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Genetic potential of sorghum germplasm against *Drechslera sorokiniana*

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Abstract

Ninety four (94) Sorghum vulgare L. (Cherry) varieties/lines have been explored for resistant genetic resources against Drechslera sorokiniana, the leaf spot disease pathogen. Screening against this destructive entity has been carried out for the first time in field conditions against natural inoculums spreading on varieties through infected crop leaves existing in the vicinity areas of suburbs of Sargodha and Research areas of the FRI institute. Four (4) and 25 Sorghum varieties were found resistant and moderately resistant while 19 varieties were found susceptible and 23 varieties were found highly susceptible in normal crop season. Rest of the 23 Sorghum varieties were found moderately susceptible. As the disease is seed soil and air borne in nature so crop rotation will help greatly to reduce the disease inoculums in the field. Seed treatment with recommended fungicides at recommended doses will be proved helpful to reduce the disease since there is no ammune varieties are available in present circumstances. If the seed crop is sprayed after the infection occurs twice fortnightly, it will control the disease effectively. This study restores the information about the availability of genetic resources maintained in the country.

Key words: Brown leaf spot, Genetic resources, Pakistan, Pathogen, Punjab, Resistance, Seed Crop, *Sorghum vulgare* L.

Introduction

Sorghum vulgare L. is a major kharif crop grown in irrigated and barani areas in the country of Pakistan. It is grown on an area of 307.5 thousand hectare which produced 186.4 kg grain yield/hectare (Anonymous 2005). Sorghum crop is attacked by many diseases (Neergaard 1978) out of those brown leaf spot disease had gain greater importance due to prevalence of its abundance air borne inoculum in the country. El-Shafey (1984) tested the monoconidial isolates of *Helminthosporium turcichum* on different sorghum hosts. Two isolates found virulent on sorghums. Damian (1998) recorded many fungi associated to sorghum seeds in Romania. Bonilla *et al.* (1999) explored the some mycobiota of *Sorghum halepense* (L.) Pers., and evaluate some species for showing capability of biological control. Sorghum has extreme genetic diversity having about 31 specie, 157 varieties and 571 biotypes. Padule *et al* (1999) reported the association of *Drechslera sorghicola* [*Bipolaris sorghicola*] alongwith three other prominent genera to the sorghum hybrid CSH 14 in Maharashtra, India with chemical seed treatment practices and field spray on seedling crop. Pinto (1999) in his studies in Brazil reported more than 20 genera of fungi in sorghum seeds. The present studies have been conducted at Agricultural Research farm at Fodder Research Institute, Sargodha working under AARI, Faisalabad. In these studies 94 *Sorghum vulgare* L, varieties/lines have been tested for genetic potential against *D. soroghicola*, brown leaf spot entity in crop season 2005.

The studies against this disease have been carried out for the first time in field conditions against natural infection existing in the vicinity areas. Field data was recorded during the first week of December, 2005 and has been reported in this article.

Materials and Methods

The crop is sown in 30 cm apart lines and having three lines in case of each variety have been grown in field in a plot size of specific dimentions. The seed of different varieties/ promising lines of sorghum have been grown in field each in two lines of 2.5 m length and 60 cm apart. The experiment was sown in augmented design using three check varieties (PARC-SV-IV, S-2000 & Heghari) in each of the 8 blocks having 12 cultivars in each block. The crop was raised adopting standard agronomic practices. Disease incidence was recorded after germination and on appearance of disease symptoms.

Field data was recorded at the time of crop maturity. It was taken under consideration that the

plant is divided into two portions i.e. lower half and upper half. The percentage of disease incidence was recorded on percent leaf area infected separately from lower and upper half of the plant. The reactions of plants against disease was applied on aggregate data of disease recorded from upper and lower half of the plant infected at near maturity level stage of the crop. The highly susceptible check variety JS-2002 have been sown all around the field for spreader. The 0-5 scale is used to estimate the disease as given in (Fig-I,2,3,4and5). The reaction of each variety have been recorded according to the data in accordance to the scale used in the estimation of reactions as given in table-1 (Mayee and Datar, 1986).

Results and Discussion

The disease reaction and percent leaf area infected in lower and upper half of the plant was reported in (Fig. 1-5) and summary of reactions and the number of varieties fallen in each reaction were reported. Four Sorghum varieties namely PARCSSII, PARCSVIV, PARCSVV and No.7 were found resistant against brown leaf spot disease caused by *Drechslera sorghicola*. Although their response level varied up to 0 to 2.5 % within varieties and strains. Twenty five varieties viz; S9902, S9905, S9907, S9908, S9910, PARCSVI, PARCSVII, S6, BM720, S-145, B-169, B-203, No.1744, No.1828, AS449, No.36519, No.39501, No.80022, No.80025, No.80027, No.80230, BMR, Balo, NTS-2 and ICSV745, were found moderately resistant against brown leaf spot disease caused by *Drechslera sorghicola*, while twenty three varieties viz; S9903, S9909, S2, PSV-2, No.337, No.1518, No.1572, No.1620, No.1623, No.1723, HEGARI, No.6001, No.80008, No.80010,SUKKAR, Sudan grass, IS20016, IS22893, GD-6517-2, DG65118, A2267-2, KSV112 and PSV16 were found moderately susceptible (Table-2). In India Padule *et al* (1999) reported the association of different fungi including reported fungus *Drechslera soroghicola* the cause of brown leaf spot disease on variety sorghum CSH-14 in treated seeds stored in store and on the sprayed crop in field.

Among the other fourty two sorghum varieties nineteen varieties No.1563 No.5017,S-167, SS-89,S-35,LXP, No. 6112 No. 960, FM-147, ICSR-93034, GD-66239, GD-65195,PSV-3PSV-29,PSV-5,GD-65130,S-9901,PSV-4 and ICSV-96143) were found susceptible in their reactions. Kalappanavar and Hiremath (1998) in India tested sorghum genotypes and they found four varieties with multiple resistance to foliar diseases i.e. IS3443, IS14332, IS8283 and SPV 463 and four varieties were fond susceptible to sooty stripe. While we found other twenty three sorghum varieties namely , JS-2002, PARC SSI, JS-4 S-5, X S-S-89, S-156, No.619, SS-9802, JS-263, No.403915 K-94, Sibi, FM-48-E 36/1, B-24, GD-65122, PVK-801, PSV-19, PSC-12, PSV-20, PSV-30 ICSV-700,KSV 574, and ICSV-93046 were highly susceptible (Table-2), only the three PARC and one variety of Fodder Research Institute, Sargodha were found resistant against *Drechslera* Brown leaf spot disease. PARC, one variety is found highly susceptible while other two are found moderately resistant.

Screening against this disease have been carried out for the first time in field conditions against natural infection exiting in the vicinity areas of suburbs of Sargodha. Not this nor any disease had been recorded yet before this studies. The existence abundance inoculums spreads showed the air-borne nature of the pathogen. For avoidance from this disease screening for resistant varieties is necessary to locate the disease free and genetically immune inbreed materials for developing new bitterly performing varieties having high yield out put in near future. So these studies have been conducted to fulfill the requirement in better ways. Desai in 1998 screened many sorghum varieties against charcoal rot disease and he found that 20 sorghum varieties are tolerant against the described entity. Disease incidence data have been recorded according to rating scale devised by Mayee and Datar (1958). Ngugi, *et al* during 2002 observed fourteen foliar and six panicle diseases with limited variation in disease prevalence and severity between the 2 years. The most common foliar diseases observed were oval leaf spot (*Ramulispora sorghicola*), rust (*Puccinia purpurea*), ladder leaf spot (*Cercospora fusimaculans*) in Western Kenya. Screening is the only effective and efficient method which describes the degree of tolerance of the different genotypes against different diseases. So our studies locate the resistant material in the sorghum inbred genotypes.

Biradar *et al.* (2000) in India studied the five promising sorghum cultivars, M35-1, SPV 932, 9-12, GRS-1 and CSH 13R. These were selected to study the influence of aberrant weather and biotic stress on grain and fodder yields, disease and pest incidence, in an experiment conducted in Karnataka, India during the rabi season of 1997-98. Results of these experiments were compared to those of a similar experiment conducted during 1987-96. A significant decrease in grain yield ranging from 12.3 (CSH 13R) to 26.9% (GRS-1) was observed in all cultivars except SPV 932,

which gave a 26.3% increase. Fodder yield also increased in all cultivars, except in GRS-1, ranging from 6.0 (CSH 13R) to 40.4% (M35-1) indicating there was no moisture stress in the soil during the crop growth. The percent incidence was higher during 1997-98 compared with that of the previous years. Sharma *et al* during 2000 in India have been studies gene action for sorghum (*Sorghum bicolor*) resistance to midge (*Stenodiplosis sorghicola*) and some leaf diseases (anthracnose caused by *Colletotrichum graminicola*, zonate leaf spot by *Gloeocercospora sorghi*, leaf blight by *Exserohilum turcicum* [*Setosphaeria turcica*] and rust by *Puccinia purpurea*). They have found different reactions of different diseases on specific varieties variably and reported the resistant and susceptible cultivars.

In present studies the brown leaf spot disease have been recorded on different sorghum varieties in varying frequencies. Most of the tested varieties were found highly susceptible against naturally invading *Drechslera soroghicola* the brown leaf spot disease causing agent inoculum under normal irrigated conditions during crop season 2006.

Table-1: Reactions followed with infection % age against brown leaf spot disease.

Stages	Reactions	Abbreviation	Percent area infected
0	Immune	I	0 % No incidence
1.	Resistant	R	1% Leaf area infected
2.	Moderately resistant	MR	1-10% Lower leaves infected
3.	Moderately susceptible	MS	11-25% Lower x middle leaves infected
4.	Susceptible	S	26-50% on all leaves , Lower leaves blighted
5.	Highly Susceptible	HS	Above 50% Lower leaves infected

Scale described by Mayee & Datar (1986)

Fig. 1: Varieties of sorghum producing resistant reaction in brown leaf spot disease.

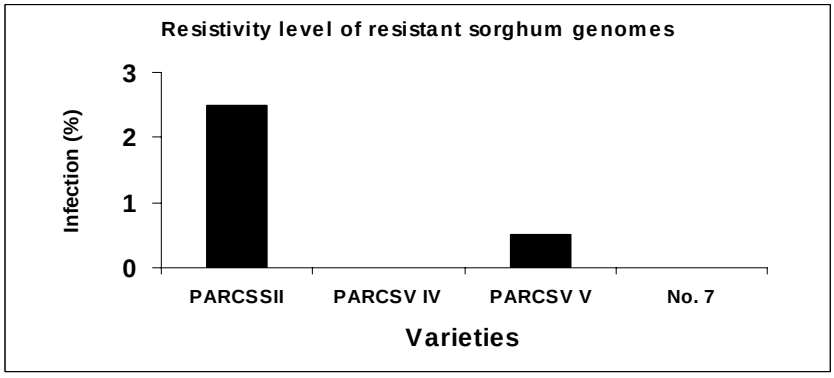


Fig. 2: Sorghum genomes producing moderately resistant reaction in brown leaf spot disease.

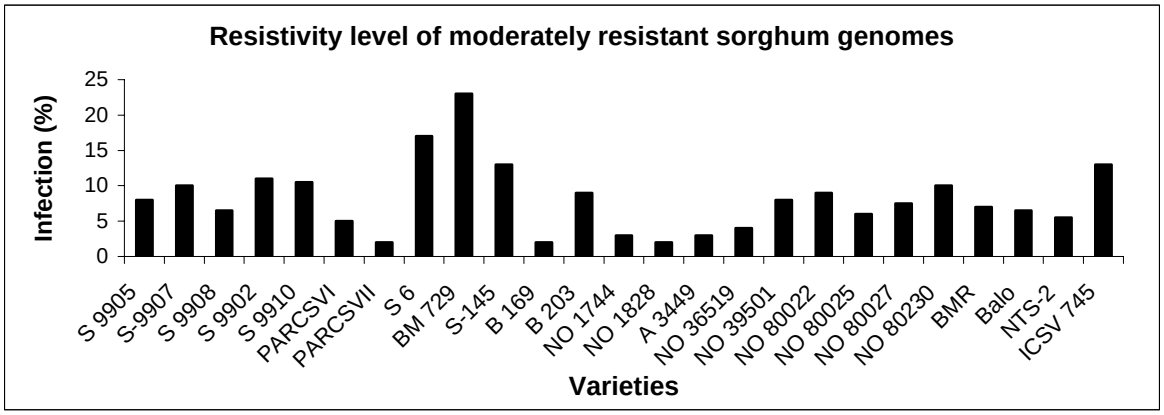


Fig. 3: Sorghum genomes producing moderately susceptible reaction in brown leaf spot disease.

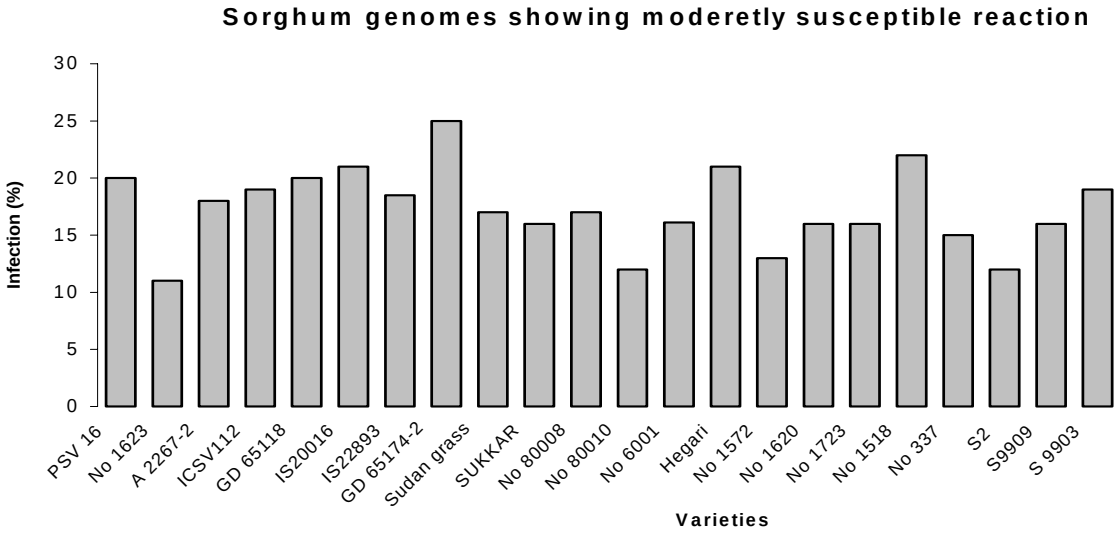


Fig. 4: Sorghum genomes producing susceptible reaction in brown leaf spot disease.

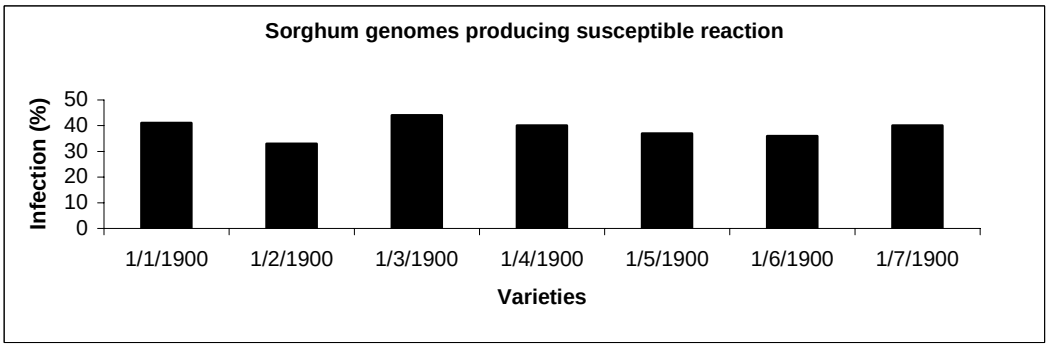
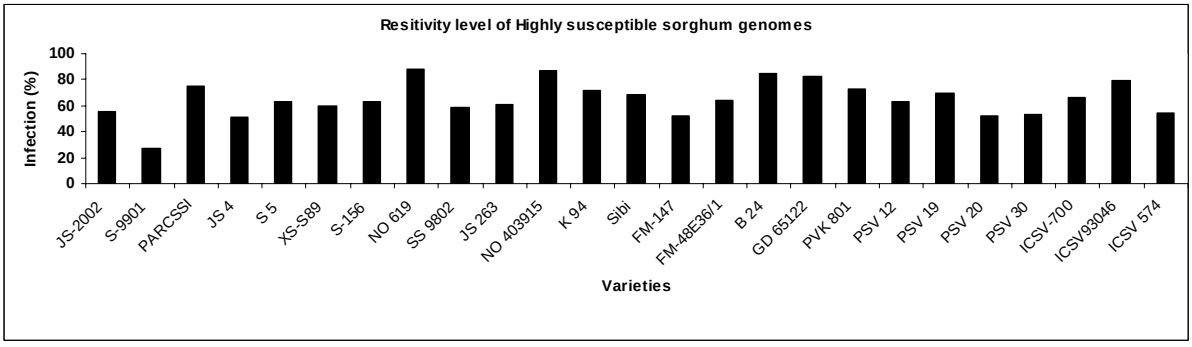


Fig. 5: Sorghum genomes producing highly susceptible reaction in brown leaf spot disease.



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