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BIOLOGY AND DAMAGE CAUSED BY OKRA FRUIT BORER, *EARIAS VITTELA* (F.) UNDER LABORATORY AND FIELD CONDITIONS

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ABSTRACT

The research studies were carried out on chewing insect pest causing rigorous damaged to fruit. The data was taken from 30 plants on a weekly basis randomly. The result shows that the overall mean percent of monthly damaged okra fruits populations founded in October, November, and December months. The highest damage in okra fruits were found December month, 79.47 ± 4.89 compression to November, 66.26 ± 12.43 and October, 34.15 ± 8.45, respectively. The total consumed mean of days by *Earias vittella* as follows; egg laid, 145.25 ± 15.45; egg hatched, 125.70 ± 22.44; hatching 85.14 ± 7.60%; egg incubation 2.95 ± 0.30 days, larval stage, 13.00 ± 0.79 days; pupae / cocoon, 9.45 ± 0.43 days, adult females, 9.45 ± 1.42 days, adult male, 7.32 ± 0.99 days, with the overall female days, 35.00 ± 1.12 and male 30.00 ± 0.43 days consumed under room temperature conditions. The biological studies of *Earias vittella* were found by mean population overall as under; At the first stage of female egg laying stage A.C temperature was 65.00 ± 14.67, egg hatched, 53.12 ± 13.57; hatching 81.27 ± 2.36%, eggs, 4.76 ± 0.92 days, larval stage, 15.00 ± 0.87 days, pupae / cocoon, 14.24 ± 0.61 days; adult females, 13.32 ± 0.41 days; male adult, 11.72 ± 1.07 days; overall female 50.00 ± 2.16 days, male 40.96 ± 2.35 days, respectively. In last it is observed that *Earias vittella* is heterophagous introducing maximum infestation at natural envirmental circumstances left behind nearly 80% if biological control might be encouraged that would be easily controlled without causing severe damage to okra vegetables.

Key words: Infestation, biology parameters, temperature factors, *in vivo* and *in vitro* conditions.

INTRODUCTION

Okra, *Abelmoschus esculentus* (L.) Moench; Malvaceae is the well known vegetable crop in sub-tropical as well as tropical region crop growing in summer (warm season) is suitable, also in late spring it also may be (Pandita *et al*., 2010), Throughout the year this vegetable crop can be cultivated and crop can give the production but only one or two months of cold season are not favorable for sufficient growing the vegetable remaining months of the year are sweatable for growing (Memon *et al*., 2004). This crop is considered as main cash crop of the country grow also in Province of Sindh, also cultivated in to Africa, Nigeria, North Australia and Southeast Asia, by highly utilization about 80% in vegetables, comprise spongy leaves, fibrous steams and fruits (Bamire,and Oke, 2003), it comprises vitamin C, Niacin, Vitamin A, riboflavin, B complex, calcium, iron and thiamin, the proportion of calcium (90mg), vitamin A (0.1mg), riboflavin (0.08mg), vitamin C (18mg), thiamin (0.07mg), niacin (0.08mg), potassium and phosphorus of 100g greater than other vegetable, for human being it has a positive role being as food source (Saifullah and Rabbani, 2009). Crop area during in summer season mostly the production manner 303.16 lots in 232.05 in area hectares in Pakistan every year (Kashif *et al*., 2008). With reference of Sindh Province by production manner 17466 tones, in 4254 hectares also during 2014 the total market rate PRs. 2483 each 40 kg was documented at Hyderabad but this crop was recorded with 108426 tones by production on 14147 hectares in Pakistan (Aslam and Amin, 2015).

Several pest species infest Okra, *A. esculentus* vegetable crop crop but ome of them relay most harm of which red spider mite and leafhopper, shoot and fruit borer, root-knot nematode, white fly and mealy bug are the severe pest reducing field and yield (Kedar *et al.*, 2014), but one *Earias* spp. Found eastwards to India, Mediterranean, South east Asia, China and whole Africa (Reed, 1990). *Earias vittella* occurs in starting of the middle season damage terminal shoots, flowers, stem and green bolls (Kranthi *et al.*, 2004). Many other insect pest nearly 72 species may harm crop yield of okra crop of which mites and insect species are causative for diseases, including many insect pests' fruit borers hits badly and about damage was found about 69% (Jagtab *et al.*, 2007). Among

harmful insects most dangerous species are recognized as *Earias* insect infestation reach up to 11-12% during the month August and September (Shah *et al*., 2011). At initial stage of development infestation occurs due to the reason of many borers such as by *E. vittella* fruits about 21 to 51.13% and in buds 21.33 to 43.99% (Singh *et al*., 2007). *Earias spp.,* are causative agent to infest okra crop was documented by many researchers hits about them 20 to 51 % (Verma *et al*., 1984) and reduction in the crop yield about 35 to 76 percent due to infect fruit become un sweatable for human use (Hafeez and Rizvi, 1994). Many pests cause 69% yield reduction including leaf roller, jassid, fruit and shoot borer, also larvae of spotted bolloworm during in November were collected from okra and first time documented in Bark at Block of the Gezira Scheme (Capizz,1986) and *Earias spp.,* infest okra at 3.8 to 12.6 in Sindh (Leghari and Kalro, 2002).

Okra crop is severely infested by fruit borer losses quality and quantity of the crops fruit (Bohmfalk *et al.,* 2001). Fruit and shoot borer, *Earias vitella* is directly damaged to fruits due to infestation fruit of okra crop nearly losses about 88 to 100% (Sinha *et al*., 1978) only due to fruit and shoot borer, *Earias vitella* 57% damage fruits and release effect in quantity in okra (Chaudhary and Daheech, 1989). About 200 to 400 eggs can be laid b moth female at one night they tender flower buds and leaves due to this colour of lady's finger occur blue and they hatch their eggs within three to four days then their caterpillars morphologically consist six stages then they attain larval stage after the passing of ten to sixteen days. The 3rd stage of is pupal stage but these stages occurs on the soil, plants some time cocoon, fallen leaves and infected pods finally within 8 to 14 days moths emerged and they between 17 to 29 days they complete their life cycle (Kedar *et al.,* 2014). In the July and August month for the completion their life cycle requires 25.05 days from egg to adult similarly their life cycle requires 22.97 days in October and November months (Upendra *et al.,* 2014). In the November month there is sweatable period for the post- ovipositional, pre-ovipositional and ovipositional, pupal, larval and sufficient incubation and it requires 12.2, 10.2, 12.2, 36.5 and 4.8 days with fecundity average per female eggs 206.4 (Bhat *et al.,* 2005), when they attain at first instar larval stage they stick hold many parts of the plants and very abruptly pupates (Rukshana *et al.,* 1995).

Several envirmental factors such as rainfall, humidity, temperature and day length relay the badly impact on the reproduction and survival (Reiter, 1989). When the caterpillar become the successful to enter last portion of the bud of the shoot causing inside wilted area in the leaves and damage the primary stalk (Atwal and Dhaliwal, 2009). Sever effect occurs due to intensity of temperature upon the insect eggs than the other factors (Cammel and Kniht, 1992) also due to the rainfall some population of eggs and insects were killed due to the rainfall negative influence (Kadam and Khaire, 1995). Coloration of the insects can be harmed by humidity and temperature at different stages and there is prolonged effect of winter season on the morphological developmental stages, power of resistance show defense and enhance the pesticides mediated metabolism, pesticides decrease sensitivity and restrict them to reach at target sites, minimize other behaviors' mechanism like as penetration activities (Scott, 1991). In this perspective no research work was carried out on biological parameters including at variable temperatures in Sindh-Pakistan and findings of this work will be fruitful for the coming researchers.

MATERIALS AND METHODS

The *Earias* sp., culture was carried out at cultivated field conditions of researchers own field and okra collection was made at Pir Jo Goth, Taluka: Kingri then brought the culture at Entomology Laboratory, Deptt: of Zoology, SALU-Khairpur, during Kharif season, 2017. Different temperature effect on the biology of the okra fruit was observed either they contain *E. vittella sp* or *E. insulana* or for the next observation it was found that of which one species found abundantly. Therefore, for the purpose to check out the sex ratio, over all consumed days, different temperature, life span, humidity percentage, adult longevity and adult, hatching %, pupal period, cocoon formation, larval stases and different biological parameters were remained under observation.

By the comparison of RH and temperature the source of hygrometers was applied for the purpose to examine the abiotic elements. For the egg laying a pair of *Earias* sp. was placed into the plastic jars which comprise little area for ventilation. By the source of sharp knife a cut is given from both sides of jar and for the passing of fresh air it was covered by muslin cloth. Then allowed them on okra fruit at separate room temperature, when the eggs hatched on okra fruits individually kept in separate petri dishes, from the eggs larvae was emerged then alternatively given them fresh food but food was not given when larvae reached at third stage as in pupal stage then adult stage is observed with wings, after that female and male couple were placed in individual jars given food as honey solution and okra fruit and within small petri dishes solution of glucose is given for best nourishment and sweatable egg hatching. Therefore, adult female and male, pupae, larvae and eggs photography was done. Finally; camera connected with CPU to monitor and digital camera was used. Photography facility was provided Biodiversity and Herbarium situates at front of the Zoology Department. This study consisted of 5 treatments and was replicated 4 times.

To access the damage percent of okra fruits with *Earias spp.* under field conditions

Overall thirty plants among the experimental plot were selected randomly also undamaged and damaged fruits checked and counted. But hardly *Earis spp.*, sign and symptoms remembered in mind along with counting. In this regard to aware the entomologists, researchers and okra growers of district Khairpur the research publication was the part of the research work. Finally, the percent which damaged was evaluated by the application of following formula:

$$\text{Damage (\%)} = \frac{\text{Number of okra fruit damaged by } \textit{Earis spp.}}{\text{Total no. of plant / fruits}} \times 100$$

Statistical analysis

The Laboratory experimental data were subjected to investigation of variations and by tha application of Duncan's Multiple Range test (DMRT) mean were tacked. The RH% and temperature both correlation was done, finally, on the biology of okra fruit borer correlation was shown for negative or positive effects and by the source of statistical package SXW, USA (8.1) version data was analyzed.

RESULTS

To observe the biology of fruit borer under air- maintained temperature conditions (20 ± 2^0C)

The biological studies of *Earias vittella* was examined during research work and mean population was observed at A.C temperature (20 ± 2^0C) female laid egg maximum at first stage in T2 (93.40 ± 12.18) and in T3 minimum (51.00 ± 20.35) and (65.00 ± 14.67) overall mean were observed which shows in T2 (79.60 ± 11.31) maximum no eggs hatched and in T3 minimum at (40.80 ± 13.29) and overall mean population in which eggs hatched at (53.12 ± 13.57) minimum egg hatching % in the T4 (77.89 ± 11.15) and maximum % in T2 (85.09 ± 2.28) similarly, totally egg hatched (81.27 ± 2.36) and in T5 egg hatches maximum (8.40 ± 1.02)days consumed and in T1minimum (5.80 ± 0.75) days were consumed. Overall mean population of egg were observed at (4.76 ± 0.92) maximum larval stage at (16.00 ± 0.98) and in T4 and minimum days consumed at (13.60 ± 1.50) in T1 and all larval overall mean population (15.00 ± 0.87) days were observed. Also for the pupal stages maximum days was consume in T4 and minimum T1 at (15.00 ± 0.89) and (13.20 ± 2.14) and pupal overall mean population observed at (14.24 ± 0.61). Adult females were observed maximum days in T3 at (13.80 ± 0.75) and in T2 minimum days in (12.60 ± 1.36). Overall adult female mean population consumed days at (13.32 ± 0.41) male adult maximum days in T4 at (13.20 ± 1.27) and minimum days in T2 at (10.00 ± 1.10) and adult male mean population observed at (11.72 ± 1.07). The female and male longevity were also observed and female longevity were observed maximum in T4 at (52.60 ± 3.44) and in T1 minimum at (45.80 ± 5.23) similarly female longevity overall mean population observed at (50.00 ± 2.16). The male longevity minimum in T1 at (38.00 ± 4.69) maximum in T4 at (44.20 ± 3.06) and overall male longevity mean population was observed, respectively (Table 1).

Biological study of fruit borer under naturally occurred room temperature (25 ± 2ºC)

During research work biological study of *Earias vittella*, fruit borer were noted at naturally room temperature (25 ± 2ºC) in laboratory. Days consumed overall mean of *Earias vittella* at first stage female laid maximum eggs (198.40 ± 44.32)and in T5 consumed maximum days in T2 consumed minimum days at (133.60 ± 54.34).Fruit borer overall mean eggs population maximum at (145.25 ± 15.54) and at (190.20 ± 44.19) eggs hatched in T5 and (99.40 ± 21.38) minimum in T1. Overall hatched eggs mean population (125.70 ± 22.44) found, in T5 egg hatched maximum (95.66 ± 2.02) percent and minimum in T1 at 72.85 ± 4.59) percent and overall population of hatched eggs (85.14 ± 7.60) percent was recorded. The maximum days were consumed in T4 at (3.40 ± 1.02) and minimum in T3 at (2.60 ± 0.49) and eggs overall mean population (2.95 ± 0.30) days was recorded. In T4 larvae consumed maximum days (14.20 ± 2.32) and minimum days in T2 (12.00 ± 1.67) and overall all larval consumed days mean population (13.00 ± 0.79) was observed. In T5 pupal requires maximum days (12.00 ± 2.28) and minimum days in T2 (8.80 ± 1.94) and pupal overall mean population consumed days (8.80 ± 1.94) was observed. Adult female consumed day's maximum in T1 and T3 at (10.40 ± 1.62) and in T4 minimum at (7.00 ± 0.89.) and adult female overall mean population was observed at (9.45 ± 1.42). Whereas; adult male maximum in T2 at (8.60 ± 0.75) and minimum in T4 at (5.80 ± 0.75) were observed and adult consumed days overall mean population (7.32 ± 0.99) was observed. The male and female longevity were also recorded and maximum longevity by days consumption female in T5 at (38.0 ± 4.12) and in T2 minimum at (33.80 ± 4.53) and female mean of overall longevity at (35.00 ± 1.12) and maximum male longevity in T5 at (33.60 ± 4.13) and minimum in T2 at (29.40 ± 3.01) days and male longevity overall mean population was recorded at (30.00 ± 0.430, respectively (Table 2)

Table 1. Biology of fruit borer under maintained air-conditioned temperature (20 ± 2^{0}C).

Trts.	Eggs laid	Eggs hatched	Hatching %	Eggs (day)	1st Stage	2nd stage	3rd stage	4th stage	All larval (days)	Cocoon (days)	Adult females (days)	Adult males (days)	Overall females (day)	Overall male (days)
T1	59.60 ± 22.11	49.00 ± 18.84	81.47 ± 4.28	5.80 ± 0.75	2.60 ± 0.49	2.80 ± 0.40	3.20 ± 0.40	5.00 ± 0.63	13.60 ± 1.50	13.20 ± 2.14	13.20 ± 1.17	11.20 ± 1.47	45.80 ± 5.23	38.00 ± 4.69
T2	93.40 ± 12.18	79.60 ± 11.31	85.09 ± 2.28	6.60 ± 1.02	2.80 ± 0.75	2.60 ± 0.49	3.40 ± 0.49	5.80 ± 1.17	14.60 ± 1.36	14.00 ± 1.41	12.60 ± 1.36	10.00 ± 1.10	47.80 ± 2.99	38.60 ± 3.01
T3	51.00 ± 20.35	40.80 ± 13.29	81.84 ± 6.76	7.00 ± 1.10	2.80 ± 0.40	3.00 ± 0.00	4.00 ± 0.00	6.00 ± 0.63	15.80 ± 0.75	14.60 ± 0.49	13.80 ± 0.75	12.20 ± 0.75	51.20 ± 0.75	42.60 ± 0.49
T4	62.00 ± 15.03	48.80 ± 15.66	77.89 ± 11.15	8.00 ± 0.89	3.00 ± 0.63	3.20 ± 0.40	3.80 ± 0.75	6.00 ± 0.63	16.00 ± 0.89	15.00 ± 0.89	13.60 ± 1.50	13.20 ± 1.72	52.60 ± 3.44	44.20 ± 3.06
T5	59.00 ± 10.68	47.40 ± 9.85	80.03 ± 5.24	8.40 ± 1.02	2.60 ± 0.49	3.20 ± 0.75	3.80 ± 0.75	5.40 ± 0.49	15.00 ± 1.41	14.40 ± 1.20	13.40 ± 1.02	12.00 ± 1.41	51.20 ± 2.04	41.40 ± 3.20
Mean ± SD	65.00 ± 14.67	53.12 ± 13.57	81.27 ± 2.36	4.76 ± 0.92	2.76 ± 0.15	2.96 ± 0.23	3.64 ± 0.29	5.64 ± 0.39	15.00 ± 0.87	14.24 ± 0.61	13.32 ± 0.41	11.72 ± 1.07	50.00 ± 2.16	40.96 ± 2.35

Table 2. Biological study of fruit borer under naturally occurred at room temperature (25 ± 2ºC).

Trts	Eggs laid	Eggs hatched	Hatching %	Eggs days	1st Stage	2nd stage	3rd Stage	4th stage	Overall larval days	Cocoon days	Adult females (days)	Adult males (days)	Overall females (days)	Overall males (days)
T1	137.00 ± 30.92	99.40 ± 21.38	72.85 ± 4.59	2.80 ± 0.75	2.60 ± 0.49	2.40 ± 0.49	3.00 ± 0.63	4.80 ± 0.75	12.80 ± 1.17	9.60 ± 1.02	10.40 ± 1.62	7.20 ± 1.33	35.60 ± 3.01	29.60 ± 3.01
T2	133.60 ± 54.34	117.00 ± 56.09	85.09 ± 6.78	3.00 ± 1.10	2.40 ± 0.49	2.60 ± 0.49	2.80 ± 0.75	4.20 ± 0.75	12.00 ± 1.67	8.80 ± 1.94	10.00 ± 1.55	8.60 ± 1.02	33.80 ± 4.53	29.40 ± 3.01
T3	138.40 ± 26.88	125.40 ± 29.10	89.97 ± 4.39	2.60 ± 0.49	2.20 ± 0.40	2.80 ± 0.40	3.20 ± 0.40	4.80 ± 1.33	13.00 ± 1.41	10.00 ± 1.41	10.40 ± 1.62	7.40 ± 1.36	36.00 ± 2.28	30.20 ± 2.64
T4	172.00 ± 64.38	161.00 ± 63.44	92.65 ± 2.98	3.40 ± 1.02	2.80 ± 0.75	3.00 ± 0.89	3.40 ± 0.49	5.00 ± 0.63	14.20 ± 2.32	9.40 ± 1.02	7.00 ± 0.89	5.80 ± 0.75	34.00 ± 4.15	29.40 ± 3.44
T5	198.40 ± 44.32	190.20 ± 44.19	95.66 ± 2.02	3.20 ± 0.75	2.80 ± 0.75	2.40 ± 0.49	2.60 ± 0.80	6.20 ± 1.17	14.00 ± 2.28	12.00 ± 2.28	9.00 ± 1.67	7.60 ± 1.50	38.20 ± 4.12	33.60 ± 4.13
Mean ± SD	145.25 ± 15.54	125.70 ± 22.44	85.14 ± 7.60	2.95 ± 0.30	2.50 ± 0.22	2.70 ± 0.22	3.10 ± 0.22	4.70 ± 0.30	13.00 ± 0.79	9.45 ± 0.43	9.45 ± 1.42	7.32 ± 0.99	35.00 ± 1.12	30.00 ± 0.43

To contact the harm percent of okra fruits with *Earias spp.* under field conditions

During research work fruit borer, *Earias vittella* and okra fruits count of both populations were made and surrounding the application of pesticides were prohibited and crop was kept without spray. Data collection period remained three months and okra undamaged and damaged fruits from October, November and December and from total thirty plants randomly count on weekly basis of undamaged and damaged fruits. Overall, results shows that mean of overall population of undamaged and damaged okra fruits were observed during three months under field conditions. The maximum fruits damage was observed in third week of October month (45.5 ± 9.50) while as fruits observed with minimum damaged same month in last week. The maximum fruit damaged in the month of November in third week (76.71 ± 22.57) and in the first week of the same month fruits damaged minimum (45.9 ± 4.46). But the highest fruits damaged were recorded in the December first week (84.09 ± 8.95) and in same month in fourth week minimum fruits damaged were observed (71.25 ± 3.30). The total percent population mean observed maximum during the December month (84.09 ± 8.95) during October minimum (34.15 ± 8.45) and during November (66.26 ± 12.43), respectively (Table 3).

Table. 3. Monthly overall mean damaged fruits by *Earias vittella* with standard deviations.

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Week/Month	October	November	December
1st week	28.7 ± 6.74	45.9 ± 4.46	84.09 ± 8.95
2nd week	38.6 ± 9.64	66.5 ± 4.00	81.13 ± 5.05
3rd week	45.5 ± 9.50	76.71 ± 22.57	81.39 ± 1.80
4th week	23.8 ± 8.93	75.94 ± 19.15	71.25 ± 3.30
Mean	34.15 ± 8.45	66.26 ± 12.43	79.47 ± 4.89

DISCUSSION

For the purpose to determine the different stages of *Earias vittella* eggs were collected and kept in two incubators at different temperatures under A.C at (20 ± 2^{0}C) and under laboratory conditions room temperature at (25 ± 2ºC). The okra crop during the months of October, November and December can grow in whole Sindh that's way chosen the temperatures. Research work shows that in *Earias vittella* eggs incubation period at air conditioned 20 ± 2^{0}C at (4.74 ± 0.92) and under laboratory conditions 25 ± 2ºC observed (2.95 ± 0.30). The result resembles of Syed *et al*. (2011) he documented *Earias vittella* eggs incubation period from many host plants including, China rose, Indian mallow and okra. By the average laboratory temperature during September month at temperature 32.6ºC in laboratory conditions 2.30 days of eggs incubation period was documented on the China rose and okra crop and during October month by temperature 30.6ºC average the incubation of eggs longest 5.0 days in Indian mallow plant was documented. During the September month by 31.3 ºC average temperature in *Earias vittella* 2.42 days were documented and in the August month 32.6ºC at average temperature consumed 2.15 days (Al-Mehammady and Roqaya, 2000). According to Shah *et al.,* (2012) eggs incubation documented two, three and four days at 35.1ºC, 31ºC and 27ºC, respectively.

During research work in *Earias vittella* period of larvae (15.00 ± 0.87) days observed in A.C at the temperature (20 ± 2^{0}C) and at laboratory temperature 25 ± 2ºC at (13.00 ± 0.87) days were recorded during October month. According to Syed *et al.* (2011) findings in august month period of larvae 9.6 and 9.16 were observed on cotton and okra and during the October last week larval period highest at 15.9 and 14.9 found on the China rose and Indian mallow. Research findings of Sundraraj and David (1987) *E. vittella* period of larvae is 18.33, 13.76 and 12.73 days were documented on *A. indicium,* cotton and okra. The work of Rukhsana *et al*., (1995) indicates that the *Earias vittella* period of larvae (18± 0.88) days and this period was observed on okra by average temperature of 30 5 ºC. According to Suryawanishi *et al.* (2001) *E. vittella* period of larvae was observed on cotton up to 5 to 16 days. Findings of Hassan and Khidir (2005) show that during cold season larvae can full grow in 10 to 10.67 days. The little difference due to the climatic conditions and availability of food which is taken by larvae Shah *et al.* (2012) according to him the maximum day consumption period of larvae was documented at 27 ± 1ºC. The research finding of Hiremath (1987) indicates 13.7 days of larval developmental stage.

When the larvae became full grown it is metamorphological changes into pupae, stop feedings due to resting stage but in this stage moth development stage occurs. The pupae are brown in colour and boat shaped in structure. This result shows that the pupal period requires (14.24 ± 0.61) days at (20 ± 2^{0}C) A.C temperature and room temperature under laboratory conditions at (25 ± 2ºC). The findings of Al-Muhammady and Roqaya (2000) indicates that period of pupal stage requires 5 to 12 days at 27 to 31^{0}C. According to Syed *et al.,* 2011) during the last week in the month of July the pupal period consume days on China rose 9.66 and in September last week by the application of average temperature at 32.6^{0}C and maximum pupal period consumed on Indian mallow about 14.4 days. *Earias vittella* pupal stage has been documented in little difference due to the host plant and climatic condition. The work of Sundraraj *et al.* (1978) shows that the pupal stage at (13.03, 12.36 and 11.16) *A. indicum,* cotton and okra host plants. According to Al-Mehammady and Roqaya (2000) findings indicate that in the month of October and August with an temperature average of 30.5^{0}C and 32. 6^{0}C and *Earias vittella* pupal period consumed days 7.78 and 6.45 days, whereas; 12.5 days of pupal period is documented by Hiremath (1987).

Earias vittella male and female at variable temperature longevity is also observed. Male life span (11.72 ± 1.07) and female life span (13.32 ± 0.41) days was observed 20 ± 2^{0}C at average air-condition average temperature. While at 25 ± 2ºC room temperature under laboratory conditions male consumed (7.32 ± 0.99) and female (9.45 ± 1.42) days. Our study shows that males lived shorter than female. The finding of Syed *et al.* (2011) shows that in July month in female having minimum longevity at 7.5 says and at 13.9 maximum days was observed on okra. While; on

cotton crop by an average temperature 32. 65ºC the longevity in male adult minimum at 9.5 days and maximum at 14.2 days was concluded and on okra at 32.12 ºC. According to Rehamn and Ali (1981) results show that male longevity 9.25 and female longevity reported at 13.91 days. Research work of Sundraraj and David (1987) represents that the female *Earias vittella* longevity on cotton, okra and *A. indicum* at 9.90, 14.13 and 14.60 and male longevity on same crops at 6.23, 9.33 and 10.76 days. While as the work of Syed *et al*., (2011) indicates that the longevity in male 9.5 days and in female longevity 7.5 days and female is shorter than the male. The work of Shitole and Patel (2010) documented that the female longevity 11.40 ± 2.91 days and longevity in male 9.20 ± 2.30) days was recorded. The work of Hiremath (1987) suggests that the female longevity 14 days and longevity in male 8.7 days, respectively.

Earias vittella life cycle was recorded at variable temperatures during this study. This research work shows that life cycle duration of *Earias vittella* at air conditioned 20 ± 2^0C consumed days (50.00 ± 2.16) and at room temperature 25 ± 2ºC consumed days (35.00 ± 1.12). According to Syed *et al*. (2011) life cycle of *Earias vittella* observed on many host plants such as; okra, Ablution and cotton. The minimum life cycle on Ablution at 33.00 days was observed with the comparison of other host plants in the last week of July month at laboratory temperature conditions at 34.12ºC. Duration of increased when temperature is decreased. According to Sundraraj and David (1987) the *Earias vittella* duration of life cycle on okra, *A. indicium* and cotton were observed at 26.9, 27.9 and 32.1. The work of Sharma *et al.* (1985) indicates that the life cycle duration was 29-49 days and the findings of Al-Mehmmady and Roqaya (2000), suggests that during October month *Earias vittella* life cycle about at 35.21 to 35.40 days. Whereas; Hiremath (1987) documented that the *Earias vittella* life cycle consumed 29.45 days and Butani and Verma, (1976) according to him life cycle duration in *Earias vittella* ranges from 22 to 25 days, respectively.

The period of fertility and fecundity in of eggs in *Earias vittella* was at the mean 65.00 ± 14.67 and mean of totally hatched eggs at 53.12 ± 13.57 and the percentage of totally hatched eggs at the air-conditioned temperature recorded at 20 ± 2^0C recorded at 81.27 ± 2.36. In *Earias vittella* the fertility and fecundity of eggs were also recorded at the mean 145.25 ± 15.54, and totally hatched eggs at 85.14 ±7.60 room temperature under laboratory conditions 25 ± 2ºC. The findings of Syed *et al*. (2011), indicates that in *Earias vittella* the fertility and fecundity of eggs were observed under laboratory conditions at 32.6 ºC. During the observation twenty five pairs were kept and observed egg laying period in females (Mean ± SE) 328.37 ± 17.33) during the ten to eleven days. During initial two days maximum fertility at 65.96 and 71.68 percent was observed but minimum fertility of the eggs during the fifth days was observed at 18.83 percent. Nearly fifty % eggs were laid during first two days. As a time passes the egg laying mechanism observed decreased. The present suggest that on several host plants larvae of female feed and at significant ($F=7.915$. $DF=3, 6$; $p< 0.05$) relay effect on egg laying period. According to Atwal and Dhaliwal (2005) they observed 200 to 400 eggs and findings of (Nayar *et al.,* 1976) 385 eggs by each female were observed. Whereas; Sundararaj and David (1987) examined in *Earias vittella* in egg laying behavior, fertility of eggs and days duration by significantly ($F= 7.448$; $DF= 3, 12$; $p< 0.001$ and ($F= 126.65$; $DF= 4.12$, $p< 0.001$) due to the feeding behavior on another host plants.

During the September month okra crop was some due to the increased population of fruit borer, increased temperature, increase their growth and reproduce on okra crop. This research study shows that the undamaged and damaged overall monthly mean population during October, November and December was recorded on okra fruits at field conditions. During the December month okra fruits were heavily damaged by *Earias vittella* at the rat of, 79.47 ± 4.89 under field conditions compared in the month of October, 34.15 ± 8.45 and November, 66.26 ± 12.43, respectively. Mandal *et al*. (2006) documented that during the month of February, 16th the infestation increased gradually till to the April, 7^{th}. In the April, 7^{th}, per hundred fruits the larval population was found maximum at 59.74. During February, 16^{th} the maximum yield was recorded at (112.60 q/ha) and minimum in (April, 7^{th}) at (77.4 q/ha) was observed. According to Mastoi *et al.* (2013) they work on several verities and shows that; *Earias vittella* during 2004 increased in huge number in June, first week and ongoing their movement till August first week until the crop was harvested. During the study fluctuation of larvae and pest population was remained under observation. During Second week of August, 2004 the pest population recorded maximum and observation was made by significant ($p< 0.05$) and average population different diversities was statically non-significant. During the fourth week of June infestation was recorded minimum at 30. 35 percent and maximum at 52.50 percent and infestation in the first week of August recorded same. During in different dates on the different vanities significant were ($p< 0.05$). The less infestation was observed on Sabzpari at 39.84 percent and high infestation on Noori-786 at (46.46) percent. Present study suggests that on okra fruit okra bollworm cause infestation on the fruits form the emergence up to harvesting. Therefore, it is strictly needed to apply certain controlling strategies from the initial stage due to which pest can be reduced, by getting late the percent of the infestation will occurs at climax.

Conclusion

In conclusion present research work shows that okra crop is fruitful crop for the chewing type of several insects including, *Earias vittella* these chewing complex infest from the initial to the last stage of okra crop. *Earias vittella* is a polyphagous in feeding behavior under natural conditions causing high mortality up to eighty percent are dependents over the range of host fruits. Present result shows undamaged and damaged monthly overall mean population on okra fruits which were recorded under field condition in the October, November and December months respectively. Under field condition during the December month infestation recorded severely on okra fruits and finally under air-conditioned temperature the biology of *Earias vittella*, maximum day's consumption and completion of life cycle is observed.

RECOMMENDATION

It is recommended that the population of *Earias vittella* on weekly basis recorded on okra crop. At the fortnightly interval basis by the release of bio-control agents on okra crop the pest population should be minimized. Due to the infestation of *Earias vittella* on okra crop reduction occurs in the yield production. A wasp which is minute polyphagous endoparasite of insect egg *Earias vittella* which introduce widely as a biological controlling agent, this agent is called Trichogrammatoidaeis. Present study also strictly suggests that further attempt and exploration should be carried on okra crop by the use of certain envirmental friendly strategies and suitable management growers will be able to enhance the quantity of okra crop and in this regard little work had been documented in upper province of Sindh.

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