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Fauna of Insect Pollinators of Cucurbits and their effects on yield at District Peshawar, Khyber Pakhtunkhwa

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Abstract

The research work was conducted in open field at Tarnab farm, Regi and Mathra during active season from May till October, 2023.Three summer vegetables Bottle Gourd (Lageraria Seceraria), Ridge Gourd (Luffa acutungulara.) and Sponge Gourd (Luffa aegyptiaca) were cultivated in the present study to collect and identify pollinators and to find its impact on cucurbits yield. In the current study 11 species Amigela cingulata, Anthophora confuse, Apis cerana, A. dorsata, A. mellifera, Xylocopa pubescene, X. fenestrate, Delta dimidiatipenne, Eristalis tenax and Papilio demoleus of 5 genera were recorded. The experiment was designed in Randomized Complete Block Design (RCBD) and structured with six treatments replicated three times. Experimental plot size was kept $6m^2$ with rows kept apart at 30cm while plant to plant distances were kept 15cm observed. Results showed that different varieties of vegetables along with covered and open flower were significantly affected weight and length of vegetables. Higher weight of vegetable was recorded from ridge gourd with uncovered flower while lower weight of vegetable was observed from the plots of bottle gourd with covered flowers. Maximum length of vegetable was noted from ridge gourd with uncovered flower while minimum length of vegetable was observed from the plots of bottle gourd with covered flowers. From the results it is cleared that yield of vegetables increases if pollination is allowed in the plant. As the pollinators fauna of the cucurbits is very diverse therefore it is recommended to further study the pollinators fauna on cucurbits to record the full diversity of pollinators.

Key Words: Pollinators, Cucurbits, Yield, Peshawar.

Introduction

Cucurbits, is a broad term use to represent all taxa of family Cucurbitaceae. It consists of 90 genera and 950 described species. Important cucurbits crops cultivated include pumpkin, squash, melon, watermelon and cucumber. These are cultivated worldwide. Other cucurbits crops of considerable value are bottle gourd, sponge gourd, bitter gourd, ridge gourd and wax gourd in the older world. These cucurbits are usually grown by small land holding farmers in southern and southeastern Asia, which are essential home gardens components. Its fruits contain calcium, vitamin A, vitamin C and iron (Pandit and Acharya, 2008).

Bottle gourds also called white flowered gourd, belonging to genus Lagenaria carried out from Africa. According to archeological findings bottle gourd arrived over 10,000 years ago in America and Asia due to human migration or through ocean in which seed float inside the gourd (Erickson et al., 2005). It is monoecious and annual crop present in different fruit shapes including globular, crooked necked, pyriform, curved, elongate, long and cylindrical.

Sponge gourd and Ridge gourd belongs to the genus Luffa and is an important member of the family Cucurbitaceae. Sponge gourd is a vegetable either eaten in raw form like cucumber or prepared like squash. It is a cross-pollinated crop. Sponge gourd is considered to be an important crop in China especially for its medicinal purposes. Fruits of sponge gourd are used in Chinese traditional medicines as antipyretic, stomachic and anthelmintic phyto-medicinal drugs. It requires warm temperature and is subtropical and tropical plant (McGregor, 1976).

Ridge gourd is also recognized as fluted loofah, angular loofah or Chinese okra. It is cultivated in many countries of the world particularly in Asia, Africa and India. It is cultivated for its immature fruit which contain minerals and dietary fibers. Ridge gourd is highly cross pollinated and depends on many insects and other pollinating agents that cause pollination, as the male and female reproductive organs are present on a single plant in different internodes separately.

Pollination on earth is very important activity for biodiversity of plants in ecosystem. Insects play a key role in continuity and sustainability of an ecosystem. Insect pollination increases the quality and productivity of the crop. Incomplete pollination may lead to poor quality and low yield of fruits and other crops. Pollination of crops through insects raises the production. About 75% of total crops and 87% of all food crops entirely dependent on insect pollinators for their reproduction hence 35% of worldwide food production depends on insect pollinators for pollination. Good management practices of pollinators increases crops production up to 45-50% in oil seeds, 100- 150% in cucurbitaceous and 50- 60% in fruits respectively. Many vegetables, fruits, nuts, stimulant crops and edible oil crops depend on pollination (Patil et al., 2015).

In order to use environmental friendly and efficient approach, pollinators are used to increase the yield of crops which are cross pollinated. In the agricultural crops the value of insect pollinators is about 217 billion US Dollars per year worldwide. Cross pollinated crops production value in Pakistan is more than 1.5 billion US dollars, of which fruits (0.98 billion) are dominant followed by vegetables (0.32 billion); nuts (0.15 billion); oil seed (0.13 billion) and spices (0.004 billion US Dollars) with average production per year (Chakravarty et al., 1990).

In Pakistan majority of pollinators belongs to order Diptera and Hymenoptera. Some other plant pollinators belongs to order Coleoptera and Lepidoptera. Among insects, most of the plants pollinators are moths, hover flies, butter flies and bees. Bees play an important part in the increase production of numerous crops. Apis millifera is one of the most important insect pollinator towards pollination of crops but bumble bees because of buzz pollination are more effective. Suitable managements of honey bees, solitary bees and other pollinators increase the farm production.

Material and Methods

The Study were conducted at Agriculture Research Institute, Tarnab Peshawar during active season from May till October, 2023.Three summer vegetables Bottle Gourd (Lageraria Seceraria), Ridge Gourd (Luffa acutungulara.) and Sponge Gourd (Luffa aegyptiaca) were cultivated in the present study for the collection and identification of pollinators and to find its impact on yield and yield components. The experimental plot size was kept $6m^2$ with rows kept at 30 cm while 15cm distance were mentionedbetween between plant to plant was 15cm. Experiment was laid out in Randomized Complete Block Design (RCBD) and consists of two treatments. Each treatment was replicated three times.

Experimental treatments were as follows.

T1 = Bottle gourd (Covered).
T2 = Bottle gourd (Uncovered).
T1 = Ridge gourd (Covered).
T2 = Ridge gourd (Uncovered).
T1 = Sponge gourd (Covered).
T2 = Sponge gourd (Uncovered).

The visiting insects were collected by using hand net, killed and was brought to the insect museum for proper identification. Identification of the specimen was done with the help of available literature and using taxonomic keys. For identification Nikon SMZ 745T stereo microscope with 400X magnification was used. After identification, all the specimens were deposited in the Insect Museum, Department of Entomology, The University of Agriculture Peshawar.

Statistical analysis

Data recorded was statistically analyzed according to analysis of variance technique used for randomized complete block design and least significant difference test was used at 5% level of significance ($P \leq 0.05$) upon significant F-test through the procedure described by Jan et al. (2009).

Results and Discussion

In the current study 11 species of 7 genera under 4 families via Apidae, Vespidae, Papilionidae and Syrphidae of order Hymenoptera, Diptera and Lepidoptera were reported. Genus Apis and genus Xylocopa was found to be the most species rich with 3 species each while the remaining genera was represented by single species. These species are new to cucurbits fauna of Peshawar, Khyber Pakhtunkhwa and Pakistan (Table No.1).

Table 1: List of insect pollinators recorded on Cucurbits in District Peshawar

Order	Family	Scientific name
	Apidae	Amigela cingulata
		Anthophora confuse
		Apis Cerana

Hymenoptera		Apis Dorsata
		Apis mellifera
		Xylocopa pubesene
		Xylocopa fenestrate
		Xylocopa Valga
	Vespidae	Delta dimidiatipenne
Diptera	Syrphidae	Eristalis tenax
Lepidoptera	Papilionidae	Papilio demoleus

Weight of vegetable

Results of the weight of vegetable was also found significant ($P \leq 0.05$) by different varieties and covering (Table-2). Maximum weight of vegetable (0.49 kg) was recorded from bottle gourd with uncovered, while minimum weight of vegetable (0.40 kg) was observed from the plots of bottle gourd with covered. Higher weight of vegetable (0.35 kg) was recorded from ridge gourd with uncovered, while lower weight of vegetable (0.25 kg) was observed from gourd with covered flowers. Maximum weight of vegetable (0.50 kg) was recorded from sponge gourd with uncovered, while minimum weight of vegetable (0.36 kg) was observed from sponge gourd with uncovered flowers. These results clearly showed that treatment plots which received pollinators gain more yield of vegetable due to high rate of pollination. Findings of the current study are similar with the recent work of Gautam et al. (2018) and Bashir et al. (2017) who observed that insect pollinators has a great impact on ridge gourd (Luffa acutangula).

Length of vegetable

Results of the length of vegetable was also found significant ($P \leq 0.05$) by different varieties and covering (Table-2). Maximum length of vegetable (14.6 cm) was recorded from bottle gourd with uncovered, while minimum length of vegetable (12.1 cm) was observed from the plots of bottle gourd with covered. Higher length of vegetable (10.8 cm) was recorded from ridge gourd with uncovered, while lower length of vegetable (9.4 cm) was observed from gourd with covered flowers. Maximum length of vegetable (13.8 cm) was recorded from sponge gourd with uncovered, while minimum length of vegetable (11.6 cm) was observed from sponge gourd with uncovered flowers. These results showed that treatment plots that received pollinators gain more length of vegetable due to high rate of pollination which directly effect on the yield of the crop. The data of the results are resemblance with the work of Gautam et al. (2018), Bashir et al. (2017) and Subhakar et al. (2015) who noted that insect pollinators has direct effect on the higher yield on ridge gourd (Luffa acutangula).

Yield of vegetable ha^{-1}

Results of the yield of vegetable ha^{-1} was also found significant ($P \leq 0.05$) by different varieties and covering (Table-2). Maximum yield of vegetable ha^{-1} (24523.8 kg/ha) was recorded from bottle gourd with uncovered, while minimum yield of vegetable ha^{-1} (5338.1 kg/ha) was observed from the plots of bottle gourd with covered. Higher yield of vegetable ha^{-1} (22238.1 kg/ha) was recorded from ridge gourd with uncovered, while lower yield of vegetable ha^{-1} (7292.2 kg/ha) was observed from gourd with covered flowers. Maximum yield of vegetable ha^{-1} (22523.8 kg/ha) was recorded from sponge gourd with uncovered, while minimum yield of vegetable ha^{-1} (22523.8 kg/ha) was observed from sponge gourd with uncovered flowers. These results showed that treatment plots that received pollinators gain more weight of vegetable due to high rate of pollination which contributes in the yield of vegetable. The data of the results are resemblance with the work of Gautam et al. (2018), Bashir et al. (2017) and Subhakar et al. (2015) who noted that insect pollinators has direct effect on the higher yield on ridge gourd (Luffa acutangula).

Table 2. Effect of Pollination on Length, Weight and Yield of Vegetables.

Treatment	Weight (kg)	Length (cm)	Yield (kg/ha)	% Increase
Ridge gourd + cover	0.248 b	9.4 b	7292.2 b	204.9
Ridge gourd + uncovered	0.352 a	10.8 a	22238.1 a	
LSD($P \leq 0.05$)	0.0352	1.3	13986	

Treatment	Weight (kg)	Length (cm)	Yield (kg/ha)	% Increase
Bottle gourd + cover	0.402 b	12.1 b	5338.1 b	
Bottle gourd + uncovered	0.494 a	14.6 a	24523.8 a	359.4
LSD(P≤ 0.05)	0.0282	1.6	6514.1	

Treatment	Weight (kg)	Length (cm)	Yield (kg/ha)	% Increase
Sponge gourd + cover	0.358 b	11.6 b	7285.7 b	
Sponge gourd + uncovered	0.501 a	13.8 a	22523.8 a	250.3
LSD(P≤ 0.05)	0.140	1.5	11723	

Conclusion and Recommendations

Conclusion

Insect pollinators were key agents of pollination of sponge, bottle and ridge gourd of the Peshawar. Morning period exhibited higher number of pollinators in comparison to evening. Maximum yield was reported in the experimental plots visited by pollinators. These plants that receives pollinators produces higher yield as compared to covered flowers due to higher production of fruits in the plant.

Recommendations

1. During blossoming stage the application of insecticides shouldn't be the first option of the farmers.
2. Community trainings should be arranged regarding pollinators and their positive impact on yield.
3. Systemic insecticides should be applied before the flowering stage which only kills the harmful insects not the pollinators.
4. It is recommended to encourage and conserve the pollinators.
5. Morning time is best for pollination. So further studied is conducted.

References

Bashir M. A., Alvi, A. M., Khan, K. A., Ishaq, M., Rehmani, A., Ansari, M. J., Atta, S., Ghramh, H. A., Batool, T. & Tariq, M. (2018). Role of pollination in yield and physicochemical properties of tomatoes (Lycopersicon esculentum). Saudi J. Bio. Sci., 25(7), 1291-1297.

Chakravarty, H. H. (1990). Cucurbits in India and their role in development of vegetable crops. In: Bates, D. M., R. W. Robinson, C. Jeffery (Eds). Biology and cultivation of Cucurbitaceae. Cornell University press, Ithaca. New York. pp, 325- 348.

Erickson, D. L., Smith, B. D., Clarke, A. C., Sandweiss, D. H. & Tuross, N. (2005). An Asian origin for a 10,000year old domesticated plant in the Americas. PNAS, USA. 102, 20-18315.

Gautam, P. P. & Kumar, N. (2018). Pollinator diversity and relative abundance of insect pollinators on ridge gourd (Luffa acutangula) flowers in Bihar (India). J. Entomology and Zoology Studies, 6(2), 1177-1181.

McGregor, S. E. (1976). Insect Pollination of Cultivated Crop Plants. USDA.

Pandit, M. K. & Acharya, S. (2008). Potential of minor cucurbits for sustainability and livelihood support in West Bengal. J. Agroforestry Environ, 2, 209–12.

Patil, K., Tomar, B. S., Singh, B. & Aher, B. M. (2015). Effect of pollination time on fruit set, seed yield and seed quality of bottle gourd CV. Pusa hybrid-3, Bioinfolet, 12(1), 90-94.

Subhakar, G. & Sreedevi, K. (2015). Nocturnal insect pollinator diversity in bottle gourd and ridge gourd in southern Andhra Pradesh. J. Current Biotica, 9(2), 137-144.