Screening of potato germplasm for resistance to stem necrosis

R.B. SINGH¹, S.M. PAUL KHURANA², S.K. PANDEY² and K.K. SRIVASTAVA¹
¹Agric. Res. Station, Ummedganj, G.P.O. Nayapura, Kota-324 001
²Central Potato Research Institute, Shimla-171 001

ABSTRACT: During autumn of 1995-96 and 1996-97 at Agricultural Research Station, Ummedganj, Kota, a total of 62 varieties/advanced hybrids and TPS populations were screened for resistance under field conditions on early plantings. Their DI and DX varied from 1-70% and 0.1-3.5, respectively. Varieties Kufri Bahar (Avg. DI=59%; DX=2.95) followed by Kufri Chandramukhi (Av. DI=46%; DX=2.3) proved highly susceptible while Kufri Sindhuri showed least (Avg. DI=3%; DX=0.15) resistance. Among hybrids tested, PS/F-220, IN-189 and MS/82-717 showed low DI (< 5%) and DX (<0.3) and were graded as resistant. Similarly, true seed population HPS 25/13 proved resistant.

Key words: Potato, stem necrosis, tospovirus, resistance, screening, germplasm.

Potato is an important cash crop in central and western plains which accounts for more than half of total potato production in the country. In recent years incidence of potato stem necrosis, caused by a tospovirus belonging to serogroup IV (Khurana et al., 1997, 1998) has been found to be gaining economic importance (Phadtare et al., 1989; Khurana, 1992; Singh and Agrawat, 1993; Sanger, 1996, Singh et al., 1997). Its incidence and consequent losses particularly in early planted crop were recorded to be high at Kota in Rajasthan and Chhindwara in Satpura plateau of M.P. making them natural ‘hot spots’ of the disease (Singh and Agrawat, 1993; Khurana et al., 1997). Varietal differences in incidence of disease were observed. A study was, therefore, conducted to screen the germplasm for finding out the possible sources of resistance to the virus-vector/disease which may be useful while developing resistant varieties.

MATERIALS AND METHODS

The experiment was conducted during autumn of 1995-96 and 1996-97 at the university farm of Agri. Res. Station, Ummedganj, Kota, a natural hot spot of this disease. The material consisted of 62 potato cultures comprising eight popular varieties of the region, 51 advanced hybrids and 3 hybrid TPS populations. Fifteen tubers of each culture were planted in two rows (3m) with hill to hill distance of 20cm. The inter row distance was kept at 60 cm. The plantings were done in the 2nd week of October. The cultures were exposed to the natural infection. Data were recorded on 20 plants at random on final disease incidence (DI) at 60 days after planting and disease index (DX) was computed according to Khurana et al. (1977) and the cultures were grouped as R, MR, S and HS.

RESULTS

The disease intensity and index of all the potato cultures tested for the two years (alongwith the ranges) have been presented in Table 1. The maximum variation in DI ranged from 1-70% (avg. 1.5-59.%) and DX from 0.1-3.5 (avg. 0.075-3.5). Both DI and DX were minimum in PS-25/13 and maximum in cv. Kufri Bahar. Among eight potato varieties tested cv. Kufri Bahar (Avg. DI=59%; DX=2.95), followed by Kufri Chandramukhi (Avg. DI=46%; DX=2.3) showed the highest values of both DI and DX and therefore, can be grouped into the highly susceptible category. Similar was the situation with cvs., Kufri Lalima, Kufri Jawahar, Kufri Badshah and Kufri Satluj which also showed higher DI (more than 30%) and DX (>1.5) indicative of their also being highly susceptible. In contrast cv. Kufri Sindhuri had the least DI and DX (Avg. DI=3%; DX=0.15) and, therefore, can be placed in the resistant group.

The variation in DI and DX among the 51 advanced hybrids was similar to the same in the varieties. Only three hybrids, viz., JN-179, MS/82-717 and PS/F-220, showed DI and DX of less than 5% and 0.3, respectively, in both the years and consequently can be graded as resistant. Among others only 10 hybrids exhibited DI between 5 to 10 % and DX between 0.25 to 0.5 and were, therefore, placed in MR group while 17 others were adjudged as susceptible and 22 as highly susceptible.
Among the three TPS populations (seedling tubers), HPS 25/13, with least DI and DX was graded as most resistant while TPS C-17 were categorised as resistant and susceptible, respectively.

**DISCUSSION**

The large variation observed in DI and DX indicates possibility of selection/identification of resistant cultures. The present results indicate that JN-189, MS/82-717 and PS/F-220 can be directly utilized as sources of resistance in stem necrosis resistance breeding programme. The results confirm the earlier findings of Khurana et al. (1997) and Sanger (1997) that cv. Kufri Sindhuri is relatively resistant to stem necrosis than the other cultivars. Sanger (1997) reported stem necrosis incidence and index ranging from 10.56-33.5 and 1.45-3.5, respectively, on cvs. Kufri Sindhuri, Kufri Lalima, Kufri Badshah and Kufri Chandramukhi. Our results also support his findings that Kufri Chandramukhi is the most susceptible variety for stem necrosis of potato. Further, it may be appropriate to systematically screen larger germplasm collections for locating more sources of resistance. Since true potato seed is a heterozygous population, i.e., a mixture of hybrid genotypes having near uniform maturity, foliage and tuber characters, they are expected to offer greater resistance/barrier to the disease/vectors. Sanger (1997) reported least DI and DX on HPS 7/13 in his studies. But because only a limited number of tubers per population were used in the experiment, it was not the true representative of the population and such differences in results were expected.

A perusal of parentage of cultures (Table 1) reveals that *Solanum tuberosum* ssp. *andigena* has been found involved either as male or female parent in a number of resistant/moderately resistant cultures, viz., JN 189, HPS 25/13, JP 132, MS/82-717 and PS/F-220. Since ssp. *andigena* is known for harboring genes for resistance to a number of diseases/pests/vectors (Harris, 1978) and is also adapted to the short photoperiodic conditions obtainable in Indian plains, screening of germplasm of this particular sub-species may yield valuable sources of resistance. Results also indicate a possibility of using true potato seed as planting material in areas where incidence of vectors and stem necrosis disease is very high and poses a problem.

### Table 1. Reaction of potato genotypes against stem necrosis

<table>
<thead>
<tr>
<th>Disease Reaction</th>
<th>Variety/Hybrid (Parentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistant (R)</td>
<td>JN-189 (K. Jawahar × <em>S. andigena</em>); MS/82-717 (K. Ashoka × PH/F-1430); HPS 25/13 (TPS-25 × TPS-13); PS/F-220 (B-8695 × K. Jyoti); K. Sindhuri (K. Red × Ekishirazu × Katahdin)</td>
</tr>
<tr>
<td>(DI &lt; 5 and DX &lt; 0.25)</td>
<td>Moderately Resistant (MR)</td>
</tr>
<tr>
<td>(DI &gt; 5 ≤ 10 and DX &gt; 0.25 ≤ 0.5)</td>
<td>Susceptible (S)</td>
</tr>
<tr>
<td>(DI &gt; 10 ≤ 30 and DX &gt; 0.5 ≤ 1.5)</td>
<td>Highly Susceptible (HS)</td>
</tr>
</tbody>
</table>
ACKNOWLEDGEMENTS

Sincere thanks are due to Dr. H.S. Dungerwal, Assoc. Director, Agric. Res. Stn., Kota for the facilities and encouragement and to the ICAR, New Delhi for financial support as well as to the Director, CPRI, Shimla for providing hybrids/varieties.

REFERENCES


Received for publication September 22, 1997