



DIVERSITY AND ABUNDANCE OF INSECTS IN COTTON FIELD FROM KHAIRPUR AND ITS ADJOINING AREAS

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Author's contribution

FS designed the study; AA performed the experiments & compiled the data.

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ABSTRACT

Cotton is one of the most important cash crop and fiber of Pakistan. It is mainly cultivated to obtain its fiber but its seed oil is also extracted which then benefits the oil industry whereas the fiber plays a significant role in the textile industry of Pakistan. It always remains vulnerable to pest due its soft foliage, broad leave sap concentration, flowering and juicy ball attract the insect attack on the crop. Some pests may attack on different parts of the plant such as the bud, stem, leaves, roots or the cotton balls. During the present investigation the diversity and abundance of insects calculated with the special reference to the association of it with different part of cotton plant. A total number of 896 insect specimens were collected pretend to 05 orders and 09 families and 12 species. Most abundant pest recorded is *Dsydercus cingulatus* (cotton stainer) with a total of 195 specimens, mainly attacking on the leaves of the plant shannon diversity index was used to analyze the data. The Shannon Weiner diversity index of insect pests on cotton crop of District Khairpur was calculated as $H' = 2.484\%$ and $E = 1.859\%$.

1. INTRODUCTION

The cotton is a preeminent cash crop and backbone of the textile industry of Pakistan. The cotton crop is seeded during the season of monsoon from April to June. Having an annual economic impact of \$600 billion worldwide (Ashfaq & Young, 1999), (Ashraf, 2008). At present more than twenty million farmers are those who exclusively reliant on cotton production or cultivate in alternation scheme (Birner *et al.*, 2009). No doubt cotton occupies a fundamental status in the agro-based economy of Pakistan and essential nonfood crop. It is demand of time to increase fiber quality with quite resistance against disease and harmful insect pest (Bhatti & Soomro, 1996), (Abelson *et al.*, 1998). Pakistan ranked among the leading producer and exporter countries of the world.

Cotton products add nearly 60% of overseas earning and domestic economy absolutely dependent on cotton and its derivatives (Sial *et al.*, 2014). (Lu *et al.*, 2012), (Wu *et al.*, 2008). Insect are found in close association with the cotton crop and almost 1326 species of insect are associated in direct and indirect way out of which 166 are considered as main pest of cotton [9]. diversity of insect also vary in the different parts of plant like some are associated with leave, boll, stem and foiler part of plant. On the basis of feeding behavior, cotton pest is categorized into sucking insect pest e.g Dusky cotton bug (*Oxycarenus hyalinipennis*), Cotton aphids (*Aphis gossypii*), Red Cotton bug (*Dsydercus cingulatus*), Cotton mite (*Boisea trivilata*), Mealy bug (*Phenacoccus solecopis*) These sucking cotton pest nourishes on leaves, bolls, flowers and buds Biting and chewing cotton pest include two order Lepidoptera (*Danaus chrysippus*), Order coleoptera (*Phyllobius calcaratus*). Some cotton pests attacking on roots and seedlings include two order

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Orthoptera (*Heteracris littoralis*), Order Odonata (*Orionothemis felixorions*). Pest attract the anatomical morphological appearance of plants like color, shape of okra leaf, spines on leaves, strength of tissues, hairs and evidences of waxes, lignifications of cell walls, frego bract shape etc. due to these characters of cotton plant, insects prefer these host plants and damaged them (Rajender *et al.*, 2018). So, it is important to see the diversity and abundance of permanent and wondering insect on cash crop.

2. MATERIALS AND METHODS

Study Area

In the region of Sindh, district Khairpur located between the latitude 68.7551 ° E and north longitude 27.5256 ° N which lies between altitude of 50m above sea level with the highest temperature 46 °F - 112 °F throughout the summer and least standard temperature rarely below 40 °F and rarely above 117 °F.

Specimen Collection

Insects were picked up from two main areas of the cotton fields of district Khairpur in such a manner that by crave up the fields into slab and then after – hours joint at least area of 0.5 acres of particular field was planned for the collection of insects in each hotspot. One and all of cotton was further mapped out into fours replicates bluish and yellowish sticks were placed in criss- cross manner on field for about three hours in a 2-meter area. The obvious data was also set down and was built up by utilizing of hand net and forceps. After three days, two hotspots were considered and unlike specimens were obtained endlessly except meanwhile climate was not fitting for insects' collection.

Data analysis

Facts were examined to discovered species multiplicity, abundance and species affluence with Shannon Weiner diversity index (Shannon, 1998). The index of diversity was preplanned by utilizing the minitabs software for statistical analysis.

Diversity index calculated by using the following formula

$$H' = \frac{N \ln N - \sum n \ln n}{N}$$

The magnitude of

$$E = H' / \ln S$$

3. RESULTS AND DISCUSSION

The sampling period was from the beginning of May 2020 to October 2020. A total of 896 specimens were sampled from the cotton field of Khairpur. The pooled - up - data of 2020 Showed insect fauna comprising species belonging to 9 families and five orders (Table 1). Collected insects belong to Hemiptera (45%), Coleoptera (22%), Lepidoptera (14%) , Orthoptera (10%) and odonata (19%) (Fig-1) .Overall highest number of specimens (45%) belongs to family pyrochoridea while libelluididae showed lower number of specimens (10%)(Fig-2) . *D.cingulatus* (195 specimens), A Grandis (151specimens), *D.chrysippus* (120specimens) and *H.littoralis* (88 specimens) were dominant species whereas *P.slenopsis* (19 specimens) , Boisea triviltata (26 specimens) and *O. hyalinipennis* (31 specimens) were minimum recorded species. Number of insects increase in May (57) followed by June (97), July (184) and August (338) which gradually decreases in September (210 specimens) where as they are absent in November (Table 2).

4. CONCLUSION

Our study concludes to estimate the abundance and diversity of insects in cotton crop near university campus. In this regard data is taken from the cotton field of university campus, district Khairpur. Total specimens 896 belonging to 5 orders, 9 families and 12 species are collected from this field. In this study, the data is analyzed by using Shannon diversity index. Significant Diversity ($H'=2.484$) and Evenness ($E= 1.859$) of insect faunal species were recorded from cotton crop. Maximum diversity was observed in August while minimum in May. Inconsistency in species richness and diversity could be due to temporal variations and extensive use of pesticides. Temperature and rainfall were probably the main factors among others that support the growth and development of insects.

5. CONFLICT OF INTEREST

Authors have declared that there is no conflict of interests regarding the publication of this article.

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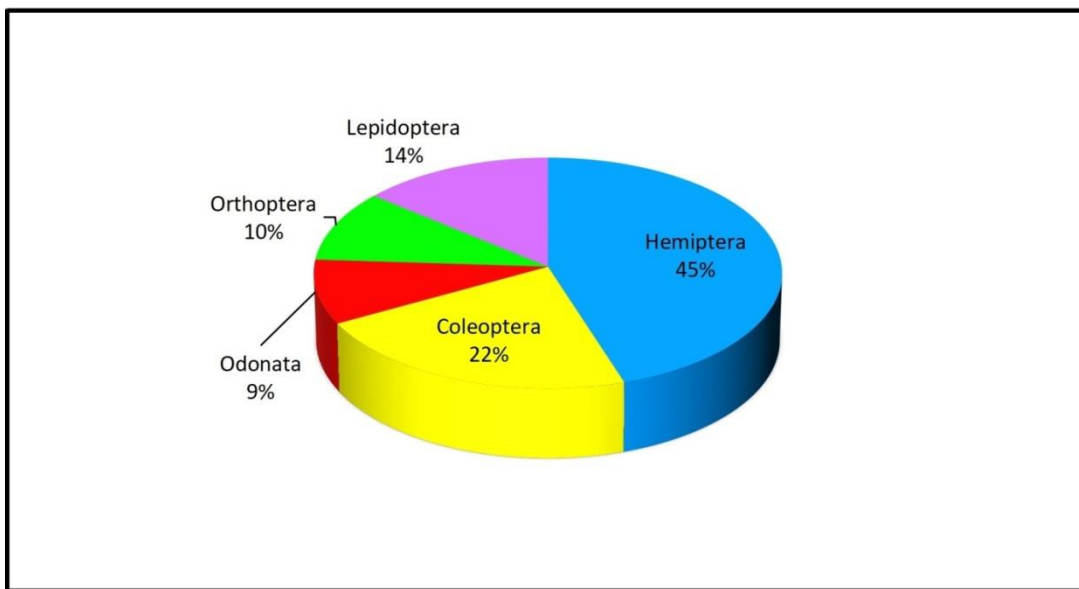


Figure 1. Percentage Proportion of insect sampled from cotton field of district Khairpur

Diversity and abundance of insects in cotton field

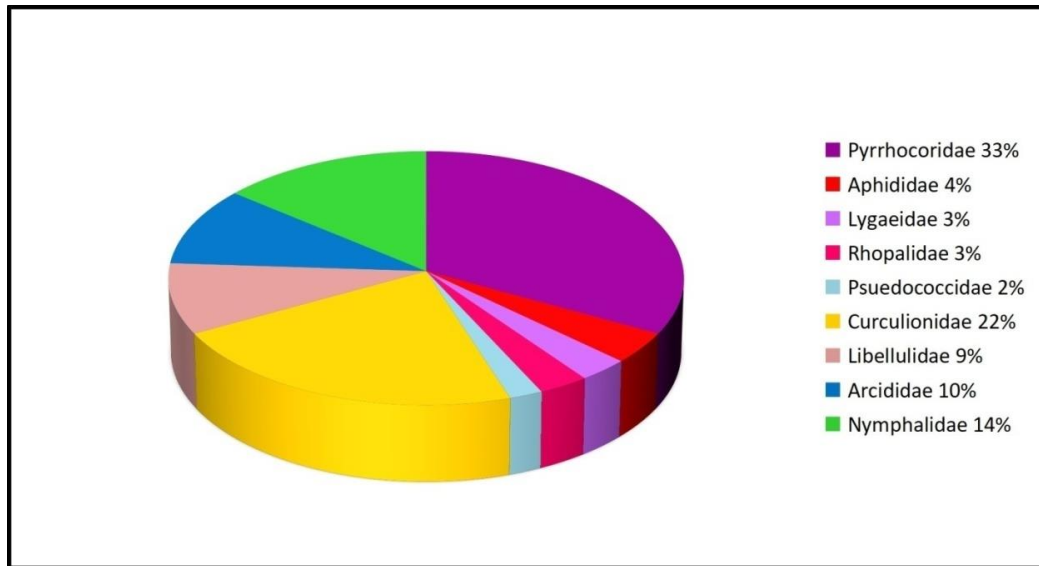


Figure 2. Families of insects sampled from cotton field of district Khairpur, Pakistan.

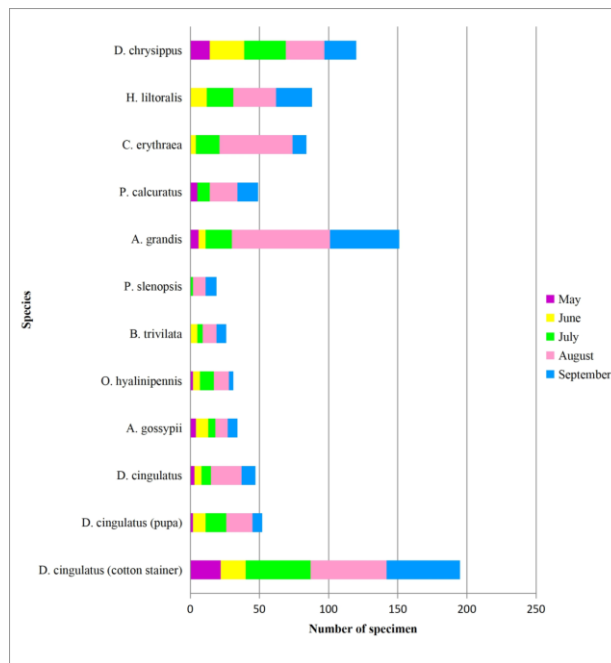


Figure 3. Month-wise number of insect fauna sampled from cotton field of district Khairpur.

Table 1. Month-wise number of insect fauna sampled from cotton field of district Khairpur.

Species	May	June	July	August	September	Total
<i>Dsydercus cingulatus</i> (cotton stainer)	22	18	47	55	53	195
<i>Dsyderus cingulatus</i> (pupa)	2	9	15	19	7	52
<i>Dsydercus cingulatus</i>	3	5	7	22	10	47
<i>Aphis gossypii</i>	4	9	5	9	7	34
<i>Oxycarenus hyalinipennis</i>	2	5	10	11	3	31
<i>Boisea trivittata</i>	0	5	4	10	7	26
<i>Phenacoccus slenopsis</i>	0	0	2	9	8	19
<i>Anthonomus grandis</i>	6	5	19	71	50	151
<i>Phyllobius calcuratus</i>	5	0	9	20	15	49
<i>Crocothemiserythraea</i>	0	4	17	53	10	84
<i>Heteracris liltoralis</i>	0	12	19	31	26	88
<i>Danaus chrysippus</i>	14	25	30	28	23	120
Total	57	97	184	338	210	896

Diversity and abundance of insects in cotton field

Table 2. Relative abundance of insect fauna sampled from cotton field of district Khairpur.

Species	May	June	July	August	September	Total
<i>Dsydercus cingulatus</i> (cotton stainer)	38.6	18.55	25.54	16.27	25.23	21.76
<i>Dsydercus cingulatus</i> (pupa)	3.50	9.28	8.15	5.62	3.33	5.80
<i>Dsydercus cingulatus</i>	5.26	5.15	3.80	6.50	4.76	5.24
<i>Aphis gossypii</i>	7.02	9.28	2.71	2.66	3.33	3.79
<i>Oxycarenus hyalinipennis</i>	3.50	5.15	5.43	3.25	1.45	3.45
<i>Boisea trivittata</i>	0	5.15	2.17	2.95	3.33	2.90
<i>Phenacoccus slenopsis</i>	0	0	1.08	2.66	3.80	2.12
<i>Anthonomus grandis</i>	10.52	5.15	10.32	21.00	23.80	16.85
<i>Phyllobius calcuratus</i>	8.77	0	4.89	5.91	7.14	5.46
<i>Crocothemis erythraea</i>	0	4.12	9.23	15.68	4.76	9.37
<i>Heteracris litoralis</i>	0	12.37	10.32	9.17	12.38	9.82
<i>Danaus chrysippus</i>	24.56	25.77	16.30	2.82	10.95	13.39
Total	6.36	10.82	20.53	37.72	23.43	

Table 3. Occurrence of cotton pests on different parts of the plant in the field district Khairpur.

Species	Flowers	Bolls	Leaves	Roots	Stem
<i>Dsydercus cingulatus</i> (cotton stainer)	-	-	+	-	-
<i>Dsyderus cingulatus</i> (pupa)	+	+	-	-	-
<i>Dsydercus cingulatus</i>	+	+	-	-	-
<i>Aphis gossypii</i>	-	-	+	-	+
<i>Oxycarenus hyalinipennis</i>	-	+	+	-	+
<i>Boisea trivittata</i>	-	-	+	-	-
<i>Phenacoccus slenopsis</i>	-	-	+	-	+
<i>Anthonomus grandis</i>	+	-	-	-	-
<i>Phyllobius calcuratus</i>	+	-	+	-	-
<i>Crocothemis erythraea</i>	+	-	+	-	+
<i>Heteracris liltoralis</i>	-	-	-	+	-
<i>Danaus chrysippus</i>	+	-	+	-	-

Table 4. Data regarding metrological factors of different months from district khairpur.

Months	Temperature C	% Relative Humidity	Rainfall (mm)	Wind (kph)
May 2020	42.4	20%	2mm	7.7kph
June 2020	43.4	61%	5mm	9.8kph
July 2020	40.6	80%	36mm	9kph
August 2020	38.6	55%	21mm	7.9kph
September 2020	37.8	20%	8mm	3.6kph

Table 5. Analysis of diversity of cotton crop y applying Shannon Diversity index

Type	N1	H1	E1
Cotton	896	2.484	1.859

N1: Total number of species

H1: Shannon diversity index **E1:** Evenness