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CARNIVORES SPIDERS FAUNA IN LADY'S FINGER, ABELMOSCHUS ESCULANTUS VEGETABLE CROP

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Abstract

Study was carried out in the vivo condition of okra vegetable crop for checking the predatory spiders on okra in the experimental area of Sindh Agriculture University, Tandojam during Kharif season, 2013. Okra crop was planted on February 15, 2013 in a row trial at 75 cm distance between row to row with 22.5 cm distance between plant to plant. The results revealed that population of predatory spiders varied between the crop seasons. The peak population of predatory was observed during the month of May and reached up to 8.00±0.33/plant. The feeding potential of predators in the laboratory condition was recorded where; wolf spider consumed (75.00%) mites, followed by fishing spider (60.50%) mites, yellow sac spider (55.00%) mites and false black widow spider (40.00%) whiteflies. The predatory spiders preferred mites than whitefly, thrips and jassid under laboratory conditions at temperature of 25±2ºC. The correlation of population of predatory spiders was positive and significant with temperature (r=0.475) while, positive and nonsignificant with relative humidity (r=0.078)..

Keywords: *Sucking pests, Temperature and RH%, Carnivores, Lady's finger*

INTRODUCTION

Okra or lady's finger, *Abelmoschus esculantus* L. (Malvaceae) is cultivated throughout Sindh, Pakistan. The immature fruits are cooked as vegetable okra soups and stews are also popular dishes. The crop is used in paper industry and the stem of the plant is used for the extraction of fiber. It is a main Kharif vegetable and the cash crop of Sindh, Pakistan. The pods have good nutritive value (Khoso, 1996). It is a native crop of Africa, South East Asia and North Australia to the pacific. It is herbaceous annual plant of naturalized and cultivated in the tropical and sub-tropical counties of the world (Memon et al*.,* 2004). Okra contains water, calcium, iron, protein, starch and also it is rich source of vitamins and also contains minerals, phosphorus, iodine and salts which play a significant role in human diet. From cultivation, this crop needs near to 8-10 irrigations till harvesting in summer season (Sahito and Bakhsh, 2012). Somewhere, if there is shortage of water the drip irrigation system is also being introduced in the tropical and sub-tropical regions of Sindh province of Pakistan. The establishment of this drip irrigation method was also utilized at the coastal areas of Karachi (Soomro et al., 2012).

This lush green vegetable crop is attacked by the many insect pests with sucking and chewing after cultivation at the stages when plant bears 2-3 leaves, at flowering and fruiting stages vigorously. Whitefly cause direct damage by feeding and produce honey dew and more alarmingly inflicts severe crop losses by transmitting fairly large number of viral diseases (Basu, 1995). Mastoi and Sahito, (2012) observed the *Bemisia tabaci* and *Earias* spp. on the different varieties of *A. esculentus* under field conditions with sever attack. The most destructive insect pests are whitefly, *B. tabaci* (G.) yellow flower thrips, *F. sulphurea* (S.) jassid, *A. biguttula biguttula* (I.) aphids, *A. gossypii* (Glov.) spotted bollworm, *E. insulana* (Bios.), American bollworm, *H. armigera* (Hub.) and mite, *T. cinnabarinus* (Boisd.). They attack on okra crop from sowing till harvest. Among these insect pests the whitefly is the injurious one which destroys the okra plant by sucking the sap from the leaves and transmitting certain viral diseases. Whitefly and other sucking complex have a range variety of highly polyphagous nature and have been recorded on a wide range of cultivated and wild plants (Sahito et al., 2012). Lanjar and Sahito, (2007) observed huge population sucked the sap from lady's finger crop. Lanjar and Sahito, (2009) studied the life cycle of whitefly, *Bemisia tabaci* (Genn.) on some spring hosts plants. Lanjar and Sahito, (2010) studied on varietal resistance of sunflower crop against, *Bemesia tabaci* (Genn.) and *Amrasca devastans* (Dist.). Whitefly is a polyphagous in nature found on mostly in vegetables crop and known as most destructive pest comparatively. Sahito et al., (2010)

studied on population dynamics of sucking insect pests of mustard crop, *Brassica campestris*. These sucking insect pests not only found in Kharif season but also found in Rabi season which infest the crop severally. Sahito et al., (2012) observed influence of abiotic factors on population development of *Bemisia tabaci* infesting, *Abelmoschus esculentus*. Sometime biotic and abiotic factors some time influenced the population of whitefly in the crops.

Biological agents reduce the population below the level of economic damage. Naturally, the control program is said to be successful (Omkar and James, 2003). The predator having huge number of predators in okra crop among them, spiders also play main role for minimizing the insect pests because of predatory life on the insect pests. Ensnare made out webs is type of catching them directly and with various types (Lohar, 2001). In Sindh province there is a diversified cropping system practiced, where the natural enemies are occurring in large numbers. The natural enemies are passing their successive generations on a wide variety of their hosts. Four species of predatory spiders were recorded in okra crop those fed over whitefly, thrips, jassids and mites. Among them, wolf spider had maximum feeding potential over mites, thrips and whitefly. However, yellow sac spider also found maximum feeder of jassid (Sahito and Talpur, 2013). Whereas, Provencher et al., (1995) attributed the number of insects killed per unit of time due to its good searching or hunting ability, wide host range, adaptation under conditions of food limitation, low metabolic rate, energy conservation mechanism and polyphagous nature makes them as a model predator. Rajeswaran et al., (2005) reported that general spider's species found in agricultural crops were carnivorous arthropods. Those consumed a huge number of preys' and do not damage to the plants. They have unique habitat and they live in almost all the environments. Spiders serve as buffers that limit the initial exponential growth of prey populations. Keeping the above facts in view an experiment was conducted for the monitoring of predatory spiders on okra ecosystem. The study shall open new area for pest control in future.

MATERIAL AND METHODS:

Study on monitoring of predatory spiders on okra was carried out in the experimental area of Sindh Agriculture University Tandojam during, Kharif season of 2013. Homogenous seeds of okra were drilled in rows 75 cm apart on well prepared seed bed on February 15, 2013. There were five rows each row had 3 meters length. Just before first irrigation, seedlings were thinned and a plant to plant distance of 22.5 cm was maintained. Recommended dose of NP fertilizer was applied in the form of urea and DAP. The full dose of phosphorus with 1/3 of Nitrogen was applied at sowing time while rest of it was split and top dressed at second and fourth irrigation, respectively. Other cultural practices were followed as per requirement. Other cultural practices i.e. thinning, weeding, most affected plants were rooted out and damaged fruits or fruits became hard were separated as per the recommendation and requirement. However, spray of any kind of insecticide was avoided and around the experimental area for proper exploitation of predatory spiders. Observation on the population of predatory spiders was recorded at weekly intervals from the third week of April, 2013. Whole plant was examined carefully during each observation date. As such for sucking pests three leaves per plant were observed. Finally means were calculated form ten plants on each observation date.

Ten leaves were selected from each replication, finally the means were calculated from these ten plants on each observation date thus. The laboratory temperature was maintained at 25±2^{0}C with 50-65% relative humidity and L16: D8 photoperiod. The temperature and relative humidity was measured through the help of Hygro meter hanged over the wall beside kept of experiment. Petri dishes in four numbers with each size of (15 cm dia, 1 cm height) were used and predatory spiders were released in these Petri dishes along with 20 adults of each pest. Those were offered to each adult of predatory spider in separate Petri dishes for 48 hours and replicated five times for each spider to know the feeding efficiency. The pests fed by predatory spiders were counted and means were calculated and feeding efficiency was evaluated with this under given formula:

$$\text{Feeding Efficiency \% age} = \frac{\text{No. of eggs / immature / adult consumed}}{\text{Total No. of spider released}} \times 100$$

Further, data on some weather factors were collected from Agro met section see the correlation between the population growths of predatory spiders and weather factors were determined. Analysis of variance was carried out of predatory spiders. These analyses were made as per the method outlined by Gomez and Gomez. For this purpose a Microsoft computer package "MSTATC" was used.

RESULTS:

The data on mean population of predatory spiders recorded on okra crop are presented in the (Table 1). The population of spider increased gradually and reached to their peak during the month of May (8.00±0.33) and minimum (4.00±0.33) population was reached in the month of April, 2013. The results (Table 2) indicated that the maximum feeding potential percentage was observed in Wolf spider (75.00%) on mites, followed by fishing spider (60.65%) on mites, yellow sac spider (50.00) on whitefly and false black widow spider (40.00%) on whitefly, respectively. The results further indicated that when data on predatory spider analyzed statistically if varied significantly (P≤0.01) between the season early

Table 1: Mean population of predatory spiders recorded on okra crop from April 20 to July 26, 2013

S.#.	Obs. date	Population/ plant + SE.	Temperature °C			RH.%
			Min.	Max.	Mean	
01	April, 20	4.00±0.13	22.5	37.5	30.00	66 %
02	April, 26	4.60±0.08	23.5	39.5	31.50	58 %
03	May, 03	4.60±0.05	24.0	43.0	33.50	68 %
04	May, 10	5.60±0.17	26.0	44.0	35.00	43 %
05	May, 17	6.60±0.35	25.5	39.5	32.50	63 %
06	May, 24	6.60±0.42	26.0	39.5	32.75	61 %
07	May, 31	8.00±0.33	26.5	40.0	33.25	69 %
08	June, 07	7.60±1.05	26.0	38.5	32.25	69 %
09	June, 14	7.60±0.87	26.5	38.0	32.25	68 %
10	June, 21	7.00±1.17	25.5	41.5	33.50	55 %
11	June, 28	6.40±1.07	26.5	37.5	32.00	70 %
12	July, 05	6.80±0.93	29.0	42.0	35.50	88 %
13	July, 12	5.40±0.88	27.0	35.5	31.25	70 %
14	July, 19	6.00±1.13	26.0	36.0	31.00	72 %
15	July, 27	4.00±1.18	26.5	33.5	30.00	75 %

Table 2: Feeding potential percentage of predatory spiders on different sucking insect pests in laboratory conditions

Name of Spiders	Insects offered	Jassid	Whitefly	Thrips	Mites
Wolf spider	20	40.00	60.50	45.12	75.00
Fishing spider	20	35.00	35.12	40.40	60.65
Yellow sac spider	20	45.00	50.00	30.50	55.00
False slack widow	20	30.25	40.00	25.00	35.15

or advance phase of okra crop showed lower activity of predatory spider while, in middle of season the predatory spiders remained more active this might be due to more presence of insect pest, in the middle of crop season.

Feeding potential of spiders

The predatory monitoring of spiders ie., Wolf spider, *Lucosa species*, Fishing spider, *Dolomedes tenebrosus*, Yellow sac spider, *Chiracanthium inclusum* and *Chiracanthium* and False black widow, *Steatoda groassa* were determined in the laboratory. Each predatory spider has offered 20 adult jassids, whiteflies, thrips and mites similarly, in the four separate Petri dishes for 48 hours. The insect consumed by predatory spiders were counted. The results (Table 2) indicated that the maximum feeding potential percentage was observed in wolf spider (75.00%) on mites, followed by fishing spider (60.65%) on mites, yellow sac spider (50.00%) on whitefly and false black widow spider (35.12%) on whitefly, respectively. Greater percent of 75.00% followed by whitefly 60.50% while, less prefer to the jassid (45.00%) and thrips (45.12%).

Relationship between population of predatory spiders and some weather factors

The results in condition between factors work out are shown in the Table 3. It may be seen from the results that temperature had the high positive correlation with the population of predatory spiders (γ = 0.475). The coefficient of determination ($\gamma 2$ = 0.226) indicated that about 22.6% total variation with population of spider was accounted due to the variation in temperature. The regression coefficient (by χ = 0.391) revealed that for a unit increased in the air temperature would also increase the population of spiders by (0.39/plant). The results further showed that relative humidity had low positive correlation with the population of predatory spiders (γ = 0.078). The coefficient of determination ($\gamma 2$ = 0.006) revealed that very negligible variation (0.01%) in to population of predatory spider was accounted for by the variation in the relative humidity. The regression coefficient ($y\chi$=0.01) indicated that for each unit

Table 3: Linear correlation between population of predatory spiders and some weather factors

Characters correlated	Coefficient of correlation (γ)	Coefficient of determination (γ2)	Regression (ŷ)	Regression coefficient
Temp.°C V/S spiders	0.475	0.226	- 6.624	0.391
RH. (%) V/S spiders	0.078	0.006	5.377	0.010

increased in the relative humidity would also increase the population of predatory spider by 0.01/plant in the okra ecosystem.

DISCUSSION:

The results of study conducted on monitoring of predatory spiders on okra indicated that the data on predatory spiders, sucking pests and feeding potential were statistically significant (P<0.01). The population of predatory spiders increased gradually on okra crop and reached to their peak during the month of May (8.00±0.33 per plant) and minimum (4.00±0.13 per plant) population was recorded in 3rd week of April, 2013. The carnivores' spiders were found in okra insect pests to prolong their progeny. Our finding are in agreement with Kumar et al., (2005) who collected many species from okra in which, *Sciilicus* specie was most potential and voracious predators they consumed huge number of sucking insect pests. But that is bit contentious to our study we here found only four species with evaluation and confirmation of feeding on sucking insect pests of okra vegetable crop. Early or advance phase of okra crop showed lower activity of predatory spiders, while in the middle season the predatory spiders remained more active this might be due to more presence of insect pests in the middle of crops season.

The results further revealed that the population of predatory spider had positive and significant correlation with temperature (γ = 0.475), while positive and non-significant with relative humidity (γ = 0.078). The result of present study are also supported by the findings of Rajeswaran et al*.,* (2005) reported that spiders are carnivorous arthropods consumed a large number of frays and do not damage crops. They have unique habitats and they live in almost all the environment spider serve as buffers that limit exponential growth of prey population. The predatory spiders are classified in five major groups based on their foraging style, prey searching ability, wide host range; ease in multiplication and polyphagous in nature make them as a potential predator in biological pest suppression, about 13 species in vegetable ecosystem were recorded.

The feeding potential of four spider species was observed against jassid, whitefly, thrips and mites. Persons et al., (2001) reported that wolf spider feeds with different tactics on prey. The maximum feeding potential of *C. danieli* found on Jassid followed by *A. argentatus*, *H. agelenoides* and *Drassodes* sp. similarly, *C. danieli* on whitefly followed by *A. argentatus, Drassodes* sp. and *H. agelenoides*. As such maximum feeding potential of *C. danieli* on thrips followed by *A. argentatus*, *Drassodes* sp. and *H. agelenoides*. In case of mites, the maximum feeding potential was recorded by *Cheiracanthium danieli* followed by *Hippasa agelenoides*, *Drassodes* sp. and *Argyrodes argentatus.* Heuts and Brunt, (2001) evaluated the behavioral relationship of predatory spiders in laboratory conditions. The overall consumption of all sucking pests indicated that two spider species, *Cheiracanthium danieli* and *Hippasa agelenoides* consumed maximum pest population in laboratory conditions during the lady fingers season.

It was found that when predatory spiders were offer adult jassid, whitefly, thrips and mites, it consumed greater number of mites (75.00%) followed by whitefly (60.65%), while low preference to jassid, (45.00%) and thrips, (45.12%), respectively. Spiders are almost ubiquitous and have long been known to be predators of insects and feed on phytophagous mite in apple orchards (Jeppson, 1975). All spiders are predaceous on many of them feed on insects. Spiders of family Lycosidae play an important biological role in regulating the population of leaf hoppers in rice (Lohar, 2001). Whereas, Sahito and Mastoi, (2013) found the beneficial spiders in eco-system of sunflower crop with different tactics on prey of sucking complex. Leite et al., (2005) also reported that predatory spiders are more useful to control the sucking insect pests of okra. Our findings are similar with Kumar et al., (2005) they reported the spiders collected from bhendi were *Xrgitipe pulchefla, Crvhnphorit cictilrdsa, Cyrtophora cicctlrnsa), Crybopharu citricola (Cyrfopharct citricala), Custeracunfha geminam, Gastemeuntha huhlu, llippasa (ycnsma, Leuctuigc ccidtcsiana, Neoscona shillongensis, Neoscona naulica, Oxyopes* sp., *Peucetia prasina, Safucus* sp. and *Zygeilla melnnocrania (ZygieHa inelonocrtuiia)* whereas, the Sciilicus species were most potential predators.

It was observed that the population of predatory spider increased gradually and reached to their peak during the month of May, and then it declined. The maximum population was recorded on May 4th (8.00±0.33 / plant). It was found that the differences in to population of predators among the season were highly significant. It

was further found that predatory spider consumed greater number of mites followed by whitefly, jassid and thrips, respectively. The correlation of temperature with the population of predatory spider was positive and highly significant (γ=0.475) while, relative humidity had low positive correlation with the population of predatory spiders (γ=0.078). It may be concluded that predatory spiders on okra crop was more abundant during the month of May, it preferred mites and whitefly relatively more as compared jassid and thrips. Temperature had the high positive influence on the development of predatory spiders while, relative humidity did show any significant relationship with the population of predatory spiders. For effective biological control of sucking pests of okra, predatory spiders may be exploited as it prefer mites more and also reduce the population of thrips, jassid and whitefly. The predatory spiders may be utilized with other IPM strategy to reduce insect pest pressure and attain good quality okra production. Hopefully, this research work will help for new research in biological control especially carnivores spiders in okra vegetable crop, in which heavily toxic insecticides are being used.

REFERENCES:

.

Basu AN (1995). *Bemisia tabacci* (Gennadius) crop pest and principle whitefly vector of plant viruses. Indian Agri. Res. Inst. New Delhi. pp. 1-2.

Heuts BA, Brunt TM (2001). Transitive predatory relationships of spider species (Arachnida: Araneae) in laboratory tests. Behavioural Processes, 53(1-2): 57-64.

Jeppson L, Kefer H, Baker W, Edwards (1975). Mites injured to Economic Plants. Univ. California. p. 614.

Khoso AW (1996). Crops of Sindh. 6th Edition Published by Bhatti Print Press, Hyderabad. Pp. 276.

Kumar PS, Alagarsamv N, Sevarkodiyone S, Baskaran S (2005). Predatory potential of spiders on some insect pests of Bhendi. Post-graduate and Research Department of Zoology, Bionotes. Ayya Nadar Janaki Animal College, Sivakasi (Tamil Nadu), India. pp. 626-124.

Lanjar AG, Sahito HA (2007). Impact of weeding on whitefly population on okra crop. Pak. J. Weed Sci. and Res., 13(3-4): 209-217.

Lanjar AG, Sahito HA (2009). Effect of some spring hosts on the life cycle of whitefly, *Bemisia tabaci* (Genn.). Pak. J. Entomol. Kar., 20(1-2): 13-18.

Lanjar AG, Sahito HA (2010). Studies on varietal resistance of sunflower crop against, *Bemesia tabaci* (Genn.) and *Amrasca devastans* (Dist.). Pak. J. Entomol. Karachi., 25(2): 147-151.

Leite GLD, Picanço M, Jham GN, Moreira MD (2005). Whitefly population dynamics in okra plantations. Pesquisa Agropecuaria Brasileira, 40(1): 19-25.

Lohar MK (2001). Applied Entomology (2nd Edi.) Sindh Agriculture University Tandojam, Pakistan. Pp. 242.

Mastoi AH, Sahito HA (2012). Varietal resistance of *Abelmoschus esculentus* against *Bemisia tabaci* and *Earias* spp. under field conditions. Pak. J. Entomol. Karachi. 27 (2): 149-156.

Memon AJ, Abro GH, Syed TS (2004). Varietal resistance of okra against, *Earias* spp. J. Entomol. 1(1): 1-5.

Omkar, James BE (2003). Searching and feeding efficiency of a ladybeetle, *Coccinella tranversalis* Fabricius on aphid, *Aphis gossypii Glover*. J. Biol. Cont., 17(2): 107-112.

Persons MH, Walker SE, Rypstra AL, Marshall SD (2001). Wolf spider predator avoidance tactics and survival in the presence of diet-associated predator cues (Araneae: Lycosidae). Animal Behaviour, 61(1): 43-51.

Provencher L, Susan E, Riechert (1995). Theoretical comparisons of individual success between phenotypically pure and mixed generalist predator populations. Ecological Modelling, 82(2): 175-191.

Rajeswaran J, Duraimurugan P, Shanmugam PS (2005). Role of spider in agriculture and horticulture in ecosystem. J. Food, Agri. and Envi., 3(3/4):147-152.

Sahito HA, Lanjar AG, Mal B (2010). Studies on population dynamics of sucking insect pests of mustard crop, *Brassica campestris*. Pak. J. Agri., Agri. Eng. Vet. Sci., 26(1): 66-74.

Sahito HA, Abro GH, Memon SA, Mal B, Mahmood R, (2012). Influence of abiotic factors on population development of *Bemisia tabaci* infesting, *Abelmoschus esculentus*. International Res. J. Plant Sci., 3(2): 12-18.

Sahito HA, Bakhsh K (2012). Effect of Marginal Quality Water on Okra under Drip Irrigation System. Successful Drip Irrigation System in Okra crop. Lambert Academic Publishing (LAP), Amazon - Germany. pp. 1-85.

Sahito HA (2013). Bio-Ecological Studies and Management of Different Crops of Sindh: Insect Pests and Natural Enemies. Lambert Academic Publishing (LAP), Amazon - Germany. pp. 1-197.

Sahito HA, Talpur MA (2013). Carnivorous Spiders on Insect Pests of Okra Crop. Academic Publishing (LAP), Amazon - Germany. pp- 46-59.

Sahito HA, Mastoi AH (2013). Beneficial Spiders in Eco-System of Sunflower Crop. Lambert Academic Publishing (LAP), Amazon - Germany. pp- 104-123.

Soomro KB, Sahito HA, Rind JA, Mal B, Kaleri SH (2012). Effect of marginal quality water on okra, *Abelmoschus Esculentus* L. Yield under drip irrigation system. Glo. Adv. Res. J. Eng. Technol. and Inno., 1(5): 103-112.