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Prevalence and distribution of basal rot disease of onion in major onion growing districts of Maharashtra during Kharif-2022

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Abstract
A survey study was carried out to determine the prevalence and incidence of basal rot disease of onion in Maharashtra from major onion growing regions. Four districts *viz.*, Nashik, Pune, Solapur and Ahmednagar of Western Maharashtra were surveyed. The survey sought to determine the crop stage at which the symptoms appear, disease incidence and yield loss in onion crop. During survey basal rot of onion was found as an important fungal disease in majority of onion fields. The onion basal rot disease is prevalent in all four districts surveyed. Nashik district recorded maximum incidence followed by Pune and Ahmednagar districts whereas minimum incidence was observed in Solapur district. The level of infection was found to be influenced by climatic conditions such as temperature, rainfall and relative humidity.

Keywords: Basal rot, *Fusarium* spp., onion, disease incidence, symptoms

1. Introduction
Onion (*Allium cepa* L.,) a member belongs to family *Amaryllidaceae* is known as common onion or bulb onion. It is one of the most well-known spice crop in the world. Onion is a low-latitude horticulture crop and is popularly regarded as "Queen of the Kitchen" (Griffiths *et al*. 2002) [8].
Allium spp. valued for its nutraceutical qualities, including its cardiovascular, anticancer, anti-diabetic and antibacterial activities and its nutritional value of onions is mostly determined by the amount of carbohydrates, dietary fibre, vitamin B6, vitamin C and folic acid. In World, onion is cultivated over an area of 5.7 million ha (Mha) which represents a production of 106.59 million tonne (MT). India ranks first in onion production (26.64 MT) fallowed by China (24.16 MT) (FAO, 2021) [7]. The area, production and productivity of onion in India during the year 2022-23 was 1791.73 thousand ha, 31005.41 thousand tonns and 17.3 MT/ha, respectively (Anonymous, 2022) [1].
The primary cause of basal rot disease of onion is *Fusarium oxysporum* f. sp. *cepae*, it is one of the most devastating soil borne plant pathogens (Burgress et al. 1998) [3], which is prevalent where ever onion is cultivated around the globe. The pathogen *F. oxysporum* f. sp. *cepae* produces mycelium as well as three types of asexual spores *viz*., microconidia, macroconidia and chlamydospores (Cramer, 2000; Howard *et al*. 2007) [4, 9]. In or on older mycelium, chlamydospores are produced having one or two round cells with thick cell walls which protect the cells against antagonists and degradation (Vincent, 1947) [14].
The disease affects the crop at all phases of development. In susceptible cultivars, yield losses up to 50% (Evert *et al*. 1985) [6], 90% losses at the seedling stage (Davis and Reddy, 1983) [5] and 30% losses occurred in the storage (Barnocakine, 1986) [2]. However, survey data on the distribution and incidence of basal rot of onion in Western Maharashtra is lacking. There is need to undertake intensive survey to identify hot spot areas for basal rot disease in Western Maharashtra. Keeping all these aspects in view, the present investigation was undertaken to know the disease incidence in major onion growing areas of Western Maharashtra.

2. Materials and Methods
2.1 Field Survey
An intensive roving survey was conducted during Kharif-2022 to know the percent disease incidence of basal rot disease in Nashik, Pune, Solapur and Ahmednagar districts of Western

Maharashtra. Total of 52 villages from 16 different tehsils were surveyed across the four districts. To calculate the percent disease incidence, at each place, five plots were selected. In each plot one square meter area at five randomly selected places were used for recording observations on basal rot disease and the number of plants exhibiting wilt symptoms were recorded separately. The overall disease incidence was recorded on the basis of symptoms on plants and number of plants observed. The geographical representation of basal rot infected areas are shown in Fig.1.

2.2 Analysis of symptoms

Symptoms occurs in patches, leaves turn yellow and dry up, affected roots are dark brown to dark pink also whitish mould appear on scale. Based on the numerical data obtained in respect of total number of onion plants and wilted plants per field surveyed, percent wilt incidence was calculated by using following formula as suggested by Mayee and Datar (1986) [11].

$$\text{Percent disease incidence (PDI)} = \frac{\text{Total number of infected plants}}{\text{Total number of plants}} \times 100$$

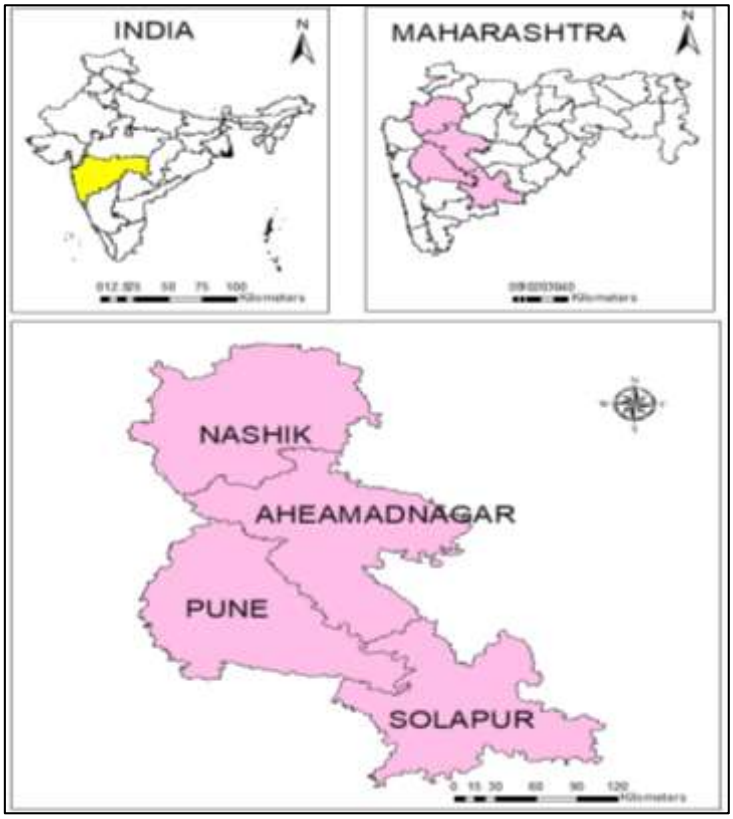

Fig 1: The geographical representation of basal rot infected areas

3. Results and Discussion

The *Fusarium* basal rot (FBR) is one of the devastating disease of onion cultivated in Western Maharashtra, therefore a roving survey was under taken to know the incidence of basal rot disease in different villages of Nashik, Pune, Solapur and Ahmednagar districts of Western Maharashtra during Kharif-2022. The survey revealed that the FBR was present in almost all parts of locations. The percentage of disease incidence in case of FBR was ranged from 27.09 to 38.83%. Highest incidence (38.83%) at Vijaynagar village in Chandwad tehsil while lowest incidence (27.09%) at Bramhapuri village in Mangalwedha tehsil (Table 1.). In Nashik district, the highest incidence (38.31%) of FBR was recorded in Chandwad tehsil and least incidence (30.89%) in Yeola tehsil. While, in Pune district the highest incidence (33.40%) of FBR was recorded in Ambegaon tehsil and least incidence (31.84%) in Junnar tehsil. In Solapur and Ahmednagar district, the highest incidence (29.20%) and (31.09%) of FBR in Mohol and Rahuri tehsil respectively. While, least incidence (27.37%) & (29.94%) of FBR in Mangalwedha and Sangamner tehsil respectively. Among all the districts, highest incidence (34.32%) of FBR was recorded in Nashik followed by Pune (32.41%) and Ahmednagar (30.58%). While, the least incidence (28.12%) of FBR was recorded in Solapur district. The current survey findings in respect of variation in disease incidence are consistent with the findings of Jayanta et al. (2018) [10] carried out a survey in four districts of North Eastern Karnataka state and noticed wilt incidence with a range of 8.33 to 38.66%. Later, Mhammad et al. (2019) [12] carried out a survey of several onion fields in Hyderabad, Tandolayar and Mirpurkhas, Kharmang Shigar and Khapulo districts of Andhra Pradesh state. They observed that the *Fusarium* wilt was found most dominating disease throughout all the onion fields visited and the maximum disease incidence was recorded from Hyderabad (60.0%) whereas, the disease incidence in district Mirpurkhas was lowest as compared to district Tandolayar, maximum incidence of *Fusarium* wilt was recorded from Hyderabad district i.e. 60.0%. In the year 2021–2022, Muthukumar et al., (2022) [13] carried out a survey in the onion-growing regions of Tiruchirappalli, Perambalur, Salem, Karur and Madurai districts of Tamil Nadu state and collected the infected diseased samples. Thogaimalai village in the Karur district showed the highest disease incidence (28.5%),

followed by Chettikulam village in the Perambalur district (24.87%). In the Oddanchatram village of Dindigul district, the lowest incidence of basal rot (10.12%) was observed.

Table 1: Incidence of basal rot disease of onion in four district of Western Maharashtra during Kharif-2022

Sr. No.	District/ Tehsils	Village	Crop stage	Variety	% incidence of basal rot disease	Taluka (Mean % Disease incidence)	District (Mean % Disease incidence)
	Nashik						
1.	Chandwad	Asarkhede	Bulb Formation	Phule Samarth	38.45	38.31	34.32
		Shirur	Bulb Formation	Local	37.67		
		Vijaynagar	Bulb Formation	Agrifound Dark Red	38.83		
2.	Deola	Dahiwad	Bulb Formation	Pancha Ganga	33.47	34.89	
		Meshi	Maturity	Local	35.82		
		Umarane	Nursery	Local	35.40		
3.	Malegaon	Ajang Vadel	Maturity	Pancha Ganga	33.61	33.78	
		Kaulane N.	Bulb Formation	Bhima Red	34.48		
		Takali	Maturity	Pancha Ganga	33.27		
4.	Nandgaon	Bangaon Bk.	Nursery	Local	32.56	32.32	
		Bhauri	Bulb Formation	Bhima Red	31.88		
		Wakhari	Maturity	Pancha Ganga	32.52		
5.	Sinnar	Dodi Bk.	Bulb Formation	Local	35.64	35.78	
		Dodi Kh.	Bulb Formation	Local	37.43		
		Dapur	Nursery	Bhima Red	34.29		
6.	Yeola	Pimpalkhute Tisare	Bulb Formation	Pancha Ganga	30.63	30.89	
		Nagarsul	Bulb Formation	Bhima Red	30.67		
		Panhalsathe	Maturity	Local	31.17		
	Pune						
1.	Ambegaon	Awasari Bk.	Bulb Formation	Poona Fursungi	33.48	33.40	32.41
		Jarkarwadi	Bulb Formation	Poona Fursungi	32.18		
		Kathapur Bk.	Maturity	Bhima Red	34.56		
2.	Junnar	Ballalwadi	Maturity	Bhima Red	32.56	31.84	
		Otur	Bulb Formation	Poona Fursungi	31.12		
		Udapur	Bulb Formation	Poona Fursungi	31.86		
3.	Khed	Kadus	Maturity	Bhima Red	32.16	31.90	
		Kharpudi Bk.	Bulb Formation	Poona Fursungi	31.18		
		Pimpalgaon	Maturity	Bhima Red	32.59		
		Rajgurunagar	Bulb formation	Poona Fursungi	32.37		
	Solapur						
1.	Mohol	Begampur	Maturity	Fursungi	28.73	29.20	28.12
		Papari	Bulb Formation	Pancha Ganga	29.96		
		Pokharapur	Bulb Formation	Local	28.91		
2.	Pandharpur	Khardi	Bulb Formation	Bhima Red	28.04	27.81	
		Nali	Maturity	Fursungi	28.17		
		Tungat	Maturity	Bhima Red	27.23		
3.	Mangalwedha	Bramhapuri	Bulb Formation	Pancha Ganga	27.09	27.37	
		Dharamgaon	Maturity	Bhima Red	27.16		
		Mangalwedha	Bulb Formation	Fursungi	28.00		
		Tandur	Maturity	Fursungi	27.26		
	Ahmednagar						
1.	Rahuri	Digras	Nursery	Local	31.27	31.09	30.58
		Khadambe Bk.	Bulb Formation	Phule Samarth	30.34		
		Khadambe Kh.	Bulb Formation	Phule Samarth	31.61		
		Rahuri	Maturity	Baswant 780	31.43		
		Vambhori	Maturity	Local	30.84		
2.	Rahata	Loni Bk.	Bulb Formation	Phule Samarth	30.09	30.45	
		Loni-Pravara.	Maturity	Baswant 780	30.19		
		Puntamba	Bulb Formation	Local	31.09		
3.	Parner	Bhandgaon	Bulb formation	Phule Samarth	30.63	30.86	
		Tikhol	Maturity	Local	31.06		
		Takali Dhokeshwar	Bulb formation	Baswant 780	30.91		
4.	Sangamner	Aurangpur	Maturity	Baswant 780	29.74	29.94	
		Chinchapur Bk.	Maturity	Local	30.51		
		Pimparne	Bulb Formation	Phule Samarth	29.62		

4. Conclusion

Based on the survey data analyzed and presented above, it is concluded that FBR infection was present throughout all districts surveyed, and need to manage the soil borne fungus. Management strategies should be employed to mitigate losses from seed sowing/nursery preparation.

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