Screening rice genetic resources for major diseases of uplands and quality traits of resistant donors

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ABSTRACT: Of the 93 rice accessions (43 exotic and 50 indigenous) screened for leaf blast resistance, Arroz Dos Indios, CNA 108-8-42, CNA 4136, IRAT 267 and Akashi were highly resistant. Fifty seven accessions exhibited moderate resistance. All exotic accessions except Laxmijata and GS 529 were resistant. Among indigenous accessions, only Pallavi besides Akashi was resistant and 19 were moderately resistant. About half (53%) of the 59 accessions evaluated for leaf brown spot reaction, possessed resistance or moderate resistance. The accessions Lohana 1, Kalamkata and Rangi were highly resistant. Accessions Aneba, Aditya, Pallavi and Dular were resistant or moderately resistant to both leaf blast and brown spot. Of the 5 highly blast resistant accessions, Arroz Dos Indios also possessed high milling out-turn, head rice, long kernel, high water uptake and volume expansion, while Akashi had high water uptake, kernel linear elongation and intermediate amylose content. Accessions Jhildihan, Lohana 1 and Rangi had high kernel linear elongation besides high level of resistance to brown spot. Such donors could prove invaluable in the hybridization programme to improve quality and disease resistance.

Key words: Oryza sativa L., upland rice, screening, blast, brown spot, quality, genetic resources

Search for appropriate donors for agro-morphological, quality attributes/traits and resistance to both biotic and abiotic stresses is a continuous process. One of the major objectives of the genetic resource management programme is to continually provide resource genes for agronomic and quality traits as well as tolerance/resistance to biotic and abiotic stresses to the breeders for diversifying the genetic base of improved varieties to suit better the changing insect-pest scenario and agroclimate so as to obtain higher yield. The resistant varieties would reduce cost of production by reducing the investment on pesticides. In this endeavour, systematic evaluation and characterization of the germplasm is the key to the success of any breeding programme. The collections at Central Rainfed Upland Rice Research Station, Hazaribag have been regularly evaluated for diseases and quality components (Chauhan et al., 1995, 1997; Shukla et al., 1995). The present investigation was attempted to evaluate exotic and indigenous rice genetic resources for reactions to blast and brown spot diseases. The quality attributes of resistant accessions to either or both diseases were also assessed and presented.

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MATERIALS AND METHODS

Ninety three (43 exotic and 50 indigenous) rice accessions were evaluated for resistance to leaf blast (Pyricularia grisea Sacc.) and fifty nine accessions for leaf brown spot (Drechslera oryzae (Breda de Haan) Subram. & Jain) diseases during 1994-1995 in upland nurseries following out-door blast nursery pattern as described elsewhere (Variar et al., 1990). The disease reaction of each accession was recorded over two seasons. Brown spot nursery received only 20 kg N/ha while blast nursery received 120 kg N/ha. The standard evaluation system (SES) for rice (Anonymous 1988) was followed to assess disease reaction.

The quality characters, viz., hulling, milling, headrice recovery, milled kernel length, kernel length/kernel: breadth ratio (L/B ratio), alkali value, amylose content, water uptake, volume expansion and kernel linear elongation were estimated following standard methods as discussed (Chauhan, 1999).

RESULTS AND DISCUSSION

Evaluation for blast

Of the 93 accessions evaluated, five were highly resistant, 19 were resistant and 38 were moderately resistant (Table 1) all others were susceptible. Except for two accessions (GS 529 and Laxmijata), all exotics.
**Table 1.** Leaf blast resistance in indigenous and exotic rice

<table>
<thead>
<tr>
<th>Disease score</th>
<th>No</th>
<th>Accession Name</th>
</tr>
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<tbody>
<tr>
<td>Highly resistant (0-1)</td>
<td></td>
<td>Arroz Dos Indios (HRC 1010)<em>, CNA 108-8-42(HRC 1016)</em>, CNA 4136 (HRC 1023)<em>, IRAT 267 (HRC 1078)</em>, Akashi (HRC 1006)</td>
</tr>
<tr>
<td>Resistant (2-3)</td>
<td></td>
<td>A63-83 (HRC1001)<em>, A08-391 (HRC 1003)</em>, Arroz de Aldeia Ca (HRC 1009)<em>, CNA 4124 (HRC 1019)</em>, CNA 4125 (HRC 1020)<em>, CNA 4127 (HRC 1021)</em>, CNA 4130 (HRC 1022)<em>, CNA 4164 (HRC 1024)</em>, CNA 5164A (HRC 1030)<em>, CNA 5164B (HRC 1031)</em>, CNA 5166 (HRC 1032)<em>, IAC 025 (HRC 1044)</em>, IAC 1246 (HRC 1045)<em>, IAC 165 (HRC 1046)</em>, 1 RAT 115 (HRC 1058)<em>, IRAT133 (HRC 1059)</em>, IRAT144 (HRC 1061)<em>, IRAT 237 (HRC 1073)</em>, Pallavi (HRC 779)*</td>
</tr>
<tr>
<td>Moderately resistant (4-5)</td>
<td></td>
<td>A 08-253 (HRC 1002)<em>, Arroz De PRODUCTO (HRC 1008)</em>, CNA 4121 (HRC 1018)<em>, CNA 4173 (HRC 1025)</em>, CNA 4744 (HRC 1027)<em>, CNA 4745 (HRC 1028)</em>, IRAT 10 (HRC 1055)<em>, 1 RAT 110B (HRC 1056)</em>, 1 RAT 190 (HRC 1066)<em>, IRAT 211 (HRC 1069)</em>, IRAT 212 (HRC 1070)<em>, 7 IRAT233</em> (HRC1072), IRAT 239 (HRC 10741), IRAT 240 (HRC 1075)<em>, IRAT 260 (HRC 1076)</em>, IRAT 263 (HRC 1077)<em>, IRAT 291 (HRC 1081)</em>, Hrangkajali (HRC 1042)<em>, CH 988 (HRC 677a)</em>, ADT 33 (HRC 766), Govind (HRC 752), Triveni (HRC 763), Aus-1 (HRC 1269), Saberi (HRC 765), 3-month variety (HRC 1130), Aareba (HRC 732) a Dular (West Bengal) (HRC 1035), Kalyani (HRC 744), Sudha (HRC 432), Tulsi (HRC 760)*, Prabhat (HRC 764), Prathalad (HRC 759), Birsadhan 201 (HRC 751), Birsadhan 202 (HRC 1270), Bhangani (NIC 105463A), Bhangani (NIC 105598)</td>
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*Exotic accessions; a and b resistant and moderately resistant, respectively, to brown spot.

**Table 2.** Rice accessions with moderate to high resistance to brown spot

<table>
<thead>
<tr>
<th>Disease score</th>
<th>No</th>
<th>Accession Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highly resistant (0-1)</td>
<td></td>
<td>Lohana I (HRC 1105), Kalamkata (HRC 1110), Rangi (HRC 1120)</td>
</tr>
<tr>
<td>Resistant (2-3)</td>
<td></td>
<td>Chandrakanti (NIC 105789), Nardha (NIC 105808), Bangani (NIC 105463), Gaharadhan (HRC 1106), Bismania (HRC 1127), CH 988 (HRC 677)*, Kanchan (HRC 758), Neela (HRC 753), Aditya (HRC 756), Lohana 2 (HRC 1108), Birendrasar (HRC 1111), Ladusar (HRC 1117), 3 month variety (H RC 11 30), Areba (H RC 732), S udha (H RC 432), Tulsi (HRC 760)</td>
</tr>
<tr>
<td>Moderately resistant (4-5)</td>
<td></td>
<td>IRAT 115 (HRC 1058)*, Aus 257 (HRC 1012), MTU 17 (HRC 770), B 76 (HRC 423), Pallavi (HRC 779), Narendra (HRC 86), Samanto (HRC 1104), Khirasar (HRC 1124), Mugadi (HRC 1128), Jhingasall (NIC 105757), Kalamdan (NIC 105814), Goramalti (NIC 105699), Dular (West Bengal) (HRC 1035), Kalyani (HRC 744)</td>
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</table>


were either resistant or moderately resistant, though four (Arroz Dos Indios, CNA 108-8-42, CNA 4136 and IRAT 267 ) exhibited high level of resistance (0-1 score). Among indigenous accessions, only Akashi was highly resistant, Pallavi was resistant and the rest were moderately resistant. Sixty two accessions (66.7%) showed resistance or moderate resistance to leaf blast. In earlier study, all the 183 indigenous traditional cultivars which were evaluated showed susceptibility to leaf blast (Shukla et al., 1995).

**Evaluation for brown spot**

Three accessions, viz., Lohana 1, Kalamkata and Rangi were highly resistant among the 59 accessions evaluated for brown spot disease. Except CH 988 and IRAT 115, the rest were indigenous collections. Twenty
nine accessions (47.5%) were either resistant or moderately resistant (Table 2). Eleven accessions were either moderately resistant or resistant to both the diseases (Table 3). For an effective varietal improvement programme, it is preferable to use donors with multiple desirable traits, such as resistance to diseases, agromorphological and quality traits.

The present study revealed that besides resistance, some of these also possessed desirable quality traits such as high kernel elongation, grain shape and size (long slender), intermediate amylose content and high milling out-turn (Table 3). Of the 5 highly blast resistant accessions, Arroz Dos Indios also possessed high milling out-turn, head rice, long kernel, high water uptake and volume expansion, while Akashi had high water uptake, kernel linear elongation and intermediate amylose content. Accessions Jhillidhan, Lohana 1 and Rangi had high kernel linear elongation besides high level of resistance to brown spot. These accessions could be valuable gene sources of resistance and quality if utilized in the hybridization programme.

### REFERENCES


