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Influence of Abiotic Factors on the Population of *Dysdercus koenigii* Fab. (Hemiptera: Pyrrhocoridae) in Cotton Field in Pakistan

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Abstract

Four different genotypes of cotton NIAB–98, FH–1000, MNH–636 and Sohni were tested during this study. The objective of this study was to see the impact of abiotic factors that is field temperature and relative humidity on population dynamics of red cotton bug, *Dysdercus koenigii* Fab. on different varieties of cotton under unsprayed field conditions of the Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad city of Pakistan. Population fluctuation of *D. koenigii*, fluctuated rates of field temperature and relative humidity were monitored after each interval. The results of the field study revealed that the bug population was found throughout the crop season from July to October 2003. The highest survival percentage of bug (19.23%) was observed during 1st week of September when the temperature and relative humidity were recorded 31˚C and 64%, respectively. While the lowest population of insect pest (4.15%) has been found during 3rd week of October when the temperature was 24˚C and relative humidity was recorded as 59%. Overall infestation of *D. koenigii* was 18.30±1.05, 17.00±0.24, 16.60±2.72 and 15.00±0.38 per three leaves on FH–1000, NIAB–98, Sohni and MNH–636 variety of cotton, respectively. Consequently, it was justified that the resistant genotype of cotton against the infestation of *D. koenigii* in relation to field temperature and relative humidity is MNH–636 while the highly affected is FH–1000.

Key Words: *Dysdercus koenigii*, Abiotic factors, Temperature, Relative humidity, Cotton.

Özet

Pakistan'da Pamuk Tarlasında *Dysdercus koenigii* Fab. (Hemiptera: Pyrrhocoridae)'nin Populasyonu Üzerindeki Cansız Etmenlerin Etkisi

Yapmış olduğumuz çalışmada, tarla koşullarında dört farklı pamuk çeşidi (NIAB–98, FH–1000, MNH–636 ve Sohni) kullanılmıştır. Bu çalışmanın amacı; Pakistan'ın Faysalabat şehrinde bulunan Tarım ve Biyoloji Nükleer Enstitüsü'nün deneme alanlarında pamuk zararlısı olan *Dysdercus koenigii* Fab.'nin populasyonu üzerindeki cansız etmenlerin (tarla sıcaklığı ile orantılı nispi nemi) etkisini ortaya koymaktır. Zararlı böcek popülâsyonu ile birlikte tarla sıcaklığı ve nispi nemin dalgalanma oranları haftada bir kez gözlenmiştir. Araştırma sonuçlarına göre; zararlı böcek popülâsyonu pamuk tarlasında kırpma sezonu (Temmuz–Ekim 2003) boyunca sürekli olarak görülmüştür. En yüksek zararlı böcek popülâsyonuna %19,23 ile sıcaklığın 31^{o}C ve orantılı nispi nemin %64 olduğu Eylül ayının ilk haftasında rastlanırken, en düşük popülâsyonu ise %4,15 ile 24^{o}C sıcaklıkta ve %59 orantılı nispi neme sahip olan Ekim ayının üçüncü haftasında tespit edilmiştir. Her bir pamuk bitkisinden rastgele üç yaprak örneği alınmış ve yapraklarda bulunan ortalama zararlı popülasyon sayıları ve pamuk çeşitleri ise sırasıyla 18,30±1,05 ile FH–1000, 17,00±0,24 ile NIAB–98, 16,60±2,72 ile Sohni ve 15,00±0,38 ile MNH–636 şeklinde kaydedilmiştir. Sonuç olarak; tarla sıcaklığı ve orantılı nispi nem şartlarında *D. koenigii* Fab.'nin popülâsyona en dayanıklı pamuk çeşidi MNH–636 olurken, bu şartlara en dayanıksız çeşit ise FH–1000 olarak tespit edilmiştir.

Anahtar Kelimeler: *Dysdercus koenigii*, Cansız etmenler, Sıcaklık, Nispi nem, Pamuk.

Introduction

Cotton, *Gossypium hirsutum* (L.), is a major cash crop of Pakistan. This crop provides means of living to millions of people engaged in its trade and textile industry (Anonymous, 2003). It contributes a major part in our foreign exchange, which is up to 68% (Khan and Khan, 1995). Cotton being the king of natural fibre is grown in 111 countries all along the world (Anonymous, 2005). Cotton is the most notorious crop for pest problems (Venugopal *et al*., 1994). About 1.326 species of insect and mite pests attack this crop in the world. In Pakistan, nearly 145 species of insects and mites have been reported of cotton crop (Ahmed, 1991). These can be mainly divided into two groups i.e.; sucking insect pests and bollworms. The sucking insect pests include whiteflies, thrips, aphids, jassids and red cotton bugs (Younas et al., 1980), are responsible for the loss of cotton crop as much as of 39–

50% in Pakistan (Naqvi, 1975; Chaudhry, 1976). Among these, the red cotton bug causes a considerable damage to cotton crop in every cotton growing season (Mishra and Kumar, 2001).

In the past, Red Cotton Bug (RCB) has been considered as a minor insect pest of cotton but in recent years it is becoming a serious insect pest of cotton crop in Pakistan, and also reported from all cotton producing areas of India (Shripat, 1971). The main damage of red cotton bug, *Dysdercus koenigii* is the sucking of cell–sap from the leaves and green bolls of cotton plants (Hill and Waller, 1990). Furthermore, this insect stains the lint with their excreta as well as causes considerable damage by reducing plant vigour, reducing oil content and the germination of seeds (Srivastava and Bahadur, 1958). Heavily attacked bolls open badly and the lint is of poorer quality. So, the abiotic factors, mainly temperature and relative humidity, play a vital role in the survival of *D. koenigii* which can decrease and/or increase its population in cotton growing fields.

This field work was planned to determine the population fluctuation of *D. koenigii* on four different genotypes of cotton in relation to field temperature and relative humidity under unsprayed field conditions so that a variety of cotton could be selected which might be more resistant to *D. koenigii* infestation.

Materials and Methods

The field experiment was carried out at the experimental area of the Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad Pakistan. This experiment was laid out in Randomized Complete Block Design (RCBD) on four different genotypes of cotton namely, NIAB–98, FH–1000, MNH–636 and Sohni with three replications. The seeds were also provided by NIAB. The plot size, row to row distance and the length of each row were 295x40ft, 2.5ft and 20ft, respectively. There were five rows in each treatment and each row has been contained 15 cotton plants. The length and width of each treatment were 25ft and 10ft, respectively. The observations were made on number of *D. koenigii* (F.) on five randomly selected plants from top, middle and bottom three leaves at weekly interval from July to October 2003. Field temperature and relative humidity were also recorded during the entire research work. At the end of this research work the data were statistically analyzed and Duncan's Multiple Range (DMR) test at 5% probability (Steel and Torrie, 1980) was applied to determine the effect of field temperature and relative humidity on the population of red cotton bug, *D. koenigii* Fab. on four different genotypes of cotton.

Result and Discussion

Red cotton bug population

The results (Table 1.) showed that the incidence of *D. koenigii* population, field temperature and relative humidity were noticed throughout the crop season from 1st week of July till 3rd week of October 2003. The peak incidence of bug population was recorded as 19.23% per three leaves during 1st week of September when the field temperature and relative humidity were 31˚C and 64%, respectively.

Table 1. Weekly mean population of *D. koenigii* Fab., mean field temperature and mean relative humidity on different genotypes of cotton observed from July to October 2003.

Months	Weeks	Mean Insect Pop±SD	Mean Temp. (˚C)	Mean R. H. (%)
July	W1	13.25±1.69	36	60
	W2	11.52±1.61	40	55
	W3	10.24±1.37	35	63
	W4	11.12±1.46	32	61
August	W1	9.32±0.47	33	65
	W2	8.20±0.32	33	73
	W3	10.72±1.41	30	66
	W4	14.45±1.72	31	82
September	W1	19.23±1.84	31	64
	W2	12.36±1.67	27	67
	W3	8.53±0.51	28	57
	W4	6.59±0.62	31	53
October	W1	5.88±0.51	29	54
	W2	5.18±0.44	27	57
	W3	4.15±0.41	24	59

This was the highest peak of the season. Figure 1. shows that the population of cotton pest decreased thereafter and reached down to 4.15% per three leaves during 3rd week of October. These presented results are in partial agreement with the findings of Bakhetia and Sidhu (1976) who revealed that the insect population remaining active throughout the crop season up to the 3rd week of October. However, present findings are not agreement with the findings of Dugger and Richter (1998) reported peak insect incidence on cotton during the months of July.

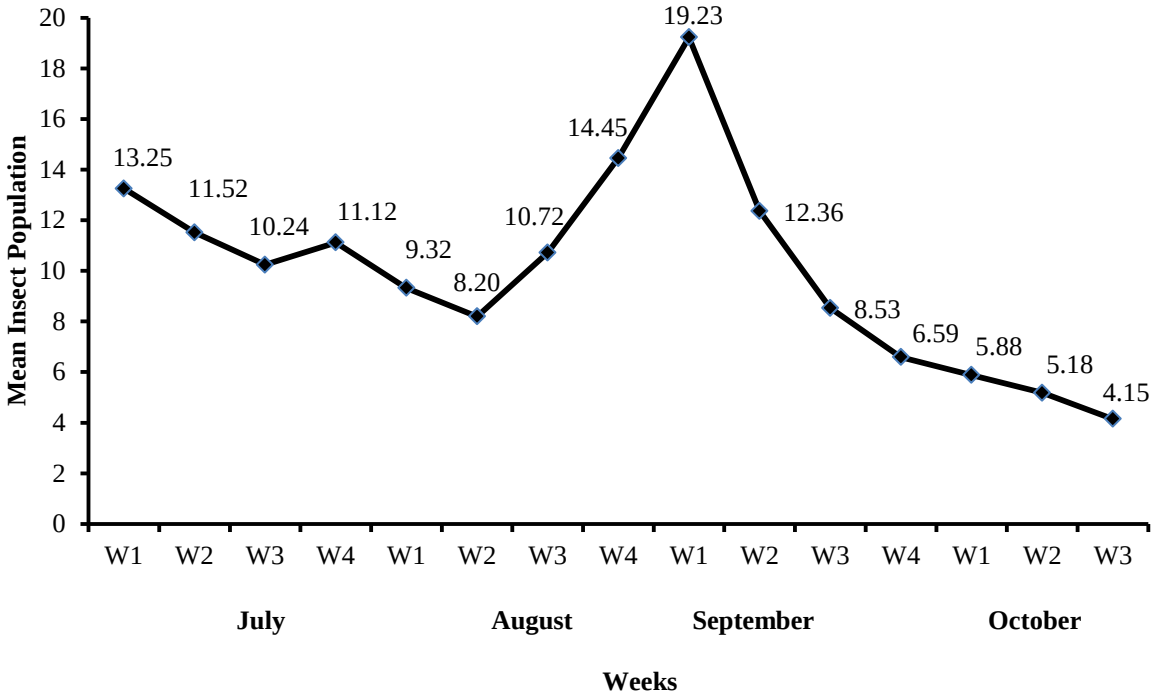

Figure 1. Mean number of *D. koenigii* Fab. population during four months at various weeks of observation on different genotypes of cotton.

Comparison between genotypes and abiotic factors in population fluctuation of *D. koenigii*

The overall mean population of *D. koenigii* in four different genotypes of cotton are given in Table 2. The data regarding the pest population revealed that the overall comparison of mean values of genotypes of cotton showed that the maximum per three leaves population of red cotton bug of 18.30±1.05 was recorded on FH–1000 while the minimum population means value of 15.00±0.38 in MNH–636 which is statistically different from all other genotypes of cotton. However there was no significant difference among the genotypes FH–1000, NIAB–98, Sohni and MNH–636 for the population of *D. koenigii* between classes A and C.

The results regarding the correlation between abiotic factors and population fluctuation of *D. koenigii* in different genotypes of cotton are given in Table 3. Results of correlation between genotypes and weather factors i.e., field temperature and relative humidity for red cotton bug population indicated that there was negative correlation between field temperature and relative humidity in FH–1000 and Sohni varieties of cotton as reported by Rote and Puri (1991), except NIAB–98 in which field temperature was negatively correlated while relative humidity was positively correlated as reported by Berlinger et al., (1996). On the other hand, the field temperature and relative humidity were showed a combine non-significant effect on the population of red cotton bug in MNH–636 genotype of cotton. Presented results support the findings of Gogoi et al., (2000), Murugan and Uthamasamy (2001) and, Panicker and Patel (2001) reported that meteorological parameters play a key role in the population fluctuation of sucking insect pests.

Table 2. Comparison of means of population of *D. koenigii* Fab. in four different genotypes of cotton

Genotypes	Mean Insect Pop.±SD	Classes
FH–1000	18.30±1.05	A
NIAB–98	17.00±0.24	B
Sohni	16.60±2.72	BC
MNH–636	15.00±0.38	C

Significant at 5%.

Table 3. Correlation coefficient values for *D. koenigii* Fab. population in four different genotypes of cotton

Genotypes	Field Temperature (°C)	Relative Humidity (%)
NIAB–98	-0.13	0.24
FH–1000	-0.21	-0.28
MNH–636	0.25	0.25
Sohni	-0.20	-0.30

Significant at 5%.

Conclusions

The study on population fluctuation of *Dysdercus koenigii* Fab. on different genotypes of cotton in relation to abiotic factors (temperature and relative humidity) revealed that the population of red cotton bug was found during 1st week of July to 3rd week of October 2003 under unsprayed field conditions. The population of pest was found high 18.30 in FH–1000 followed by NIAB–98, Sohni and MNH–636 varieties of cotton having 17.00, 16.60 and 15.00 red cotton bug population, respectively.

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