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Prevalence of *Rhizoctonia bataticola*, inciting dry root rot of soybean in agro-climatic zones of Marathwada region of the Maharashtra state

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Abstract

Dry root rot caused by *Rhizoctonia bataticola* (Taub) Butler, is one of the most widely distributed and destructive disease of Soybean [*Glycine max* (L.) Merrill], causing accountable quantitative and qualitative losses. The survey study revealed that the disease as of common occurrence in soybean crop and widely distributed throughout all three Agro-climatic Zones of Marathwada region surveyed. Prevalence/ incidence of the disease was more severe during *Kharif*, 2017-18, compared to *Kharif*, 2016-17. Almost all soybean varieties grown in the region were found more or less prone to dry root rot disease. The disease was found more severe in Scarcity Zone (28.24%), followed by Assured rainfall zone (24.32%) and Moderate rainfall zone (17.38%).

Keywords: *Glycine max*, *Rhizoctonia bataticola*, dry root rot, incidence, agro-climatic zones

Introduction

Soybean [*Glycine max* (L.) Merrill], suffers from more than 100 pathogens (Sinclair & Shurlieff, 1975) [4]. Among these, dry root rot caused by soil borne plant pathogenic fungus *Rhizoctonia bataticola* (Tabb.) Butler is one of the major constraints to soybean cultivation. Previously, this disease was supposed to be minor importance, in many crops, but now has emerging as a major threat to soybean and other pulse crops. Under rainfed agriculture, the disease (*R. bataticola*) has been reported to incur potential seed yield losses in the range of 3-36% (Sangeetha and Jahagirdar, 2013) [3] and also reduce plant population per unit area upto 77 percent (Muthusamy and Mariappan, 1991) [1]. In Marathwada region, soybean crop has mostly been grown largely as rainfed crop, due to which the crop is obviously prone to the attack by dry root rot (*R. bataticola*) and charcoal rot (*M. phaseolina*) diseases. Survey and surveillance to record incidence and severity of crop diseases are essential to design appropriate plant protection measures and to enable timely adoption of control measures. Therefore, present study was undertaken to assess the prevalence/ incidence of soybean dry root rot disease in Marathwada region of the Maharashtra State.

Materials and methods

A roving survey of randomly selected soybean crop fields, covering three Agro-climatic zones viz., Scarcity Zone (SZ), Assured Rainfall Zone (ARZ) and Moderate Rainfall Zone (MRZ) of Marathwada region of the Maharashtra state (Fig. 1) was undertaken, during the months of July to September, of two *Kharif* seasons, 2016-17 and 2017-18, to assess dry root rot disease incidence and simultaneously to collect the plant disease samples. During *Kharif* 2016-17, the soybean crop fields randomly surveyed were 17, 141 and 43, respectively in the scarcity zone, assured rainfall zone and moderate rainfall zone. Whereas, during *Kharif* 2017-18, the soybean crop fields randomly surveyed were 23, 193 and 56, respectively in the scarcity zone, assured rainfall zone and moderate rainfall zone. For the purpose, a 10 m² area, per soybean crop field was randomly selected, counted total number of soybean plants and number of plants showing typical dry root rot symptoms and percent root rot disease incidence was calculated by following formula.

$$\text{Percent Disease Incidence: } \frac{\text{No. of Plants Infected}}{\text{Total No. of Plants Observed}} \times 100$$

Results and discussion

The results on dry root rot incidence are presented tahsil-wise (Table 1), district-wise (Table 2 and Fig. 1 & 2), soybean

variety-wise (Table 3 and Fig. 3 & 4) and agro-climatic zone-wise (Table 4 and Fig. 5 & 6), which are being interpreted herein under following sub-heads.

Table 1: Tahsil-wise soybean dry root rot incidence during *Kharif*, 2016-17 and 2017-18

Sr. No.	Districts	Tahsils	2016-17		2017-18	
			No. of Fields	Av. Incidence (%)	No. of Fields	Av. Incidence (%)
Scarcity Zone						
1	Aurangabad	Vaijapur	3	30.45	4	36.18
		Gangapur	2	25.78	5	28.19
2	Beed	Ashti	1	27.53	3	39.66
		Patoda	2	26.34	2	34.15
		Shirur (Kasar)	2	24.67	3	28.20
3	Osmanabad	Bhoom	3	14.23	4	27.97
		Paranda	4	19.55	2	32.44
Overall Average / Total:			17	24.08	23	32.40
Assured Rainfall Zone						
1	Aurangabad	Paithan	4	17.32	5	22.50
		Aurangabad	3	23.69	6	27.18
		Phulambri	2	14.45	4	18.22
		Sillod	3	22.37	5	29.63
2	Jalna	Jalna	4	32.72	6	36.61
		Ambad	2	12.84	3	17.56
		Bhokardan	1	20.68	2	25.27
		Jaffrabad	4	18.26	5	22.88
		Partur	6	27.34	8	32.53
		Mantha	5	29.10	9	31.00
3	Beed	Gevrai	3	15.92	3	17.57
		Beed	2	18.66	2	20.45
		Majalgaon	3	19.02	4	25.72
		Kaij	2	22.38	1	23.85
		Ambajogai	6	16.99	7	21.32
		Parali (Vaijnath)	4	24.50	5	29.77
4	Osmanabad	Osmanabad	1	27.19	2	30.47
		Kalamb	4	31.42	5	36.12
		Tuljapur	1	16.20	1	19.26
		Umarga	2	22.54	3	26.10
5	Latur	Latur	6	23.97	9	28.33
		Chakur	3	18.62	5	22.78
		Udgir	2	24.37	4	27.91
		Renapur	2	17.56	3	21.44
		Ahmadpur	3	14.94	2	17.67
		Ausa	1	23.89	1	26.11
6	Parbhani	Nilanga	3	26.17	3	29.33
		Parbhani	10	20.45	12	27.50
		Jintur	7	24.10	9	32.63
		Gangakhed	5	18.46	8	24.55
		Manwath	6	28.12	7	32.49
		Sailu	4	31.24	6	37.52
		Purna	3	17.65	5	24.23
		Pathri	5	29.44	4	35.60
		Sonpeth	1	23.71	2	27.89
Palam	2	25.10	3	29.15		
7	Nanded	Loha	2	19.22	2	22.67
		Mukhed	1	20.42	3	26.88
		Deglur	1	14.57	1	19.11
		Naigaon	3	19.33	5	23.74
		Kandhar	4	23.81	6	27.63

8	Hingoli	Sengaon	5	28.12	7	36.75
Overall Average / Total:			141	22.07	193	26.57
Moderate Rainfall Zsone						
1	Nanded	Nanded	5	14.78	9	19.93
		Ardhapur	3	12.26	4	17.86
		Mudkhed	2	18.42	3	22.88
		Bhokar	3	13.50	2	16.96
		Himayatnagar	2	10.29	1	15.34
2	Hingoli	Basamat	6	17.83	8	20.79
		Hingoli	9	16.54	11	19.60
		Aundha	8	18.90	10	23.87
		Kalanuri	5	14.56	8	18.40
Overall Average / Total:			43	15.23	56	19.52

Tahsil-wise dry root rot incidence

During the survey years, Tahsil-wise dry root rot incidence (Table1) ranged from 10.29 (Himayatnagar) to 32.72 (Jalna) and 15.34 (Himayatnagar) to 37.52 (Sailu) percent, during *Kharif*, 2016-17 and 2017-18, respectively. However, maximum dry root rot incidence was recorded in Jalna tahsil (32.72 and 36.71%), respectively during *Kharif*, 2016-17 and 2017-18, followed by Sailu tahsil (31.24 and 37.52%) and Kalamb tahsil (31.42 and 36.12%). Rest of the tahsils

recorded dry root rot incidence in the range of 12.26 (Ardhapur) to 30.45 (Vaijapur) percent and 15.34 (Himayatnagar) to 36.18 (Vaijapur) percent, during *Kharif*, 2016-17 and 2017-18, respectively. Whereas, minimum disease incidence was recorded in Himayatnagar tahsil (10.29 and 15.34%), during *Kharif*, 2016-17 and 2017-18, respectively, followed by Ardhapur tahsil (12.26 and 17.86%) and and Bhokar tahsil (13.50 and 16.96%).

Table 2. District-wise soybean dry root rot incidence during *Kharif*, 2016-17 and 2017-18

Sr. No.	Districts	No of locations		Av. Incidence (%)		Pooled Mean (%)
		2016-17	2017-18	2016-17	2017-18	
1	Aurangabad	17	29	22.34	26.98	24.66
2	Jalna	22	33	23.49	27.64	25.57
3	Beed	25	30	21.78	26.74	24.56
4	Osmanabad	15	17	21.86	28.73	25.30
5	Latur	20	27	21.36	24.80	23.08
6	Parbhani	43	56	24.25	30.17	27.21
7	Nanded	26	36	16.66	21.30	18.98
8	Hingoli	33	44	19.19	23.88	21.54
Overall Average / Total		201	272	21.37	26.28	---

District-wise dry root rot incidence

Results (Table 2, Fig. 1 & 2) revealed maximum dry root rot incidence of 24.25% and 30.17% in Parbhani district, respectively during *Kharif* 2016-17 and 2017-18, with maximum pooled mean incidence of 27.21%. This was followed by the districts viz., Jalna (23.49%, 27.64% and 25.57%), Osmanabad (21.86%, 28.73% and 25.30%),

Aurangabad (22.34%, 26.98% and 24.66%), Beed (21.78%, 26.74% and 24.56%), Latur (21.36%, 24.80% and 23.08%), Hingoli (19.19%, 23.88% and 21.54%) and Nanded (16.66%, 21.30% and 18.98%), respectively. Overall average root rot incidence was maximum (26.28%) during *Kharif*, 2017-18 and was comparatively minimum (21.37%) during *Kharif*, 2016-17.

Table 3: Variety-wise soybean dry root rot incidence during *Kharif*, 2016-17 and 2017-18

Sr. No.	Soybean Variety	No. of locations		Av. Incidence (%)		Pooled Mean Incidence (%)
		2016-17	2017-18	2016-17	2017-18	
1	MAUS-1	14	18	16.48	19.32	17.90
2	MAUS-61	17	22	11.33	12.68	12.01
3	MAUS-71	22	31	25.24	30.22	27.73
4	MAUS-81	11	16	15.93	20.14	18.04
5	MAUS-158	25	37	26.87	32.95	29.91
6	MAUS-162	38	46	31.95	39.64	35.80
7	MAUS-612	26	28	27.64	35.17	31.41
8	JS-335	31	47	22.43	28.67	25.55
9	KDS-344	9	13	19.16	24.48	21.82
10	MACS-1410	8	14	16.68	19.56	18.12
Overall Average / Total		201	272	21.37	26.28	---

Variety-wise dry root rot incidence

Result (Table 3, Fig. 3 & 4) revealed that in Marathwada region, the soybean varieties developed and recommended / released by the Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani are popularly grown by the farmers. Among 10 soybean varieties popularly grown and crop field surveyed (*Kharif* 2016-17 and 2017-18), maximum root rot incidence was found in MAUS-162 (31.95 and 39.64%, respectively), during *Kharif*, 2016-17 and 2017-18, with pooled mean maximum incidence (35.80%). This was

followed by MAUS-612 (27.64%, 35.17% and 31.41%, respectively), MAUS-158 (26.87%, 32.95% and 29.91%, respectively), MAUS-71 (25.24%, 30.22% and 27.73%, respectively) and JS-335 (22.43%, 28.67% and 25.55%, respectively). In rest of the varieties, the root rot incidence ranged from 11.33 to 22.43 percent and 12.68 to 24.48 percent, respectively during *Kharif*, 2016-17 and 2017-18, with pooled mean incidence in the range of 12.01 to 21.82 percent.

Table 4: Agro-climatic zone-wise soybean dry root rot incidence, during *Kharif*, 2016-17 and 2017-18

Sr. No	Agro-climatic Zones	No of locations		Av. Incidence (%)		Pooled Mean Incidence (%)
		2016-17	2017-18	2016-17	2017-18	
1	Scarcity Zone	17	29	24.08	32.40	28.24
2	Assured Rainfall Zone	141	193	22.07	26.57	24.32
3	Moderate Rainfall Zone	43	56	15.23	19.52	17.38
	Overall Average/ Total	201	272	20.46	26.16	23.31

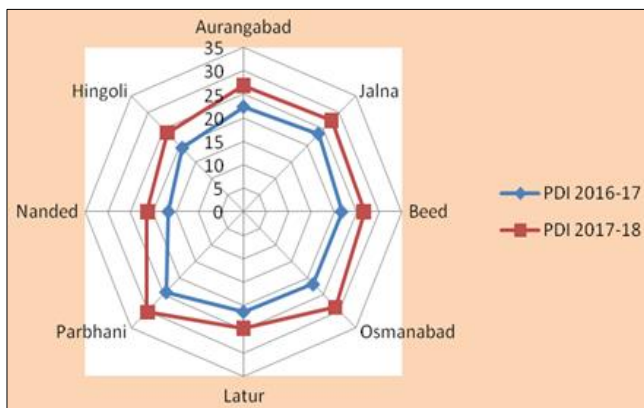


Fig 1: District-wise soybean dry root rot incidence in Marathwada region

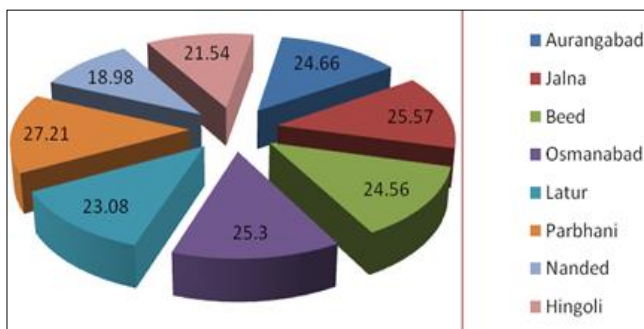


Fig 2: District-wise soybean dry root rot pooled mean incidence in Marathwada region

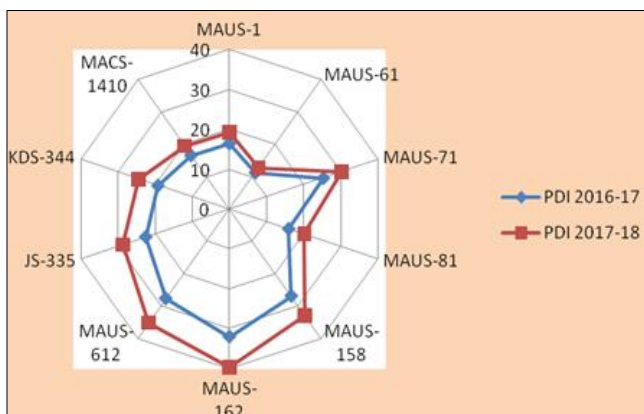


Fig 3: Variety-wise soybean dry root rot incidence in Marathwada region

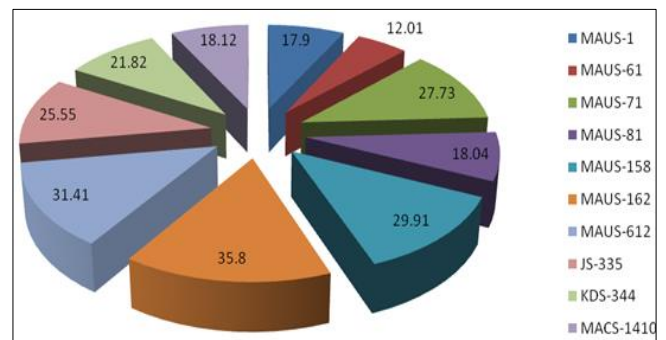


Fig 4: Variety-wise soybean dry root rot pooled mean incidence in Marathwada region

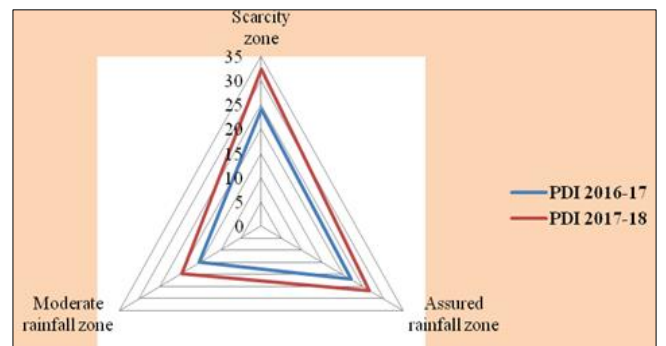


Fig 5: Agro-climatic Zone-wise soybean dry root rot incidence in Marathwada region

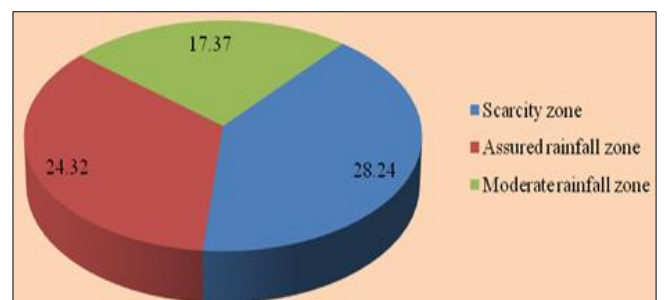


Fig 6: Agro-climatic Zone-wise soybean dry root rot pooled mean incidence in Marathwada region

Agro-climatic zone-wise dry root rot incidence

Results (Table 4, Fig. 5 & 6) revealed that among three agro-climatic zones surveyed, Scarcity Zone (SZ) had maximum root rot incidence of 24.08 and 32.40 percent, respectively

during *Kharif* 2016-17 and 2017-18, with maximum pooled mean incidence of 28.24 percent. This was followed by Assured Rainfall Zone (22.07%, 26.57% and 24.32%, respectively) and Moderate Rainfall Zone (15.23%, 19.52% and 17.38%, respectively). Overall average root rot incidence was maximum (26.16%) during *Kharif*, 2017-18 and it was comparatively minimum (20.46%) during *Kharif*, 2016-17.

The results of the present findings were in accordance to Sangeetha and Jahagirdar (2013) ^[3] who did roving survey during *kharif* 2010 in major soybean growing areas of northern Karnataka to assess the distribution and incidence of root rot and reported that percent disease incidence was in range of 3.36 to 36.30 from different locations. Muthuswamy and Mariappan (1991) ^[1] observed that collar rot disease incidence was up to 77 percent due to *Rhizoctonia* sp. Maglekar and Raut (1997) ^[2] reported 30 percent yield loss in soybean due to *Rhizoctonia* root rot in Vidharbha region of Maharashtra.

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