Indian J. Genet., 68(3): 317-319 (2008)

Short Communication

Identification of donors for sheath blight resistance in wild species of rice

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(Received: November 2006; Revised: May 2008; Accepted: August 2008)

Sheath blight disease of rice caused by *Rhizoctonia solani* Kiihn (teleomorph: *Thanetophorus cucumeris*) is one of the major production constraints in India, especially during the wet season. In general, the disease is more where rice is cultivated under high humid conditions and fertility production system [1]. Yield loss due to this disease may be as high as 50% under favourable conditions [2]. Strategies to manage this disease are limited to chemical control only, as donors with high level of resistance are not available. However, many workers have reported existence of partial resistance to this disease in cultivated species of *Oryza* [3-5]. Identification of donors and their utilization in breeding for sheath blight resistance from wild relatives of *Oryza* could be the possible alternative to overcome the problems [6-8]. Therefore, the present study was undertaken to search for donors for resistance to sheath blight in wild relatives of rice.

Thirty two accessions belonging to eleven different species of *Oryza viz.,* 11 accessions of *O. rufipogon,* 8 of *O. nivara,* 3 of *O. eichingeri,* 2 each of *O. ojficinalis* and *O. latifolia* and one each of *O. longistaminata, O. minuta, O. aha, O. meridionalis, O. punctata* and *O. grandiglumis* were screened against sheath blight along with susceptible variety of *O. saliva* (cv. Ajaya). Experiments were conducted under both glass house and field condition. Twenty days old seedlings were transplanted (single seedling/hill) in the field under close spacing 10 x 10 cm (plant to plant and line to line) to create microclimate favorable for disease development. The screening was done in two crop growth stages *viz.,* vegetative stage and flowering stage. One set of plants was screened under natural condition and other set was screened by artificially inoculating the plants. Artificial inoculation was done by growing the fungus in autoclaved rice stem pieces (3-4 cm long) soaked with peptone solution (1% solution) and then putting 3-4 stem pieces inside each hill and tied up with a rubber band. The humidity during the crop growth period in field was observed to vary from 85-95%. Same experiment was also conducted under glass house condition. The observations on first appearance of symptoms, lesion height (cm) and percent culm length infected were recorded after 21 days of inoculation.

Crosses were made between susceptible *O. sativa* (HM 36-6-4-F) and resistant *O. latifolia* (DRW 37004) and *O. sativa* (HM 36-6-4-F) x *O. punctata* (DRW 32002) and F,s were produced using embryo rescue technique. The 10-12 days embryos were excised and cultured in % MS medium and incubated in dark at 25 ±1°C till it germinated and after germination plants were kept under light at room temperature. At 3 leaf stage, plants were transferred in liquid medium for hardening and after two weeks plants were transferred to soil. The FIS of both the crosses were highly sterile; the BC_1F_1 plants were produced using *O. sativa* as recurrent parent following the embryo rescue technique. As many as 5 BC_1F_1 plants in *O. sativa x O. latifolia* and 8 BC_1F_1 plants in *O. sativa* x *O. punctata* were produced. At tillering stage, the tillers of each BC_1F_1 plants were separated and planted both in pots and field to increase the plant populations. Agronomic practices, plant spacing and artificial sheath blight inoculation in parents, F_1s and BC_1F_1 and the check variety Ajaya were followed as described.

None of the accessions were entirely free from sheath blight infection either in field or in glass house condition. However, there was considerable variation in the lesion heights among the accessions (Table 1). Disease intensity was invariably more at flowering stage than at vegetative stage and under artificial inoculation than natural infection. Intensity of the disease was more or less similar in field and glass house condition. Average percentage of lesion height (percentage of lesion height to total culm height) among the different wild rice accessions ranged from 5.1 % (DRW-22017-5) to 44.4% (DRW-21021) while in check variety it was 47.9%. Of

Table 1. Mean lesion height (cm) of sheath blight in different species of *Oryza* at vegetative and flowering stages under natural (N) and artificially infection (I)

Wild rice/accession No.	Genome	Mean lesion height in cm								Average % age of lesion height
		Vegetative stage				Flowering stage				
		Field		Net house		Field		Net house		
		N	I	N	I	N	I	N	I	
O. longistaminata (DRW 26009)	AA	13	16	15	18	26	28	25	28	24.6
O. alta (DRW 3 8001)	CCDD	9	12	10	16	28	33	30	35	27.2
O. latifolia	CCDD									
DRW 37004		4	8	7	13	14	19	17	18	12.6
DRW 37001		4	7	6	10	30	34	32	36	23.6
O. officinalis	CC									
DRW 3 1006		10	16	12	14	28	30	30	31	29.5
DRW 3 1007		13	19	17	21	33	36	34	35	35.9
O. meridonalis (DRW 24008)	AA	9	12	10	11	19	20	18	21	16.5
O. minuta (101141)	BBCC	10	16	14	17	27	30	29	30	15.8
O. grandiglumis (DRW 39001)	CCDD	3	7	4	9	14	18	16	17	26.7
O. eichengeri	CC									
DRW 33003		13	15	14	17	34	38	37	39	27.6
DRW 33004		14	18	16	21	21	26	24	25	14.8
DRW 33001		9	13	10	12	22	26	24	26	13.8
O. punctata (DRW 32002)	BBCC	7	12	10	11	30	34	33	36	30.3
O. nivara	AA									
DRW 2 10280		16	18	17	21	29	34	30	33	29.2
WR 101		12	15	16	19	24	26	26	27	30.4
DRW 2 1009		8	9	7	10	14	18	16	20	19.3
DRW 2 1037		18	21	20	22	29	32	32	33	44.4
DRW 21021		11	14	13	16	21	26	24	25	18.6
DRW 21021-5		9	12	10	15	19	22	20	22	16.3
DRW 2 1022		14	18	17	19	35	37	34	36	26.3
WR 106		6	8	6	8	14	17	17	19	11.7
O. rufipogon	AA									
WR 125		6	9	8	9	12	15	14	16	9.7
DRW 22020-2		13	17	15	19	35	39	37	40	27.0
DRW 22021		11	14	13	16	33	35	34	37	29.2
DRW 220 11		16	19	14	22	33	35	34	37	28.5
DRW 22027-6		18	19	17	21	33	34	34	36	25.2
VN2		17	19	18	20	32	34	31	35	21.9
WR 135		9	13	11	14	16	17	17	19	12.6
WR 118		13	18	15	20	29	34	32	34	25.2
DRW 220 17-5		3	4	3	6	4	6	6	8	5.1
WR 124		16	20	18	19	32	37	35	37	27.8
WR24		10	11	12	13	21	24	23	23	33.0
O. sativa (Ajaya) check	AA	17	20	19	21	37	39	38	39	47.9
Mean -	10.9	14.2	12.5	15.8	25.1	28.3	26.8	28.9		
SE(±) 0.76	0.86	0.79	0.81	1.44	1.46	1.42	1.45			

the thirty two wild rice accessions screened, two showed 5-10% lesion height, 10 showed 10-20% lesion height, 14 showed 20-30% lesion height and rest were highly susceptible.

At vegetative stage, both in field and net house, under natural and artificial inoculation 6 accessions, one each *of O. latifolia* (DRW 37001), *O. grandiglumis* (DRW 39001) and 2 each from *O. nirvara* (DRW 21009 and WR 106) and *O. rufipogon* (WR 125 and WR 22017-5) showed less than 10 cm average lesion height. Seven accessions, one each from *O. latifolia* (DRW 37004), *O. meridionalis* (DRW 24008), *O. eichingeri* (DRW 33001), *O. punctata* (DRW 32002), *O. nivara* (DRW 21021-5) and two in *O. rufipogon* (WR 125 and WR 24) showed average lesion height up to 15 cm and 10 accessions showed lesion height between 15-20 cm. While at flowering stage only one accession of *O. rufipogon* (DRW 22017-5) showed below 10 cm lesion height and 7 other accessions showed lesion height in between 10-20 cm. Considering the disease development in both the stages, Ace. DRW 22017-5 of *O. rufipogon* had less than 10 cm lesion height in all the experiments and considered as resistant. While one accession each of O. *latifolia* (DRW *37004), O. meridionalis* (DRW 24008), two accessions of *O. nivara* (DRW 21009 & WR 106) and two accessions of a *rufipogon* (WR 125 & WR 135) were moderately resistant with lesion height below 20 cm in different environments and different growth stages and with percentage of lesion height less than 20% (Table 1). The different stability measures *viz.,* coefficient of variation (CVi), environmental variance (Si^2), regression coefficient (bi) and ecovalence measures (Wi) calculated for different promising accessions proved the stability of the resistance in those accessions (data not shown).

The differential reaction and progress of sheath blight disease was also observed in BC_1F_1 populations. Four distinct severity groups with scores 3, 5, 7 and 9 (0-9 SES scale) was observed in 5 BC_1F_1 plants from *O. sativa* x *O. latifolia* after 21 days of inoculation. Similarly, four different severity scores were observed in 8 BC_1F_1 plants from *O. sativa* x *O. punctata.* One BCiFi plant of each *O. sativa* x *O. latifolia* and *O. sativa* x *O. punctata* showed high level of resistance with score 3 and one each from *O. sativa* x *O. latifolia* and *O. sativa* x *O. punctata* showed moderate level of resistance with score 5. This indicates that the sheath blight resistance is heritable and there is scope for introgression of genes from distantly related species.

Intensive search has been made for a long time for suitable resistant donors that can be used in targeted sheath blight resistant breeding programme. Several such studies suggested the presence of partial sheath blight resistance in different cultivated germplasm [3-5]. The present findings suggested that the genetic variability exists in wild rice accessions in respect to sheath blight resistance. Similar observations were also reported by earlier workers [6-8]. The introgression of sheath blight resistance from distantly related species (other than AA genome) is a difficult task due to very less recombination between *Oryza sativa* and other genome. Hence the *O. rufipogon* accession DRW 22017-5 provides an important source for sheath blight resistance, which can be exploited to improve the modern high yielding cultivars and pyramiding it with the genes for moderate resistance in cultivated germplasm would certainly increase the level of resistance. Further screening of large number of accessions of wild rice in highly conducive conditions would help in identification donors with higher level of resistance.

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