Distribution of pathotypes flora of wheat leaf rust pathogen
(*Puccinia recondita f. sp. tritici*) in Nepal

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Wheat, the world's most extensively grown crop is the third most important source of food and income in Nepal. It occupies an area of 640,802 hectare and produce 10,86,470 mt with the average productivity of 1.69 mt/ha (3). There are several constraints towards realizing the potential yield in wheat.

One of the major causes of instability of wheat production has been the rust epidemics. Losses incurred by leaf rust have been estimated up to 40 per cent in severe epidemic (2, 4). The resistance is often neutralized with the evolution of new pathogenic races soon after the new disease resistant cultivars have been extensively grown. The identification of pathogen variation has great significance for the success of resistance breeding programmes. The success of resistance breeding programmes depend to a very large extent on knowledge of virulence spectrum. Therefore, investigations were initiated to study the pathotypes distribution of *Puccinia recondita* Rob. ex Desm. *f. sp. tritici* Eriks. and Henn. in Nepal.

Leaf rust samples were collected randomly at every 20 km or so depending upon the geographical location and availability of crop. In addition to surveys, samples were also collected from selected geographical areas and variety of special interest. Samples were collected in paper envelopes, dried under shade at room temperature and brought to Directorate of Wheat Research Regional Station, Flowerdale, Shimla for virulence analysis.

Samples were revived on 2 per cent water agar and multiplied on susceptible host (Agra local) with the help of lancet needle to get sufficient uredospores for inoculating the differentials (6) (Table 2). The trays with the seeds sown were kept on to the glasshouse benches and watered regularly for uniform growth of the seedlings. The temperature of glasshouse was between 22°-25°C.

The seedling infection types (ITs) data were recorded after 12-15 days of inoculation using scale of Nayer et al. (9) modified from Stakman et al. (10). The pathotypes were designated based on the resistant or susceptible reactions produced on the differentials following the binary notation system of Nagarajan et al. (7).

One hundred four samples of leaf rust were analysed. Pathotype 77-2 (109R31-1) was found most predominant (72.11%) followed by 77-4 (125R31-1) in 20.19% and 77-5 (121R63-1) in 7.69% of the samples analysed, based on the seedling reactions on differentials (Table 1).

<table>
<thead>
<tr>
<th>Development region</th>
<th>No. samples analysed</th>
<th>77-2</th>
<th>77-4</th>
<th>77-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eastern</td>
<td>18</td>
<td>11</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Central</td>
<td>27</td>
<td>18</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Western</td>
<td>27</td>
<td>22</td>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td>Mid-Western</td>
<td>18</td>
<td>15</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Far Western</td>
<td>14</td>
<td>9</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>104</td>
<td>75</td>
<td>21</td>
<td>8</td>
</tr>
</tbody>
</table>

Pathotypes 77-2 (109 R31-1) was most predominant in mid Western (83.33%) followed by Western (81.48%), Central (66.66%), Far Western (64.28%) and Eastern (61.11%) Development Region of Nepal. It was also observed in foothills, Doti, Kabre, Tanhu, Gorkha, Lumjung and Kashi areas of Nepal. It was detected in more than 72% of samples. This pathotype was widely distributed through the wheat growing areas of the kingdom and was isolated from Nepal 297, Nepal 251, UP 262, RR 21, BL 1022, Vinayak, Annapurna-1, Annapurna-3, BL 1066, NL 683, some local and un-
Table 2. Infection types on the differentials of Set 0, A and B against the leaf rust (Puccinia recondita tritici) pathotypes identified in samples from Nepal

<table>
<thead>
<tr>
<th>Differential Pathotype and infection type</th>
<th>77-2</th>
<th>77-4</th>
<th>77-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>(109R31 (125R23 (121R63 -1))</td>
<td>-1)</td>
<td>-1)</td>
<td>-1)</td>
</tr>
</tbody>
</table>

Set-0

- IPW 94 (Lr 23+)
- Kharchia Mutant (Lr 9+)
- Raj 3765
- PBW 343
- UP 2338
- K 8804
- Raj 1555
- HD 2189
- Agra local

Set-A

- Selkirk/Kc*6 (Lr 14a)
- Prelude*6/Agent (Lr 24)
- Timvera (W 1308) (Lr 18)
- Egret (Lr 13)
- Tc*6/K Lucero (Lr 17)
- Kenya W1483 (Lr 15)
- TC*6/Lee (Lr 10)
- Agatha (T4 Line) (Lr 19)

Set-B

- Loros (Lr 2c)
- Webster (Lr 2a)
- Democrat (Lr 3)
- Thew (Lr 20)
- Malakoff (Lr 1)
- Benno (Lr 26)

# Reactions variable

known wheat varieties from different agroecological zone of the country. Pathotype 77-4 (125 R 23-1) was observed more in Eastern (33.33%) followed by Central (25.92%), Western (18.51%), Mid Western (18.51%) and Far Western (7.14%) region of Nepal. It was prevalent in morang, Saptari, Siraha, Mahotari, Sarlahi and Rautahat district of Nepal. This pathotype was isolated from Nepal 297, UP 262, RR 21 (Saptari, Sirha, Ilam) whereas from UP 262-(Mahotari and Rauthat), BL 1066, BL 1135 and Annapurna-4 (Yampaphant Lumgung).

Pathotype 77-5 (121 R 63-1) was observed in 7.69% of total samples analysed. It was prevalent in Far Western (28.57%) followed by Central (7.4%), Mid Western (5.55%) and Eastern (5.55%) part of Nepal. This pathotype was not observed in Western Development Region of Nepal. It was observed in Dhingardhi, Surkhet, Chitwan, Barbute, Manaco, Ramche, Dunda and Lal Koiti on Kalyansona, RR21 and UP 262. One sample of UP 262 from Chitwan yielded pathotype 77-5 (121 R 63-1) whereas, one sample of RR 21 from Barbote had 77-5 (121 R 63-1) and rest of this pathotype identified from unknown and local wheat varieties from farmers fields.

Pathotype 77-5 (121 R 63-1) is a new one which has been reported for the first time in Nepal. Detail of prevalence of leaf rust pathotypes location wise has been also reported for the first time. This pathotype has got combined virulence for Lr 23 and Lr 26 which is most common occurring resistance gene/s in Nepalese wheat (Annapurna -1,3,4 and others). The lines/varieties with Lr 26 in different nurseries, hybridization block and under farmers field conditions have been still imparting resistance in both natural and artificial inoculation conditions with mixture of different pathotypes. It might be because of low inoculum load of pathotype 77-5 (121 R 63-1).

One sample from Hardinath, Danusha on highly popular variety Bhrikuti yielded 77-2 (109 R 31-1). Samples from Rupandehi yielded 77-2 (109 R 31-1) followed by 77-4 (125 R 23-1). Pathotype 77-2 (109 R 31-1) followed by 77-4 (125 R 23-1) were most frequently occurring in Nepal 297 throughout the Tarai and lower valleys, however, one samples of Nepal 297 in Nepalganj produced 77-4 (125 R 23-1).

Earlier reported pathotypes 12, 12-2, 12-4, 77, 77-1, 77-3, 77-A, 77-A-1, 104, 104-1, 104-2, 104-A, 104B, 107, 108-1, 20, 22, 26 and 57 were not observed from the samples analysed during present investigation. (1, 8). This could be due to less number of samples. However, it might be possible that these pathotypes could be present in certain inaccessible pockets or shift in pathotypes population might have occurred due to changed varietal pattern. The results revealed that pathotypes having matching virulence for Lr 1, 2, 10, 13, 14a, 15, 17 and 23 are quite common in Nepal.

Pathotype 77-2 (109 R 31-1) and 77-4 (125 R 23-1) were predominant in whole Nepal, Bihar, U.P. West Bengal, Himachal Pradesh, Jammu and Kashmir, Punjab and Haryana of India and Bangladesh. However, 77-5 (121 R 63-1) was distributed in Far Western, Central, Mid Western and Eastern part of Nepal, Nilgiri hills and above mentioned states of India (8).

Both pathotypes 77-2 (109 R 31-1) and 77-4 (125 R 23-1) which are virulent on Lr 23 and avirulent on...
Lr 26 were identified from different parts of the kingdom. Pathotype 77-5 (121 R 63-1) has combined virulence for Lr 23 and Lr 26 was identified in samples from Dhangadhi, Surkhet, Barbote, Manaco, Chitwan and Lalkoiti. During 1993, resistant varieties including Nepal 297 and Nepal 251 with Lr 13+12 were found highly susceptible due to pathotype 77-2, which posed a great threat to wheat cultivation in Nepal (5).

REFERENCES

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