



E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2015; 3(3): 335-338
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Received: 11-04-2015
Accepted: 15-05-2015

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Impact of dusky cotton bug (*Oxycarenus laetus* Kirby) on seed germination, lint color and seed weight in cotton crop

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Abstract

Study was carried out to determine the yield losses (qualitative as well as quantitative) caused by (*Oxycarenus laetus* Kirby) Dusky Cotton Bug (DCB) in cotton crop during July to October, 2011 and 2012 under field conditions in the area of Entomological Research Institute, Faisalabad. Different numbers of DCB viz., 0, 5, 10, 15, 20 and 25 pairs per boll were detained with muslin's cloth bags. Observations were made on 100-seed weight, seed germination and visual staining of lint. Maximum lint discoloration (Slightly dark yellow during both the study years), reduction in cotton seed germination (28.2 & 32.13%) and reduction in seed weight (18.12 & 20.62%) were obtained during the study period (2011 and 2012, respectively) when population of dusky cotton bug was maintained as 25 pairs per boll.

Keywords: Dusky Cotton Bug (DCB), Cotton lint, Seed germination, 100-seed weight, Punjab, Pakistan

1. Introduction

Cotton is one of the main cash crops which accounts 7.8 percent of value added in agriculture and 1.6 percent of GDP. It not only provides raw materials to the local textile industry, but the cotton lint is also exported. The crop was cultivated on an area of 2.8 million hectares during the year, 2011-12^[2]. The production is reported at 13.6 million bales, higher by 18.6 percent over the last year's production of 11.5 million bales^[2]. The area of cotton crop for the year 2010-11 showed a decrease of 13.4% over the previous year. The corresponding decrease in area may be due to flood and excessive rains, wide attack of sucking insect pest and Cotton Leaf Curl Virus^[3].

Among 1326 species of insect pests of cotton^[4], throughout the world dusky cotton bug (*Oxycarenus* spp.) is one of the pests of cotton^[7] and causes less damage to the cotton by staining the lint as compared to the major cotton insect pests. It can be managed by management practices used for bollworms. Due to the introduction of Bt cotton in the country, insecticidal spray has been reduced and it is also observed that Bt does not affect the sucking insect pests^[11]. That's why pest's infestation is increasing with every passing year. The population buildups of the dusky cotton bug up to even 749 nymphs and adults in a single boll have been observed in Egypt and Sudan^[10]. In Pakistan many sucking insect pests and chewing insect pests attack cotton crop every year. Cotton insect pests status has much changed by the introduction of Bt cotton and changes in the sowing plan of cotton i.e. early sowing. Some minor pests are changing their status due to increase in their incidence like stink bug and dusky cotton bug on Bt cotton crop^[12]. In Pakistan considerable qualitative and quantitative losses to cotton are observed due to increase in the population of dusky cotton bug which resulted in premature falling of squares/brackets, flowers, and small bolls^[11]. *Oxycarenus laetus* Kirby (Lygaeidae: Hemiptera) is a common pest of some economic crops such as cotton and okra. The cotton seed bug feeds mainly on the seeds of cotton and causes multiple injuries to cotton seed that includes reduction in seed weight used for oil extraction and viability of seeds^[13], injuries to the embryo radical and cotyledons^[10, 14] reducing the value of seed cotton and staining the lint when insect bodies are crushed in the ginning process^[5]. It causes loss in cotton seed oil content, cotton yield and seed weight up to 6, 6.8 and 32 percent, respectively^[16]. In case of severe attack, a significant decrease in cotton seed weight (up to 15%) and reduction in seed germination potentially as much as 88 percent, may occur^[10]. When the population of Dusky cotton bug was 50 pairs per boll it caused 42.9% 40.8%,

35.1%, and 29.3% losses in seed cotton weight, seed weight, oil content, and seed germination, respectively [17], Kengegowda [8] stated that Bt cotton hybrids are attacked by more number of red cotton bugs and dusky cotton bugs. Adults and nymphs of dusky cotton bug suck oil from mature cotton seeds and obtain moisture from leaves of young stems [1].

Among sucking insect pests, population of dusky cotton bug, *O. laetus* is increasing due to early sowing of cotton and by abundant sowing of Bt cotton varieties. Cotton crop period has prolonged about 2-3 months and bug has got a chance of survival on early sown cotton, a wide range of alternate host plants are available throughout the year and left over material of cotton are the main reasons for its increase. On non Bt cotton a large number of pyrethroids were used against bollworm which also helped to check the population of dusky cotton bug and Red cotton bug. On Bt cotton cultivars very less quantity of pyrethroids is used and bug population has increased. It is attaining the status of major pest on cotton crop. So it is inevitable necessity of the time to develop effective integrated pest management on cotton crop. The objective of the study is to determine the impact of Dusky Cotton Bug on cotton in term of seed germination, lint colour and seed weight.

2. Materials & Methods

Two years study was conducted during July to October, 2011 and 2012 to determine the losses caused by Dusky cotton bug (*Oxycarenus laetus* Kirby) and their effect on seed germination, seed weight and lint staining at Entomological Research Institute, Ayub Agricultural Research Institute, Faisalabad. Cotton genotype Bt-121 was sown following Completely Randomized Design replicated four times. Muslin’s cloth cages were prepared by using binding wires to avoid the escape of different pairs of insects. For each treatment in each replication, 10 bolls were covered with these cages and 0, 5, 10, 15, 20 and 25 DCB pairs were released in each cage. After the maturity of the bolls, the seeds were extracted from these bolls and 100 seeds were extracted from each sample to study the seed germination and seed weight reduction caused by dusky cotton bug. The data were subjected to statistical analysis with and means were compared with LSD test at p=0.05. Lint collected from each treatment was also compared regarding its staining according to the scale reported by Srinivas and Patil [17], which is given as follows:

Table 1: Srinivas and Patil lint staining scale and colour

Lint Staining Scale	Colour of Lint
0	Pure white
1	White
2	Light yellowish
3	Slightly yellowish
4	Slightly dark yellowish
5	Dark yellowish

3. Results & Discussion

The results (Fig. 1) reveal significant difference (P≤ 0.01) among treatments regarding percent seed germination during 2011. The maximum effect on germination of cotton seed was observed in treatment where 25-pair were released resulting in minimum germination i.e., 57.94 percent and differed significantly from those of where 20-pairs, 15-pairs, 10 pairs and 5-pairs were released with 62.86, 66.72, 70.32 and 73.99 percent germination, respectively. The control treatment with 80.50 percent germination also differed significantly from those of found in all other treatments. Similar trend in germination percentage was also recorded during 2012 in all

the treatments (Fig 2). The maximum germination of cotton seed was observed in control (81.50 %). The release of 5 pairs, 10 pairs, 15 pairs, 20 pairs and 25 pairs showing 75.99%, 70.44%, 65.57%, 61.22 and 55.31% germination, respectively differed significantly with one another.

It is evident from the results that the germination was significantly and continuously decreased by increasing the number of pairs of dusky cotton bug during 2011 and 2012. The present findings are in broader sense can tally with those of Hill [6] and Schaefer and Panizi [15] who reported that dusky cotton bug may reduce cotton seed germination severely.

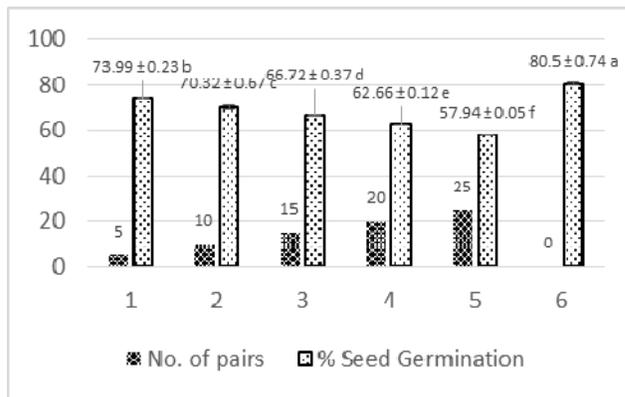


Fig 1: Seed Germination (%) in Cotton Affected by the Release of Different Pairs of Dusky Cotton Bug during 2011.

Means sharing similar letters are not significantly different by DMR Test at P=0.05. LSD at 5% 1.53

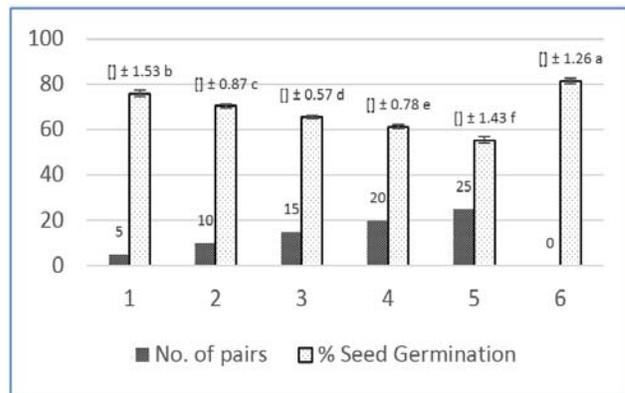


Fig 2: Seed Germination (%) in Cotton Affected by the Release of Different Pairs of Dusky Cotton Bug during 2012.

Means sharing similar letters are not significantly different by DMR Test at P=0.05. LSD at 5% 3.08

Results (Fig. 3) regarding percent reduction in seed cotton germination over control during 2011 reveal that maximum reduction (28.25%) was recorded in the treatment where 25-pairs of dusky cotton bug were released, followed by 20-pairs (22.16%), 15-pairs (17.12%), 10-pairs (12.65%), and 05-pairs (08.09%). The results presented in Fig-4 regarding percent reduction in seed germination during 2012 reveal similar trend as that of recorded during 2011. However, the maximum reduction (32.13%) over control was recorded in the treatment where 25-pairs of dusky cotton bug released, followed by 20-pairs (24.88%), 15-pairs (19.54%), 10-pairs (13.57%), and 05-pairs (6.75%). The present findings can tally with those of Sewify and Semeada [16] who reported that the percent reduction in seed germination was directly associated with

increase in DCB population and vice versa and not inconformity with the same scientists who reported that the population of 50-bugs per boll (25-pairs) caused the reduction in seed germination by only 6.28% but in the present study 25-pairs caused reduction to the tune of 28.25% during 2011 and 32.13% during 2012. The Present findings are also in accordance with Khan *et al* [9] who reported that seed germination decreased, whereas percent reduction in seed germination over control increased with increasing bug density. Bug density in the range of 5–25 pairs caused approximately 9.3%–40.7% reduction in seed germination over control in both laboratory and field trials.

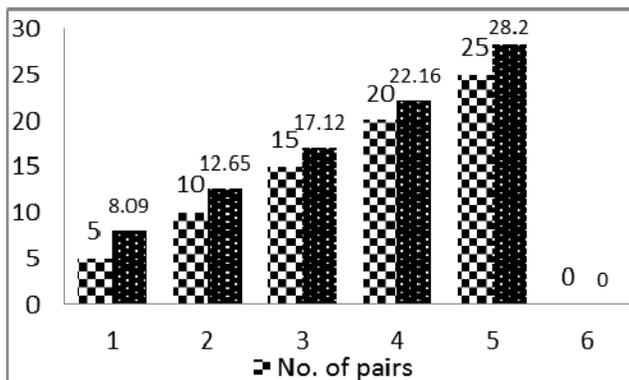


Fig 3: Reduction in Seed Germination (%) Caused by the release of different pairs of Dusky Cotton Bug in Cotton during 2011.

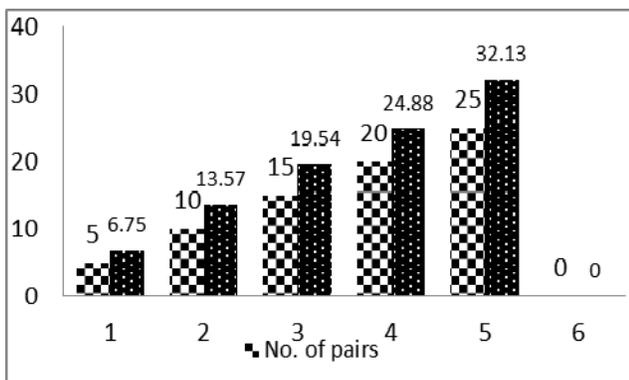


Fig 4: Reduction in Seed Germination (%) Caused by the release of different pairs of Dusky Cotton Bug in Cotton during 2012.

Nymphs and adults of dusky cotton bug feed gregariously on immature seeds which do not ripe and remain light in weight. The results in fig. 5 regarding 100-seed weight reveal significant difference among treatments. The maximum 100-seed weight was recorded to be 7.45-g was recorded in the control plot during 2011 and differed significantly from all other treatments, whereas 100-Seed weight in other treatments were 6.10-g, 6.40-g, 6.56-g, 6.67-g and 6.90-g where 25, 20, 15, 10 and 5-pairs of DCB were released, respectively and also differed significantly with one another. Significant difference was also recorded among treatments regarding 100-seed weight during 2012 (Fig. 6). The maximum 100-seed weight was recorded to be 7.47-g in control treatment and differed significantly from those of observed in all other treatments. Non-significant difference was found to exist in between T1 and T2; T2 and T3; and T3 and T4. The 100-seed weight in T1, T2, T3 and T4 was recorded to be 6.70, 6.53, 6.32 and 6.16-g, respectively. The treatment T5 (25-pairs) showed 5.93-g 100-seed weight and differed significantly from those of found in all other treatments.

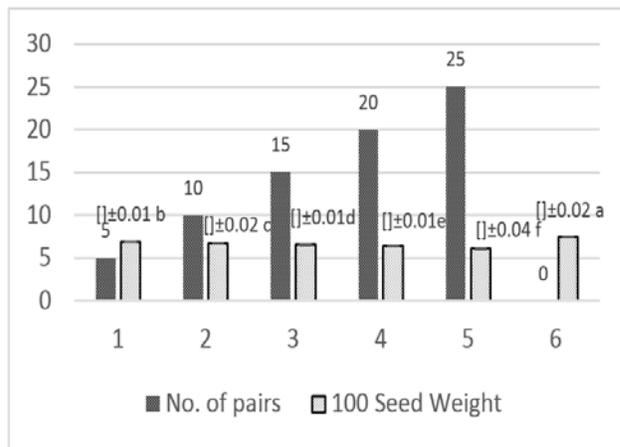


Fig 5: 100-Seed Weight in different Treatments During 2011.

LSD at 5% = 0.01

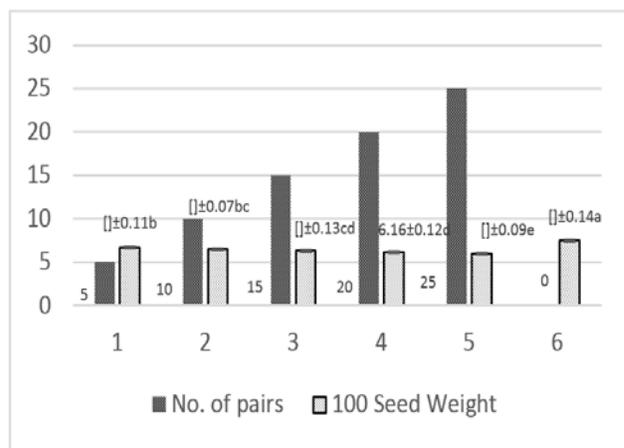


Fig 6: 100-Seed Weight in different Treatments During 2012.

LSD at 5% = 0.22

Means sharing similar letters are not significantly different by DMR Test at P=0.05.

The results (Fig.7) showed that Dusky Cotton Bug reduced the seed weight over control during 2011 by 18.12 % in the treatment where 25-pairs were released. Seed weight reduction in other treatments were 14.13%, 11.97%, 10.48%, and 07.33% where 20-pairs, 15-pairs, 10-pairs and 05-pairs were released, respectively.

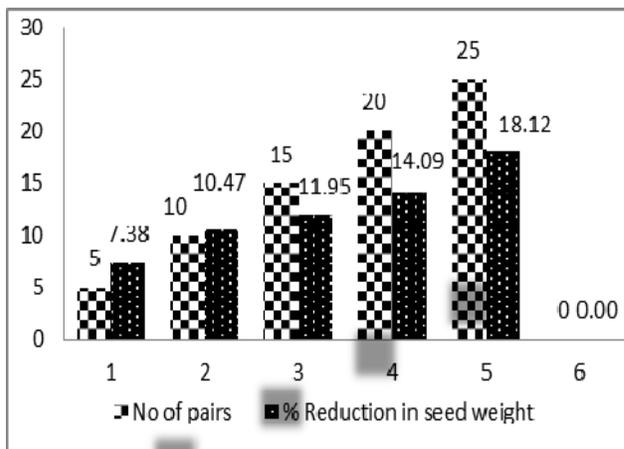


Fig 7: Reduction in Seed Weight (%) Caused by the release of Dusky Cotton Bug during 2011.

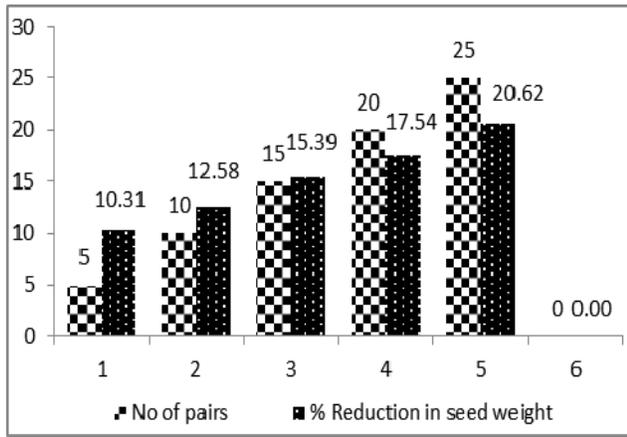


Fig 8: Reduction in Seed Weight (%) Caused by the release of Dusky Cotton Bug during 2012.

The results given in Fig. 8 reveal that DCB reduced the seed weight over control during 2012 by 20.62 % in the treatment having 25 pairs. Seed weight reduction in other treatments were 17.54%, 15.39%, 12.58% and 10.31% where 20-pairs, 15-pairs, 10-pairs and 05-pairs were released, respectively. The minimum reduction (10.31 %) in seed weight was observed in treatment having 5 pairs. The present study results can be compared with those of Sewify and Semeada [16] who reported that with population of 50 per boll, *O. hyalinipennis* caused 32 per cent reduction in seed weight. The embryos are shriveled and discolored [10] and weight loss can occur up to 15% [15].

Table 1: Lint Staining and its colour in different Treatments during 2011- 2012

Sr.#	Treatments	Lint staining during 2011-12	Color of Lint
T1	5-Pairs	1	White
T2	10-Pairs	2	Light yellowish
T3	15-Pairs	3	Slightly yellowish
T4	20-Pairs	4	Slightly dark yellowish
T5	25-Pairs	4	Slightly dark yellowish
T6	Control	0	Pure white

In case of cotton lint staining, maximum staining was shown in the treatment having 25-pairs and 20-pairs of DCB which is slightly dark yellowish during both the year i.e., 2011 and 2012. Lint in the Control was found to be pure white. Staining effect was not observed in the treatment having 5-pairs of DCB as lint was white in color. However, 10 and 15-pairs of DCB showed the light Yellowish and slightly yellowish lint staining, respectively. The present findings are also in conformity with those of Khan *et al* [9] who reported that the color of lint changed from pure-white to white when bolls were exposed to 10 and 15 pairs of bugs, while it changed to light-yellow and slightly yellow when bolls were exposed to 20 and 25 pairs of bugs, respectively. The present findings are contradicted with those of Srinivas and Patil [17] who reported no lint staining occurred with the release of 10-pairs/boll of DCB. From the above results, it is evident that population of 5-pairs of DCB per boll does not reduce the quality of cotton lint. Furthermore, it is concluded that yellowing of cotton lint increased with increasing the DCB numbers per boll.

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