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SHORT COMMUNCATION

EVALUATION OF BARLEY GENOTYPE AGAINST STRIPE DISEASE

SATISH KUMAR* AND S. S. KARWASRA

Department of Plant Pathology,
CCS Haryana Agricultural University,
Hisar-125 004 (Haryana), India
**(e-mail : satishkumar14101982@gmail.com)*

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SUMMARY

Stripe disease of barley caused by *Drechslera graminea* (Rabenh.) Shoemaker is a widely distributed disease in many barley grown parts of the world, but it has assumed more importance with the introduction of some new high yielding varieties. The present investigations were undertaken during 2007-08 and 2008-09 crop seasons with a view of elicit information on effect of six rowed barley lines/ varieties when compared with two rowed barley lines/varieties on the basis of mean infection value, two rowed lines/varieties had more resistance than six rowed. Grouping on the basis of mean infection value in six rowed barley 3 lines/ varieties were highly resistant, while in two rowed 4 lines / varieties were highly resistant. Use of resistant varieties is one of the most economical and efficient way to counteract the pathogen due to its long lasting nature.

Key words : Stripe disease, barley, genotype, six rowed, two rowed

Stripe disease is occurring regularly in different barley growing areas of the state. Due to continuous cultivation of susceptible varieties under favorable conditions, it has emerged as a serious problem. Due to the extensive cultivation of high yielding barley varieties, the problem of stripe disease has assumed a significant importance. Stripe disease incited by *Drechslera graminea* (Rabenh.) Shoemaker is very destructive disease of irrigated barley crop. This disease is very serious throughout the world, wherever barley is cultivated. It is also common in North India, particularly in Haryana and Rajasthan states and causes huge loss in grain yield (Kumar and Karwasra, 2019). The pathogen is seed borne in nature and it survives exclusively as mycelium on pericarp or hull of the seed. Diseased plant arise only from infected seeds and they become systematically infected, senescence early and produce a poor yield due to shrivelled seed. There is no spread of infection between plants during the growing season. The fungus produces masses of conidia (anamorph of *Drechslera graminea*) on leaves of diseased plants. These conidia are carried by the wind to developing seed on the ear of healthy plants with in the crop and in neighbouring crops. Developing barley seed is susceptible to infection from anthesis to soft dough stage (Teviotdale and Hall, 1976). Since, some of the spores germinate and infect the developing seed, there is potential for infection to multiply significantly from one season to next season. The pathogen has been reported as an obligate parasite, and practically no authentic record have been produced yet that conidia are produced on artificial media. But on the other hand, it has been reported that this pathogen successfully sporulates on the lesions on the foliages and glumes under natural conditions. In Haryana, the disease was first reported by Tyagi (1974) on variety C 138 and in 1976 Harichand further reported on many commonly grown varieties. Disease plants arise only from infected seeds. After the germination of the seed, the pathogen becomes systemic and the plants senescence early and produce poor yield due to the shriveled grains. There is no secondary spread of infection. Since, these conidia germinate and infect the developing seed, so there is potential for the production of diseased seed, which act as source of infection for the next season. Being a seed borne disease, it is observed where the barley crop is grown throughout the world. The information on evaluation of barley (*Hordeum vulgare* L.) genotype against stripe disease is limited. Keeping this view in mind, an attempt was made to study the evaluation of barley genotype against stripe disease.

The present investigation entitled, "Evaluation of barley (*Hordeum vulgare* L.) genotypes against stripe disease" was carried out during 2007-08 and 2008-09 *rabi* seasons. The field experiments were conducted at the experimental research area of the Department of Plant Pathology, CCS Haryana

Agricultural University, Hisar located at 215.2 M above the mean sea level with a longitude of 75º46′E and latitude of 29º10′N has a wide range of temperature fluctuation during summer and winter seasons and is characterized as a Semi arid Zone. The minimum and maximum temperature ranges from 0ºC to 48ºC, respectively. The annual average rainfall is 430 mm. The major part of rainfall is received during monsoon season which occurs from July to September. A few millimeters of rainfall can be expected in winter too. During 2007-08 crop season the diseased plants were selected at the experimental research area, Department of Plant Breeding (Wheat and Barley section), CCS Haryana Agricultural University, Hisar in the seed production area of variety BH 393. At maturity these selected plants were harvested separately, thrashed and the seed obtained was used for carrying out further studies.

In the present study, 26 barley genotypes (13 six rowed and 13 two rowed) were screened against *D. graminea* under field conditions during 2008-09. Twenty six barley varieties/entries *i.e*. 13 of six rowed and 13 of two rowed were sown in paired rows of 2 m length. The observations on per cent infected plants and tillers were recorded in last week of March. The genetic resistance of 13 six rowed genotypes and 13 two rowed genotypes was compared on the basis of overall mean infection value. The mean value of plants and tillers infected of 2 rowed and 6 rowed barley varieties/entries were compared to see which has overall less disease incidence. Suitable indices were formulated to assess disease infection. Disease intensity was determined using the method given by Mohammad and Mahmood (1974). Score card used was :

The infection values were obtained by multiplying the number of leaves in each grade 0, I, II, III, IV, V by the corresponding mean value of each grade 0, 10, 30, 50, 75 and 95, respectively. Summing up all the resulting figures and dividing by total number of leaves in all grades. Thus formula followed was :

Grade	Symptoms	Severity	Mean value
0	Leaves with no disease	Nil	0
I	Leaves with light brown stripes	1-20	10
II	Leaves with dark brown stripes	21-40	30
III	Leaves with dark brown to black stripes	41-60	50
IV	Leaves beginning to lose normal green colour with rather long stripes	61-90	75
V	Leaves drying with stripes running through the leaf	91-100	95

$$\text{Infection value} = \frac{\Sigma(\text{number of diseased leaves in each grade} \times \text{Mean value of each grade})}{\text{Total number of leaves in all grade}}$$

On the basis of comparative susceptibility and resistance determined by mean infection values varieties/lines were grouped into different reaction categories. The categories were: highly resistant, resistant, moderately resistant, moderately susceptible, susceptible and highly susceptible.

Seeds of susceptible variety BH 393 when artificially inoculated with the isolated fungus produced typical symptoms of the disease which appeared in the form of yellow spots to brown stripes on the seedlings. The symptoms started from base and extended to tip of the leaf causing necrosis of the infected tissues. The fungus sporulated extensively on such infected leaves and microscopic examination showed that spore characters were similar to the earlier description of this pathogen (Vivek, 1994). Initial symptoms of the fungal infection appeared in the form of small yellow spots, later on elongating into yellow brown stripes. These stripes started from the base extended to the tip of leaf causing necrosis of the infected tissue. When observed under microscope, the necrotic tissues showed abundant sub hyaline to yellow brown coloured conidia. The conidia were thin walled, 2 to 7 septate and cylindrical in shape. A total of twenty six barley varieties/ lines *i.e*. 13 of six rowed and 13 of two rowed were screened against *D. graminea* under natural conditions in the field during 2008-09 crop season. Observations on disease incidence were recorded on the basis of number of plants and tillers infected. A grayish black fungus was isolated from barley leaves showing typical symptoms of stripe disease which was identified as *Drechslera graminea* on the basis of growth and other morphological characters. Results on per cent plants and tiller infection are given in Table 1 and 2.

The results presented in Table 1 showed that out of 13 varieties/lines of six rowed screened three varieties BH 902, RD 2740 and RD 2035 had no infection, while in rest of the varieties/lines infected plants varied from 4.00 per cent to 27.86 per cent. Similarly, infected tillers varied from 1.43 per cent to

TABLE 1
Screening of 6 rowed barley entries against *Drechslera graminea* under field conditions during 2007-08

S. No.	Entries	Plants infected (%)	Tillers infected (%)	Mean infection value
1.	BH 902	0.00	0.00	0.00
2.	UPB 1004	8.61	6.55	7.58
3.	UPB 1006	4.00	1.43	2.54
4.	JB 149	21.53	11.18	16.35
5.	RD 2743	12.00	8.76.	10.38
6.	K 889	9.71	4.28	6.99
7.	PL 816	4.44	2.59	3.51
8.	PL 817	6.53	3.43	4.98
9.	RD 2740	0.00	0.00	0.00
10.	HUB 196	4.00	2.66	3.33
11.	PL 818	12.00	7.33	9.66
12.	RD 2035	0.00	0.00	0.00
13.	BH 393	27.86	174	20.8
Mean	-	8.51	4.76	6.62

TABLE 2
Screening of 2 rowed barley entries against *Drechslera graminea* under field conditions during 2008-09

S. No.	Entries	Plants infected (%)	Tillers infected (%)	Mean infection value
1.	RD 2668	0.00	0.00	0.00
2.	K 896	8.00	5.40	6.7
3.	DWRUB 75	0.00	0.00	0.0
4.	DWRUB 76	0.00	0.00	0.0
5.	RD 2752	6.10	3.60	4.85
6.	RD 2678	4.00	1.40	2.70
7.	RD 2681	0.00	0.00	0.0
8.	DWRUB 52	2.80	0.95	1.87
9.	RD 2753	7.00	4.66	5.83
10.	K 551	12.00	9.55	10.77
11.	RD 2755	1.15	0.70	0.92
12.	PL 824	13.00	8.60	10.8
13.	K 888	9.00	5.04	7.02
Mean	-	4.85	3.01	4.26

13.74 per cent. Mean infection value of all the 13 six rowed barley varieties/line was 6.62 per cent. Similar observations have also been reported by Vivek (1994). Likewise, out of 13 varieties/lines of two rowed barley screened four varieties RD 2668, DWRUB 75, DWRUB 76 and RD 2681 had no infection, while in rest of the varieties lines infected plants varied from 1.15 per cent to 13.00 per cent. Infected tillers varied from 0.70 per cent to 9.55 per cent. Mean infection value of all the 13 two rowed barley varieties/lines was 4.26 per cent. This study revealed that 2 rowed barley possess comparatively more resistance than 6 rowed barley varieties/lines.

On the basis of mean infection value calculated following the scale and formula adopted by Mohammad and Mahmood (1974) out of 13 varieties/lines of 6 rowed barley, three varieties BH 902, RD 2740 and RD 2035 were found highly resistant (infection value 0), none was resistant (infection value 1-5%), 3 entries namely UPB1006, PL 816 and HUB 196 were moderately resistant (infection value 6-10%), 3 entries namely UPB 1004, K 889 and PL 817 were moderately susceptible (infection value 11-25%), 2 entries namely RD 2743 and PL 818 were susceptible (infection value 26-40%) and rest 2 varieties/ entries namely JB 149 and BH 393 were highly susceptible with infection value >40%. The six rowed genotypes had high mean infection value i.e. 6.62 per cent than the two rowed genotypes with mean infection value of 4.26 per cent. Our results are in accordance with the findings of Mathur and Bhatnagar (1992); who also reported that two rowed barley are more resistant than six rowed barley genotypes. When these genotypes were categorized under field conditions on the basis of infection values, 3 genotypes i.e. BH 902, RD 2740 and RD 2035 were found highly resistant, none was resistant; UPB 1006, PL 811 and HUB 196 were moderately resistant, UPB 1004, K 889, PL 817 were moderately susceptible, RD 2743, PL 818 as susceptible, while JB 149 and BH 393 were highly susceptible among the 6 rowed barley varieties/lines to stripe disease (Table 3). Similarly, data depicted in Table 4 revealed that out of 13 varieties/ lines of 2 rowed barley, four varieties viz. RD 2668, DWRUB 75, DWRUB 76 and RD 2681 were found highly resistant (infection value 0), one variety RD 2755 was found resistant (infection value 1-5%), two varieties/ lines viz., DWRUB 52 and RD 2678 were found moderately resistant with (infection value 6-10%), three varieties/ lines namely K 896, RD 2452 and RD 2753 were found moderately susceptible (infection

TABLE 3
Comparative susceptibility of barley (6 rowed) varieties/ lines to stripe disease caused by *Drechslera graminea* under field conditions

Varieties/lines	Infection value (range)	Reaction category
BH 902, RD 2740, RD 2035	0	Highly resistant
Nil	1-5	Resistant
UPB 1006, PL 816, HUB 196	6-10	Moderately resistant
UPB 1004, K 889, PL 817	11-25	Moderately susceptible
RD 2743, PL 818	26-40	Susceptible
JB 149, BH 393	>40	Highly susceptible

TABLE 4
Comparative susceptibility of barley (2 rowed) varieties/ lines to stripe disease caused by *Drechslera graminea* under field conditions

Varieties/lines	Infection value (range)	Reaction category
RD 2668, DWRUB 75, DWRUB 76, RD 2681	0	Highly resistant
RD 2755	1-5	Resistant
DWRUB 52, RD 2678	6-10	Moderately resistant
K 896, RD 2452, RD 2753	11-25	Moderately susceptible
K 888, K 551,PL 824	26-40	Susceptible
Nil	>40	Highly susceptible

value 11-25%), similarly three varieties/ lines K 888, K 551 and PL 824 were found susceptible (infection value 26-40%) and none of variety/ line was found highly susceptible (infection value > 40%). Present investigations are in accordance with the observation of Kumar (2003) who also reported BH 393 as highly susceptible and K 551 as susceptible. Screening of genotypes revealed that there is sufficient material with the barley breeders which can be utilized for incorporating resistance against stripe disease.

CONCLUSION

Use of resistant varieties is one of the most economical and efficient way to counteract the pathogen due to its long lasting nature. Therefore, to overcome the problem of *Drechslera graminea* disease**,** it is recommended to raised the resistant genotype of barley *i.e*. BH 902, RD 2740, RD 2035 among six rowed whereas, RD 2668, DWRUB 75, DWRUB 76. RD 2681 among two rowed.

REFERENCES

Kumar, J., 2003 : Studies on the effect of Stripe disease of barley on seed quality and its management. Ph. D. Thesis, Haryana Agricultural University, Hisar, India.

Kumar, S. and S. S. Karwasra, 2019 : Effect of seed treatment by fungicides to control stripe disease on yield and productivity of barley. *Forage Res*., **45** : 51-54.

Mathur, A. K. and Bhatnagar, G. C., 1992 : Sources of resistance in barley against stripe disease caused by *Helminthosporium gramineum*. *Indian Phytopath*, **45**: 115-116.

Mohammad, A. and Mahmood, M., 1974 : A method for evaluating the intensity of *Helminthosporium* stripe of barley. *Plant Dis. Reptr*., **58** : 265-267.

Teviotdale, B. L. and Hall, K. H., 1976 : Effect of light and temperature on number and length of *Helminthosporium gramineum* conidia produced in culture. *Journal of Botany*, **45** : 644-648.

Tyagi, P. D., 1974 : Barley diseases situation in Haryana during 1973-74. All India Barley Workshop, New Delhi.

Vivek Kumar, 1994 : Studies on stripe diseases of Barley *(Hordeum vulgare L*.) caused by *Drechslera graminea* (Rabenh.) Shoemaker. M.Sc. Thesis, CCS Haryana Agricultural University, Hisar.