Wide hybridization studies between *O.sativa* (cultivated Asian rice) and *O.nivara* (wild rice)

P.V.Hemachandra  
Rice Research and Development Institute  
Batalagoda,  
Ibbagamuwa
Staff involved

- N.M. Anoma Nawarathne, A.I.
- D.W.A.J.Dissanayake, A.I.
- W.M.U.S.Geethika, T.A.
O.nivara

- Found in dry and intermediate zone of Sri Lanka
- AA genome
- No evaluation data related to Brown Plant Hopper (BPH) resistance
O.Nivara – collected near Mahiyangana Raja Maha Vihara
Wide hybridization

- Hybridization with two different species.
- Difficult
- Possible using conventional breeding techniques
Objective

- Collect, screening and transfer of BPH resistant gene from wild rice species (*O.nivara*) to *O.sativa* using wide hybridization technique
Rice Research and Development Institute
Batalagoda, Ibbagamuwa
Procedure

- Collection of *O.nivara* accessions
- Screening against BPH
- Wide hybridization
- Generation advancement
Collection of *O. nivara* accessions

- previous wild rice collection data was obtained from Plant Genetic Resources centre and National Herbarium, Royal Botanic garden, Peradeniya
- 14 Collection missions
- 06 districts, Anuradhapura, Matale, Kurunegala, Badulla, Puttalam and Polonnaruwa
- Seeds collected for BPH screening
Screening against BPH

- Screened against BPH using Standard evaluation system (Henrichs et al 1985)
- Susceptible check  Bg 380
- Resistant check   PTB 33
Screening against BPH

- Seeds were germinated at screen house at RRDI
- After 10 days BPH were introduced
- Favorable conditions for BPH were maintained at screen house
- Data were recorded according to the standards
- 1st data set was recorded at Bg 380 showed rating level 05
- 2nd data set was recorded at Bg 380 showed rating level 07
Wide hybridization

- *O. sativa* var. Bg 380 used as female parent
- Selected BPH resistant accession (WRAC 04) used as male parent
- Ten crosses were made
- Bg 380 emasculated by hand
- Pollination was performed with fresh pollen of *O. nivara* accession
- Pollinated spike lets were covered by oil paper bags
Generation advancement

- F1 seeds were planted at RRDI plant cage
- Filled F2 seeds were screened against BPH
- BPH resistant F2 seeds were planted
- This procedure was followed till F4 seeds were formed
- F5 seeds were planted at the field as 03 raw progenies
Results

- Forty different accessions were collected from following district

<table>
<thead>
<tr>
<th>District</th>
<th>No. of accession collected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anuradhapura</td>
<td>18</td>
</tr>
<tr>
<td>Badulla</td>
<td>02</td>
</tr>
<tr>
<td>Kurunegala</td>
<td>05</td>
</tr>
<tr>
<td>Matale</td>
<td>13</td>
</tr>
<tr>
<td>Polonnaruwa</td>
<td>01</td>
</tr>
<tr>
<td>Puttlam</td>
<td>01</td>
</tr>
</tbody>
</table>
Collection sites of *O. nivara* accessions
## BPH Screening results

<table>
<thead>
<tr>
<th>Reaction against BPH</th>
<th>No. of accessions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistant</td>
<td>03</td>
</tr>
<tr>
<td>Resistant/ moderately Resistant</td>
<td>15</td>
</tr>
<tr>
<td>moderately Resistant</td>
<td>15</td>
</tr>
<tr>
<td>moderately Susceptible</td>
<td>03</td>
</tr>
<tr>
<td>Susceptible</td>
<td>04</td>
</tr>
</tbody>
</table>
Wide hybridization results

- Forty-two F1 seeds were formed
- All are germinated
- More vigorous F1 plants were observed
Parents

- *O.sativa* var Bg 380
- Mother plant
- BPH susceptible variety

- *O.nivara* WRAC 04
- pollen parent
- BPH resistant accession
After hybridization
Progress

- $F_1$ seeds
- Planted at plant cage
F<sub>1</sub> plants

- Vigorous plants
- Plant height In between parents
- High percentage of empty seeds
## Average plant height of parental lines and F1s

<table>
<thead>
<tr>
<th>O. Nivara WRAC 04</th>
<th>O. Sativa var. Bg 380</th>
<th>F1 plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>130 cm</td>
<td>95 cm</td>
<td>112 cm</td>
</tr>
</tbody>
</table>
Results con...

- All F1 plants produced F2 seeds
- Only 10% were filled
- Fill seed percentage were increased with generation advancement
F₂ to foam seeds

- Only straw color seeds – fill
% filled seeds, % resistant plants with generation

<table>
<thead>
<tr>
<th>Generation</th>
<th>% filled seeds</th>
<th>% resistant plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>100</td>
<td>-</td>
</tr>
<tr>
<td>F2</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>F3</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>F4</td>
<td>90</td>
<td>92</td>
</tr>
</tbody>
</table>
Screening for BPH resistance
Screening F2 plants
Screening F4 plants
Progress published ASDA 2008

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Objectives:
- Evaluate possibility of interspecific use gene from wild rice (*O. nivara*) in cultivated rice (*O. sativa*) through wide hybridization technique

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Investigation of Brown Plant Hopper resistance in *Oryza nivara* and *Oryza eichingeri* derived lines

S.A.P. Madurangi *et al* 2008
Conclusion

- Three *O.nivara* accessions have BPH resistant genes.
- Wide hybridization results suggest that BPH resistant gene from *O.nivara* WRAC 04 can be incorporated to *O.sativa* var. Bg 380.
- Molecular studies confirmed these findings.
Acknowledgements

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