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Screening of Sugarcane Genotypes for Resistance Against Early Shoot Borer, *Chilo Infuscatellus* Snellan

Y. Swathi, M. Saicharan, P. Jalendar Naik, G. Eswara Reddy, G. Rakesh, M. Vijay Kumar, M. Sreedhar

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ABSTRACT

Genotypes of various maturity groups were evaluated against early shoot borer, *Chilo infuscatellus* Snellan under natural field conditions at Regional Sugarcane and Rice Research Station, Rudrur, Nizambad which fall under semi-arid tropics in Northern Telangana Zone of Telangana state in India during Eksali season 2019-20. The per cent incidence of Early shoot borer (ESB) at different days after planting was varied among the genotypes. The highest per cent incidence of ESB was recorded at 60 Days after planting (2.94 to 30.64) followed by at 90 Days after planting (1.33 to 25.73) and the percent incidence at 45 Days after planting ranged from 0.00 to 12.3 and lowest per cent incidence was recorded at 120 Days after planting (0.31 to 7.58). Based on cumulative incidence, 18 genotypes were classified as less susceptible (8), moderately susceptible (9) and 1 genotype as highly susceptible. The genotype 2014 R 11 exhibited least susceptibility to early shoot borer with cumulative incidence of 2.76% whereas highest cumulative incidence of 31.22 was recorded in Co 8014.

Keywords Early shoot borer, *Chilo infuscatellus,* Genotypes, Per cent incidence, Resistance.

INTRODUCTION

Sugarcane (*Saccharum officinarum* L.) is a commercial and cash crop grown in tropical and subtropical countries of the world. Sugarcane crop effectively collects the solar energy and stores this energy in the form of fiber and fermentable sugars which are used as biproducts in industries. In India, it is cultivated in an about 4.57 million hectares of land with annual production of 355.70 million tonnes and productivity of 77.89 tonnes per hectare during 2019-20 (Directorate of Economics and Statistics 2020). The major constraints in yield improvement of sugarcane are incidence of various pest and diseases, inadequate irrigation facilities, lack of multiple resistant varieties, poor knowledge levels of sugarcane growers in judging the actual time of incidence of pest and diseases in sugarcane, nine species of insect pests attack regularly and cause considerable damage to the crop (David 1977). Among the insect pests the borers, particularly early shoot borer (*Chilo infuscatellus* Snellan),was found to be more deterrent pest, widely

Y. Swathi[1]*, M. Saicharan[2], P. Jalendar Naik[3] G. Eswara Reddy[4], G. Rakesh[5]

[1,2,3,4,5]Scientist, Regional Sugarcane and Rice Research Station, Rudrur, Telangana 500030, India. Professor Jayashankar Telangana State Agricultural University

M. Vijay Kumar[6], M. Sreedhar[7]

[6,7]Principal Scientist, Regional Sugarcane and Rice Research Station, Rudrur, Telangana 500030, India
Professor Jayashankar Telangana State Agricultural University
Email: swathiagri09@gmail.com
* Corresponding author

distributed and cause huge damage in all sugarcane growing areas in the country. It infests the crop during inter node formation stage. The young larvae bore into the mother shoot and move upwards and destroy the apical meristem resulting in drying of entire clump which leads to suboptimal plant stand during germination phase of the crop. But during tillering phase, the infestation of early shoot borer causes mortality of tiller loss in yield due to formation of canes with reduced weight and sucrose content (Krishnamurthy Rao 1954). Some researchers have reported that, the early shoot borer causes 41.29% incidence during tillering stage (Umashankar *et al.* 2017) and destroys 23-65% mother shoots and 6.4, 27.1 and 75% primary, secondary and tertiary tillers respectively (Khan and Krishnamurthy 1956).

Several control methods have been evaluated from time to time. Among the different management strategies, the use of resistant genotypes is one of the important components of Integrated Pest Management. The use of resistance genotypes is the efficient way to reduce the economic damage caused by early shoot borer. Therefore a field level investigation was taken up to identify resistant genotypes to early shoot borer under natural conditions.

MATERIALS AND METHODS

Preliminary study on field screening of 18 genotypes was done to identify less susceptible clones against ESB, *Chilo infuscatellus* Snellan during 2019-20 at Regional Sugarcane and Rice Research Station, Rudrur which fall under semi-arid tropics in Northern Telangana Zone of Telangana state in India. Three budded setts of 18 genotypes with known checks Co 8014 and Co 86032 were considered for investigation.

The experiment was laid out in a Randomized Block Design with 18 genotypes and was replicated thrice. The planting of crop was taken up during second fortnight of February 2019. All agronomic practices were carried out as per the package of practices recommended for sugarcane cultivation in Telangana state. No plant protection measures were taken up in experimental plot.

The cumulative per cent incidence was worked out by relative the progressive totals of infested tillers (dead hearts) in proportion to the total number of tillers (Sithanantham 1973) at 120 Days after planting. Based on the per cent cumulative incidence of early shoot borer, genotypes were graded according to Rao and Krinshnamoorthy (1973).

Table 1. Categorization of early shoot borer incidence based on cumulative per cent incidence.

Sl. No.	Grade/ Category	Cumulative per cent incidence
1	Less susceptible (LS)	0-15%
2	Moderately susceptible (MS)	15-30%
3	Highly susceptible (HS)	>30%

The number of dead hearts caused by early shoot borer out of the total number of tillers observed in all the entries at 45, 60, 90 and 120 days after planting (DAP) was recorded. After each count, the dead hearts were pulled out to avoid counting them later on. The per cent incidence of early shoot borer and cumulative per cent incidence were calculated by using formula mentioned below.

$$\text{Percentage of incidence (SSB)} = \frac{\text{No. of deasd hearta}}{\text{Total No. of shoots}} \times 100$$

$$\text{Cumulative percent incidence (ESB)} = \frac{\text{Total no. of dead hearts at 120 DAP + No. of dead hearts at 45,60 and 90 DAP}}{\text{Total no.of shoots at 120 DAP}} \times 100$$

RESULTS AND DISCUSSION

The perusal of data in Table 1 indicated that, per cent incidence of early shoot borer at 45 days after planting in all the screened genotypes ranged from 0.00 to 12.3. Based on the per cent incidence of early shoot borer at 45 days after planting, 16 genotypes were less susceptible including two checks viz., Co 8014 (12.3) and Co 86032 (2.7). Among these 16 less susceptible genotypes viz., 2016R22, 2016R36, 2016R37, 2016R60,2016R61, 2016R97, 2013 R76, 97R129, 2014R50, 2014R11, 2015R21, 2015R33 recorded zero per cent incidence at 45 days after planting. However 2016R62 (1.17), 2016R74 (0.95), 2013R 81(0.49) and 2010R 854 (3.51) recorded values as mentioned in parenthesis. None of the genotypes fell

under moderately and highly susceptible category (Table 2). It was found that most of the genotypes were found free from the incidence of early shoot borer. This might be due to fast growth of the genotypes which might have helped to the genotypes to escape from the early shoot borer incidence. Similar observations were also made by Umashankar *et al.* 2017, Karla and Chaudhary (1964). The genotypes viz., 2016R36, 2016R61, 2016R97, 2013R76, 2013R81, 2014R11 and 97R129 have out performed in terms of resistance to early shoot borer consistently from 120 days after planting and they were classified under less susceptible category.

Incidence of early shoot borer at 60 DAP in all the screened genotypes had ranged from 0.00 to 30.64%. Among the 18 genotypes, 10 genotypes were graded as less susceptible (LS) and 97 R129 (2.94%), 2014R11 (3.65%) and 2016R61 (4.37%) were found to be resistant to early shoot borer. Six genotypes i.e., 2016R37 (15.68%), 2016R 62 (15.61%), 2016R74 (20.92%), 2014R50 (16.18%) and 2010R 854 (16.94%) including standard check Co 86032 (22.55%) fell under moderately susceptible category. The genotype 2016 R22 with 30.14 % incidence was classified highly susceptible at 60 days after planting. The per cent incidence of early shoot borer steadily increased from 30th to 90th day and there after it declined. This is in confirmation with the findings of Sithanatham *et al*. (1975). The young crop at 30 to 60 days was found susceptible to early shoot borer as female moths prefer to lay eggs at 45 days old crop. This is in line with findings with Rao and Shiva (1962).

At 90 days after planting, the per cent incidence of early shoot borer in all the genotypes had decreased. The incidence ranged from 0.00 to 25.73%. None of the genotype was recorded highly susceptible at 90 DAP. The genotype 2016R 22 (17.47%) along with check Co 8014 (25.73%) were moderately susceptible. Remaining 16 genotypes were less susceptible to early shoot borer. Among less susceptible genotypes, 2014R11 (1.33%) was recorded lowest incidence of early shoot borer (Table 2 and Fig. 1).

Table 2. Cumulative per cent incidence of early shoot borer *Chilo infuscatellus* in various sugarcane genotypes during 2019-20 at regional sugarcane and rice research station, Rudrur.

Sl. No.	Genotype	Per cent incidence of ESB					
		45 DAP	60 DAP	90 DAP	120 DAP	Cumulative incidence	
1	2016R 22	0.00(0.00)	30.14 (33.27)	17.47 (23.86)	5.3 (13.23)	23.99 (29.25)	MS
2	2016R36	0.00(0.00)	11.41(19.59)	9.19 (17.61)	3.98 (11.49)	13.32 (21.38)	LS
3	2016R37	0.00(0.00)	15.68 (23.25)	12.45 (20.63)	3.93 (11.32)	16.75 (24.05)	MS
4	2016R60	0.00(0.00)	11.48 (19.53)	7.42 (15.72)	4.9 (12.69)	17.87 (24.70)	MS
5	2016R61	0.00(0.00)	4.37 (9.49)	3.85 (10.98)	1.19 (6.22)	5.3 (12.90)	LS
6	2016R62	1.17 (3.59)	15.61 (22.72)	10.19 (18.30)	4.2 (11.66)	15.08 (22.83)	MS
7	2016R74	0.95 (3.24)	20.92 (27.16)	13.39 (21.35)	3.83 (11.23)	15.68 (23.30)	MS
8	2016R97	0.00(0.00)	7.16 (15.48)	3.28 (8.54)	1.93 (6.53)	9.22 (17.63)	LS
9	2013R76	0.00(0.00)	6.15 (14.02)	5.85 (12.91)	3.87 (11.07)	10.19 (18.57)	LS
10	2013R81	0.49 (2.32)	6.57 (14.38)	4.81 (12.46)	3.87 (11.00)	9.74 (18.17)	LS
11	2014R50	0.00(0.00)	16.18 (23.49)	13.65 (21.59)	4.37 (12.01)	15.59 (23.25)	MS
12	2014R11	0.00(0.00)	3.65 (10.79)	1.33 (5.42)	0.31 (1.85)	2.76 (9.19)	LS
13	97R129	0.00(0.00)	2.94 (8.05)	1.96 (6.55)	1.97 (6.60)	4.04 (11.54)	LS
14	2010R854	3.51(8.80)	16.94 (22.02)	13.52 (19.82)	2.04 (7.88)	15.07 (22.61)	MS
15	2015R21	0.00(0.00)	12.18 (20.25)	10.2 (15.33)	5.75 (13.15)	16.26 (23.69)	MS
16	2015R33	0.00(0.00)	12.89 (19.37)	10.43 (17.96)	7.58 (15.90)	16.94 (23.83)	MS
17	Co8014	12.3(20.52)	30.64 (33.58)	25.73 (30.45)	6.91 (15.22)	31.22 (33.94)	HS
18	Co86032	2.7 (5.51)	22.55 (28.24)	9.6 (17.95)	5.08 (12.87)	17.69 (24.85)	MS
	Mean	1.17	13.75	9.68	3.95	14.26	
Range	Minimum	0	2.94	1.33	0.31	2.76	
	Maximum	12.3	30.64	25.73	7.58	31.22	
	SEm (+)	2.13	3.36	3.49	1.73	1.70	
	CD @ (p=0.05)	6.15	9.69	10.08	4.99	4.89	

*Figures in parentheses are angular transformed values.

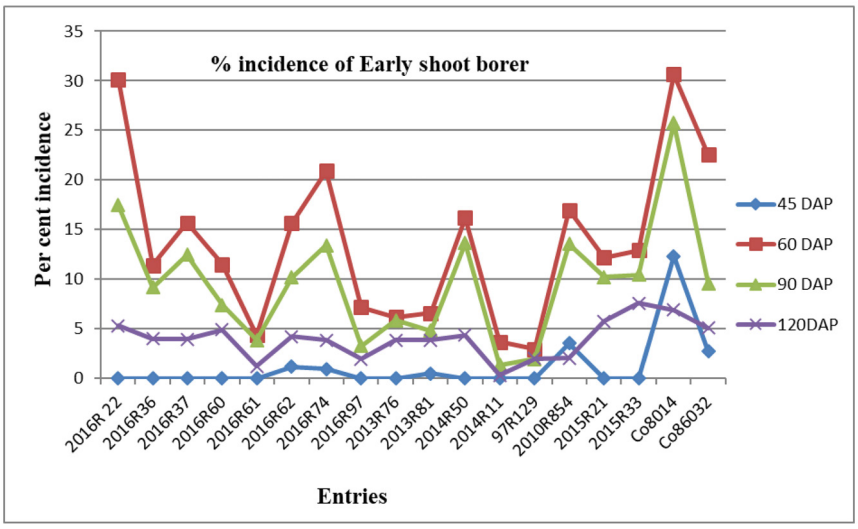

Fig. 1. Progressive per cent incidence of Early Shoot Borer *Chilo infuscatellus* from 45 day after planting to 120 days after planting in various genotypes during 2019-20 at Regional Sugarcane and Rice Research Station, Rudrur.

Similarly at 120 days after planting the percent incidence of early shoot borer decreased further. The per cent incidences of early shoot borer at 120 DAP in all the screened genotypes ranged from 0.31 to 7.58. All the 18 genotypes were grouped under less susceptible categories including two standard checks. Highest incidence of early shoot borer was recorded in 2015R 33 (7.58%). All the genotypes including both the standard checks Co 8014 (6.91%) and Co 86032 (5.08%) were found least susceptible to early shoot borer. It could be due to inherent capacity to produce more number of tillers, thereby reducing the shoot borer incidence. These results were found similar with findings of Umashanker *et al.* (2017), Rao and Rao (1961).

CONCLUSION

The results of field screening of various genotypes for resistance to early shoot borer revealed that the genotypes viz., 2014R11 (2.76%), 97R129 (4.04%), 2016 R61 (5.3%), 2016R97 (9.22%), 2103R81 (9.74%), 2013 R 76 (10.19%) and 2016R36 (13.32%) recorded less than 15% of incidence (Less Susceptible) while genotypes 2010R854 (15.07%), 2016R62 (15.08%), 2014R50 (15.59%), 2016R74 (15.68%), 2015R21 (16.26%), 2016R37 (16.75%), 2015R33 (16.94%), Co 86032 (Check-17.69%), 2016R60 (17.87%) and 2016R 22 (23.99%) recorded 15 to 30 % incidence (moderately susceptible), whereas check Co 8014 (31.22%) has recorded above 30% incidence by early shoot borer and was graded as highly susceptible (HS).

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