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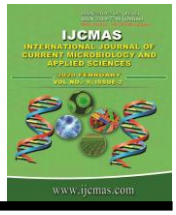

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Field Incidence of the Pink Bollworm on Bt Cotton in Raichur region of Karnataka

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A B S T R A C T

This study was conducted to assess the damage caused by the pink bollworm (PBW) to plants in Bt cotton fields. Fifteen fields in Raichur district of Karnataka were used for the study that was conducted during 2015-16. These included irrigated and rainfed fields. Boll and locule damage varied from 55.42 to 94.90%, and 63.18 to 90.20% respectively, across the fields. Average boll and locule damage under rainfed condition was 68.47% and 74.93%, whereas, it was 77.23% and 80.04%, under irrigated condition, respectively. There was no significant difference in the damage caused by PBW in both rainfed and irrigated conditions. This field study indicated that the damage to Bt cotton plants was very high in the study area, and was not influenced by cultural practices like irrigation, and the hybrids cultivated.

Introduction

Cotton is cultivated in nearly 12.35 million hectares in India (AICRP on Cotton, 2018), which is among the highest for any country. However, the productivity of cotton in India is low, which can be increased through improved plant protection, because insect pests alone reduce productivity by 50 to 60% (Sundaram *et al*., 1999). The devastations caused by the pink bollworm, *Pectinophora gossypiella* (Saunders) to Bt cotton crops in Gujarat and southern Deccan Plateau since 2015-16, suggest that yields from transgenic plants are below the potential. Recent trends show pink bollworm (PBW) as the greatest threat to Bt-cotton with repeated widespread attacks. Kranthi (2015) reported that PBW has developed resistance to both *Cry1Ac* and *Cry2Ab* endotoxin genes.

PBW was of serious concern to cotton farmers about 30 years ago due to which many nations banned import of raw cotton from India. Interestingly, the PBW populations remained low since 1982; populations seem to have rebounded only since 2015 (Kranthi, 2015). Non-compliance

of refuge strategy (Tabashnik *et al*., 2010), poor maintenance of trait purity, or loopholes in the interactions between the insect and the plant, could have led to the development of resistance in PBW.

Though, infestation by PBW on cotton in multiple cotton growing belts is widespread/apparent, the studies related to assessment of damage on *Bt* cotton is scanty. This study therefore aimed at estimating the damage caused by PBW to Bt cotton plants in Karnataka.

Materials and Methods

Damage assessments of PBW were taken up during 2015-16 in15 Bt cotton fields spread across Raichur district, Karnataka, which is one of the major cotton-growing areas. Different hybrids of Bt cotton, namely *BanniBt, Bindas, Ajeeth, Bhakthi, Varsha, Jaadoo, Kaveri, ATM* and *Lakshmi gold* which are cultivated in the farmers' field, were sampled during the study period.

Of the 15 fields, four were cultivated under rainfed conditions, and the remaining were irrigated. From each Bt cotton field, 30 plants were selected at random for assessing the extent of damage.

Following observations were recorded from selected plants

A) total number of opened bolls; B) total number of squares and un-opened bolls; C) total number of bolls infested by PBW (includes squares, un-opened and opened); D) five mature bolls were randomly selected from each plant and parameters like, total number of locules/boll, number of locules damaged by PBW were recorded from the selected bolls. Student's t-test and ANOVA tests were used to analyse the data.

Results and Discussion

The results from the study showed that all the selected fields, irrespective of the hybrid and cultivation practices followed by the farmers, were damaged by PBW. Similarly, all 30 plants sampled in each field were damaged. The boll damage varied from 55.05 to 96.52 per cent across the selected fields. The boll damage was significantly different across the fields studied and highest boll damage was recorded in field no. 11, 12 and 15 (Table 1) (One-way ANOVA, $F=15.36$, $P<0.05$, df=14, 449).

Similarly, locule damage varied from 63.17 to 90.29 per cent across the selected fields. The locule damage was also significantly different across the fields studied and highest locule damage was recorded in field no. 5, 6, 7, 11 and 15 (One-way ANOVA, $F=11.03$, $P<0.05$, df=14, 449). The average boll and locule damages were 74.73 per cent (n=8,421 bolls) and 78.59 per cent (n=9,406 locules) across the fields studied (Fig. 1). In the case of Bt cotton, the primary field evidence for development of resistance in a bollworm species is large scale damage to the crop by the target bollworm. Damage by PBW ranged from >50% to >90% across different fields, which was very high; some of the farmers could not harvest a single boll in their fields. All these establish that the field populations of PBW were resistant to Bollgard-II.

Damage under rainfed and irrigated cotton fields

The average boll and locule damage under rainfed condition (n=4 fields) was 68.47 per cent (n=2,360 bolls) and 74.93 per cent (n=2,534 locules) respectively, while the same under irrigated condition (n=11 fields) was 77.23 per cent (n=6,061 bolls) and 80.04 per cent (n=6,872 locules), respectively.

Table.1 Extent of damage to Bt cotton plants, bolls and locules caused by PBW in Raichur region

Field No.	Hybrids planted by farmers	Damage parameters					
		Total number of bolls		Total no. of infested bolls	% Plant damage	% Boll damage	% locule damage
		Green	Open				
1	BanniBt	245	402	492	100	74.29 ^{b}	69.83 ^{b}
2	Bindas*	269	155	235	100	55.05 ^{b}	77.18 ^{b}
3	Ajeeth*	280	388	494	100	73.18 ^{b}	63.17 ^{b}
4	Bhakthi*	251	395	491	100	75.46 ^{b}	76.35 ^{b}
5	Unknown*	241	381	426	100	66.42 ^{b}	81.16 ^{a}
6	Ajeeth	159	373	431	100	80.56 ^{b}	90.29 ^{a}
7	Varsha	213	240	357	100	79.64 ^{b}	87.09 ^{a}
8	Jaadoo	453	397	562	100	67.37 ^{b}	78.69 ^{b}
9	Kaveri	189	257	299	100	64.46 ^{b}	68.04 ^{b}
10	Jaadoo	239	300	377	100	68.21 ^{b}	72.85 ^{b}
11	ATM	175	199	355	100	96.52 ^{a}	86.83 ^{a}
12	Lakshmi gold	260	256	420	100	83.31 ^{a}	80.74 ^{b}
13	Bhakthi	313	367	488	100	72.67 ^{b}	79.37 ^{b}
14	Unknown	257	171	325	100	76.93 ^{b}	78.17 ^{b}
15	BanniBt	189	407	516	100	86.80 ^{a}	89.01 ^{a}
					SEm±	**0.05**	**0.03**
					CD @5%	**0.37**	**0.25**

(n=30 plants from each field); *-Rainfed fields

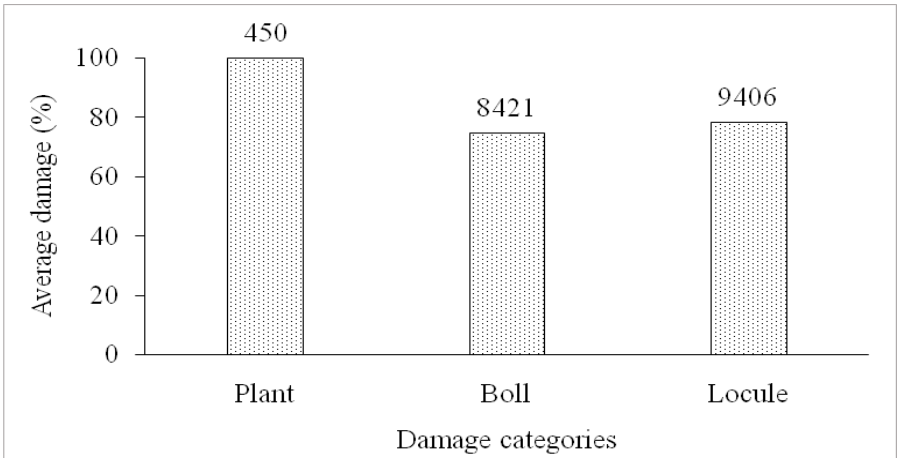

Fig.1 Average infestation of PBW to plants, bolls and locules at sampling in the Raichurregion during 2015. The number of samples in each category has been mentioned above the respective columns.

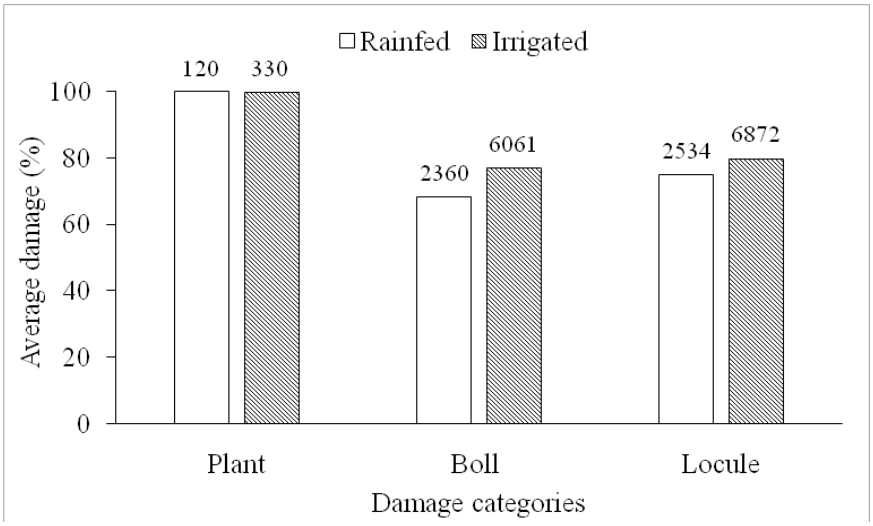

Fig.2 Average infestation of PBW to plants, bolls and locules in the rainfed and irrigated cotton fields in Raichurregion during 2015. The number of samples in each category has been mentioned above the respective columns.

There was no significant difference between the two conditions (Student's t-test, boll damage t=1.83, P=0.09, df=14; locule damage t=1.31, P=0.21, df=14) (Fig. 2). Blaise and Kranthi (2011) suggested that the Bt toxin concentration in the Bt cotton plants was directly related the soil moisture content in the soil. That means, plants cultivated under irrigated condition will have better expression of Bt toxins than the plants cultivated under rainfed conditions.

One would expect a lesser PBW damage in the plants with better expression of Bt toxins. However, the present study reveals that, there is no such difference in the damage caused by PBW to the Bt cotton plants cultivated under both irrigated and rainfed conditions. In contrary to the above results and the literature pertaining to the Bt toxin expression, Gutierrez *et al*., (2015) recorded PBW damage only in the irrigated cotton fields, but not in the rainfed cotton fields in Yavatmal district, which is one of the major cotton growing district in Maharashtra.

Although cotton serves as a host for a variety of herbivorous insects, it is usual for one insect species to dominate the others and reach pestiferous levels at a given time. The failure of Bt cotton in reducing PBW populations, and the near absence of other bollworm species, has, perhaps, created a vacant niche for the PBW, thus allowing it to build pestiferous populations. Over reliance on plant genotype for pest management is certainly a major reason for the PBW outbreak. Therefore, it is suggested that standard Integrated Pest Management practices have to be followed irrespective of the plant genotype.

References

AICRP on Cotton, 2018, Project Coordinator's Report: 2017-18, http://aiccip.cicr.org.in/CD_17-18/3_A1_A17_PC_report.pdf.

Blaise, D And Kranthi, K. R., 2011, Cry1Ac expression in transgenic *Bt*cotton hybrids is influenced by soil moisture and depth. *Current Science*,101(6):783-786.

Kranthi, K. R., 2015, Pink bollworm strikes Bt.-cotton. *Cotton statistics and news*, Cotton Association of India. No.35: 1-6.

Sundaram, V., Basu, A. K., Krishna Iyer, K.

R., Narayanan, S. S., and Rajendran, T. P., 1999, Handbook of cotton in India. Mumbai: Indian Society for Cotton Improvement. p. 552.

Tabashnik, B. E., Sisterson, M. S., Ellsworth, P. C., Dennehy, T. J., Antilla, L., Liesner, L., Whitlow, M., Staten, R. T., Fabrick, J. A., Unnithan, G. C., Yelich, A. J., Ellers-Kirk, C., Harpold, V. S., LI, X. C. and Carriere, Y., 2010, Suppressing resistance to Bt cotton with sterile insect releases. Nature Biotechnology., 28(12):1304-1307.

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