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Association of important resistance contributing parameters for shoot fly, stem borer and aphid on *Rabi* sorghum cultivars

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Abstract

Sorghum [*Sorghum bicolor* (L.) Moench] is an important cereal crop in India popularly known as 'Jawar' or 'Great millet'. In Maharashtra about 18 important insect pests have been recorded on sorghum crop. In sorghum major incidence of shootfly, stem borer and sorghum aphid are observed. In screening programme in all thirty two sorghum genotypes including three checks were replicated twice under Randomized Block Design for resistance to mention insect pest. The study, leaf glossiness ranged from 1.0 to 4.0, lower the score higher was the glossiness and vice versa. The resistant check entry IS-18551 (1.0) and IS-2205 (1.6) recorded significantly lower values than values of all other entries. significantly maximum vigour was recorded in resistant check IS-18551 (1.33) and IS-2205 (1.45) which was at par with Sargaon L., IS-40838, Pop sorg-158, IS-24308, Pbn ent.5, IS-17666, PVR-660, Pop sorg-19. The chlorophyll content index at 21 DAE ranged between 27.70 and 37.30 in different sorghum lines. Among the sorghum lines screened, the least chlorophyll content index score recorded in resistant check IS-18551 (27.0) and IS-2205 (27.80), which was at par with lines viz., IS-13721 (28.42), Pop sorg-158 (28.42), IS-17666 (29.98), Pbn ent.5 (30.15). The maximum height recorded in resistance checks IS-18551 (182 cm) and IS-2205 (179.0 cm). It was however at par with line Tandur-2, IS-17757, IS-26998, IS-17666, SPV-1411 Sargaon L., PVR-660, IS-31420, Pop Sorg.19 and Pbn.ent.4. The minimum stem tunnelling percentage was recorded in resistant lines IS-18551 (6.40) and IS-2205 (7.20), which were par lines viz., IS-26998 (7.40), Pop Sorg.-19 (8.40), IS-30970 (8.90), PVR-660 (9.20), Tandur-2 (9.29). Among the followed lines were SPV-1411 (9.60), IS-24308 (10.0), IS-31123 (11.20), IS-17666 (11.80), IS-31420 (12.40), Pop Sorg.-220 (13.60).

Keywords: association of important resistant- parameters- shootfly, stem borer, aphids

Introduction

Sorghum [*Sorghum bicolor* (L.) Moench] is an important cereal crop in India popularly known as 'Jawar' or 'Great millet'. It is probably originated in East Central Africa and it was introduced in India from East Africa in the year 1500 BC. This crop grows as both *Kharif* and *Rabi* sorghum. This crop mostly used for food as well as fodder purpose.

Maharashtra is foremost sorghum growing state in the country with an area, production, productivity of *Rabi* jowar was 20.21 lakh ha, 17.40 lakh tonnes and 861kg ha⁻¹, respectively (Anonymous 2016-17).

In sorghum major incidence of shootfly, stem borer and sorghum aphids observed. Pest control by different method like physical chemical biological cultural but one of the best methods is host plant resistance mechanism. This method is very safe and low cost input method. The two mechanisms antixenosis and antibiosis are present in host plant which is responsible for resistance to pest.

Methodology

Plant heights of three plants selected at random in each replication was measured in cm from the ground level to the tip of ear head at the time of harvest. The chlorophyll content index of five randomly selected leaves in each plot was recorded at 21st day after germination by using SPAD-502 chlorophyll meter. At the time of harvest, total length of stalk and peduncle was measured. The plants selected for observation were split open giving vertical cut and length of tunnelling was measured to work out percent tunnelling. Randomly two plants were selected for sugar Bricks index with the help of hand refractometer. Bricks index was recorded at 65 DAE. The observations on leaf glossiness in the scale 1 to 5 were recorded at 14th day after

emergence. The observation on seedling vigour in the scale 1 to 5 was recorded 14 days after emergence.

Result and Discussion

Association of shoot fly infestation with resistance contributing characters

Seedling leaf glossiness was correlated with egg count at 7th, 14th and 21st days after emergence. The correlation coefficient values (Table 1) show that there was seedling glossiness score was positively significant at 7th DAE (0.559**) and 14th DAE (0.591**), eggs number indicating non-preference for oviposition on glossy seedlings; however, egg count 21st DAE (0.500**) had highly positive significant association.

Seedling vigour score had highly positive significant association with eggs observed on 14th DAE (0.517**) which indicated that vigorous lines were non-preferred by the score on shoot fly for egg laying. The 7th DAE (0.514**) and 21st DAE (0.398) had significant positive impact on shoot fly oviposition.

Plant height at maturity influences the egg number laid by shoot fly on sorghum leaves. The plant height had highly significant negative impact on egg laying by shoot fly at 14th (-0.471**) and 21st DAE (-0.623**) which expressed that the lines having faster growth in turn lines were taller and not preferred for egg laying. Early oviposition was not much affected by plant height as there was non-significant negative correlation. Chlorophyll index (Table 1) had highly significant positive impact on oviposition by shoot fly at 14th DAE (0.459**); however, it had significant positive influence on eggs laid by shoot fly at 7th DAE (0.398*), while 21 DAE (0.336) showed positive non-significant impact.

Table 1: Association of sorghum plant characters with reaction of shoot fly oviposition

Parameter	Shoot fly eggs, at		
	7 DAE	14 DAE	21 DAE
Plant stand	-0.397*	-0.354*	-0.227
Seedling glossiness score	0.559**	0.591**	0.500**
Seedling vigour score	0.514**	0.517**	0.398*
Plant height	-0.601**	-0.471**	-0.623**
Chlorophyll content	0.398*	0.459**	0.336
Bricks index	0.549**	0.550**	0.425*

*Correlation coefficients significant at $P = 0.05$ ($r = 0.349$)

**Correlation coefficients significant at $P = 0.01$ ($r = 0.449$)

Bricks index reading at 7th DAE (0.549**) and 14th DAE (0.550**) had highly significant association with ovipositional preference. At 21st DAE (0.425*).

Seedling glossiness score was highly positively associated with shoot fly dead hearts at 14th (0.851**), 21st (0.850**) and 28th (0.861**) days after emergence (Table 2). The intensity of leaf glossiness of sorghum lines showed positive impact in expressing the shoot fly dead hearts.

Seedling vigour score had highly significant positive impact on shoot fly dead hearts at 14th (0.927**), 21st (0.950**) and 28th DAE (0.946**) indicating vigorous seedlings being less vulnerable to shoot fly there by reducing dead hearts.

Plant height at maturity was negatively and significantly correlated with shoot fly dead hearts at 14th (-0.387*), 21st (-0.381*) and 28th DAE (-0.424*).

Significantly high impact of chlorophyll content in leaves was associated with shoot fly dead hearts at 14th (0.775**), 21st (0.807**) and 28th DAE (0.792**) indicated higher chlorophyll in leaves favored the shoot fly development.

Table 2: Association of sorghum plant characters with reaction of shoot fly dead hearts

Parameter	Shoot fly dead hearts (%)		
	14 DAE	21 DAE	28 DAE
Plant stand	-0.346	-0.387*	-0.386*
Seedling glossiness score	0.851**	0.850**	0.861**
Seedling vigour score	0.927**	0.950**	0.946**
Plant height	-0.387*	-0.381*	-0.424*
Chlorophyll content	0.775**	0.807**	0.792**
Bricks index	0.607**	0.642**	0.660**

*Correlation coefficients significant at $P = 0.05$ ($r = 0.349$)

**Correlation coefficients significant at $P = 0.01$ ($r = 0.449$)

Bricks index reading recorded at 14th (0.607**), 21st DAE (0.642**) and 28th (0.660**) had highly significant positive association with shoot fly dead hearts.

Association of stem borer with resistance contributing characters

The stem borer dead hearts percentage in various sorghum lines was at low level with stem tunnelling percentage (0.135). The plant attributes were studied had positive but non-significant association with stem borer dead hearts percentage (table 3). Then character associated as with Plant stand, plant height expressed negative significant impact on stem borer dead hearts percentage. The chlorophyll index recorded at 21 DAE (0.650) had highly significant impact on stem borer dead hearts percentage.

Table 3: Association of sorghum plant characters with stem borer dead hearts

Parameter	Stem borer dead hearts (%)
Plant stand	-0.448*
Plant height	-0.414*
Chlorophyll index	0.650**
Stem tunnelling (%)	0.135

*Correlation coefficients significant at $P = 0.05$ ($r = 0.349$)

**Correlation coefficients significant at $P = 0.01$ ($r = 0.449$)

Association of sorghum plant characters with aphid damage score

The relationship Aphid damage score and different sorghum plant characters are presented recorded in table 4. Chlorophyll content (0.665), and Bricks index (0.846) was positive and highly significant correlation with aphid damage score. The remaining character with low level score plant height (-0.078) had negative non significant impact relationship with aphid damage.

Table 4: Association of sorghum plant characters with aphid damage

Parameters	Aphid damage score
Plant height	-0.078
Chlorophyll content	0.665**
Bricks index	0.846**

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