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# Distribution and Severity of Dry Root Rot of Chickpea Caused by *Rhizoctonia bataticola* in Parts of North Karnataka, India

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**A B S T R A C T**

Chickpea (*Cicer arietinum* L.) is one of the most important food legumes and India accounts for approximately 75% of world's chickpea production. Despite the high total production, yields of chickpea are low due to many biotic and abiotic constraints. Among the biotic constraints more than 50 diseases have so far been reported on chickpea. Among them soil borne disease dry root rot caused by *Rhizoctonia bataticola*, is the major limiting factor in chickpea production. The survey on the incidence of dry root rot of chickpea was carried out to know the prevalence and distribution of the disease in eight districts of North Karnataka *viz.*, Bidar, Kalaburgi, Yadgir, Raichur, Koppal, Ballari, Dharawad and Vijaypura representing chickpea growing rainfed situations during *rabi*, 2015-16.

## Introduction

Chickpea is an important pulse crop being cultivated in almost all over the world including temperate and sub-tropical regions. It originated in South West Asia and is cultivated from ancient times both in Asia and European countries. India is the largest producer of chickpea contributing over 70 per cent of the world production occupying an area of 10.22 million ha with a production of 9.88 million tonnes and with productivity of 920 kg/ha (Anon., 2016). The major chickpea growing states of our country are Madhya Pradesh, Uttar Pradesh, Rajasthan, Maharashtra, Andhra Pradesh and Karnataka.

*Rhizoctonia* is a genus of anamorphic fungi in the order Cantharellales and family Ceratobasidiaceace. *Rhizoctonia* species do not produce spores, but are composed of hyphae and sclerotia (hyphal propagules), asexual stage of fungi, saprophytic, but some act as facultative plant pathogens causing commercially important crop diseases. The dry root rot in chickpea was first reported from India by Mitra (1931); later, the disease has been reported from most chickpea-growing areas in India and other countries like Iran (Kaiser *et al.,* 1968), the USA (Westerlund *et al.,* 1974) and several countries in Asia and Africa (Nene *et al.*, 1996). The disease was earlier known as "Rhizoctonia wilt" in chickpea; however, later it was named as "dry root rot". The dry root rot was not of much significance in chickpea earlier; however, it has become a major threat to chickpea production in recent years due to altered weather conditions, particularly on the account of longer drought spells. Higher temperature and soil moisture depletion during crop growth period particularly at pre-harvesting stage is predisposing chickpea to dry root rot (Sharma and Pande, 2013). Recent surveys conducted during 2010–2013 indicated widespread and increased incidence of dry root rot in the central and southern states of India (Ghosh *et al.,* 2013). Disease was found irrespective of soil types, cropping system and cultivars used and incidence ranged from 5 to 50 per cent or more in badly infected soils.

Considering the severity and loss caused by *R. bataticola*, it was thought necessary to initiate systematic studies on emerging and destructive dry root rot disease problem occurring in different parts of Karnataka.

## Materials and Methods

A roving survey was conducted to record the occurrence and distribution of dry root rot of chickpea in 8 districts of the major chickpea growing areas in North Karnataka *viz*., Bidar, Kalaburagi, Yadagiri, Raichur, Koppal, Ballari, Bijapur and Dharwad during *rabi*, 2015-16. In each districts, three taluks were selected, in each taluks minimum two villages were selected, in each village minimum three fields were selected and in each field, five plots of 10 $m^2$ were selected and the incidence of disease was recorded after counting the diseased and healthy plants. While surveying, data on variety grown, soil type, plant protection measures taken, based on infected plants and total number of plants observed, disease incidence was calculated. Chickpea plants showing the typical dry root rot symptoms were collected from surveyed areas, packed in labeled paper bags and brought to the laboratory for isolation of the pathogen. Meantime, the co-ordinates of surveyed fields were also recorded with the help of GPS. Based on observations the disease incidence was calculated by following formula.

$$\text{Dry root rot incidence (\%)} = \frac{\text{Number of plants infected}}{\text{Total number of plants}} \times 100$$

## Results and Discussion

A roving survey was conducted during *rabi*, 2015-16 in eight chickpea growing districts of North Karnataka. The per cent dry root rot incidence was recorded at 55–80 days old crop. The results indicated that the incidence was noticed in all the fields wherever the survey was conducted.

Results indicated that Bidar district recorded the mean dry root rot incidence of 25.87 per cent (Table 2). Highest dry root rot (34.20%) was recorded in Madagatti village of Bhalki taluk followed by Humnabad village (32.11%) and Gadgi (30.32%) village of Bidar taluk and lowest incidence of 16.12% was recorded in Manhalli village of Bidar taluk (Table 1).

Survey conducted in Kalaburgi district indicated that mean incidence of dry root rot was 35.54% for the two years (Table 2). Highest incidence of dry root rot (45.55%) was observed in Bhusnur village of Aland taluk followed by Sannur village (42.33%) of Kalaburgi taluk and Aland village of Aland taluk (40.00%). While, Ijeri village of Jewargi taluk recorded least dry root rot of 24.56%. (Table 1). Survey of Yadagiri district revealed that highest dry root rot was found in Bheemarayanagudi village (11.10%) of Shahapur taluk followed by Malanoor (7.00%) and Yadagiri (5.60%) and least dry root rot was recorded in Aldhal village (0.50%) of Shorapur taluk (Table 1). The mean incidence in Yadagiri district for dry root rot was 3.19%. Among twelve villages in Raichur district, Huvinahadgi village of Devadurga taluk recorded highest dry root rot (45.23%) followed by Jalahalli (36.44%) village of Devadurga taluk and Kollur (35.56%), the least dry root rot (18.35%) was recorded in Bhupur village of Lingasugur. The district mean incidence of dry root rot was 31.20% for two years.

The mean incidence of Koppal district recorded 14.20% dry root rot (Table 2). The highest disease incidence (23.00%) was found in Halagere village of Koppal taluk followed by Kuknoor village of Yelbarga taluk (17.00%) and there was least incidence of dry root rot in the fields of Bewoor village (08.00%) of Yelbarga taluk. The average incidence dry root rot in Ballari district was 13.98%. Maximum incidence was observed in Belagallu village (24.59%) of Ballari taluk followed by Kolagallu village of Ballari taluk (21.53%) and Hansi village of Kudligi taluk 13.00%. Least incidence was in Siraguppa village of Siraguppa taluk (04.81%) during *rabi*, 2015-16 (Table 1). In Vijayapura district survey revealed that highest dry root rot (45.00%) was found in Bableshwar village of Sindagi taluk followed by Kuntoji village (34.35%) of Muddebihal taluk and Golageri village (32.85%) of Sindagi taluk and lowest was in Vijayapura village (17.39%) of Vijayapura taluk. However, an average incidence for the district for two years survey is 29.09%. Dharawad district recorded the mean incidence of dry root rot were 8.27 per cent. Survey was conducted in eight villages of Dharawad district, among them highest dry root rot (12.35%) was found in Bhadrapur village followed by Tadhal village of Nargund taluk (11.21%) and least dry root rot (02.00%) was recorded in Dharwad village of Dharwad taluk (Table 1).

The data on mean incidence (Table 2) with respect to taluk over season indicated that the highest mean incidence of dry root rot was recorded in Aland taluk (38.43%) of Kalaburgi district followed of Jewargi taluk (34.56%) and Kalaburgi taluk (34.22%) of Kalaburgi district. The least incidence of dry root rot (2.40%) was recorded in Shorapur taluk of Yadagiri district.

The survey on the incidence of dry root rot of chickpea was carried out to know the prevalence and distribution of the disease in eight districts of North Karnataka *viz.*, Bidar, Kalaburgi, Yadgir, Raichur, Koppal, Ballari, Dharawad and Vijaypura representing chickpea growing rainfed situations. Survey of the disease over a period of time provides information about the intensity with which it affects the yield. In addition, it is a source of information about severity of disease in relation to soil environment and edaphic factors. In the present study, the data on survey revealed that, the dry root rot incidence varied from locality to locality. This may be due to varieties grown, environmental conditions *viz.*, relative humidity, temperature and soil moisture content, cropping pattern like maize-chickpea, bajra-chickpea and chickpea and chickpea and buildup of inoculum.

**Table.1** Incidence of dry root rot of chickpea in major chickpea growing districts of North Karnataka during *rabi*, 2015-16

| District | Taluks | Villages | No. of fields | Variety | Seed treatment | Soil type | Disease incidence (%) |
|---|---|---|---|---|---|---|---|
| Bidar | Bidar | Bidar | 3 | JG-11 | *Trichoderma* | Black | 26.75 |
| | | Andura | 3 | A-1 | *Trichoderma* | Black | 28.23 |
| | | Manhalli | 3 | A-1 | No | Red | 16.12 |
| | | Gadgi | 3 | A-1 | No | Black | 30.32 |
| | Bhalki | Halahalli | 3 | A-1 | No | Black | 20.2 |
| | | Madgatti | 3 | A-1 | No | Black | 34.20 |
| | | Godihiperga | 3 | A-1 | *Trichoderma* | Clay loamy | 22.80 |
| | Humanabad | Humanabad | 3 | JG-11 | No | Black | 32.11 |
| | | Sanahalliked | 3 | JG-11 | *Trichoderma* | Red | 25.35 |
| | | Chitguppa | 3 | JG-11 | No | Red | 25.00 |
| | | Bachnal | 3 | JG-11 | No | Red | 23.55 |
| **Mean** | | | | | | | **25.87** |
| Kalaburgi | Kalaburgi | Kalaburgi | 3 | JG-11 | *Trichoderma* | Black | 35.25 |
| | | Kadagancha | 3 | JG-11 | No | Black | 30.10 |
| | | Itga Khandal | 3 | A-1 | No | Black | 37.45 |
| | | Sannur | 3 | JG-11 | No | Black | 42.33 |
| | | Kamalapur | 3 | JG-11 | No | Black | 26.00 |
| | Aland | Aland | 3 | A-1 | *Trichoderma* | Black | 40.00 |
| | | Bhusnur | 3 | A-1 | No | Black | 45.55 |
| | | Tadola | 3 | JG-11 | No | Black | 33.00 |
| | | Khajuri | 3 | A-1 | No | Black | 35.20 |
| | Jewargi | Raddewadgi | 3 | MNK-1, JG-11 | *Trichoderma* | Black | 32.80 |
| | | Jewargi | 3 | JG-11 | No | Black | 35.65 |
| | | Andola | 3 | JG-11 | No | Black | 39.89 |
| | | Ijeri | 3 | JG-11 | No | Black | 24.56 |
| | | Nelogi | 3 | JG-11 | No | Black | 39.90 |
| **Mean** | | | | | | | **35.54** |
| **District** | **Taluks** | **Villages** | **No. of fields** | **Variety** | **Seed treatment** | **Soil type** | **Disease incidence (%)** |
| Yadagiri | Yadagiri | Yadagiri | | A-1 | No | Black | 5.60 |
| | | Mailapur | 3 | JG-11 | No | clay | 1.60 |
| | | Munderga | 3 | JG-11 | No | Red | 1.0 |
| | | Gurmitkal | 3 | A-1 | No | Black | 3.23 |
| | Shahapur | Bheemarayangudi | 3 | A-1 | *Trichoderma* | Back | 11.10 |
| | | Vibhutihalli | 3 | JG-11 | No | Clay loamy | 2.65 |
| | | Gogi | 3 | A-1 | No | Clay loamy | 3.00 |
| | | Madriki | 3 | JG-11 | No | Black | 1.55 |
| | Shorapur | Malanoor | 3 | A-1 | No | Black | 7.00 |
| | | Devapur | 3 | JG-11 | No | Black | 3.15 |
| | | Tintani | 3 | JG-11 | No | Red | 1.10 |
| | | Kakkeri | 3 | JG-11 | No | Red | 2.15 |
| | | Manjalapur | 3 | JG-11 | No | Red | 1.12 |
| | | Aldahal | 3 | JG-11 | No | Red | 0.50 |
| **Mean** | | | | | | | **3.19** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Raichur | Raichur | Raichur | | MNK-1 JG-11 | *Trichoderma* | Clay loamy | 32.15 |
| | | Kallur | 3 | A-1 | No | Black | 30.45 |
| | | Kalmala | 3 | JG-11 | No | Black | 34.5 |
| | | Kasbe camp | 3 | JG-11 | No | Black | 26.00 |
| | | Sirawar | 3 | A-1 | No | Black | 35.35 |
| | Lingasugur | Bhupur | 3 | JG-11 | No | Red | 18.35 |
| | | Honnahalli | 3 | A-1 | No | Black | 26.44 |
| | | Hatti | 3 | JG-11 | Carbendazim | Clay loamy | 21.15 |
| | Devadurga | Masarakal | 3 | A-1 | No | Black | 32.89 |
| | | Jalahalli | 3 | A-1 | No | Black | 36.44 |
| | | Kollur (M) | 3 | A-1 | No | Black | 35.56 |
| | | Huvinahadgi | 3 | A-1 | No | Black | 45.23 |
| **Mean** | | | | | | | **31.20** |
| **District** | **Taluks** | **Villages** | **No. of fields** | **Variety** | **Seed treatment** | **Soil type** | **Disease incidence (%)** |
| Koppal | Koppal | Hyati | 3 | JG-11 | No | Clay loamy | 12.00 |
| | | Halagere | 3 | A-1 | No | Black | 23.00 |
| | Kushtagi | Kyadiguppa | 3 | A-1 | No | Black | 15.00 |
| | | Matur | 3 | JG-11 | No | Black | 10.23 |
| | Yelbarga | Bewoor | 3 | JG-11 | No | Red | 08.00 |
| | | Kuknoor | 3 | JG-11 | No | Black | 17.00 |
| **Mean** | | | | | | | **14.20** |
| Ballari | Ballari | Kolagallu | 3 | JG-11 | No | Clay loamy | 21.53 |
| | | Belagallu | 3 | JG-11 | No | Black | 24.59 |
| | Siraguppa | Siraguppa | 3 | JG-11 | No | Red | 04.81 |
| | | Halekota | 3 | A-1 | *Trichoderma* | Black | 11.00 |
| | Kudligi | Kudligi | 3 | A-1 | No | Black | 09.00 |
| | | Hansi | 3 | A-1 | No | Black | 13.00 |
| **Mean** | | | | | | | **13.98** |
| Vijayapura | Vijayapura | Vijayapura | 3 | JG-11 | *Trichoderma* | Black | 17.39 |
| | | Arakeri | 3 | JG-11 | No | Black | 21.45 |
| | | Jalageri | 3 | A-1 | No | Black | 25.49 |
| | Muddebihal | Kuntoji | 3 | A-1 | No | Clay loamy | 34.35 |
| | | Gangur | 3 | A-1 | No | Black | 26.25 |
| | Sindagi | Sindagi | 3 | A-1 | No | Black | 29.5 |
| | | Golageri | 3 | A-1 | No | Black | 32.85 |
| | | Bableshwar | 3 | A-1 | No | Black | 45.00 |
| **Mean** | | | | | | | **29.09** |
| Dharwad | Dharwad | Dharwad | 3 | JG-11 | *Trichoderma* | Red | 02.00 |
| | | Yettingudda | 3 | JG-11 | No | Black | 08.23 |
| | | Kallapur | 3 | JG-11 | *Trichoderma* | Red | 05.00 |
| | Nargund | Nargund | 3 | A-1 | No | Black | 10.23 |
| | | Tadhal | 3 | A-1 | No | Red | 11.21 |
| | Navalgund | Yamanur | 3 | A-1 | No | Black | 06.00 |
| | | Bhadrapur | 3 | A-1 | No | Black | 12.35 |
| | | Javoor | 3 | A-1 | No | Black | 11.15 |
| **Mean** | | | | | | | **8.27** |
| **Total Mean** | | | | | | | **23.72** |

**Table.2** Talukwise incidence of dry root rot of chickpea in parts of North Karnataka during *rabi*, 2015-16

| Sl. No. | District | Taluks | Dry root rot incidence (%) |
|---|---|---|---|
| 1 | Bidar | Bidar | 25.35 |
| | | Bhalki | 25.73 |
| | | Humanabad | 26.50 |
| | | **Mean** | **25.87** |
| 2 | Kalaburagi | Kalaburagi | 34.22 |
| | | Aland | 38.43 |
| | | Jewargi | 34.56 |
| | | **Mean** | **35.73** |
| 3 | Yadagiri | Yadagiri | 2.85 |
| | | Shahapur | 4.57 |
| | | Shorapur | 2.40 |
| | | **Mean** | **3.27** |
| 4 | Raichur | Raichur | 31.69 |
| | | Lingasugur | 21.98 |
| | | Devadurga | 37.53 |
| | | **Mean** | **30.40** |
| 5 | Koppal | Koppal | 17.50 |
| | | Kustagi | 12.61 |
| | | Yelaburga | 12.50 |
| | | **Mean** | **14.20** |
| 6 | Ballari | Ballari | 23.06 |
| | | Siraguppa | 7.90 |
| | | Kudligi | 11.00 |
| | | **Mean** | **13.98** |
| 7 | Vijayapura | Vijayapura | 21.44 |
| | | Muddebihal | 30.30 |
| | | Sindagi | 35.95 |
| | | **Mean** | **29.23** |
| 8 | Dharawad | Dharawad | 5.07 |
| | | Nargund | 10.72 |
| | | Navalagund | 9.83 |
| | | **Mean** | **8.54** |
| **Overall mean incidence** | | | **38.72** |

Even, it could also be attributed to the existence of variability or pathogenic diversity present in the fungus. In *rabi* 2015-16, the incidence of dry root rot was maximum (45.55 %) in Bhusnur village of Aland taluk, Kalaburgi district followed by Huvinahadgi village of Devadurga taluk, Raichur district, recorded highest dry root rot (45.23 %). The least was noticed in Aldahal (1.00 %) and Munderga village (1.00 %) of Yadagiri taluk. Similarly, Veerendra Kumar (2004) noticed an incidence of 9.97 per cent

dry root rot of chickpea in Gulbarga followed by Raichur (5.16 %) and Bidar (4.28 %). The highest incidence was 12.24 per cent in Chittapur of Gulbarga and least was in one of the locations of Raichur (3.21 %). Mono-cropping with closer spacing and also drought and high temperature increased the vulnerability of the crop and enhanced the aggressiveness of the pathogen. The present findings are also supported by Garrett *et al.*, (2006); Kaur *et al.*, (2012) and Sharma *et al.*, (2016). Srinivas (2016) reported through survey that percent disease incidence was ranged from 6.67 to 15.33 per cent in Karnataka and 0.67 to 3.33 per cent in Andhra Pradesh at different locations.

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