Resistance to Net Blotch *[Helminthosporium teres* Sacc.] and Leaf Spot [*Bipolaris sorokiniana* (Sacc.) Shoemaker] in Barley

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Barley accessions including released varieties, advanced lines and exotic were screened under artificial inoculation for resistance to net blotch (*Helminthosporium teres* Sacc.) and leaf spots (*Bipolaris sorokiniana* (Sacc). Shoemaker) under field conditions for two years. Out of the 239 accessions evaluated, six were highly resistant to net blotch and 15 were highly resistant to leaf spot. Five lines namely, DL 472, RD 2052, BH 87, KARAN 16 and K 18 were highly resistant to both the diseases.

Key words : Barley Germplasm, Leaf Spot, Net Blotch, Resistance

Barley (*Hordeum vulgare* L) is an important grain cereal used for a variety of purposes in India including animal feed, human food and in industry for malting and brewing. Barley suffers from many diseases and amongst them the stripe (yellow) rust and leaf blights (net blotch and leaf spot) are of major importance in the main barley growing area of the north-western plains, where the better management is provided to the crop and the crop growth is luxuriant. Due to cultivation of barley under warm humid climates of north-eastern and north-western plains during mid February to end of March under better management, the incidence of leaf blights caused by *Bipolaris sorokiniana* (Sacc.) Shoemaker and net blotch caused by *Helminthosporium teres* (Sacc.) have increased. The effect of these diseases is quite devastating if prevalent together, causing severe damage by premature forced drying of foliages and poor grain filling in susceptible varieties. The barley cultivation for malting purposes is to be done under optimum management of nutrient and water, for which the blights are likely to become the major production constraint both for yield and grain quality. There are only a few classified reports in the country on the sources of resistance to the two diseases identified after the artificial screening (Prakash and Misra 1976, 1977; Singh and Chand 1981 and Singh and Singh 1978). However, none of those sources, except BG 105, is available at present either with the national barley programme or with the collection at National Bureau of Plant Genetic Resources, New Delhi. Moreover, most of them were old native lines with lot of undesirable traits. Therefore the germplasm evaluation under artificial inoculation was undertaken at Directorate of Wheat Research (DWR), Karnal with improved lines, released varieties and exotic sources to identify the diverse sources of resistance. This will help in organizing the leaf blight resistance breeding programme in barley.

Materials and Method

The experiments were conducted at DWR, Karnal during 1998-99 and 1999-2000 crop seasons. In total 239 barley genotypes consisting of released varieties, advanced lines and exotic germplasm accession received from ICARDA, Syria and CIMMYT, Mexico in form of the international observation nurseries, were planted in two rows of 5m length at 30 cm distance between rows. The field screening for the net blotch and leaf spot was done under artificially inoculated conditions. The crop was raised as per recommended agronomic practices and the disease epiphytotic conditions were created by providing sufficient irrigation in the field. The susceptible check entry RD 25-3 was planted on borders all around the screening blocks. The crop was inoculated with a spore suspension of both the pathogens separately on each side by keeping the concentration of spores around 10^5/ml of water, after 40 days of sowing. The spore culture was prepared by growing pathogens on autoclaved sorghum grains for two weeks at 25± 1°C. The spore suspension was prepared in water by shaking the grains of sorghum having spores of pathogens and putting few drops of Tween 80 in water. The suspension was later sieved in muslin cloth and was sprayed during evening by knapsack sprayer. Proper moisture conditions were maintained in the field by spraying of water on crop for three subsequent days and later by providing surface irrigations. The observations on disease incidence were taken separately for *B. sorokiniana* and *H. teres* in 0-9 scale, as proposed by Saari and Prescott (1985) at dough stage. The categorization was made as follows :

0-1=Highly resistant, 2= Resistant, 3-4=Moderately resistant, 5-6= Susceptible and 7-9= Highly susceptible.

Table 1 Reaction of barely genotypes to net blotch (*Helminthosporium teres*) and leaf spot (*Bipolaris sorokiniana*)

Reaction type (on 1-9 scale)	Net blotch *(H.teres)*	Leaf spot *(Bipolaris sorokininana)*
1 (Highly resistant)	4th INWFBCB-130, DL 472 RD 2052, BH 87, KARAN 16, K18	20th IBON-3, 20th IBON-38, 20th IBON-71, 20th IBON-87, 20th IBON–139, BONMRA(94-95)-73 DL 472, DG 105, RD 2052, BH87, EB 921, DWR21, K18, KARAN 16, KARAN 741
2 (Resistant)	22nd IBON-62, BG 105, BCU 944 BCU 1235, BCU 1596, BCU 1606, BCU 1623, CLIPPER, CANUT, DWR 16, DWR 18, DWR 19, DWR 21, ICARDA 55, K 19, LAKHAN, RD 103	20th IBON-96, 22nd IBON-283, 2nd INFBON-8 BONMRA (94-95)-24, BONMRA (94-95)-28, BCU 944, BCU 1412, BCU 1606, BCU 2137, DWR 19, DWR 20, DL 100, RD 103, RD 2035, UBE 469,
3-4 (Moderately resistant)	96 Genotypes	82 Genotypes
5-6 (Susceptible)	81 Genotypes	81 Genotypes
7-9 (Highly susceptible)	39 Genotypes	46 Genotypes

The entries found resistant during 1998-90 crop season, were re-tested during 1999-2000 to confirm their reaction to both the diseases.

Results and Discussion

Based on the two consecutive year's evaluation under artificial inoculation for the two diseases, the barley genotypes were classified into various categories (Table 1). It was observed that six entries such as 4th INWFBCB-130, DL 472, RD 2052, BH 85, Karan 16 and K 18 were highly resistant to net blotch were as 15 accessions (Table 1) were highly resistant to *Bipolaris sorokiniana* (leaf spot). There were five lines identified as highly resistant (DL 472, RD 2052, BH 85, Karan 16 and K 18) for both the diseases.

Out of 239 genotypes tested most of the genotypes fall into the categories of moderately resistant to susceptible types. It has also been observed that most of the lines with high resistance to both the diseases are of the Indian origin, though a few of the exotic barley varieties/high are also having resistance to the leaf blights. Similar studies on identifying resistant sources for net blotch and leaf spot diseases were done by Prakash and Misra (1976, 1977), Singh and Singh (1978) and Singh and Chand (1981) in Indian barley. However the resistant lines identified now are in much improved background and can be directly utilized in the resistance-breeding programmes.

In addition to the above two diseases, two genotypes namely DL 472 (yellow rust) and RD 2052 (cereal cyst nematode) are also known sources of resistance to another disease/pests of economic importance. Since the national programme on barley has taken up the work on malt barley improvement for optimally managed cultivation, the importance of the leaf blights has increased in the states of Punjab, Haryana and Western Uttar Pradesh were hot and humid atmosphere during March may catalyze the disease development affecting the crop yield and grain quality.

The lines identified above may be used as donor parents in the leaf blight resistance-breeding programme, as they are mostly coupled with good yield potential and not in any wild or grassy background.

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References

Prakash O and AP Misra (1976) Barley variety as a source of resistance to net blotch. *Indian J. Myco. Plant Path.* **6:** 109-110.

Prakash O and AP Misra (1977) Barley variety as a source of resistance to spot blotch (*Helminthosporium sativum*). *Indian J. Myco. Plant Path.* **7:** 208-209.

Saari EE and JM Prescott (1975) A scale for appraising the foliar intensities of wheat diseases. *Plant Disease Reporter* **59:** 377-380.

Singh M and JN Chand (1981) Sources of resistance in barley against net blotch pathogen. *Indian Phytopath.* **34:** 249.

Singh A and S Singh (1978) Resistant donors against *Helminthosporium teres* inciting net blotch of barley. *Indian Phytopath.* **31:** 520-521.