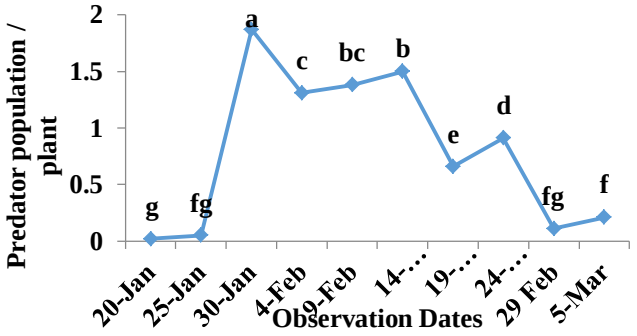

Figure- 3.8: Mean number of predators on okra varieties at different observation dates.

Note: Means sharing similar letters are not significantly different by Fisher's LSD test at P = 0.05

4. DISCUSSION

The present study was carried out on Efficacy of Neem product against major sucking pests on different okra varieties under field conditions. Repellency of Neem Seed Extract was studied against whitefly on okra plants at LUAWMS. Three genotypes of okra crop sown separately at Coconut Farm, Uthal. Okra crop was sown had sprayed with Neem Seed Extract against whitefly, jassid, aphid, borer and population of these insect pests and predators was compared on three varieties of okra crop separately sown in Randomized Complete Block Design (RCBD). In okra varieties Rama Krishna had slightly more resistance to whitefly, jassid and aphid as compared to Rani and Anamika. The highest population was recorded on 25th January but the population persisted and remained present in the okra field throughout the growing season but at later stages its population was relatively lower. Predator population was comparatively higher on okra Rama Krishna variety as compared to Rani and Anamika varieties. The predator population showed a gradual decrease with slight ups and downs on different observation dates. Minor population remained in the field upto the final observation. The findings of the current research are in accordance with those of [10] observed that the efficacy of bio-pesticides against sucking pests on the okra crop and summarized that the application of neem product was most suitable for controlling sucking pests. [14] showed that increase in yield of 51.78 and 41.36% was recorded in IPM and farmer's plots respectively. The difference of yield in both the plots was 200 kg. [20]evaluated the efficacies of some insecticides and revealed that the treatments of neem formulation after 15 days intervals population of jassid had reduced. [17] reported that the insect pests such as aphids, whiteflies, jassids, thrips, fruit borer and spotted bollworm were found infesting okra crop and population of whitefly and Thrip was less than 1.0/ leaf. [1]examined efficacy of neem oil against sucking insect pests of okra and compared with the chemical control. It was observed that neem oil spray controlled the sucking insect pests on okra effectively and kept the population below economic threshhold level. [7]treated jassid population on okra plants in pots treated with neem oil and neem extract used for seed priming and foliar application was significantly affected. Jassid infestation was 5.33/ leaf when seed was primed with solution based 10 percent neem oil + foliar spray against the highest jassid population of 30.33/ leaf in control pots. There was a significant decrease in mealy bug population due to use of neem oil and neem extract for seed priming and foliar application and the decrease in mealy bug population in treatments was in the range of 33.54% to 82.60% indicating that seed primed with solution based 10% neem oil + foliar spray was more effective to suppress mealy bug infestation on okra than rest of the treatments. Preference and non preference of pests due to biochemicals especially secondary compounds. Predator population is dependent on the availability of pests. In the current research it was deserved that predator population decreased after the

decrease of sucking pests but later on it slightly increase due to the availability of less active insect pests in the field. Finally it was deserved that population of all the pests on various crop varieties remained below EIL after the application of 2% NSE on 25th Jan. and later on at fortnightly intervals. These showed that insect pests of all these vegetable crop varieties can be managed with this treatment.

5. CONCLUSION

The results of present study revealed varietal preference of monitored insect pests differed significantly in tomato varieties. Since pest population increased beyond ETL on 25th January. Therefore, 2 percent neem seed extract was applied on the test vegetables on 25th January, 09th and 24th February. These applications kept the pest population below ETL till the last observation on 5th March. Population of predators were not affected significantly by application of 2 percent neem seed extract because of predators which are not phytophagous like other pests.

REFERENCES

[1]Agro, A.K. (2016). Effect of addition of neem oil on efficacy of insecticides against sucking insects of okra . Unpublished M.Sc thesis, Sindh Agriculture University, Tandojam, Pakistan.

[2]Ali, S. S., Ahmad, S., Ahmed, S. S., Rizwana, H., Siddiqui, S., Ali, S. S. & Shah, M. A. (2016). Effect of biopesticides against sucking insect pests of brinjal crop under field conditions. *Journal of Basic and Applied Sciences*, *12*, 41-49.

[3]Bhatti, I.M., & Soomro, A.H. (1996). Agricultural Inputs.Publ.Directorate General, ARS, Hyd., pp.235-338.

[4]Binage, A. B., Suryawanshi, D. S., Munde, A. T., Mane, P. D., Salunke, S. G. & Kedar, P. B. (2004). Studies on efficacy of some botanicals against major pests of cabbage. *Journal of Soils and Crops*, *14*(1), 163-165.

[5]Boucher, T. J., Ashley, R., Durgy, R., Sciabarrasi, M., & Calderwood, W. (2003). Managing the pepper maggot (Diptera: Tephritidae) using perimeter trap cropping. *Journal of Economic Entomology*, *96*(2), 420-432.

[6]Bukhari, SSA., Khoso, AG. & Ahmed, SS. (2017). A Quiz of Entomology, First Edition chapter- 04. page 112, published by Students' Aid Foundation (SAF) Pakistan , ISBN: 978-969-9388-06-4

[7]Channa, A.A. (2017). Effect of neem oil on vegetative growth and production of okra. Unpublished M.Sc. thesis, Sindh Agriculture University, Tandojam, Pakistan.

[8]FAO. (2004). Approaches of choice- Integrated Pest Management (IPM) and Integrated Vector Management (IVM), Food and Agriculture Organization of the UNO, Pp. 4-5.

[9]Gopalan, C., Sastri, S.B.V. & Balasubramanian S. (2007). Nutritive value of Indian foods. National Institute of Nutrition. (NIN), ICMR, India.

[10]Haq, A. (2006). Efficacy of different neem products against sucking complex on okra *Abelmoschus esculentus*(l.). Unpublished M.Sc. thesis, (Entomology), Sindh Agriculture Unievrsity, Tandojam, Pakistan.

[11]Jacquelyn, W. (1999). Agriculture businesses communities families home and garden, kidsarus natural. University of Arkansas Cooperative Extension Program, University of Arkansas at Pine Bluff, USDA, Arkansas, USA., 1-3.

[12]Janjua, M.N. (2015). Screening of biopesticides against insect pests of tomato. Unpublished M.Sc. thesis, Sindh Agriculture University, Tandojam, Pakistan.

[13]Krishna, V.V., Byju, N.G. & Tamizheniyan,S. (2003). Integrated Pest Management in Indian Agriculture; A Developing Economy Perspective, (pp. 45), Radcliffe's IPM World Textbook.

[14]Nahiyoon, A.A. (2008). Population variation of sucking complex in IPM and traditional practiced okra crop. Unpublished M.Sc. thesis, Sindh Agriculture University, Tandojam, Pakistan.

[15]Oyelade, O. J., Ade-Omowaye, B. I. O., & Adeomi, V. F. (2003). Influence of variety on protein, fat contents and some physical characteristics of okra seeds. *Journal of Food Engineering*, *57*(2), 111-114.

[16]Saker, I., Suliman, R & Namora, D. (2003). Importance of plant extracts in managing *Aphis fabae*. In *Arab Scientist Org.The Eightth Arab Congress of Plant Protection,* (pp. 12-16), U.A.E.

[17]Shabozai, N.K. (2009). Some studies on integrated pest management on okra crop. Unpublished M.Sc. thesis, Sindh Agriculture University, Tandojam, Pakistan.

[18]Sudhakar, P., Chattopadhyay, G. N. Gangwar, S. K. & Ghosh, J. K. (2007). Effect of foliar application of Azatobacter, Azospririllum and Beijerinkia on leaf yield and quality of mulberry (*Morus alba*). *Journalof Agriculture Sciences*. 134: 227-234.

[19]Ware, M. (2017) Benefits and uses of okra , MedicalNewsToday Newsletter, Last updated Fri 20 October 2017 https://www.medicalnewstoday.com/articles/311977.php

[20]Yadav, J. B., Singh, R. S., & Tripathi, R. A. (2008). Evaluation of bio-pesticides against pest complex of Okra . *Annals of Plant Protection Sciences*, *16*(1), 58-61.

[1] Eason, G., Noble, B., & Sneddon, I. N. (1995). On certain integrals of Lipschitz-Hankel type involving products of Bessel functions, Phil. Trans. Roy. Soc. London, vol. A247, pp. 529-551.

[2] Maxwell, J. C. (1892). A Treatise on Electricity and Magnetism, 3rd ed., vol. 2. Oxford: Clarendon, pp.68-73.

[3] Nicole, R. (2016). Title of paper with only first word capitalized, Journal Name Stand. Abbrev., in press.

[4] Media and plastic substrate interface," IEEE Transl. J. Magn. Japan, vol. 2, pp. 740-741, August 1987 [Digests 9th Annual Conf. Magnetics Japan, p. 301, 1982].

[5] Young, M. (1989). The Technical Writer's Handbook. Mill Valley, CA: University Science.