

## Survey for the Incidence of Foot Rot of Black Pepper Caused by *Phytophthora capsici* Leonian in Shivamogga and Chickmagalur Districts of Karnataka State

Lydia M. Thomas\* and B. Gangadhara Naik

Department of Plant Pathology, College of Agriculture, University of Agricultural and Horticultural Science, Shivamogga-577204, Karnataka, India

\*Corresponding Author E-mail: [lydia1721a@gmail.com](mailto:lydia1721a@gmail.com)

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### ABSTRACT

Black pepper (*Piper nigrum* L.), the king of spices is one of the most important spice crops cultivated in India. The cultivation and production of black pepper is limited by many diseases of which foot rot caused by *Phytophthora capsici* is the most important and serious disease. All parts of the plant are susceptible and prone to the infection at any stage of the crop creating huge losses of around 25-30%. The survey report revealed a highest incidence (65%) of the disease in Mathodu village of Shivamogga taluk in Shivamogga district. In Chickmagalur district, highest (50.00%) disease incidence was recorded in Kabilaseathve village of Chickmagalur taluk and Boothanakkadu village of Mudigere taluk. Least disease incidence was reported in Thirthahalli and Koppa taluks of Shivamogga and Chickmagalur districts respectively. All the surveyed locations of Shivamogga and Chickmagalur districts in 2015-16 showed the presence of disease.

**Key words:** Black pepper, Foot rot, *Phytophthora capsici*,

### INTRODUCTION

Black pepper (*Piper nigrum* L.) famous as “Black Gold” and also known as “King of Spices” is one of the most important agricultural commodities of commerce and trade in India since pre-historic period. Black pepper is cultivated to a large extent in Kerala and Karnataka and to a limited extent in Tamil Nadu and other states. The crop is grown in about 0.165 lakh hectares with a production of 363.5 tons annually with productivity of 761 kg/ha. Kerala and

Karnataka account for a major portion (92 %) of production of black pepper in the country. Black pepper is a perennial vine grown for its berries which is extensively used as spice and in medicine.

Diseases and pests are the major limiting factors in the successful cultivation of black pepper. It has been reported that, although 17 diseases are recorded in black pepper, *Phytophthora* foot rot and slow decline cause severe economic losses<sup>1</sup>.

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The other diseases of black pepper which also contribute in the yield reduction include, anthracnose, mosaic, *Fusarium* wilt<sup>2</sup>. Crop losses due to *Phytophthora* foot rot or quick wilt is recognized as one of the major causes for the low productivity in India<sup>3</sup>.

During 2015-16 a roving plot survey was conducted in the major pepper growing areas of Shivamogga and Chickmagaluru districts of Karnataka state.

## MATERIAL AND METHODS

A roving plot survey was conducted to record the incidence of foot rot of black pepper caused by *Phytophthora capsici* Leonian in the major black pepper growing areas of Shivamogga and Chickmagaluru districts. In each garden, 20 vines were randomly selected, to record per cent disease incidence.

The per cent disease incidence was calculated by using the following formula

$$\text{Percent disease incidence} = \frac{\text{Number of plants affected}}{\text{Total number of plants observed}} \times 100$$

### Isolation of pathogen from infected plant tissues

The standard isolation technique given by<sup>4</sup> for *Phytophthora* species was followed for isolation of pathogen from black pepper vines showing typical symptoms of foot rot disease (Plates 1 &2). The samples were collected from the farmer's field during the survey. The infected tissues were washed under tap water. It was then cut into small pieces and surface sterilized with one per cent sodium hypochlorite solution for one minute, followed by repeated washing using sterile distilled water and blotting on sterile paper towels under aseptic conditions. Such bits were transferred into Petri dishes containing 20 ml of molten and cooled Corn Meal Agar (CMA) medium incorporated with ampicillin and streptomycin and incubated at 20-25°C for five days. Colonies, which developed from the bits, were identified by microscopic observation by taking mycelial and sporangial character as means for identifying the pathogen. After identification, culture thus obtained was purified by repeated sub culturing on PDA and incubated at 25±2°C for further studies.

### Isolation of pathogen from soil

During the survey, soil samples were collected from the base of infected plants. Unripe apples (variety Golden Delicious) were used as baits for isolating *Phytophthora* species from soil<sup>5</sup>. After 3- 4 days of incubation at 24±3°C, the

browning parts of apple flesh around holes were plated onto a selective medium (Corn meal agar) supplemented with ampicillin and streptomycin. The culture thus obtained was purified by repeated sub culturing in PDA and the pathogen was identified based on microscopic studies.

## RESULTS AND DISCUSSION

Four villages each from Shivamogga taluk and Bhadravathi taluk, five villages in Hosanagara taluk and seven villages in Thirthahalli taluk were surveyed in Shivamogga district. Five villages in NR Pura, six villages in Koppa taluks, four from Shringeri taluk, nine villages from Chikkmagaluru taluk and ten villages from Mudigere taluks were surveyed from Chikkmagaluru district. The soil and infected root, leaf and stem samples collected from various fields were brought to the laboratory and analyzed for the presence of pathogens as explained in Material and Methods and the data are presented in Table 1 and 2.

Per cent disease incidence ranged from 5 to 65 in various villages surveyed. In Shivamogga district, Matthodu village of Shivamogga taluk showed highest per cent disease incidence of 65%. It was followed by Ashoknagara (38.00 %) of Bhadravathi taluk. Least per cent disease incidence (5.00%) was recorded in Hulimande, Honnangi, Beluru and Melinakuruvalli villages of Thirthahalli taluk (Table.1).

Out of the thirty four villages surveyed in Chickmagaluru district, highest (50.00%) disease incidence was recorded in Kabilaseathve village of Chickamgaluru taluk and Boothanakkadu village of Mudigere taluk. The field observed was not properly maintained and several vines were defoliated and wilted to death. Several villages viz., Koppa, Blagadde, Hirekere, Sigadallu, Surli, Hosakoppa, Hulavi, Mahagondagalli, Haandi, Badriyanagar and Bilanalli, surveyed in Chickmagaluru district, during various time periods recorded least per cent disease incidence. Koppa and NR Pura taluks surveyed during the pre-monsoon period recorded considerably lesser disease incidence (Table.2).

In Shivamogga district maximum disease incidence was observed in Shivamogga (28.00) followed by Bhadravathi (18.75) taluks with a district mean per cent disease incidence of 16.65. Mean per cent disease incidence varied from taluk to taluk. In Chickmagaluru district, high disease incidence was observed in Chikkamagaluru taluk (22.00) followed by Mudigere (16.00) and least incidence was observed in Koppa (5.83), followed by Sringeri (6.50) taluk (Table. 3).

This variation in the disease severity may be due to the factors like location of the field, availability of congenial conditions for the growth of the pathogen, management of the field including cultural practices followed, type of the cultivars used, timing of conducting survey and level of inoculums present in the soil<sup>6</sup>.

It was observed that the gardens where back pepper were grown as pure crop with silver oak tree as support, were seen to be less infected with disease. Black pepper grown as intercrop with arecanut alone showed more disease incidence.

The results were in conformity with the reports made on death of vines in Wynad region of Kerala reported as early as in 1902.<sup>7, 8</sup> recorded death of pepper vines upto 20 per cent in Cannanore district (Kerala). While, <sup>9</sup> recorded upto 25 to 30 per cent loss in some gardens in Cannanore and Calicut districts. In Lampung, an outbreak of foot rot occurred during 1967-68 destroying 40-50 per cent of pepper crop<sup>10</sup>. Such reports on losses due to heavy incidence of pepper wilt have been reported from Uttara Kannada<sup>6</sup>, Shimoga<sup>11</sup>, Uttara Kannada, Shimoga and Chikkamagalore<sup>12</sup> districts of Karnataka state. The present study has helped to identify the major pepper growing areas affected by foot rot disease in Shivamogga and Chikkamagaluru districts which would pave way for the formulation of preventive and curative management strategies. This led to identifying areas where potential threat has been observed due to foot rot. Similar studies were reported by<sup>13&14</sup> in systemic surveys conducted in Calicut and Cannanore districts of Kerala state.

#### **Isolation of *Phytophthora capsici***

Upon tissue isolation, the pathogen was isolated, purified and identified as *Phytophthora capsici* Leonian based on morphological and cultural characters in accordance with the description given by<sup>4&16</sup>. *Phytophthora capsici* was also isolated from soil collected around the root zone of wilted black pepper vines by baiting technique using apple. The fungal culture had a typical white mycelia growth with radial sectoring. The fungus in the present study produced aseptate mycelium. Sporangia induced through float incubation technique were papillate with very long pedicels and the shape was variable from oval to lemon shaped. Hyphal swellings were seen on those cultures which were placed in sterile distilled water.



Plate 1: Pepper vine showing wilting



Plate 2: Typical water soaked lesion on black pepper leaf

Table 1: Survey on incidence of foot rot of Black pepper in Shivamogga district

District	Taluk	Village	Varieties	Intercrop with	Disease incidence (%)
Shivamogga	Shivamogga	College of Agriculture, Shivamogga	Panniyur-6, Pournami	Arecanut, Cocoa, Cardamom	20
		Malligehalli	Panniyur-1,2	Arecanut	12
		Shettihalli		Arecanut	15
		Matthodu	Karimunda, Panniyur-1,2,5, Sreekara, Panchami, Subakara	Arecanut, Nutmeg	65
	Bhadravathi	Ashok nagara	Panniyur-1	Arecanut	38
		Nimbe gundhi	Karimunda, Panniyur	Arecanut	10
		Beernahalli cross	Panchami, Panniyur-1,3,5	Arecanut	12
		Kaimara	Panniyur-1	Arecanut	15
	Hosanagara	Nagodi	Panniyur	Arecanut	10
		Sagara	Panniyur	Arecanut	25
		Chinnamane	Panniyur	Arecanut	10
		Kauthi	Panniyur	Arecanut	12
		Kunjavalli	Panniyur	Arecanut	10
	Thirthahalli	Hulimande	Panniyur	Arecanut	5
		Honnangi	Panniyur	Arecanut	5
		Devangi	Panniyur	Arecanut, Banana,	5
		Balagatte	Karimunda	Arecanut	10
		Beluru	Panniyur	Arecanut	5
Thorebailu		Panniyur	Arecanut	10	
Melinakuruvalli		Panniyur-1, Malligesara	Arecanut	5	

Table 2: Survey on incidence of foot rot of Black pepper in Chickmagaluru district

District	Taluk	Village	Intercrop	Disease incidence (%)
Chickmagaluru	NR Pura	Vaggade kallu	Arecanut	10.0
		Shankarapura	Arecanut	10.0
		Madaboor	Arecanut	13.3
		Mensur	Arecanut	15.0
		Umbalebailu	Arecanut	10.0
	Koppa	Kagodu	Arecanut	10.0
		Koppa	Arecanut	5.0
		Balagaddi	Arecanut	5.0
		Hirekere	Arecanut	5.0
		Sigadalu	Arecanut	5.0
		Surali	Arecanut	5.0
	Sringeri	Hosakoppa	Arecanut	5.0
		Asagudu	Arecanut	10.0
		Addagodi	Arecanut	6.0
		Hulavi	Arecanut	5.0
	Chickmagaluru	Chikkachatnagere	Arecanut	40.0
		Rudra farm	Arecanut, coconut, Coffee	30.0
		Moogthohalli	Silver oak	14.3
		Aladagudde	Silver oak, Coffee	6.0
		Vasthare	Silver oak	15.0
		Huluvalle	Silver oak	7.45
		Mavinahalli	Silver oak	11.0
		Kabilaseathve	Silver oak, Coffee	50.0
		Kelaguru	Silver oak	25.0
	Mudigere	Mahagondagalli	Silver oak, Coffee	5.0
		Haandi	Silver oak	5.0
		Badriyanagar	Silver oak	5.0
		Boothanakaadu	Silver oak	50.0
		Kudregundi	Silver oak	20.0
		Bilanalli	Silver oak	5.0
Betadamane		Silver oak	15.0	
Uduse		Silver oak	10.0	
Horadi		Silver oak	30.0	
Kushalnagar	Silver oak	15.0		

Table 3: Taluk wise mean incidence of foot rot of Black pepper in Shivamogga and Chickmagaluru district

District	Taluk	Mean Per cent disease incidence	District mean Per cent disease incidence
Shivamogga	Shivamogga	28.00	16.65
	Bhadravathi	18.75	
	Hosanagara	13.40	
	Thirthahalli	6.43	
Chickmagaluru	NR Pura	11.66	12.41
	Koppa	5.83	
	Sringeri	6.50	
	Chickmagaluru	22.08	
	Mudigere	16.00	

### CONCLUSION

Foot rot of black pepper was found to be a highly destructive disease in different locations of Shivamogga and Chickmagalur districts. However, areas with long history of pepper cultivation and imprudent irrigation had more severe disease, which in some locations resulted in failure of the entire crop. Therefore, proper cultural practices and phytosanitary measures need to be followed by farmers to overcome the problem in their gardens.

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