ABSTRACT: Over 3 seasons, 271 exotic potato germplasm accessions from 21 countries were screened against stem necrosis disease caused by groundnut bud necrosis virus at the Central Potato Research Station, Gwalior (Madhya Pradesh) – a natural hot spot for the disease in early planted potatoes. Based on the average disease incidence and disease index, 46 accessions were found to be highly resistant, 62 resistant, 91 moderately resistant, 52 susceptible and 20 highly susceptible. Many of the highly resistant or resistant accessions were improved types and therefore can be used in potato breeding programme for developing varieties suitable for early production in stem necrosis prone areas of the Central and Western plains of India.

INTRODUCTION

World-wide potato (Solanum tuberosum L.) is an important food crop, and ranks fourth behind rice, wheat, and maize for tonnage produced. In India, more than half of potato production is in the central and western plains where it is an important cash crop, with early potatoes fetching premium prices. However, stem necrosis disease of potato caused by the tospovirus groundnut bud necrosis virus (3) and transmitted by thrips (6) has become a serious problem in early potatoes (4, 11). Necrotic lesions appear on the stem and leaves, and veinal necrosis is also common. At necrotic sites, stems become fragile and break just by touch or wind. Although control measures are available, viz., seed treatment and spray with insecticide imidacloprid to check the groundnut bud necrosis virus (12), there is no substitute to varieties resistant to stem necrosis for farmers taking early crop for table purpose. Hence, resistant varieties suitable for growing in this region are required. The Central Potato Research Institute, Shimla maintains (mainly in tuber form by clonal propagation in fields and glasshouses and partly in vitro or as true seeds (1)) the Indian National Active Germplasm Collection for Potato, with more than 2,700 accessions of cultivated and wild species received from 30 countries. Because of the importance of stem necrosis disease, a programme of screening accessions was started in 1997 at Gwalior (Madhya Pradesh), a natural hot spot of the disease. In the present paper, stem necrosis disease resistance of 271 exotic potato germplasm accessions, mostly tuberosum cultivated types, studied over the period 2000-2005 is reported.

MATERIALS AND METHODS

Field disease resistance screening studies were carried out at Central Potato Research Station, Gwalior during 1999-2000 to 2004-05 seasons. 271 accessions were studied in 3 lots. Accessions were multiplied, initially by planting 67 accessions followed by a further 67 and 137 accessions in the subsequent two seasons. After the multiplication season, for 3 seasons 30-40 tubers were planted from each accession during early October (10 tubers per row, row spacing 60 cm, plant hill spacing 20 cm). Standard agronomic practices

1Central Potato Research Station, Post Bag No. 4, P.O. Morar, Gwalior 474 006, Madhya Pradesh, India.
E-mail: aksomani31@gmail.com
were followed but without insecticides so that the thrip vector was not affected. Disease incidence (DI) of stem necrosis \(i.e.\%\) infected plants) and intensity were recorded in the multiplication season (data only used in case of borderline results) and subsequent 3 seasons, 40 and 55 to 60 days after planting (DAP) on a six point scale. Disease Index (DX) was calculated as described by Somani and Gopal (10).

The germplasm accessions were grouped into 5 classes: highly resistant (DI and DX nil \textit{i.e.\ no disease}); Resistant (DI \(\leq\)5\%, DX \(\leq\)1\%); moderately resistant (DI \(>\)5 to 15\%, DX \(>\)1\% to 3\%); susceptible (DI \(>\)15 to 25\%, DX \(>\)3 to 5\%) and highly susceptible (DI \(>\)25\%, DX \(>\)5\%). Where DI and DX were not in the same class but DX was higher (16 accessions), the accessions were classified on the basis of higher DX. Where the results were borderline (12 accessions), the disease in the multiplication season, was also taken into consideration before deciding the resistance class.

The accessions screened were from 21 countries: 77 accessions from the USA; 36, Netherlands; 34, UK; 28, Germany; 10 Peru; 9, Mexico; 8, France; 7, Canada; 5 each from Ireland and USSR; 4 each from Romania and Spain; 3, Norway; 2 each from Belgium, Colombia and Czechoslovakia; and one each from Denmark, Italy, New Zealand and Sweden (5). The source of the remaining 31 germplasm accessions is not known. The countries to which these germplasms belong may use this information about resistance to stem necrosis, if needed.

RESULTS AND DISCUSSION

Of the accessions studied, 46 (17\%) were found to be highly resistant; 62 (23\%) resistant; 91(33\%) moderately resistant; 52 (19\%) susceptible and 20 (8\%) highly susceptible (Table 1). In general, the mechanisms of virus resistance are poorly understood and more investigations are required (13), although with stem necrosis resistance, the phenomena of vector ‘non preference’ towards plants of some accessions \textit{i.e.\} antibiosis may be involved (8).

Some of the germplasm accessions found to be highly resistant or resistant to stem necrosis in the present study, have also been reported to be resistant to late blight, PVX and PVY \textit{viz.}, foliage resistant to late blight (CP-1404, CP-1407, CP-1424, CP-1607, CP-1613, CP-1762, CP-1861, CP-1911, CP-1984, CP-2024 and CP- 2055); tuber resistant to late blight (CP-1485, CP-1497, CP-1523, CP-1558, CP-1961, CP-1984 and CP- 2030); resistant to PVX (CP-1413. CP-1582, CP-1595, CP-1597, CP-1607, CP-1613, CP-1664, CP-1970 and CP-1971) and resistant to PVY (CP-1424, CP-1595, CP-1597, CP-1613, CP-1667, CP-1676, CP-1970 and CP-1971) (5). Singh \textit{et al.}, (7) have also reported that accessions CP-1426 and CP-1439 (respectively resistant and moderately resistant to stem necrosis in present study) are resistant to PVX. Therefore, if any of the above germplasm accessions is used directly for cultivation in stem necrosis disease prone area, additional benefit of resistance to other diseases will be there specially that of late blight. Further, if these germplasm accessions are used in breeding varieties resistant to stem necrosis, we may have resistance to late blight or other degenerative virus diseases also in newly developed variety.

This work supports previous studies at Deesa (Gujarat), Gwalior (Madhya Pradesh), Kota (Rajasthan) that germplasm highly resistant and resistant to stem necrosis disease is available (2, 9, 10). Most of the germplasm accessions found resistant to stem necrosis are improved types, \textit{i.e.\ they have characters
Stem necrosis in exotic potato germplasm

Table 1. Stem necrosis disease rating in exotic germplasm (tuberosum) accessions of potato.

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<tr>
<th>Disease rating</th>
<th>CPRI' accession number</th>
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suitable for growing them directly without further crossing and breeding. If necessary, these can more rapidly be utilized in breeding programmes than the species. This may lead quickly to the development of varieties suitable for early potato production in areas at risk from stem necrosis disease or varieties suitable to fit in paddy-potato-wheat crop rotation. Study is required to be carried out to find out among the resistant accessions suitable for growing as such in stem necrosis prone area. This will have additional benefit of not loosing resistance to these diseases at the cost of stem necrosis. Also, stem necrosis resistance is to be incorporated in ‘new lines’ of breeding potato varieties.

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**LITERATURE CITED**


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