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Short communication. Screening of sorghum genotypes for resistance to damage caused by the stem borer *Chilo partellus* (Swinhoe)

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Abstract

Twenty sweet sorghum and three grain sorghum —*Sorghum bicolor* (L.) Moench— genotypes were tested for resistance to the damage caused by the sorghum stem borer *Chilo partellus* (Swinhoe) under infested field conditions in the Dharwad region of northern Karnataka, India. Five different types of damage were taken into account: leaf scraping, dead heart, pinhole, peduncle and stem tunnelling damage. Genotype SSV-7073 was found to be the most resistant with respect to all the damage types studied. In addition, the genotypes Nandyal, SSV-53, SSV-6928, HES-4 and IS-2312 showed little peduncle and stem tunnelling damage. These genotypes might be considered potentially resistant varieties and may serve as material of interest in sorghum improvement programmes.

Additional key words: insect damage, resistance, *Sorghum bicolor*.

Resumen

Nota corta. Evaluación de genotipos de sorgo para resistencia al barrenador del tallo *Chilo partellus* (Swinhoe)

En la región de Dharwad, en el norte de Karnataka (India) se evaluaron, en condiciones de campo, 20 genotipos de sorgo dulce y tres de sorgo de grano [*Sorghum bicolor* (L.) Moench], para estudiar los daños causados por el barrenador del tallo, *Chilo partellus* (Swinhoe). Se consideraron cinco clases de daños: hojas deshilachadas, hojas agujereadas, médula muerta y excavación de túneles en tallos y pedúnculos. El genotipo SSV-7073 fue el más prometedor y resistente para el conjunto de daños, y los genotipos Nandyal, SSV-53, SSV-6928, HES-4 e IS-2312 mostraron pocas excavaciones de túneles en tallos y pedúnculos. De aquí que estos genotipos pueden ser considerados como variedades potencialmente resistentes, y ser incorporados en programas de mejora del sorgo.

Palabras clave adicionales: daño por insecto, resistencia, *Sorghum bicolor*.

Sorghum, *Sorghum bicolor* (L.) Moench, is the main food and cash crop of millions of poor people associated with the predominantly mixed crop-livestock farming systems of both northern and southern India. Sorghum grows mainly in the rainy (July-October), late rainy (August-December) and post-rainy seasons. It is attacked by nearly 150 insect species, leading to annual losses of over $1.0 billion in the semi-arid tropical region (ICRISAT, 1992). Lepidopteran stem borers and other insect pests are the major biotic constraints to increase sorghum grain production in India. Durden (1953) studied the incidence of *Chilo partellus* on maize and sorghum in Kongwa and found the percentage infestation of sorghum to be > 35% higher than that suffered by maize. This author also reported the peak population of pests to occur in mid June.

Stem borers are difficult to control, largely because of the nocturnal habits of the adult moths and the cryptic feeding behaviour of the larvae, which reside inside the plant stems. The chemical control of stem borers is economically unviable and indeed impractical for many resource-poor, small-scale farmers. The technologies and chemical inputs that have proven harmful

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to human health and the environment need to be replaced with safer alternatives (Ranjekar *et al*., 2003); this is imperative for improving crop quality and productivity in the race to feed the burgeoning population. The aim of this work was to analyse 23 sorghum genotypes for their resistance to the sorghum stem borer, *Chilo partellus.* The possible large-scale cultivation of the suitable genotypes is discussed.

Field experiments (randomised block design with three replicates) to screen different sorghum genotypes for resistance to *C. partellus* were conducted at the Main Research Station, North Dharwad (in the northern part of Karnataka State; 15° 20' N 75° 07'E; altitude 678 m above mean sea level) during the year 1998-99. All plants were grown on black soil.

The 20 sweet sorghum and three grain sorghum genotypes screened were obtained from the ICRISAT (Patancheru, Hyderabad). Each plot measured about 5 × 0.9 m and contained two rows (5 m in length) of each genotype. Sowing was performed in the last week of July; the recommended package of plant protection measures was followed. Genotypes DJ-6514 and CSH-14 were used as susceptible controls, and IS-2312 as a resistant control. Stem borer infestation was recorded in the experimental plants and the damage caused by the larvae was evaluated taking into account: i) the number of plants showing leaf scraping damage, ii) dead heart damage 40 days after sowing (DAS), iii) the number of plants with pinhole damage at 50 DAS, iv) the number of plants with peduncle damage at panicle emergence, and v) the number of plants with stem tunnelling damage at harvest. The data were converted to percentages and analysed using Duncan's multiple range test (0.05%).

Leaf scraping damage ranged from 3.22-12.89%, the lowest scores being recorded for SSV-7073 (3.22%), SSV-53 (3.69%), IS-2312 (3.87%), Nandyal (4.09%) and SSV-96 (4.04%). Dead heart damage varied from 4.05% (SSV-7073) to 25.21% (SSV-74). Genotypes SSV-7073 (2.19%), SSV-53 (3.69%) and SSV-6928 (3.85%) showed the least pinhole damage. The percentage incidence of peduncle damage ranged from 5.17% (SSV-7073) to 41.43% (DJ-6514), while that of stem tunnelling damage ranged from 6.32% (SSV-7073) to 51.18% (SSV-74) (see Table 1 for complete results).

Table 1. Percentage damage caused by the stem borer in the tested sorghum genotypes

Genotype	Damage (%)				
	Leaf scraping	Dead heart	Pinhole damage	Peduncle damage	Stem tunnelling
AKFS-35	8.49 d	18.12 c	8.08 cd	21.63 ef	18.2 f
AKSS-4	8.08 d	16.23 cd	6.81 def	19.57 f	21.28 ef
ASSV-9502	11.50 ab	18.52 bc	10.69 bc	32.63 bc	39.67 bc
ASSV-9504	12.89 a	16.22 cd	8.42 cd	31.67 bc	35.37 cd
ASSV-9505	8.40 d	14.00 d	7.37 def	20.90 ef	18.76 f
CSH-14	12.88 a	24.18 a	12.86 ab	36.00 b	49.15 a
DJ-6514	12.67 a	24.26 a	14.37 a	41.43 a	49.20 a
HES-4	4.97 efg	6.42 f	4.11 hi	6.80 ij	8.27 gh
IS-2312	3.87 gh	8.78 e	4.49 ghi	7.6 ghi	8.56 gh
ISSV-9526	9.55 bcd	19.00 bc	7.75 de	25.87 d	35.16 cd
ISSV-9531	6.16 e	7.45 ef	6.56 defg	8.20 ghi	9.55 g
Nandyal	4.09 gh	7.5 ef	5.16 fghi	7.73 ghi	7.81 gh
Rio	9.26 cd	18.49 bc	7.63 de	32.27 bc	34.87 cd
SSV-108	8.48 d	14.18 d	6.53 defg	23.6 de	21.82 ef
SSV-119	11.00 abc	21.85 ab	11.44 ab	38.57 a	42.56 b
SSV-12611	9.46 bcd	16.88 cd	6.52 defg	26.47 d	25.19 e
SSV-2525	5.66 ef	7.77 ef	6.11 defgh	9.67 g	8.60 gh
SSV-53	3.69 gh	6.03 f	3.69 i	7.3 hi	8.30 gh
SSV-6928	4.70 efg	8.03 ef	3.85 i	7.77 ghi	8.09 gh
SSV-7073	3.22 h	4.05 g	2.19 j	5.17 j	6.32 h
SSV-74	12.22 a	25.21 a	13.60 ab	39.17 a	51.18 a
SSV-84	9.66 bcd	19.37 bc	7.17 def	30.23 c	32.57 d
SSV-96	4.04 fgh	7.26 ef	5.42 efghi	9.3 gh	8.72 gh

Means followed by the same letter in a column do not differ significantly (Duncan's multiple range test; 0.05%).

The management of insect pests in agriculture must be both safe and effective. Molecular tools now provide the opportunity for developing genotypes that carry resistance traits. With respect to dead heart, leaf scraping, pinhole, peduncle and stem tunnelling damage, genotype SSV-7073 seems to be the most resistant variety. Nandyal, SSV-53, SSV-6928, HES-4 and IS-2312 were also promising, especially in terms of resistance to peduncle and stem tunnelling damage. Deshpande (1978) found no leaf scraping or dead heart damage in 15 sorghum genotypes when screening for resistance to *C. partellus,* but two genotypes, E-302 and E-303, showed lower stem tunnelling damage; these were reported as resistant to the stem borer. Patel and Sukhani (1990) reported the genotype SPV-102 to be most promising in terms of resistance to stem borer damage, yielding the highest quantity of fodder and grain. These authors recommended it as a resistant variety for cultivation in sorghum agroecosystems. Singh *et al*. (1968), who rated the degree of resistance on the basis of dead heart damage, recorded 507 sorghum varieties to be resistant. The TNAU (1976) studied promising sorghum varieties and hybrid genotypes under natural infestation conditions in the field and found leaf injury, dead heart and stem tunnelling damage to be very low among the genotypes tested.

Boica *et al*. (1983) evaluated the resistance of 25 grain sorghum and 10 sweet sorghum genotypes to stem borer attack and reported the grain sorghum genotypes DA-47, BR-301 and Ranchero, and the sweet sorghum genotypes CMS × S-717 and CMS × S-623, to be the most resistant. Saxena (1990) reported the genotype IS-18363 to be highly susceptible, IS-18463 and IS-2146 to be moderately susceptible, IS-4660 and IS-2205 to be moderately resistant, and IS-1044 to be highly resistant. Of the 23 genotypes screened in the present study, SSV-7073 appeared as a promising, resistant genotype, while Nandyal, SSV-53, SSV-6928, HES-4 and IS-2312 showed reduced levels of peduncle and stem tunnelling damage. The control genotypes DI-6514 and CSH-14 showed the highest levels of panicle and harvest stage damage. Genotype SSV-7073 showed very significantly less dead heart, leaf scraping, pinhole, peduncle or stem tunnelling damage compared to all others; it may therefore hold promise as a resistant genotype in sorghum improvement research. Nandyal, SSV-53, SSV-6928, HES-4 and IS-2312 were promising in terms of peduncle and stem tunnelling damage; they might also be used as resistant varieties or be incorporated into sorghum research programmes with the aim of obtaining higher yields and greater economic benefits.

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