Two new pathotypes-29R45 and 93R39 of *Puccinia triticina* from India


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ABSTRACT: Two new pathotypes 29R45 and 93R39 of *Puccinia triticina* Eriks. (Brown rust of wheat) are described here. Both the pathotypes are virulent on *Lr26* (1BL.1RS translocation), which occurs in about 40% of the recently identified Indian wheat varieties. Pathotypes 29R45 is virulent on *Lr23* whereas 93R39 is avirulent. In addition to virulence on bread wheat, pathotype 29R45 was found more virulent on durum, emmer wheat and some barley lines. Implications of new pathotypes, their avirulence/virulence formulae, and resistance sources are listed.

Key words: *Puccinia triticina*, brown/leaf rust of wheat, new pathotypes, resistance sources

Wherever, the infection types of a sample differed from the existing pathotypes (pts., singular pt.), single spore isolations were taken. These single spore isolates were then tested with closely resembling pathotypes under same set of conditions. To find resistance lines, 500 Indian, exotic wheat lines were evaluated at seedling stage. Since one of the pathotypes infected barley lines, barley germplasm was also evaluated. International equivalents of these pathotypes were also designated following Mc Vey *et al.* (2004).

RESULTS AND DISCUSSION

Pathotype 29R45

In 2004-05 crop season, four samples of brown rust of wheat collected from Hooli, Hebbali, Navalgund and Arabhavi on Local Red, Local bread wheats and HD 2329 (Karnataka) and from Kopergaon in Ahmadnagar (Maharashtra) on HD 2189 yielded same culture.

On sets of differentials it resembled pathotype 12 group and was found to have combined virulence for both *Lr23* and *Lr26*. Earlier none of the pathotypes from this group was virulent on both these resistance genes. The new pathotype has been designated as 29R45 (12-5) and on international set as FHTKL.
(Table 1). It differed from pathotypes 5R37 and 49R37 in its virulence on Lr20 and Lr23 whereas pt. 5R13 for virulence on Lr26.

Avirulence/virulence formula of new pathotype (29R45) is Lr1, 2a, 9, 10, 13*, 15, 19, 24, 25, 28, 29, 32, 36, 41, 42, 43, 45/ Lr2b, 2c, 3, 11, 12, 14a, 14b, 16, 17a*, 17b, 18, 20, 21, 22a, 22b, 23, 26, 27+31, 30, 33, 34, 35, 37, 38, 44, 46, 48, 49 (* Temperature sensitive). Advance Varietal Trial (2004-06) lines DBW17, HD 2816, HD4713, MACS 3121, MACS 3125, NIDW325 and Raj 6546, which were resistant to all the pathotypes, were susceptible to this pathotype. This pathotype produced susceptibility on many exotic/Indian durum and emmer advance lines. Lines AKW 3294, AKDW 2997-16, Altar 84, DWR 1006, DWR 1013, GW 1128, GW 1129, HD 4675, HD 4713, HI 8498, HI 8550, HI 8638, MACS 2788, MACS 2884, MACS 2915, MACS 3075, Raj 6514, Raj 6566-15 and RRM 46 were resistant to all the pathotypes except pt. 29R45. Another peculiar feature of this pathotype is its virulence on barley lines. Thirty five of the National Barley Disease Screening Nursery 2004-05 lines were susceptible to this pathotype.

**Pathotype 93R39**

Another sample from Agra Local planted in wheat disease trap plot nursery at Kanpur (Uttar Pradesh) revealed a pathotype close to 162 group but different to all the known pathotypes of P. triticina in India. It is designated as 93R39 (162-2). Like 93R47, new pathotype is virulent on Lr26, however, is avirulent on Lr20. In comparison, pathotype 93R15 it is avirulent on Lr26 whereas 93R39 is virulent (Table 1). Avirulence/virulence formula of pathotype 93R39 is Lr1, 9, 13, 14ab*, 15, 19, 20, 21, 23, 24, 25, 27+31*, 28, 29, 32, 36, 38, 40, 41, 42, 43, 45, 46 / Lr2a, 2b, 2c, 3, 10, 11, 12, 14a, 14b, 16, 17a, 17b, 18, 22a, 22b, 26, 30, 33, 34, 35, 37, 44, 48, 49.

For identifying resistance sources, 500 known resistance lines of bread, durum wheat and triticale were evaluated against both the new pathotypes under temperature-controlled conditions (22°C). Two hundred and seventy lines resistant to both the pathotypes have been listed in Table 2. New pathotypes have been added to the culture collection and long-term storage at the station.

Earlier, 6 pathotypes were reported in 12 group and latest 69R13 was recorded in 1990 (Prashar et al., 1991). Pathotype 29R45 is the first pathotype in this group with virulence for both Lr23 and Lr26. Susceptibility of barley to brown rest of wheat as to pathotype 29R45 is already known in literature (Niks et al., 1996). Analysis of avirulence and virulence structure suggested that pt. 29R45 could be the result of somatic hybridization of pts. 5R13 and 5R37. Role of somatic hybridization in the origin of new pathotypes has been documented and reviewed by Knott (1989). Some of the new pathotypes identified from Karnataka and Maharashtra were not recorded in Nilgiri hills and northern India as has been documented for pt. 253R 31 (Bhardwaj et al., 2005). It is very likely that pathotype 93R39 has evolved by one step up mutation to Lr26 in pt. 93R7, independent of recently identified pt. 93R 47 (Nayar et al., 2004).

**Table 1. Differentiating infection types of new pathotypes 29R45 and 93R39 of P. triticina**

<table>
<thead>
<tr>
<th>Pathotype name</th>
<th>International equivalent</th>
<th>Malakoff (Lr1)</th>
<th>Webster (Lr2a)</th>
<th>Lr10</th>
<th>Lr15 (Kenya)</th>
<th>Thew (Lr20)</th>
<th>IWP94 (Lr23)</th>
<th>Benno (Lr26)</th>
</tr>
</thead>
<tbody>
<tr>
<td>29R45</td>
<td>12-5*</td>
<td>FHTKL</td>
<td>0;</td>
<td>0;</td>
<td>3* 3* 3*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5R13</td>
<td>12A</td>
<td>FGTL</td>
<td>0; 3†</td>
<td>3*</td>
<td>0; 3* 0;</td>
<td>3* 0;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5R37</td>
<td>12-1</td>
<td>FHPTL</td>
<td>0;</td>
<td>3†</td>
<td>0; 3*</td>
<td>3* 3*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>49R37</td>
<td>12-3</td>
<td>FHTTQ</td>
<td>0; 3†</td>
<td>3*</td>
<td>3* 3*</td>
<td>3* 3*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>121R63-1</td>
<td>77-5</td>
<td>THTTS</td>
<td>3* 3* 3†</td>
<td>3*</td>
<td>3* 3* 3*</td>
<td>3* 3*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21R55</td>
<td>104-2</td>
<td>PHTTL</td>
<td>3* 3* 3†</td>
<td>3*</td>
<td>3* 3* 3*</td>
<td>3* 3*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>93R39</td>
<td>162*</td>
<td>KHTTL</td>
<td>0; 3* 3*</td>
<td>3*</td>
<td>0; 3*</td>
<td>3* 3*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>93R7</td>
<td>162</td>
<td>KGTL</td>
<td>0; 3* 3*</td>
<td>3*</td>
<td>0; 3*</td>
<td>3* 3*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>93R47</td>
<td>162-1</td>
<td>KHTTL</td>
<td>0; 3* 3*</td>
<td>3*</td>
<td>0; 3*</td>
<td>3* 3*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* -New pathotypes; †- Temperature sensitivity
Among the rust resistance genes in Indian wheat material Lr1, Lr9 and Lr24 are resistant to both the pathotypes. In addition Lr25, Lr28, Lr32, Lr41, Lr42 and Lr45 also provide protection against all the pts. of *P. triticina* in India.

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**REFERENCES**


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