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Survey for dry root rot of chickpea caused by *Rhizoctonia bataticola* in different region of Madhya Pradesh, India

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Abstract

Chickpea (*Cicer arietinum* L.) which popularly known as 'Gram' is an important pulse crop of India. Madhya Pradesh is major hub of chickpea cultivation of country. Three important diseases i.e. collar rot, wilt and dry root rot affect chickpea cultivation every year with varying level of incidence in different parts of M.P. In present investigation, a roving survey was conducted at different fields to reveal status of dry root rot of chickpea in M.P. It was conducted in month of February for consecutive two cropping season (2020 and 2021). Over two seasons, the maximum mean incidence was recorded in Nainpur of Mandla (14.19%) followed by Panagar of Jabalpur (12.57%) and Jatara of Tikamgarh (12.49%). Whereas the least incidence was noticed in Narsinghpur Tehsil of Narsinghpur (2.63%) Overall district wise average incidence was ranged between 5.93 (Narsinghpur) to 10.67% (Tikamgarh). Variety wise, RVG202 (12.4%) was most affected with dry root rot, whereas JG 64 was recorded lowest (2.5%) incidence. The information on distribution of dry root rot and varietal incidence could be useful in deriving appropriate management strategies for disease in M.P.

Keywords: Chickpea, survey, dry root rot, disease incidence and *Rhizoctonia bataticola*

Introduction

The cultivated chickpea (*Cicer arietinum* L.) is a legume originated from south west Asia. Chickpea seeds is a good source of protein (18-23%) with having balanced amount of carbohydrates, starch, fat, crude fiber, soluble sugar and minerals such as calcium, phosphorous, iron, vitamin C, B complex. Predominantly chickpea is being consumed as dal or variety of snack foods, sweets and condiments. Its high dietary proteins good for human consumption and nitrogen fixation ability by forming nitrogen-fixing nodules interaction with rhizobia made it unique (Ferguson *et al.*, 2010) [4].

Chickpea is grown across the world and In India it is majorly cultivated in M.P. Punjab, Haryana, Uttar Pradesh, Rajasthan, Andhra Pradesh, Karnataka, and Maharashtra. It is mostly cultivated under rainfed condition in a variety of soil, varying in residual moisture. In India area under chickpea was 10.22 M/ha with production 9.88 MT and productivity 967 kg/ha. (Anonymous 2020) [11].

Chickpea crop is sensitive to different biotic and abiotic stress. The chickpea crop can be attacked by more than 172 pathogen viz as 67 fungi, 22 viruses, 3 bacteria, 80 nematodes and mycoplasma from all over the world (Nene *et al.*, 1996) [9]. Among major disease, dry root rot which affects crop at reproductive stage is a serious and widely distributed disease of chickpea. Dry root rot of chickpea caused by *Rhizoctonia bataticola* (Taub.) Butler. (Synonym: *Macrophomina phaseolina* (Maubl.) Ashby.) is an important disease complex causes root rots and seedling blight in many grain legumes when the plants are exposed with other stresses (Hwang *et al.* 2003) [6]. This pathogen is survive in soil in the form of microsclerotia. It has several host crops and due to which its inoculum is always available in most of the cropping system.

Ahmed and Mohammed (1986) [2] reported 70.80% yield loss due to dry root rot in gram at full podding and 48.90% at pre-harvest stage. Use of resistant varieties is also not a soul control measure against dry root rot of chickpea.

Looking to the economic significance of dry root rot of chickpea, the present investigation was conducted to know the present status of this devastating disease in different districts of Madhya Pradesh.

Materials and Method

A roving survey to record chickpea dry root rot incidence was conducted in 10 district of Madhya Pradesh during the month of February for two year (2019-20 and 2020-21). On an average 3 growing region of chickpea in each district were visited and percent disease incidence was recorded by counting total chickpea plant in 1x1m² area and total dry root rot infected plants. Plants showing typical symptoms were also investigated for microscopic association of pathogen and final confirmation of pathogen by isolation, purification and characterization. Typical symptoms like straw coloured appearance of plants at pod formation, black rotted roots, shredding of bark, and root broken easily with presence minute dark black sclerotial bodies on root surface were considered for identification of disease. The per cent disease incidence was calculated as per formula given below-

$$\text{Per cent disease incidence} = \frac{\text{Number of infected plants}}{\text{Total number of plants}} \times 100$$

Survey was conducted at farmer's field under different block/ Tehsil of ten different districts, average incidence was

computed for different blocks/Tehsil.

Results and Discussion

A survey to understand the distribution and occurrence of DRR was conducted in major chickpea growing districts of Madhya Pradesh Nainpur of Mandla recorded highest average dry root rot incidence of 13.51% followed by Panagar of Jabalpur (12.98%) and Jatara of Tikamgarh (12.31%) during *Rabi* 2019-20. The least incidence was noticed in Narsinghpur Tehsil of Narsinghpur (2.38%) followed by Timarni of Harda (3.74%) during *Rabi* 2019-20. However, during *Rabi* 2020-21, the incidence of dry root rot was maximum in Nainpur of Mandla (14.88%) followed by Lakhnadaun of Seoni (12.83%) and Jatara of Tikamgarh (12.68%). The least incidence of dry root rot was noticed in Narsinghpur Tehsil of Narsinghpur District (2.87%). Over two seasons, the maximum mean incidence was recorded in Nainpur of Mandla (14.19%) followed by Panagar of Jabalpur (12.57%) and Jatara Tehsil of Tikamgarh District (12.49%). The least was noticed in Narsinghpur Tehsil of Narsinghpur District (2.63%) (Table1). Sunkad *et al.* (2018) [13] reported prevalence and distribution of dry root rot of chickpea in eight districts of North Karnataka. It was maximum (45.55%) in Bhusnur village of Kalaburagi district. Ghosh *et al.* (2013) [5] conducted a survey in central and Southern parts of India and Dry root rot disease was found in all the sites with ranged from 8.9-10.3%.

Table 1: Tehsil-wise pooled incidence of dry root rot of chickpea in Madhya Pradesh during *Rabi* 2019-20& 2020-21 (pooled)

S. No.				Average disease incidence (%)		Pooled Mean
	District	Tehsil	Soil type	2019-20	2020-21	
1	Harda	Harda	Deep black	7.78	7.89	7.83
		Khirkhiya	Light black	5.65	6.13	5.89
		Timarni	Medium black	3.74	4.81	4.27
2	Hoshangabad	Kaisla	Red soil	10.16	10.52	10.34
		Seonimalwa	Black cotton	7.63	11	11.23
		Hoshangabad	Deep black cotton	11.12	11.52	11.31
3	Betul	Chicholi	Light soil	5.19	6.18	5.68
		Bheempur	Red soil	9.64	10.25	9.94
		Betul	Medium black soil	10.74	12.67	12.21
4	Chhindwara	Chhindwara	Light red soil	5.38	5.89	5.63
		Amarwara	Light black soil	6.01	4.78	5.39
		Mohkhed	Black cotton soil	7.8	8.04	7.93
5	Seoni	Lakhnadaun	Black soil	9.46	12.83	11.14
		Seoni	Black soil	8.27	7.9	8.08
		Ghansaur	Light soil	4.63	5.04	4.83
6	Tikamgarh	Jatara	Light soil	12.31	12.68	12.49
		Baldevgarh	Sandy loam soil	8.94	8.34	8.64
		Tikamgarh	Sandy loam soil	10.71	11.06	10.89
7	Mandla	Bichhiya	Red yellow soil	6.03	6.11	6.07
		Nainpur	Red yellow soil	13.51	14.88	14.19
		Mandla	Red yellow soil	7.39	7.12	7.27
8	Jabalpur	Sihora	Medium black soil	7.32	6.29	6.81
		Jabalpur	Medium black soil	11.52	10.4	10.95
		Panagar	Medium black soil	12.98	12.17	12.57
9	Katani	Katani	Deep soil	4.28	4.3	4.28
		Rithi	Medium deep soil	7.35	6.81	7.00
		Bohariband	Medium deep soil	12.08	12.26	12.15
10	Narsinghpur	Narsinghpur	Black soil	2.38	2.87	2.63
		Gotegaon	Medium black soil	6.76	6.8	5.77
		Gadarwara	Medium black soil	8.25	8.53	8.4
Range				2.38-13.51	2.87-14.88	2.63-14.19

District wise data revealed that during *Rabi*, 2019-20 average dry root rot incidence in the ten districts ranged from 5.72% (Harda) to 10.65% (Tikamgarh). During *Rabi*, 2020-21

average dry root rot incidence in the ten districts was ranged from 6.06% (Narsinghpur) to 10.69% (Tikamgarh) (Table 2).

Table 2: District-wise incidence of dry root rot of chickpea during 2019-20 and 2020-21

S. No.	District	Average disease incidence (%)		Mean
		2019-20	2020-21	
1	Harda	5.72	6.27	5.99
2	Hoshangabad	9.63	9.00	9.31
3	Betul	8.53	9.70	9.11
4	Chhindwara	6.42	6.24	6.33
5	Seoni	7.45	8.59	8.02
6	Tikamgarh	10.65	10.69	10.67
7	Mandla	8.99	9.37	9.18
8	Jabalpur	10.61	9.64	10.12
9	Katani	7.86	7.78	7.82
10	Narsinghpur	5.80	6.06	5.93
Range		5.72-10.65	6.06-10.69	5.93-10.67

Variety wise information revealed that 14 different chickpea varieties were being grown by the farmers. During *Rabi*, 2019-20 the average dry root rot disease incidence was ranged from 2.54 (JG 63) to 15.58 (JG 74) per cent in Madhya Pradesh. Maximum average dry root rot incidence (15.58%)

was recorded on JG 74 and minimum average dry root rot incidence (2.54%) on JG 63. During *Rabi*, 2020-21 the average dry root rot incidence was ranged from 2.34 (JG 64) to 12.78 per cent (RVG 202) (Table 3).

Table 3: Variety-wise incidence of dry root rot of Chickpea in Major Chickpea growing districts of Madhya Pradesh during 2019-20 to 2020-21

S. No.	Varieties	No. of locations		Average disease Incidence (%)		
1	JG-14	19	19	9.00	9.71	9.35
2	JG-12	17	17	8.00	7.77	7.88
3	JG-11	10	10	8.75	9.27	9.01
4	JG-315	10	10	8.39	8.68	8.53
5	JG-130	6	6	6.07	6.15	6.11
6	RVG-202	6	6	12.07	12.78	12.42
7	JAKI-9218	5	5	5.27	4.73	5.00
8	JG-74	1	1	15.58	6.78	11.18
9	JG-16	3	3	10.63	11.07	10.85
10	JG-322	2	2	7.90	8.42	8.16
11	JG-63	4	4	2.54	2.70	2.62
12	JG-64	3	3	2.66	2.34	2.5
13	Desi	1	1	3.30	3.37	3.33
14	JG-36	1	1	9.34	9.42	9.38
Range				2.54-15.58	2.34-12.78	

Overall survey results revealed that the percent disease incidence of dry root rot varied from location to location and variety to variety. However, the dry root rot was found in almost all the chickpea fields surveyed. Date (2014) reported dry root rot incidence between 10.12 to 23.14% in different

districts of Maharashtra. Several researcher were also reported various level of dry root rot incidence in different part of India in chickpea Kadam *et al.* (2018) [7], Sharma *et al.* (1983) [11], Pandey and Singh (1990) [10] and Ghosh *et al.* (2013) [5].

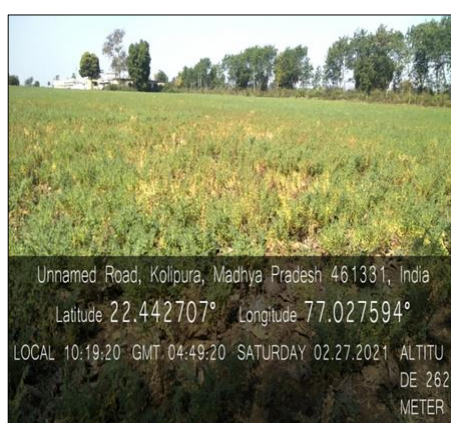


Fig 1: Overview of Dry root rot infected field

Fig 2: DRR symptoms showing root.

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