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SCREENING OF FORAGE SORGHUM HYBRIDS FOR STEM BORER INFESTATION UNDER NATURAL CONDITIONS IN NORTH-WESTERN HARYANA

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ABSTRACT
Experiment was conducted to evaluate forage sorghum hybrids along with resistance checks for stem borer resistance related traits at CCS HAU Hisar, during *kharif* 2017. To measure the insect pest infestation four parameters which directly related to insect infestation *viz.* percentage of dead hearts at 35 DAE (days after emergence), percentage of dead hearts at 45 DAE, total percentage of dead hearts after 45 DAE (%), stem tunneling at the time of 1st and 2nd cut were recorded. Among all, three hybrids (31A x HJ 541, 31A x IS 2205 and 31A x COFS 29) were recorded with lowest incidence of dead hearts at 35 DAE, 45 DAE and total dead hearts at 45 DAE. Among these hybrids 31A x IS 2205 is good green fodder yielder also.

KEY WORDS: Hybrids, dead hearts, tunneling and forage.

INTRODUCTION

Sorghum as a fodder crop is very popular among the farming community and the major area is under sorghum cultivation specially for fodder during *summer* and *kharif* season in the northern parts of India. It is mostly grown in parts where due to less rainfall production of corn crop is not possible. Livestock being an important part of the Indian economy and for the huge livestock population there is urgent need to target deficit fodder availability. In India, the area under cultivated sorghum is 6.07 million hectare with production of 4.23 million tonnes and productivity 697 kg/ha. In Haryana, 53 thousand hectares area was under sorghum with production of 28 thousand tons and productivity 528 kg/ha for grain (Anonymous, 2015-2016). But there is a significant deficit in green fodder and dry fodder availability in country. Insect pest incidence being a major factor causing huge lose of fodder quality as well as quantity. ICRISAT, 1992 reported, an annual loss of $1 billion in the semi arid tropical region as the crop is attacked by nearly 150 insect species. Among which the stem borer species is considered as serious pests of sorghum. In present scenario insect pest infestation in *kharif* sorghum is major threat to yield and quality

Spotted stem borer, *Chilo partellus* (Swinhoe) (Lepidoptera: Pyralidae) is one of the most damaging insect pest which causes 35% infestation and cause huge loss in fodder yield and quality of sorghum (Divya *et al*., 2009) during *kharif* and *Rabi* seasons. Due to stem borer damage, the upper two leaves dry up as the third instar larvae of the stem borer bore into the shoot and migrate to the base of the plant damaging the growing point, producing a symptom called “Dead Hearts”. Larvae continue to feed inside the stem throughout the crop growth resulting in poor development of grains, stem breakage, lodging, direct damage to panicles and loss in grain yield.

Stem borer infestation starts about 20 days after seedling emergence, and dead hearts appear on 30-40 days old plants. Stem tunneling occurs at the later stages resulting in significant yield and quality reduction (Dhillon & Chaudhary, 2018). Hisar has been identified as the hotspot of stem borer infestation and screening and the problem is increased significantly over the years. For enhancing green fodder yield either we have to bring more area under fodder cultivation but due to urbanization, industrialization and traditional inclination among farmers there is little scope of increasing area under cultivation of fodder crops. Only 4.4% of the total cropped area of the country is under fodder crops cultivation and also our natural grazing lands and pastures are fast degrading and decreasing. Hence for green fodder production and productivity improvement coupled with better quality and developing multicut varieties/hybrids. So, before any breeding methodology can be effectively applied for improvement of sorghum material for these characters, a genetic analysis of forage quantitative characters is necessary. So keeping this in view, a study was conducted to develop forage varieties/hybrids with desirable characteristics; there is necessity of knowledge and information on genetic breeding strategy for genetic improvement of sorghum as fodder crop. Sorghum is classified as often cross pollinated crop and therefore, has the unique opportunity of being exploited both for additive genetic component by developing varieties and for non-additive genetic component by developing hybrids.

MATERIALS AND METHODS

The present investigation was conducted in the Forage Research Area of the Department of Genetics and Plant Breeding, Chaudhary Charan Singh Haryana Agricultural University, Hisar (Haryana), India during *Kharif* 2017. During the season from April to November in 2017 rainfall received was 532.6 mm in 25 rainy days. Hisar is located at 29° 10' N, 75° 46' E and altitude is 215.2m. The experiment consisted of 3 replications raised in Randomized Block Design in 2r x 2m each. The experimental material comprised of twenty five forage sorghum hybrids, 10 parents (five females and five males) and two standard checks (SSG 59-3 and CSH 24MF).

The observations were taken on five randomly selected plants in each genotype for six parameters of insect infestation *viz.* percentage of dead hearts at 35 DAE (days after emergence), percentage of dead hearts at 45 DAE, stem tunneling-at the time of 1st cutting and 2nd cutting was also taken. Observations were recorded for stem borer (*Chilo partellus*) attack as set by Mathur (1991). For stem borer data were collected at 35 and 45 days after germination and per cent dead hearts were calculated using the following formula.

$$\% \text{ Dead heart} = \frac{\text{Number of dead heart/ plot}}{\text{Number of plants/plot}} \times 100$$

Observations were recorded at the time of 1st and 2nd cutting by measuring the length of tunnel produced by stem borer and then percentage of total plant height damaged by stem borer was calculated.

$$\% \text{ damage} = \frac{\text{Length of tunnel produced/ plant (cm)}}{\text{Height of plant (cm)}}$$

RESULT AND DISCUSSION

Data was obtained from thirty seven genotypes for various stem borer infestation related traits. Out of this COFS 29 genotype had least dead heart incidence at 35 days after emergence (0.85%). The mean dead hearts incidence was 11.93% and varied from 0.85 (COFS 29) to 29.29% (126A x HJ 541). Dead heart at 45 days after emergence ranged from 0.95 to 20.58% with a general mean value 7.20%. Dead heart at 45 days after emergence was least in SSG 59-3 *i.e*. 0.95%. After 45 days of emergence, total dead heart symptoms were least in 31A x HJ 541 (2.89%) but the range varied from 2.89 to 49.37% with a grand mean of 19.12%. No stem tunnelling was observed in 126A x COFS 29, 94012A x SSG 59-3 and 94012A x HJ 541 during both cuts but the range for I st cut varied from 0.00-7.12 and for 2nd cut tunnelling range was 0.00-12.09 (Table 1).

TABLE 1: Range for stem borer infestation related traits among parents and hybrids

S. No.	Trait	Range
1	Dead hearts 35 Days after emergence (%)	0.85-29.29
2	Dead hearts 45 Days after emergence (%)	0.95-20.58
3	Stem Tunneling at 1st cut	0.00-7.12
4	Stem Tunneling at 2nd cut	0.00-12.09

Analysis of variance: The analyses of variance for the characters under study are presented in Tables 2. There was significant genotypic variation among the genotypes for dead hearts at 35 DAE, 45 DAE and total dead hearts after 45 DAE (Table: 2) but for observation stem tunnelling at 1st cut, 2nd cut and total stem tunnelling of the season are not included in analysis due non significant variation. Percentage of dead hearts is insect resistance parameter. Lesser the percentage of dead hearts in the cross combination, more the resistance will be in hybrid against stem borer and therefore, significant negative heterosis is desirable for the character. Hybrids which were performing better than both checks: 31A x HJ 541, 31A x IS 2205 and 31A x COFS 29 over the first and second check. Out of all the parents best line was 31A & 14A and tester was IS 2205 having least damage caused by borer incidence. For insect resistance parameters, the parents 31A and IS 2205 were adjudged as good general combiner.

TABLE 2: Analysis of variance for insect resistance characters in forage sorghum

Sources of Variation	D.F.	Dead Hearts after 35 DAE	Dead Hearts after 45 DAE	Total Dead Hearts after 45 DAE
Replication	2	0.66	1.14	3.33
Treatment	36	183.06**	66.52**	402.82**
Error	72	3.51	2.35	5.94

Among all, three hybrids (31A x HJ 541, 31A x IS 2205 and 31A x COFS 29) were recorded with lowest incidence of dead hearts at 35, 45 and total dead hearts. Out of these 31A x IS 2205 being good green fodder yielder also.

Similarly, Bhagwat *et al.*, 2011 reported that deadhearts ranged from 11.7 to 42.2% and the mean damage was 21.6%. The entries CSV 17, IS 2312, IS 18551, CSV 15 and SPV 1616 were at par with the resistant check (IS 2205), which recorded 11.7% DH. Similarly, Muturi *et al.* 2012 reported upto 24 cm long tunnels in sorghum stem and IS 8193 genotypes under study had 8% more tunnelling as compared to most resistant genotype ICSA 472.

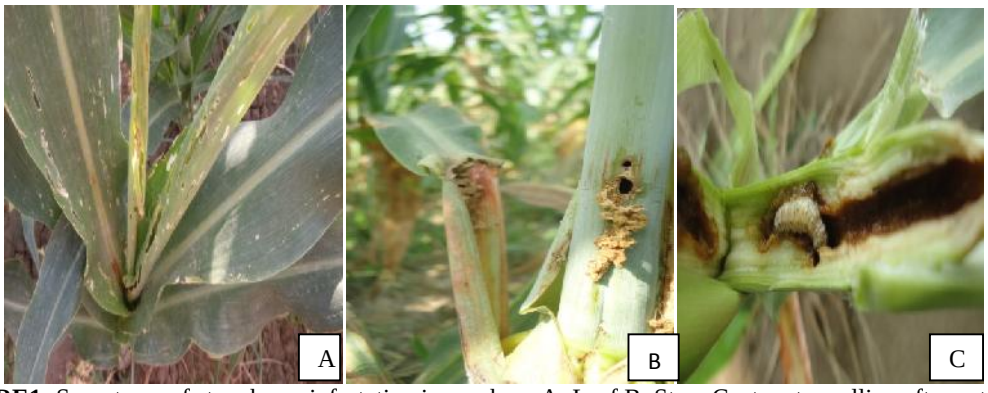

FIGURE1: Symptoms of stem borer infestation in sorghum A: Leaf B: Stem C: stem tunnelling after cutting of stem

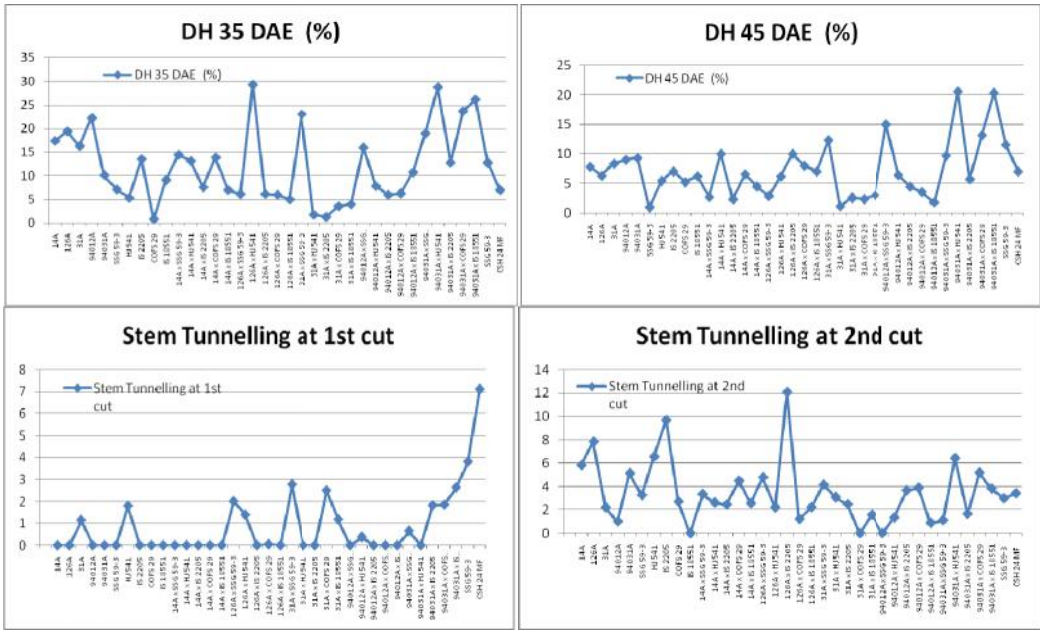

FIGURE 1: Showing performance of parents and hybrids for all stem borer infestation related traits (DH: Deadheart; DAE: Days after Emergence)

Hybrid 31A x HJ 541 exhibited the maximum negative heterosis for the insect resistance parameters followed by 31A x COFS 29. The result indicated that there is good scope for insect resistant improvement in sorghum through heterosis breeding. Similar results were reported by Tahir (2005). For insect resistance parameters, the parents 31A and IS 2205 were adjudged as good general combiner which can be exploited further for insect pest resistance breeding. From the above study it was concluded that hybrids 31A x HJ 541, 31A x IS 2205 and 31A x COFS 29 had recorded lowest incidence of dead hearts and hybrids 126A x COFS 29, 94012A x SSG 59-3, 94012A x HJ 541 had lowest stem tunneling % in the season under report. Out of which 31A x IS 2205 was recorded to have good green fodder yield also.

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