Short communication

Screening black pepper (*Piper nigrum* L.) varieties/cultivars against *Phytophthora* disease in the nursery

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Abstract

Fifty genotypes of black pepper (*Piper nigrum* L.) including released varieties and cultures were screened against *Phytophthora capsici* foot rot disease in nursery to identify resistant materials. None of the genotypes screened were immune to *P. capsici*. ‘Kalluvally II’, ‘Panniyur 5’, and ‘Kalluvally IV’, however, showed less than 60% leaf infection and were statistically at par with ‘Balankotta’, ‘Cheriyakaniakadan’, and ‘Shimoga’. ‘Kalluvally II’ also suffered relatively lower mortality rates (26.67%), implying some tolerance against *P. capsici*. ‘Panniyur 5’ was moderately susceptible while the remaining cultivars were clearly susceptible to the disease, as they showed higher leaf infection and mortality.

Keywords: *Phytophthora capsici*, Disease resistance.

Black Pepper (*Piper nigrum* L.) is one of the most important spice crops of India with the state of Kerala accounting for more than 90% of its area under cultivation. Incidence of the dreaded *Phytophthora capsici* foot rot in the nursery, however, is a problem in most pepper growing regions of Kerala, where conditions are conducive for disease build-up especially during the southwest monsoon season (Sarma et al., 1996). Identifying the sources of resistance, therefore, becomes important for effective and long term control of the disease. Although some moderately *Phytophthora* tolerant lines of black pepper were identified earlier (e.g., ‘Balankotta’, ‘Kalluvally’, ‘Neelamundi’, culture 54; Turner, 1971; Sarma et al., 1996; Rajagopalan et al., 1998), there is need to screen more accessions/cultures. Hence an attempt was made to evaluate 50 genotypes of black pepper for resistance/tolerance against rot disease caused by *P. capsici*.

Seven black pepper varieties released by the Kerala Agricultural University and four by the Indian Institute of Spices Research, Kozhikode, besides 39 cultivars maintained at the germplasm bank of Pepper Research Station, Panniyur were screened. The experiment was laid out in a completely randomized design with four replications. Each replication consisted of 250 rooted cuttings per accession. The planting materials were collected and multiplied using rapid multiplication techniques. The vines were planted in polythene bags (8 x 15 cm) filled with potting mixture (1:1:1 ratio of sand, soil and cow dung) during the first week of March 1999. Four month-old cuttings were artificially inoculated with *P. capsici* as per standard procedures. Inoculation was done with the zoospore suspension or culture disc of actively growing mycelia with sporangia of *P. capsici* on leaves, stems, and roots. For this, *P. capsici* was isolated using Potato Dextrose Agar (PDA) medium from naturally infected pepper cuttings by standard techniques and the Koch’s postulates were established. The organism was purified by hyphal tip method and identified based on morphological and cultural characters. The isolate was maintained by

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periodic subculturing in PDA medium. Observations on the incidence of leaf infection and mortality were recorded at regular intervals and the data were analyzed using one-way ANOVA followed by Duncan's Multiple Range Test for mean separation.

None of the genotypes tested were immune to *P. capsici*. However, they showed varying intensities of leaf infection and mortality (Table 1). For instance, 'Kalluvally II', 'Panniyur 5', and Kalluvally IV' showed less than 60% leaf infection and were largely similar to 'Balankotta', 'Cheriyakaniakadan', and 'Shimoga'. Although 'Kalluvally II' showed the lowest mortality (26.67%), it was on par with six other genotypes. Among the released varieties, 'Panniyur 5' had the lowest leaf infection and mortality levels (31.3%) implying some degree of tolerance for this cultivar against *P. capsici*. Other genotypes evaluated showed high leaf infection and mortality, signifying susceptibility to the disease. The present results are also in agreement with the previous attempts to screen pepper genotypes against *Phytophthora* rot (Shylaja et al., 1996; Sarma et al., 1997, and Rajagopalan et al., 1998). These workers reported that the genotypes evaluated did not exhibit any absolute resistance. But 'Kalluvally', 'Balankotta', Narayakodi', 'Uthirankotta', 'Cheriyakaniakadan', 'Neelamundi', and 'Cholamundi' showed moderate tolerance against the disease. The tolerant reaction of 'Kalluvally II' may be attributed to the anatomical and biochemical differences as exemplified by Dagde (1999), who studied the anatomical and biochemical differences between the moderately tolerant 'Kalluvally' and the susceptible 'Panniyur 1'.

Table 1. Leaf infection and mortality percentage of black pepper varieties/cultivars screed at the Pepper Research Station, Panniyur against *P. capsici* foot rot in the nursery.

Varieties/Cultivars	Leaf infection (%)	Mortality (%)
'Aimperian'	91.3 (1.28)[abcd]	82.4 (1.14)[a]
'Angamali'	95.3 (1.36)[ab]	68.8 (0.98)[abcd]
'Arakulam munda'	87.3 (1.21)[abcdef]	69.2 (0.98)[abcd]
'Balankotta'	70.7 (1.04)[defg]	40.0 (0.68)[def]
Ceylon	92.0 (1.29)[abcd]	62.1 (0.91)[abcd]
'Cheriyakaniakadan'	74.0 (1.08)[cdefg]	66.7 (0.96)[abcd]
'Kalluvally II'	54.0 (0.84)[g]	26.7 (0.54)[f]
'Kalluvally IV'	56.0 (0.5)[g]	41.1 (0.69)[def]
'Kaniyakadan'	87.3 (1.21)[abcdef]	53.3 (0.82)[bcdef]
'Karimkotta'	86.7 (1.21)[abcdef]	62.0 (0.91)[abcd]
'Karimunda 1'	89.3 (1.25)[abcd]	73.7 (1.04)[abc]
'Karimunda II'	90.0 (1.25)[abcd]	62.2 (0.92)[abcd]
'Karuvilanchi'	90.0 (1.25)[abcd]	72.0 (1.02)[abc]
'Kottanadan'	81.3 (1.13)[bcdef]	62.0 (0.91) [abcd]
'Kottaram'	86.7 (1.21)[abcdef]	53.3 (0.82)[bcdef]
'Kuthiravally'	95.3 (1.35)[abc]	80.3 (1.12)[ab]
'Malligesara'	92.7 (1.30)[abcde]	66.8 (0.98)[abcd]
'Munda'	90.0 (1.26)[abcd]	72.1 (1.03)[abc]
'Mundi'	85.0 (1.18)[bcdef]	64.4 (0.93)[abcd]
'Neelamundi'	92.0 (1.29)[abcd]	68.9 (0.99)[abcd]
'Nilgiris'	96.0 (1.38)[ab]	73.3 (1.03)[abc]
'Padarpan'	88.0 (1.22)[abcdef]	68.0 (0.98)[abcd]
'Panchami'	85.3 (1.18)[bcdef]	75.9 (1.08)[abc]
'Panniyur 1'	88.7 (1.24)[abcde]	67.2 (0.97)[abcd]
'Panniyur 2'	68.0 (0.97)[efg]	67.8 (0.97)[abcd]
'Panniyur 3	90.0 (1.27)[abcd]	67.3 (0.96)[abcd]
'Panniyur 4'	95.3 (1.40)[ab]	73.7 (1.04)[abc]
'Panniyur 5'	55.0 (0.84)[g]	31.2 (0.59)[ef]
'Panniyur 6'	90.7 (1.26)[abcd]	60.0 (0.89)[abcd]
'Panniyur 7'	85.3 (1.18)[bcdef]	59.3 (0.89)[abcd]
'Perumkodi'	64.0 (0.97)[fg]	55.6 (0.85)[abcde]
'Perumunda'	98.0 (1.46)[a]	71.1 (1.01)[abc]
'Poonjarmunda'	95.3 (1.39)[ab]	77.7 (1.08)[abc]
'Pournami'	85.3 (1.19)[bcdef]	64.4 (0.94)[abcd]
'Shimoga'	76.7 (1.08)[cdef]	82.3 (1.14)[ab]
'Sreekara'	86.0 (1.19)[abcdef]	53.7 (0.82)[abcdef]
'Subhakara'	93.3 (1.31)[abcd]	66.7 (0.96)[abcd]
'Thevarmundi'	86.0 (1.19)[abcdef]	72.7 (1.03)[abc]
'Thevarmundi'	91.3 (1.28)[abcd]	80.0 (1.11)[ab]
'Thulakodi'	97.3 (1.41)[ab]	69.0 (0.98)[abcd]
'Uthirankotta 1'	88.0 (1.23)[abcdef]	64.4 (0.94)[abcd]
'Uthirankotta II'	94.0 (1.34)[abcd]	63.9 (0.89)[abcd]
'Vellanamban I'	83.3 (1.15)[bcdef]	57.9 (0.87)[abcde]
'Vellanamban II'	84.7 (1.17)[bcdef]	69.5 (0.92)[abcd]
Culture 406	86.0 (1.19)[abcdef]	62.2 90.92)[abcd]
Culture 1558	92.7 (1.30)[abcde]	69.3 (0.99)[abcd]
Culture 6391	94.0 (1.32)[abc]	69.3 (0.99)[abcd]
TMB I	87.3 (1.21)[abcde]	58.7 (0.89)[abcd]
TMB VIII	90.0 (1.29)[abcd]	67.1 (0.96)[abcd]
TMB IX	85.3 (1.29)[abcdef]	48.9 (0.77)[cdef]

Arc-sine transformed values are given in parenthesis. Means with the same superscript (column-wise for a parameter) do not differ significantly.

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Boron nutrition of tomato (*Lycopersicon esculentum* L.) grown in the laterite soils of southern Kerala

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Abstract

A pot culture experiment was conducted to study the effects of 0, 0.5, 1.0, and 1.5 kg B ha^{-1} with recommended doses of chemical fertilizers (75:40:25 kg N, P_2O_5 and K_2O ha^{-1}; RDF) and RDF+ farmyard manure (FYM; 25 tonnes ha^{-1}) on growth, yield, and quality of tomato as well as the B status of a lateritic soil in southern Kerala. B significantly increased plant height and number of primary branches. It also reduced the days to flowering and increased fruit set (12.5 to 20% more at the highest level) both with and without FYM. Benefit–cost ratio was 40% greater for the highest level of B when applied in conjunction with RDF compared with RDF alone (no B). Quality parameters like reducing sugars, total sugars, vitamin C, and lycopene concentrations also improved following B application. Nevertheless, B availability in these soils attained sufficiency levels (2 mg kg^{-1}) at 0.5 kg ha^{-1} of applied B, implying the need to exercise caution especially when applying higher doses.

Keywords: Boron availability, Fruit quality, Micronutrient fertilization, Recommended fertilizers.

Tomato (*Lycopersicon esculentum* L.) is India's most extensively grown vegetable crop after potato (*Solanum tuberosum* L.). It is cultivated over an area of 0.466 million ha with a production of 8.271 million tonnes, accounting for 7.95% of the world's tomato area and production (Chadha, 2002). Tomato is considered a heavy feeder of micronutrients and B in particular is important for its growth, fruit set, and disease resistance (Srinivasamurthy et al., 2003). Major soils of Kerala, derived from acid igneous rocks are, however, deficient in B (SSO, 2007). Moreover, being highly mobile in the soil (Tisdale et al., 1986), leaching losses further aggravate B insufficiency in the high rainfall zones of Kerala, frequently leading to development of deficiency symptoms in crop plants. Since the difference in concentration between sufficiency and toxicity levels of micronutrients being very narrow, blanket applications of B to correct deficiency is sometimes risky, as it would lead to environmental hazards. This paper reports an attempt to optimize the B requirement of tomato in the lateritic soils of southern Kerala and summarizes the impact of applied B on growth, yield, and quality of tomato, besides how the available soil B pool is altered following B additions.

A pot culture experiment was conducted from September 2004 to January 2005 at Vellayani using the surface soil collected in bulk from Thiruvallom (Vizhinjam Soil Series), nearby type location of laterite soil (Kandic Haplustult). The soil after drying under shade and sieving (2 mm) was filled in 32 earthen pots (50 cm diameter) at the rate of 8 kg per pot. The experimental variables (eight) were 0, 0.5, 1.0, and 1.5 kg ha^{-1} B supplied as borax in combination with the recommended doses of chemical fertilizers (RDF: 75:40:25 kg N, P_2O_5 and K_2O ha^{-1}, i.e., 0.3:0.17:0.1 g pot^{-1}; KAU, 2002) and RDF + farmyard manure (25 tonnes FYM ha^{-1}, i.e., 100 g pot^{-1}). There were four

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