Academic Journal of Entomology 11 (2): 36-39, 2018
ISSN 1995-8994

DOI: 10.5829/idosi.aje.2018.36.39

Change of Cotton Lint Quality as Influenced by Insect Growth Regulators (IGRs) Used against Dusky Cotton Bug, *Oxycarenus hyalinipennis* Costa (Hemiptera: Lygaeidae)

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Abstract: This studywas conducted to investigate the effect of five Insect Growth Regulators (IGRs) i.e., Methoxyfenozide (Runner® 240SC), Lufenuron (Silent® 5EC), Triflumuron (Capture® 20SC), Pyriproxyfen (Priority® 10.8EC) and Lufenuron (Match® 50EC) against dusky cotton bug, *Oxycarenushyalinipennis*and its impact on lint quality of cotton.Counted number of *O. hyalinipennis* was exposed to and detained on seedcotton treated with LC_{50}, LC_{70}, LC_{90} and LC_{100} of the same insecticides. The lint with released *O. hyalinipennis* (dead and alive) was ginned conventionally at different post treatment intervals that were 1, 2, 3, 4, 5, 6 and 7 day post treatment and deterioration in lint quality was determined on the basis of lint staining scale. The results revealed that the color of lint changed from light yellow to white when seedcotton were exposed to Runner® and Silent® whereas from slightly yellow to white when exposed to Capture®, Priority® and Match® during 7 day post treatment. The present research work will helpful to use the environmental friendly IGRs against *O. hyalinipennis* and protect the lint quality which ultimately affects the market price/value.

Key words: Insect Growth Regulators · Lint Quality · Dusky Cotton Bug · DPT

INTRODUCTION

Cotton is amain cash crop for Pakistan and a major source of foreign exchange. It accounts for 7.8% of the value added in agriculture and 1.6% of the Gross domestic product (GDP)[1]. The value added by the cotton crop accounts for 37.1% of the overall agriculture earnings [2, 3]. Average per acre yield of cotton in Pakistan is still low compared to other countries [4]. Amongstseveral factors which are responsible for the low yield of cotton, insect pests are the most important factor causing 30-40% yield losses [5, 6].

The dusky cotton bug *Oxycarenushyalinipennis* is an emerging threat to the cotton industry of Pakistan but still there is debate going on about its pest status. While in many countries, it has gotten the status of major pest of cotton responsible for qualitative and quantitative losses in cotton. The *O. hyalinipennis* begins feeding, mating and laying eggs when mature cotton seeds are available. Both nymphs and adults suck oil from seeds. Females lay eggs in the cotton lint and feed on the seeds [7].

Oxycarenus hyalinipennis was reported as a serious pest of cotton that caused not only weight losses in cottonseed, but decreased germination and oil quality in Egypt [8]. Feeding by large populations of *O. hyalinipennis* can cause 88% reduction in seed germination [9]. This pest caused 6.8, 32 and 6 percent reduction in cotton yield, seed weight and oil content, respectively [9]. When population of dusky cotton bug was 50 pairs/boll, it caused losses in cotton weight (42.92%), seed weight (40.84%), oil contents (35.16%) and seed germination (29-32%)[10]. Due to the crushing during ginning process, the lint of cotton is stained to pinkish color [8]. After the attack of these bugs, cottonseeds show normal from the outside, but the embryos are shrunken, stained and 15% weight loss can occur [11,12]. It has been considered as major pest of cotton and Okra in Southeast Asia, India and Africa [8]. Besides cotton, feeding of dusky cotton bug has also

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been reported on many fruits and vegetables which includeokra, grapes, corn, apple, figs, avocado, pineapple, dates, peach and pomegranate, as well as hibiscus [13].

Previously, lepidopterous pests on cotton were controlled by broad spectrum insecticides such as Pyrethroids which also controlled and suppressed the minor pests [14] but now with the successful cultivation of *Bt* cotton on large scale dramatically reduced the pesticides application on cotton crop in throughout growing season [15]. It is, therefore essential to screen out highly effective, toxic and/or deterrent insecticides as well as their effective doses which can be recommended against this bug in future to minimize the probabilities of its migration and settling to cotton field.

The currentstudywas planned to investigate the change in cotton lint quality as influenced by some insect growth regulators (IGRs) i.e., Methoxyfenozide (Runner® 240SC), Lufenuron (Silent® 5EC), Triflumuron (Capture® 20SC), Pyriproxyfen(Priority® 10.8EC) and Lufenuron (Match® 50EC)used against dusky cotton bug, *Oxycarenushyalinipennis*.

MATERIALS AND METHODS

The experiment was conducted in Integrated Pest Management (IPM) laboratory at Department of Entomology, University of Agriculture, Faisalabad (UAF), Pakistan, during 2012.

Collection of the Dusky Cotton Bug: Population of *O. hyalinipennis* was collected from cotton field area of University of Agriculture in large plastic jars by shaking the infested plants parts inside the jars. The collected population was separated into adults and immatures (nymphs) populations in rearing cages provided with their respective food i.e., cotton bolls and leaves. The cages, having adults, was also be provided with seedcotton for collection of eggs which was separated, placed on soaked filter paper till hatching. The hatched young ones were shifted to new cages. Similarly, adults from cages of nymphal stages were aspirated and shifted to adult cages for eggs production. The collected eggs were placed on moist filter paper and put inside incubator that was maintained at 30±5°C and 60-65% R.H. The hatched nymphs were shifted to nymphal cages till their transformation into adults. The culture of *O. hyalinipennis* was maintained for whole set of experiments.

Table 1: Scale for determination of visual staining of lint caused by the *O. hyalinipennis*

Lint Staining Scale	Color of Lint
0	Pure White
≤ 1	White
≤ 2	Light Yellow
≤ 3	Slightly Yellow
≤ 4	Slightly Dark Yellow
≤ 5	Dark Yellow

Determination of Cotton Lint Quality Alteration as Influenced by IGRs *O. hyalinipennis*: A counted number of mixed populations (10 individuals of each life stages) of *O. hyalinipennis* was exposed to and detained on seedcotton treated with LC_{50}, LC_{70}, LC_{90} and LC_{100} of each insecticide. The seedcotton with released *O. hyalinipennis* (Dead/alive) was ginned conventionally at different post treatment intervals, i.e., 1, 2, 3, 4, 5, 6 and 7day post treatment and deterioration in its lint quality was determined on the basis of visual lint staining scale as described by Srinivas and Patil[14]and given below in Table 1.

Statistical Analysis: The data collected on % repellency and lint staining was subjected to Analysis of Variance (ANOVA) and Tukey's Honestly Significant Difference (HSD) Test.

RESULTS AND DISCUSSION

Highly significant variation in lint color was observed when *O. hyalinipennis* was exposed to different insect growth regulators at different post treatment intervals (Table 2). As the results showed, after 1 and 3 DPT intervals, the lint color was changed to light yellow when exposed to Runner® (1.6 and 2.0 grade staining, respectively) and Silent® (1.8 and 2.0 grade staining, respectively); while after 4 DPT intervals, changed to light yellow when exposed to Capture® (1.6 grade staining), Priority® (1.6 grade staining) and Match® (1.6 grade staining) (Table 3).

After 2 DPT intervals, the lint color was changed to slightly yellow when exposed to Runner® (2.2 grade staining) and Silent® (2.4 grade staining); while after 1 to 3 DPT intervals, changed to slightly yellow when exposed to Capture® (2.4, 2.6 and 2.2 grade staining, respectively), Priority® (2.6, 2.6 and 2.2 grade staining, respectively) and Match® (3.0, 2.6 and 2.4 grade staining, respectively) (Table 3).

Table 2: ANOVA parameters of different days post treatment intervals of insect growth regulators on lint quality of seedcotton used against *O. hyalinipennis*

		Insect Growth Regulators	
Lint Staining(Day post treatment)	df	F	P
1	$6^a/28^b$	34.4	< 0.01
2	$6^a/28^b$	28.5	< 0.01
3	$6^a/28^b$	62.5	< 0.01
4	$6^a/28^b$	95.9	< 0.01
5	$6^a/28^b$	202	< 0.01
6	$6^a/28^b$	152	< 0.01
7	$6^a/28^b$	104	< 0.01

a = Degree of freedom for different insect growth regulators; b = Error degree of freedom.

Table 3: Effect of different DPT intervals of different insect growth regulators on lint quality of seedcotton used against *O. hyalinipennis*

	Days Post Treatments						
IGRs	1	2	3	4	5	6	7
Runner®	1.6^d	2.2^b	2^b	1^b	1^{cd}	0.2^c	0.2^b
Silent®	1.8^{cd}	2.4^b	2^b	1^b	1^{bc}	0.2^c	0.2^b
Capture®	2.4^{bcd}	2.6^b	2.2^b	1.6^b	1^b	0.6^{bc}	0.2^b
Priority®	2.6^{bc}	2.6^b	2.2^b	1.6^b	1^b	1^b	0.2^b
Match®	3^b	2.6^b	2.4^b	1.6^b	1^b	1^b	0.6^b
C1	4^a	3.8^a	4.6^a	5^a	5^a	5^a	5^a
C2	0^e	0^b	0^c	0^c	0^d	0^c	0^b

C1 = Without IGRs and with O. hyalinipennis;C2 = Without IGRs and without *O. hyalinipennis* Means of mortality with different alphabets are significantly different from each other at 5% probability level by Tucky's HSD test

After 4 to 7 DPT intervals, the lint color was changed to white when exposed to Runner® (1.0, 0.2, 0.2 and 0.2 grade staining, respectively) and Silent® (1.0, 0.6, 0.2 and 0.2 grade staining, respectively); while after 5 to 7 DPT intervals, changed to white when exposed to Capture® (1.0, 0.6 and 0.2 grade staining, respectively), Priority® (1.0, 1.0 and 0.2 grade staining, respectively) and Match® (1.0, 1.0 and 0.6 grade staining, respectively) (Table 3).

After 1 to 2 DPT intervals, the lint color was changed to slightly dark yellow (4.0 and 3.8 grade staining, respectively); while after 3 DPT intervals, changed to dark yellow (4.6, 5.0, 5.0, 5.0 and 5.0 grade staining, respectively) in C_1 (Without IGRs and with *O. hyalinipennis*). After 1 to 7 DPT intervals, the lint color was remained pure white (0 grade staining) in case of C_2 (Without IGRs and without *O. hyalinipennis*) (Table 3).

The possibility of changing the lint color after 1-7 DPT is due to the mortality rate of different life stages of *O. hyalinipennis* and effectiveness of different IGRs. As the days gradually increased, the mortality rate of different life stages of *O. hyalinipennis* and effectiveness of different IGRs were decreased with the passage of time. As a result, lint color changed from light yellow to white. Exposure of Runner® and Silent® changed the lint color into white in 4 days treatment intervals while same effect was observed by collective action of all treatment in 5, 6 and 7 days post treatment intervals. After 1-7 day post treatment intervals, the lint revealed no changes in its color and remained pure white, when exposed to C_2 because lint was without IGRs and *O. hyalinipennis*.

Results are in agreement with those of Khan *et al*. [16] who had reported that after exposure of bolls to 10 and 15 bugs' pairs, the lint color was altered from pure white to white. While after exposure of bolls to 20 and 25 bugs' pairs, the lint color was altered to light yellow and slightly yellow, respectively. Results of this research work are not in agreement with those results which are reported by Henry [8]. According to him,due to the crushed insects, cotton lint is stained pinkish. According to research conducted by Schaefer and Panizzi [12] yellow coloration may be because of the reaction of toxic saliva, secreted during feeding, with immature cotton lint.

CONCLUSION

The study was conducted to investigate the alterationin lint quality of cotton influenced by five different IGRs which were used against *O. hyalinipennis*. Results indicated that color of lint was changed when seed cotton was exposed to the tested IGRs. This research will be helpful to the utilization of eco-friendly IGRs against the tested insect pest of cotton and keep the lint quality which eventually distresses the market price/value.

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