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Survey, Characterization and Pathogenic Effect of Chickpea Dry Root Rot (*Rhizoctonia bataticola*) in Tikamgarh (MP)

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ABSTRACT

Among the fungal diseases of chickpea, dry root rot is the most destructive constraint to chickpea productivity as the disease is more prevalent during hot temperature of 30 to 35°C and low soil moisture conditions. The result revealed that the disease was prevalent in all the areas in surveyed blocks showing its wide spread occurrence during 30 days after sowing in *rabi* season. The dry root rot incidence in different localities varied from 0.5 to 9.87%. The maximum mean incidence (5.47%) was recorded at Ladwari village of Niwadi (Fig. 1) followed by Aalampura (5.37%) of Palera, Keripura (5.27%) of Prithvipur, Durganagar (5.17%) of Baldevgarh, Bhopalpura (4.82%) of Prithvipur, Rajnagar (4.55%) of Baldevgarh, Alopa (3.95%) of Palera, Ghour (3.86%) of Jatara, Rajapur (3.75%) of Niwadi, Hashgora (3.05%) of Jatara and Maughatt (2.06%) of Tikamgarh block. The colony growth characteristics were found different among the isolation of Tikamgarh District. The light grey color (*Rb*1, *Rb*4) with appressed growth pattern of *Rhizoctonia bataticola* colonies was observed in Tikamgarh and Jatara blocks isolates. It was evident from the results that isolates showed variability in morphological characters.

Keywords Survey, Dry rot, Chickpea, Characterization, Pathogenicity.

INTRODUCTION

Chickpea (*Cicer arietinum* L.) belongs to the family Fabaceae. It is the premier pulse crop grown in more than 50 countries originated in South West Asia and is cultivated from ancient times both in Asia and European countries. It is the world's second most important food legume next to common bean. In Madhya Pradesh, the chickpea production was 97 lakh tons from an area of 26.21 lakh hectare with an average productivity of 877 kg ha^{-1} during 2016-17 (Anon 2017 a). Tikamgarh District is situated under Bundelkhand zone of Madhya Pradesh.

The annual production was 240.26 thousand tons from 20.26 thousand hectare with an average productivity 1200 kg ha^{-1} (Anon 2017 b). Among the

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fungal diseases of chickpea, dry root rot is the most destructive constraint to chickpea productivity as the disease is more prevalent during hot temperature of 30 to 35°C and low soil moisture conditions (Pande and Sharma 2010). Affected plants are usually straw colored, but in some cases the lower leaves and stems show brown discoloration. The tap root appears black, rotten and devoid of most of the lateral and fine roots. The dead root become quite brittle and show shredding of bark. When the dry stem of the collar region is split vertically, sparse mycelium and minute sclerotia can be seen in the pith (Nene *et al*. 1991).

MATERIALS AND METHODS

The laboratory and field experiments were carried out at the Department of Plant Pathology, College of Agriculture Tikamgarh, (JNKVV) Jabalpur. Chickpea plants showing typical symptoms of dry root rot that is, dead roots were quite brittle and show shredding of bark and lateral root, at flowering and pod formation stage were collected from different locations of Tikamgarh District under Bundelkhand agro- climatic condition of MP. The location included in six blocks of block- Tikamgarh (village-Kanti and Maughatt) block-Jatara (village-Hashghora and Ghour) block-Baldevgarh (village-Durganagar and Rajnagar) block-Newadi (villge-Ladwari and Rajapur) block-Parthvipur (village-Bhopalpura and Keripura) block-Palera (Alampura khas and Alopa).

The cultures of *R. balaticola* were purified by frequent sub culturing by the hyphal tip method and maintained by mass transfer on potato dextrose agar medium at 25±20°c. The morphological characters of the pathogen *Rhizoctonia bataticola* were recorded from cultures grown on PDA medium. Pot experiment using soil infestation technique was carried out in order to determine the pathogenic capability of *Rhizoctonia bataticola* on chickpea plant roots. Pots were filled with soil which was prepared by growing pure culture of *Rhizoctonia bataticola* on sand chickpea flour medium in 250 ml conical flask in 20 ml distilled water. Controlled pots were filled with soil, without adding inoculum, healthy and surface sterilized seeds of chickpea variety JG-315 were disinfected with 2.5% sodium hypo-chlorite. The seeds were sown at the rate of 15 seeds per pot. The pathogen was re-isolated from the internal tissues of infected plants in PDA for confirmation of Koch's Postulate (1983).

RESULTS AND DISCUSSION

The result presented in Table 1 revealed that the disease was prevalent in all the areas in surveyed blocks showing its wide spread occurrence during 30 days after sowing in *rabi* season. The dry root rot incidence in different localities varied from 0.5 to 9.87%. The maximum mean incidence (5.47%) was recorded at Ladwari village of Niwadi (Fig. 1) followed by Aalampura (5.37%) of Palera, Keripura (5.27%) of Prithvipur, Durganagar (5.17%) of Baldevgarh, Bhopalpura (4.82%) of Prithvipur, Rajnagar (4.55%) of Baldevgarh, Alopa (3.95%) of Palera, Ghour (3.86%) of Jatara, Rajapur (3.75%) of Niwadi, Hashgora (3.05%) of Jatara and Maughatt (2.06%) of Tikamgarh block. The lowest mean incidence of dry root rot disease was recorded at Kanti (1.26%) of Tikamgarh block (Table 1). At maturity stage, The

Table 1. The prevalence of dry root rot disease incidence at 30 days interval after sowing and at maturity stage during *rabi* season.

Blocks	Villages	Disease incidence	
		30 DAS	At maturity
Tikamgarh	Kanti	1.26 (6.30)	12.08 (18.46)
	Maughatt	2.06	12.89 (20.97)
Jatara	Hashgora	3.05 (9.97)	21.83 (27.79)
	Ghour	3.86 (11.30)	22.21 (28.09)
Baldevgarh	Durganagar	5.17 (12.94)	24.48 (39.64)
	Rajnagar	4.55 (12.18)	27.59 (31.68)
Niwadi	Ladwari	5.47 (13.17)	31.53 (34.14)
	Rajapur	3.75 (11.13)	32.59 (34.81)
Prithvipur	Bhopalpura	4.82 (12.62)	12.58 (20.76)
	Keripura	5.27 (13.16)	13.25 (21.34)
Palera	Aalampura	5.37 (13.24)	20.32 (26.78)
	Alopa	3.95 (11.06)	20.22 (26.71)
SE (m)±		0.96	1.41
CD (0.05)		2.75	4.04

maximum mean incidence (32.59%) was recorded at Rajapur village (Fig. 2) followed by Ladwari (31.53%) of Niwadi block, Rajnagar (27.59%) of Baldevgarh block, Durganagar (24.48%) of Baldevgarh block, Ghour (22.21%) of Jatara block, Hashgora (21.83%) of Jatara block, Aalampura (20.32%) of Palera block, Alopa (20.22%) of Palera block, Keripura (13.25%) of Prithvipur block, Maughatt (12.89%) of Tikamgarh block and Bhopalpura (12.58%) of Prithvipur block. The lowest mean incidence of dry root rot disease was recorded at Kanti (12.08%) of Tikamgarh block. The close conformity of the result of studies on dry root rot of chickpea was also reported by Manjunatha and Naik. (2011) at Raichur, Gulbarga and Bidar districts in Karnataka, Khan *et al*. (2012) surveyed at Jammu and Kashmir and Gurha and Trivedi (2008) surveyed for the prevalence of dry root rot of Chickpea fields in Shimoga, Raichur and Bangalore Districts in Karnataka.

The results presented in Table 2 revealed that the colony growth characteristics were found different among the isolation of Tikamgarh district. The light grey color (*Rb*1, *Rb*4) with appressed growth pattern of *Rhizoctonia bataticola* colonies was observed in Tikamgarh and Jatara blocks isolates. While grey black color (*Rb*2 and *Rb*12) with fluffy colony growth pattern was observed in Maughatt (Tikamgarh) and Alopa (Palera) blocks. While black color (*Rb*3 and *Rb*11) with Semi- appressed colony growth pattern

Table 2. Colony growth characteristics of *R. bataticola* isolated from Tikamgarh district.

Blocks	Location (*R. bataticola*) isolated	Colony growth characteristics	
		Color	Growth pattern
Tikamgarh	Kanti (*Rb*1)	Light grey	Appressed
	Maughatt (*Rb*2)	Grey black	Fluffy
Jatara	Hashgora (*Rb*3)	Black	Semi-appressed
	Ghour (*Rb*4)	Light grey	Appressed
Baldevgarh	Durganagar (*Rb*5)	Light black	Fluffy
	Rajnagar (*Rb*6)	Light black	Fluffy
Niwadi	Ladwari (*Rb*7)	Light brown	Appressed
	Rajapur (*Rb*8)	Light black	Appressed
Prithvipur	Bhopalpura (*Rb*9)	Light brown	Semi-appressed
	Keripura (*Rb*10)	Light black	Fluffy
Palera	Aalampura (*Rb*11)	Black	Semi-appressed
	Alopa (*Rb*12)	Grey black	Fluffy

Plate 1. Appressed growth pattern of isolated pathogen.

was observed in Hashgora (Jatara) and Aalampura (Palera) blocks. While Light black colour (*Rb*5, *Rb*6, *Rb*8 and *Rb*10) with fluffy colony growth pattern was observed in Durganagar and Rajnagar (Baldevgarh), Rajapur (Niwadi) and Keripura (Prithvipur) blocks. While Light brown color (*Rb*7 and *Rb*9) with appressed colony growth pattern was observed in Ladwari (Niwadi) and Bhopalpura (Prithvipur) blocks isolates. It was evident from the results that isolates showed variability in morphological characters (Plate. 1– 2). Similar results were also reported by Suryawanshi *et al*. (2008) *Macrophomina phaseolina* isolation was done from T9, PU 30, TPU 4, UK 17, UPU97-10 cultivars of black gram from stem and leaves.

The resulted presented in Table 3 revealed that in this macro sclerotia (average size) = 103.3-117.2×90.1-106.5 µm and micro sclerotia (average size) = 72.7-87.5×57.1-73.5 µm. The sclerotia and chlamydospore characters were different in the isolates of different locations of Tikamgarh District.

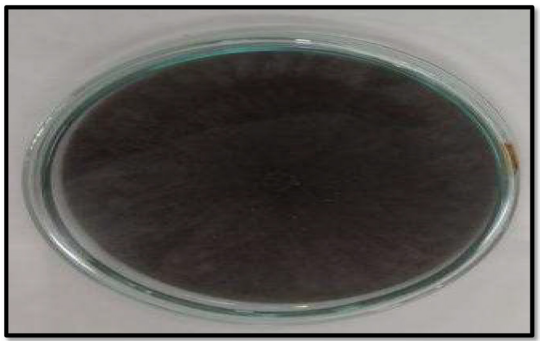

Plate 2. Fluffy growth pattern of isolated pathogen.

Table 3. Sclerotia and chlamydospore characteristics of *R. bataticola* isolated from Tikamgarh district.

Blocks	Location	Sclerotia			Chlamydospore		
		Size (µm)	Shape	Texture	Size	Shape	Color
Tikamgarh	Kanti (*Rb*1)	116.38×103.49	Ovoid	Smooth	6-12 µ	Globose	Jet black
	Maughatt (*Rb*2)	83.29× 50.93	Round	Rough	6-12 µ	Sub -globose	Light black
Jatara	Hashgora (*Rb*3)	83.29× 50.93	Round	Rough	6-12 µ	Sub -globose	Light black
	Ghour (*Rb*4)	116.38×103.49	Ovoid	Smooth	6-12 µ	Globose	Jet black
Baldevgarh	Durganagar (*Rb*5)	116.38×103.49	Ovoid	Smooth	6-12 µ	Globose	Jet black
	Rajnagar (*Rb*6)	116.38×103.49	Ovoid	Smooth	6-12 µ	Globose	Jet black
Niwadi	Ladwari (*Rb*7)	116.38×103.49	Ovoid	Smooth	6-12 µ	Globose	Jet black
	Rajapur (*Rb*8)	83.29×50.93	Round	Rough	6-12 µ	Sub -globose	Light black
Prithvipur	Bhopalpura (*Rb*9)	83.29×50.93	Round	Rough	6-12 µ	Sub -globose	Light black
	Keripura (*Rb*10)	83.29×50.93	Round	Rough	6-12 µ	Sub -globose	Light black
Palera	Aalampura (*Rb*11)	116.38×103.49	Ovoid	Smooth	6-12 µ	Globose	Jet black
	Alopa (*Rb*12)	83.29×50.93	Round	Rough	6-12 µ	Sub -globose	Light black

The smooth texture, Ovoid shape with sclerotia size 116.38×103.49 µm were observed in isolates *Rb*1, *Rb*4, *Rb*5, *Rb*6, *Rb*7 and *Rb*11 of Tikamgarh, Jatara, Baldevgarh, Niwadi, Prithvipur and palera blocks isolates. While the Rough texture, Round shape with sclerotia size 83.29×50.93 µm were observed in isolates *Rb*2, *Rb*3, *Rb*8, *Rb*9, *Rb*10 and *Rb*12 of Tikamgarh, Jatara, Niwadi, Prithvipur and Palera blocks isolates. All isolates were more aggressive on the original host from which it was isolated, which was shown by the variability in pathogenic characters (Sundravadana *et al*. 2012).

Chlamydospores with globose shape and Jet black color were observed in isolates of *Rb*1, *Rb*4, *Rb*5, *Rb*6, *Rb*7 and *Rb*11 of Tikamgarh, Jatara, Niwadi, Prithvipur and Palera blocks. While semi-globose with light black color chlamydospores were observed in isolates of *Rb*2, *Rb*3, *Rb*8, *Rb*9, *Rb*10 and *Rb*12 of Tikamgarh, Jatara, Niwadi, Prithvipur and Palera blocks. The size of chlamydospores in all isolates were 6-12 µm in diameter. Micro-sclerotia were hyaline, 1-2 septate. Chlamydospores were formed singly or in pairs or in clusters in sporodochia. Pigmentation varied from white to dull white, creamy, grey and black. Black was prominent among the isolates (Aghakhani and Dubey 2009). The results Table 4 showed adverse effect of *Rhizoctonia bataticola* on seed germination. The germination of chickpea seed ranged between 80-90% (mean 86 %) as compared to 90% in control. The dry root rot percentage recorded after one month of sowing showed 2.5-4.0% incidence in pots infested with *Rhizoctonia bataticola* isolates. There was no disease in uninfested pots (control). The maximum dry root rot (100%) was recorded in isolates of Alopa (*Rb*12) and Durganagar (*Rb*5) of palera and Baldevgarh blocks followed by 98% Keripura (*Rb*10) of Prithvipur block, 97% Rajnagar (*Rb*6) of Baldevgarh, 95% Maughatt (*Rb*2) and Bhopalpura (*Rb*9) of Tikamgarh and Prithvipur blocks, 94% Aalampura (*Rb*11) of Palera block, 93% Ghour (*Rb*4) of Jatara block, 92% Kanti (*Rb*1) of Tikamgarh block, 91% Ladwari (*Rb*7) of Niwadi block and 90% Hashgora (*Rb*3) of Jatara block. The lowest 89% mortality due to dry root rot pathogen was recorded in Rajapur (*Rb*8) isolates of Niwadi block.

The present study reveals that 100% disease

Table 4. Pathogenic effect of *R. bataticoala* isolates in pot condition in chickpea variety.

Blocks	Location	No. of seed sown	Germination (%)	Seedling height (cm)	Incidence (%)
Tikamgarh	Kanti (*Rb*1)	15	89	25.24	92
	Maughatt (*Rb*2)	15	90	24.31	95
Jatara	Hashgora (*Rb*3)	15	90	32.22	90
	Ghour (*Rb*4)	15	87	26.11	93
Baldevgarh	Durganagar (*Rb*5)	15	80	27.01	100
	Rajnagar (*Rb*6)	15	80	27.03	97
Niwadi	Ladwari (*Rb*7)	15	89	25.24	91
	Rajapur (*Rb*8)	15	90	24.31	89
Prithvipur	Bhopalpua (*Rb*9)	15	90	32.22	95
	Keripura (*Rb*10)	15	87	26.11	98
Palera	Aalampura (*Rb*11)	15	80	27.01	94
	Alopa (*Rb*12)	15	80	27.03	100
	Average	15	86	26.98	94.5
	Check	15	100	45.32	0.00

incidence was observed at lodging and soft stalk stages, besides recording the maximum spread of pathogen up to five nodes. Mean root infection was also observed, based on this it has been established that CSV-8R is the susceptible cultivar and RS-29 is resistant cultivar to charcoal rot. The split open plants also revealed the presence of mycelia and sclerotia of fungus. This implies that *M. phaseolina* is the most important stalk rot pathogen.

CONCLUSION

The dry root rot incidence started from seed germination which was recorded at 30 days as increased in dry root rot because of suitable temperature for *Rhizoctonia bataticola* growth during October to November month about 30-32 ^{0}C while at 60 days after sowing dry root rot of plant decreased due to decrease in temperature during December to January. The dry root rot increased again after January to February which was recorded at 90 days. The variability in incidence showed different, soil texture and crop varieties grown by the farmer's at different locations colony growth, mycelium, sclerotia chlaymaydophores showed variability in shape, size and colors.

REFERENCES

Aghakhani M, Dubey SC (2009) Determination of genetic diversity among Indian isolates of *Rhizoctonia bataticola* causing dry root rot of chickpea. *Antonie van Leeuwenhoek* 96: 607–619.

Anonymous (2017 a) Annual Progress Report 2017: Indian Institute of Pulse Research Kanpur.

Anonymous (2017 b) Advanced Estimated Report of Directorate of Economics and Statistics, Department of Agriculture and Corporation, Ministry of Agriculture and Corporation 03: 1-42.

Gurha SN, Trivedi S (2008) Status of soil borne pathogens infecting chickpea in Karnataka State. *Ann Pl Prot Sci* 16(1): 257-258.

Khan RA, Bhat TA, Kumar K (2012) Management of chickpea (*Cicer arietinum* L.) dry root rot caused by *Rhizoctonia bataticola* (Taub.) Butler. *Int J Res Pharmaceut Biomed Sci* 3(4): 1539-1548.

Koch RC (1983) Upper die milz branched important fungine. Entgegmingan of danvon Pasture in Gesf. Gehatinon vortray T. Fischer, Kassel.

Manjunatha SV, Naik MK (2011) Cultural and morphological diversity in isolates of *Rhizoctonia bataticola* causing dry root rot of chickpea. *J Mycology Pl Pathol* 41 (2): 279-281.

Nene YL, Reddy MV, Haware MP, Ghanekar AM, Amin KS (1991) Field diagnosis of chickpea diseases and their control. ICRI–SAT. *Inform Bull* 28: 52.

Pande S, Sharma M (2010) Climate change: Potential Impact on Chickpea and Pigeonpea Diseases in the Rainfed Semi-Arid Tropics (SAT). IN: 5th International Food Legumes Research Conference (IFLRC V) and 7th European Conference on Grain Legumes (AEP 7th) April 26-30, 2010. Antalya, Turkey.

Sundravadana S, Alice D, Thirumurugan S (2012) Exploration of variability in colony morphology and virulence of *Rhizoctonia bataticola* isolates causing dry root rot of pulses. *Global J Biosci Biotechnol* 1(1): 91-97.

Suryawanshi VP, Hajare ST, Karnewar SD, Kamble NS, Dhawle RN, Digraskar OS (2008) Isolation, identification and pathogencity of Macrophomina phaseolina with special reference to blackgram. *J Soils Crops* 18(1): 143-146.