

Screening of black pepper (*Piper nigrum* L.) germplasm for resistance to foot rot disease caused by *Phytophthora capsici* Leonian

R Suseela Bhai, M Anandaraj, Y R Sarma, S S Veena & K V Saji

Indian Institute of Spices Research

Marikunnu P. O., Calicut - 673 012, Kerala, India.

E-mail: suseela@spices.res.in

Received 09 May 2007; Revised 27 July 2007; Accepted 12 September 2007

Abstract

Studies were conducted at Calicut (Kerala) to locate sources of resistance among 491 accessions of cultivars, 691 hybrids, 124 wild accessions and 182 Karimunda and 60 Kottanadan selections of black pepper (*Piper nigrum*) using stem inoculation technique against foot rot disease caused by *Phytophthora capsici*. One hybrid (Acc. 1375), two wild accessions (Accs. 3160 and 3260) and four Kottanadan selections (2466, 2471, 2515 and 2433) were promising with disease index 1 and no external lesion after inoculation of the pathogen under greenhouse conditions.

Keywords: black pepper, *Phytophthora capsici*, *Piper nigrum*, resistance, screening.

Foot rot caused by *Phytophthora capsici* Leonian is the most devastating disease of black pepper (*Piper nigrum* L.) in India. Growing resistant cultivars along with other promising traits such as yield would be a viable strategy to tackle this disease. In India screening for resistance against *Phytophthora* infecting black pepper was initiated in 1979 at the erstwhile National Research Centre for Spices (NRCS), Calicut (now the Indian Institute of Spices Research (IISR) which has the largest collection of black pepper germplasm in the country. Sarma & Nambiar (1979) developed a rapid screening technique for identifying resistant sources of black pepper using root inoculation technique. Later root inoculation technique was restricted to screening seedling progenies and a stem inoculation technique was standardized for screening rooted cuttings

since the collar region was considered as a major site of infection (Sarma *et al.* 1990). Based on this technique an open pollinated progeny of Perambramundi was identified as tolerant and released as IISR - Shakti after several rounds of screening and field evaluation. The present paper deals with screening germplasm accessions of black pepper maintained by IISR, Calicut, using stem inoculation technique for locating sources of resistance.

Cultivars, hybrids, wild germplasm and Karimunda and Kottanadan selections of black pepper were multiplied and 3-month old rooted cuttings with 3 or 4 nodes maintained in the greenhouse were used for screening against *P. capsici*. These studies were undertaken at the IISR Experimental Farm, Peruvannamuzhi (Kerala), during 1982–2003.

Table 1. Reaction of black pepper accessions to stem inoculation by *Phytophthora capsici*

Rating	Cultivars	Hybrids	Wild accessions	Karimunda selections	Kottanadan selections
Lesion 0 mm & Index 1.0	Nil	1375	3160, 3260	Nil	2466, 2471, 2515, 2433
Lesion 1.0–5.0 mm & Index 1.0	1239, 1535	10, 780, 1372	456, 656, 3100, 3128	Nil	2549, 2437
Lesion 5.1–10.0 mm & Index 1.0	1212, 1230, 4236, 4253, 4269	Nil	3086	Nil	2410, 2436, 2571, 2578
Lesion 1.0–5.0 mm & Index 1.5	263, 1150, 1217, 1225, 1369, 1428, 1529, 1578	Nil	527, 3057	Nil	2420, 2428, 2556
Lesion 5.1–10.0 mm & Index 1.5	1619, 1637	Nil	722, 3128	Nil	Nil
Lesion >10.0 mm & Index >1.5	All others	All others	All others	All	All others

The rooted cuttings were inoculated by making a pin prick with the sharp edge of a needle at the centre of the third internode from the tip of the stem and placing an inoculum disc of 3 mm size taken from the growing margin of 72 h old culture of *P. capsici* at the point of pin prick. The inoculated portion was covered with a wet cotton pad and tied with a polythene strip to keep the inoculum in place without drying. The inoculated cuttings were incubated for 72 h in green house maintained at a temperature of 25–28°C with RH 75%–90%. After 72 h, the cotton pad was removed and the lesion length was measured. Then the stem was split open longitudinally and the depth of penetration was assessed using a visual score rating and used as index for rating the accessions on 0–4 scale. The ratings (index) are: 0=no penetration, 1=up to 25% penetration, 2=25%–50% penetration, 3=50%–75% penetration and 4=>75% penetration. Ten rooted cuttings were screened per accession and their average score was taken (Eikemo et al. 2003).

Various levels of reactions were observed among the screened accessions (Tables 1 & 2). Among the various accessions screened, one hybrid (Acc. 1375), two wild accessions (Accs. 3160 and 3260) and four Kottanadan selections (2466, 2471, 2515 and 2433) were promising with a disease index of 1 and no external lesion after inoculation of the pathogen.

Table 2. Black pepper accessions short-listed based on their reaction to *Phytophthora capsici*

Accession	Lesion length (mm)	Index
Cultivars		
1239	3.80	1
1535	4.10	1
Hybrids		
10	4.75	1
780	4.85	1
1372	2.60	1
1375	0.00	1
Wild accessions		
656	2.40	1
3100	3.67	1
3126	0.33	1
3160	0.00	1
3260	0.00	1
Kottanadan selections		
2466	0.00	1
2471	0.00	1
2515	0.00	1
2433	0.00	1
2459	2.00	1
2437	3.00	1

Holliday & Mowat (1963) adopted both leaf and stem inoculation technique for screening and the percentage of root necrosis and number of plants wilted were taken for measuring resistance/tolerance of black pepper cultivars. Later, Turner (1971 & 1973) used zoospore suspension as inoculum and adopted percentage root necrosis as the criteria for assessing the degree of tolerance. Turner (1971) reported *Piper* species such as *P. colubrinum* and *P. obliquum* as resistant using root inoculation method. *P. guinense* has also been reported as resistant to the pathogen (Anonymous 1977). Sarma *et al.* (1982) screened 41 black pepper cultivars and 73 wild *Piper* species against *P. palmivora* adopting root dip inoculation technique and found that Narayakodi, Kalluvalli, Uthiaramkotta and Balankotta showed low percentage of infection and none of the wild species showed resistance. By adopting the stem inoculation technique a few promising lines could be identified among hybrids and wild accessions and Kottanadan selections. These lines have to be assayed for root infection to the pathogen and evaluated in the field.

References

- Anonymous 1977 Ghana-a potential producer of pepper. Pepper News 1 (2): 4-5.
- Eikemo H, Stensvand, Davik J & Tronsmo A M 2003 Resistance to crown rot (*Phytophthora cactorum*) in raspberry cultivars and in offspring from crosses between cultivars differing in susceptibility to the disease Ann. Appl. Biol. 142: 83-89.
- Holliday P & Mowat W P 1963 Foot rot of *P. nigrum* L. (*Phytophthora palmivora*). Phytopathology Paper No. 5, Commonwealth Mycological Institute, Kew.
- Sarma Y R & Nambiar K K N 1979 Screening of pepper (*Piper nigrum* L.) against *Phytophthora palmivora*. In: Venkataram C S (Ed.) Proc. PLACROSYM-II 1979 (pp. 403-406). Indian Society for Plantation Crops, Kasaragod.
- Sarma Y R, Nambiar K K N & Nair M K 1982 Screening of black pepper (*Piper nigrum* L.) and *Piper* species against *Phytophthora palmivora*. In: Nambiar K K N (Ed.), Proc. Workshop on *Phytophthora* Diseases of Tropical Cultivated Plants (pp. 242-247). Central Plantation Crops Research Institute, Kasaragod.
- Turner G J 1971 Resistance in *Piper* species and other plants to infection by *Phytophthora palmivora* from *Piper nigrum*. Trans. Brit. Mycol. Soc. 57: 61-66.
- Turner G J 1973 Pathogenic variation in isolates of *Phytophthora palmivora* from *P. nigrum* Trans. Brit. Mycol. Soc. 60: 583-585.