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Research Article

Biology of Field and Lab Susceptible Population of Red Cotton Bug

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Abstract

Red cotton bug technically known as *Dysdercus cingulatus* F. is a polyphagous and sucking pest of cotton. This notorious pest now acquired the status of serious emerging pest of cotton in Pakistan. In this experiment we were took susceptible population of F15 and F25 generations of RCB along with field population to compare and observe the following factors like weight and length of all instars, developmental duration period of all instars, mating, fecundity, along with the hatchability of eggs. We found that the field population of RCB which was grown in natural environment having significant difference like filed population complete their life cycle earlier as compare to F15 and F25 similarly weight, height, fecundity and hatchability was more than F15 and F25. Whereas, the F15 also shown some significant difference with the compression of F25 with slight changes like developmental duration more less in F15 similarly height, fecundity and hatching is more in F15 as compare to F25. This study will help in understanding the development, biology and control of red cotton bug.

Keywords: *Dysdercus cingulatus* F; Susceptible Population 15th, 25th; Field Population; Weight; Length; Developmental Duration Period; Mating; Fecundity; Hatchability; Mortality

Introduction

Red cotton bug (RCB) belongs to the family Pyrrhocoridae, it is a serious pest of cotton and also known as cotton strainer. It caused severe lint staining problem in cotton resulting in decrease in market value [1]. Both adults and nymphs feed on developing fruits and affect the crop yield and quality of fruits as the suck sap from the plant [2]. It is distributed in various parts of world and is an important pest of cotton in South East Asia [3]. It is serious pest of okra, sorghum, millet, hollyhock, hibiscus, milky weed, Silk cotton tree and jute. It cause severe economic loss to the hosts belonging to family Malvaceae and Bombaceae [4]. They damaged the ripened cotton seed and developing boll through feeding [5]. The attack of RCB causes low germination and less oil content in seed also provide secondary infection of bacterium *Nematospora gossypii* which enters in injury site and stains the fiber. A few years ago until 2010, RCB was considered as a minor pest in Pakistan, however, now this boll-feeding insect with piercing sucking mouthpart has acquire the status of common pest of cotton. It is thought that this pest is a major cause of cotton staining [6]. The *Dysdercus Cingulatus* F. have different developmental results on different diet it showed faster developmental rate on cultivated species rather then on wild species [4]. Previously researcher found that different proportion of diet can affects the reproduction rate and biology of the RCB. Economically this pest also comprises main importance because it destroy economical crop like cotton and has been use for research purpose [7]. The purpose of this experiment is to study the biology of RCB under laboratory condition also find the difference among the field population, F15 and F25 generation of RCB on the basis of development, weight, height, fecundity and hatchability of eggs at each instar.

Material and Methods

This study was carried out in Central Cotton Research Institute (CCRI) Multan with aim to study the biology of RCB under lab conditions. F15 and F25 generations of red cotton bug were taken and biology of these generation was studied. Similarly, adults were also taken from field and reared under conditions and observed. And difference between Field, F15, and F25 were observed.

Equipment

Rearing jars, Rearing cups, Camel brush, Water bottle, Cotton seeds, Nappy liner, Weight balance, measuring rod.

Figure 1

Collection and Rearing of field RCB

Adult of RCB were collected from the fields of central cotton research institute, Multan. They were reared in lab in plastic jar/container with soil on daily basis and cover jar mouth with nappy liner. New seeds of cotton were given at two days interval until nymph development. To acquire eggs, pair of adults kept in plastic jars. The mouth of containers was closed with muslin fabric. The glasses were day by day checked for eggs deposition.

Three petri dishes were taken, in each petri dish 50 eggs were kept and hatching day and number of eggs which were hatched time to time observed. The raising of the nymph (n = 25) was done independently in small cups on cotton seeds. Perceptions in regard to the duration of nymphal instars and span of every stage were recorded. Newly moulted adult were discharged in plastic jars in sets for oviposition. The number of eggs laid by every female was observed. The weight and length of every stage were noted.

Rearing of Susceptible F15 and F25 generation of Red cotton bugs

Red cotton bugs were raised up to several generation under lab conditions. Adult of F15 and F25 were kept in plastic jars with soil and mouth of jars was covered with nappy liner. The containers were checked every day for eggs deposition. Eggs laid on the base were gathered and put in petri dishes. Three petri dishes were taken, in each petri dish 50 eggs were kept and hatching time and number of hatched eggs noted. The rearing of nymph (n= 25) was completed separately in small cups on new cotton seeds. Perceptions in regard to the duration of nymphal instars were recorded. Recently developed in stars were released in plastic jugs in sets for oviposition. The numbers of eggs laid by single female was calculated. The weight and length of every instar were noted.

Results and Discussion

Description of egg stage

The eggs were delicate to touch, whitish in shading with oval or circular fit as a fiddle which later on ended up buff yellow before incubating. The eggs were laid in masses on the soil.

Description of nymphal stages

The nymph of RCB passed through five instars. The newly moulted first instar of RCB was oval fit as a fiddle with orange buff in shading changing to red following 24 hours. The head was smaller than the thorax and abdomen. The compound eyes were red and situated on dorsolateral position on either side of the head.

The newly moulted second instar nymph was oval in shape and reddish in colour. The eyes were black and dotted with red pigment. The mesonotum was also distinct but smaller than the pronotum. The recently moulted second instar of RCB was oval in shape and reddish in colour. The eyes were dark and dotted with red spots.

Figure 2

Figure 3

Figure 4

The freshly moulted third instar nymph was flat in shape with triangular head and reddish in colour. The most striking change in this instar was emergence of wing pads from the mesothoracic and metathoracic regions. Three pairs of very faint dorsal spots also developed on the abdomen.

The fourth instar nymph of was cylindrical in shape and scarlet red in colour. The mesothoracic wing pads developed considerably to reach the posterior margin of the metathorax.The metathorax was visible only in its mid-dorsal area. White transverse bands appeared from one side to other on the third to seventh abdominal

sterna. The freshly moulted fifth instar nymph of D. koenigii was cylindrical in shape and scarlet red in colour. The legs and antennae were black in colour.The mesothoracic wing pads became very prominent. A white band appears on the anterior margin of prothorax. The nymph to develop into female adult was larger than the male.

Description of Adults of RCB

The adults of RCB were strongly built, medium sized and scarlet reddish in color. The head was triangular in shape. The thorax was well defined and joint with head by a cervix which was not visible from the dorsal side due to overhanging pronotum. The pronotum was large and appearing like a convex shield. It was narrow at anteriorly and broad posteriorly. The forewings were longer and narrower than the hind wings. The forewings bore a black oval spot in the center. The hind wings were transparent, membranous and broader than the forewing. There were no any special morphological characters to distinguish male and female adult but, male is smaller than the female in length and width. For the purpose of mating, a male mount on the abdomen of the female, bend its abdomen downward to bring it in contact with the female genitalia and establish copulation. The male then descends and turns black so that they have their heads in opposite direction. Both the copulating individuals continue to feed and move about in the direction determined by the female as it was stronger and larger than the male.

Figure 5: Adults of Red Cotton Bug.

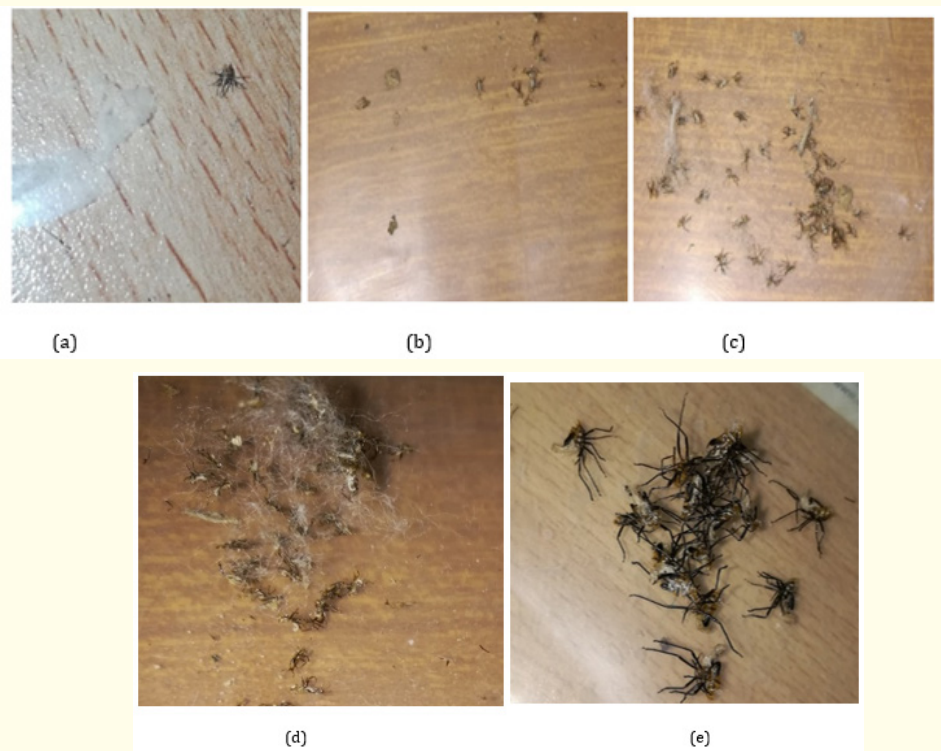

Figure 6: (a): First moult, (b): 2nd Moult., (c): 3rd Moult., (d): 4th Moult., (e): 5th Moult.

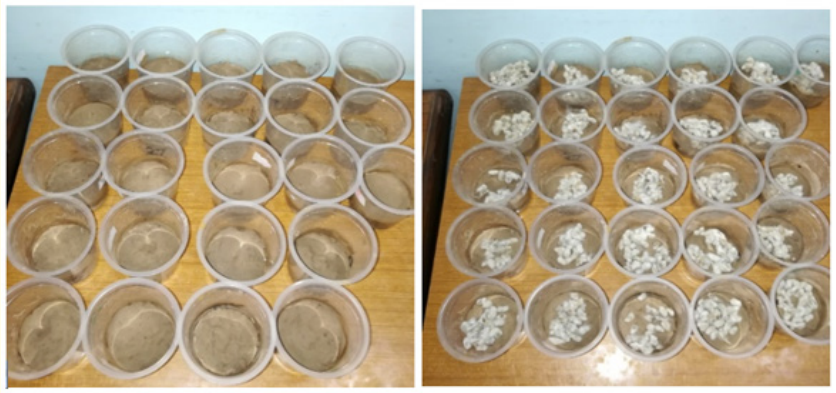

Figure 7: (a): Soil Preparation., (b): Cotton seed in cups.

Figure 8: (a): Release of RCB in cups, (b): Changing of cotton seeds.

Duration of developmental stages

RCB Developmental Stage	Developmental Duration (Days)					
	Field Population		Susceptible F15		Susceptible F25	
	Average ± S. D	Range	Average ± S. D	Range	Average ± S. D	Range
Egg	5.67 ± 0.47	5-6	6.33 ± 0.47	6-7	8 ± 0.47	8-10
1st Instar	2.95 ± 0.624	2-4	4.04 ± 0.637	3-5	5.57 ± 0.48	5-6
2nd Instar	4.33 ± 0.637	3-5	5.04 ± 0.567	4-6	6.05 ± 0.70	5-7
3rd Instar	5.12 ± 0.68	4-7	6.18 ± 0.57	5-7	6.63 ± 0.48	6-7
4th Instar	5.25 ± 0.737	4-8	7.0 ± 0.79	6-8	8.01 ± 0.80	7-9
5th Instar	8.91 ± 0.81	7-11	10.95 ± 0.9	11-13	11.52 ± 0.7	11-14
Adult period						
Female	18.0 ± 1.69	16-20	18.33 ± 0.47	18-19	19.67 ± 0.94	19-21
Male	25.67 ± 1.88	23-27	26.33 ± 0.94	25-27	26.67 ± 0.47	26-27
Total life period						
Female	47 ± 4.54	41-52	51.67 ± 0.94	49-53	56.33 ± 1.24	57-61
Male	53 ± 1.63	51-55	61.0 ± 0.81	56-61	64.66 ± 1.24	66-63

Table 1: Developmental duration of field and Lab susceptible population of RCB.

Weight (mg) of Field and Lab susceptible population of RCB

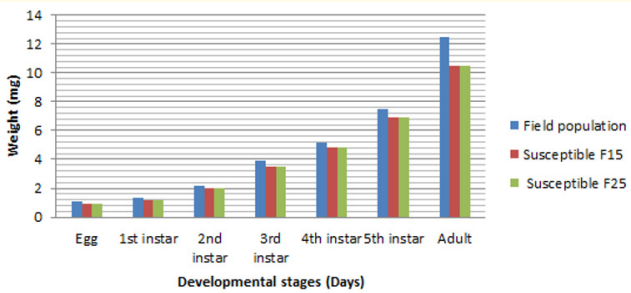

Figure 9: Length (mm) of Field and Lab susceptible population of RCB.

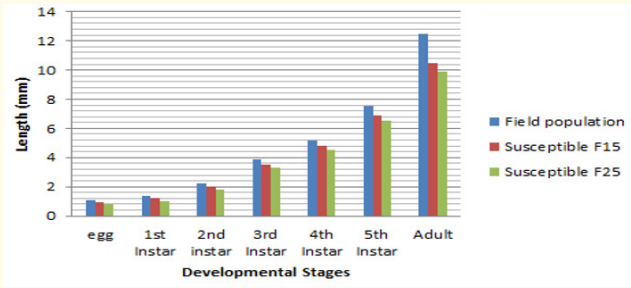

Figure 10: Egg laying of Field and Lab Susceptible population.

No of Mates	Numbers of Eggs laid								
	Field Population			Susceptible F-15			Susceptible F-25		
	Pair 1	Pair 2	Pair 3	Pair 1	Pair 2	Pair 3	Pair 1	Pair 2	Pair 3
1st Mate	88	73	99	73	53	60	43	55	35
2nd Mate	57	67	66	68	45	55	40	43	50
3rd Mate	35	Dead	Dead	Dead	Dead	Dead	Dead	Dead	Dead

Table 2: No of eggs laid by field and Lab susceptible population.

Comparison of Egg Hatching percentage of field and Lab population

Figure 11

Discussion

Sahayaraj., *et al*. [7] had also been found that the diet successive proportion affects the reproduction and developmental rate of RCB. Another research also revealed that the average incubation period was 4.97 ± 0.82 days with an average hatching percentage of 87.33 ± 3.61. The color, shape, size and duration of eggs, first, second, third, fourth and fifth instar nymphs even adults' results are similar to present findings. The total nymphal duration was recorded as 37.52 ± 1.71 days. The female of red cotton bug laid on an average 95.2 ± 19.13 eggs/female in its life spam [2]. Similarly, another Study reveal that there are five nymphal instars of red cotton bug which are completed in 23.42 ± 2.49 days. The female lived longer (20.85 ± 6.12 days) than the male (16.18 ± 6.06 days). Female mate three times in her life duration and there was statistically significant difference in mating period (days), number of eggs and hatching percentage in each mating time. Egg laying and hatchability more in 1st mating rather than in 2nd and 3rd mating respectively. The oviposition duration was 12.43 ± 0.82 as in above given data [3,8-16].

Conclusion

Life cycle of field population was found to be complete early, weight and length of RCB of field population is more as compared to F-15 and F-25 due to availability of ample food in field as compared to lab population. Field population complete its life cycle in natural environment where as lab population completes its life cycle in controlled man made environment that's why significant difference was observed. Number of eggs were also found more in field population as compare to lab population and incubation period was also found less as compared to other population. When hatching percentage of three populations was compared hatching percentage was found more in case of field.

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