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Survey of storage rot of onion and physiological weight loss of onion due to artificial inoculation of *Aspergillus niger* inciting pathogen of onion storage rot

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Abstract

The survey on incidence of storage rot of onion was carried out for period of six months from July to December in Rajgurunagar, Chakan and Talegaon vegetable market during 2020. The results of present study revealed that, the highest storage rot incidence was recorded in December (28.33%) followed by November (26.33%), October (20.33%) and July (19.83%). While, lowest storage rot incidence was recorded in August (13.50%) followed by September (15.16%).

Physiological weight loss of onion bulb was assessed by inoculating *A. niger* and recorded weight loss 15, 30, 45 and 60 days after inoculation. White onion showed maximum physiological weight loss (22.87%) compared to red onion (10.41%) noted 60 days after inoculation.

Keywords: Onion, storage rot, *Aspergillus niger*, survey, weight loss

1. Introduction

Amongst the vegetable crops, onion is one of the most important commercial crop in India. Maharashtra is the major onion growing state in the country with an area of 5.08 lakh ha and average annual production is 53.55 lakh MT (Anonymous, 2020) [2]. The principal onion growing districts in the Maharashtra State are Satara, Nashik, Jalgaon, Pune, Solapur and Ahmednagar occupying about 94.68 per cent of area under cultivation of onion.

Storage black mould rot is a serious disease of onion. Ko *et al.*, (2002) [3] reported up to 36% losses of bulbs by the infection of *Aspergillus niger*. *Aspergillus niger* is a cosmopolitan fungus mainly responsible for spoilage and bio-deterioration of food material (Samson *et al.*, 2004) [7]. Generally this disease occurs more in white onions as compared to the red and pink onions. The phenol content in white onions is very low and therefore they are prone to the infection of *Aspergillus*. Onion storage rot disease causes extensive losses in storage and transit under tropical conditions (Thamizharasi and Narsimham, 1992) [8].

Therefore, the objectives of this study, were to survey the incidence of the storage rot of onion in different vegetable markets and determine the physiological weight loss of red and white onions artificially inoculated with *Aspergillus niger*, a rot causing fungal pathogen.

Materials & Methods

Survey of storage rot of onion in Rajgurunagar, Chakan and Talegaon market

A survey was carried out at 15 days interval at Rajgurunagar, Chakan and Talegaon market to study the incidence of storage rot of onion on the basis of typical symptoms from August to December during 2020. One hundred samples were selected randomly from the retailers of each market. Thus, totally 300 samples were examined for each time from all three locations for the incidence of rot of onion caused by *A. niger*.

The per cent storage rot incidence was calculated by following standard formula:

$$\text{Disease incidence (\%)} = \frac{\text{Number of infected bulbs}}{\text{Total number of examined bulbs}} \times 100$$

Study the physiological losses in weight of onion bulbs infected by *A. niger*

Healthy and mature red and white onion bulbs with uniform size were taken for the study. The samples were washed with clean water to remove extraneous surface material and then sterilized with NaOCl (1%) and finally washed by distilled sterile water for three times.

Then bulbs were separately inoculated with spore suspension of *A. niger* by pin prick method as described earlier. The inoculated bulbs were incubated at ambient temperature. Physiological losses in weight of infected bulbs were assessed on 15th, 30th, 45th and 60th days after the inoculation of *A. niger*. Losses in weight were calculated by the following formula:

$$\text{Loss in weight} = \frac{W_1 - W_2}{W_1} \times 100$$

Where,

W1 = weight of bulb recorded at the time of inoculation

W2 = weight of bulb recorded after 15th, 30th, 45th and 60th day after inoculation.

Results & Discussion

Survey on incidence of storage rot of onion in Rajgurunagar, Chakan and Talegaon market.

The survey was carried out at 15 days interval at Rajgurunagar, Chakan and Talegaon vegetable market for assessing the incidence of storage rot of onion during July to December, 2020. The results revealed that the presence of *Aspergillus spp.* (storage rot) at Shri. Chatrapati Shivaji Maharaj market yard, Rajgurunagar, Chakan Bhaji Mandai and Vegetable market, Talegaon.

Table 1: Survey on incidence of storage rot of onion in Rajgurunagar, Chakan and Talegaon during 2020

Locations	Per cent Disease Incidence (PDI)						Mean
	Rajgurunagar		Chakan		Talegaon		
	I	II	I	II	I	II	
July	19.00	16.00	19.00	23.00	20.00	22.00	19.83
August	12.00	10.00	14.00	18.00	13.00	14.00	13.50
September	13.00	17.00	16.00	12.00	15.00	18.00	15.16
October	23.00	21.00	19.00	22.00	17.00	20.00	20.33
November	26.00	28.00	25.00	25.00	28.00	26.00	26.33
December	26.00	29.00	31.00	28.00	29.00	27.00	28.33

I = 1st fortnight, II = 2nd fortnight

The data presented in Table 1 (Fig. 1) showed that, the disease incidence was observed in range of 12-29 per cent at Shri. Chhatrapati Shivaji Maharaj market yard, Rajgurunagar. Highest (29%) disease incidence was recorded in 2nd fortnight of December. While, lowest (12%) disease incidence was observed in 1st fortnight of August at Shri. Chhatrapati Shivaji Maharaj market yard, Rajgurunagar. Similar results were found in Bhaji Mandi, Chakan. At Chakan vegetable market, per cent storage rot incidence was ranged from 12-31 per cent. Highest storage rot incidence i.e. 31% was recorded in

1st fortnight of December, while lowest incidence (12%) was recorded in 2nd fortnight of September. In case of Talegaon vegetable market, the highest storage rot incidence and lowest incidence was recorded in 1st fortnight of December (29%) and August (13%), respectively. The highest storage rot incidence was recorded in December (28.33%) followed by November (26.33%), October (20.33%) and July (19.83%). While, lowest storage rot incidence was recorded in August (13.50%) followed by September (15.16%).

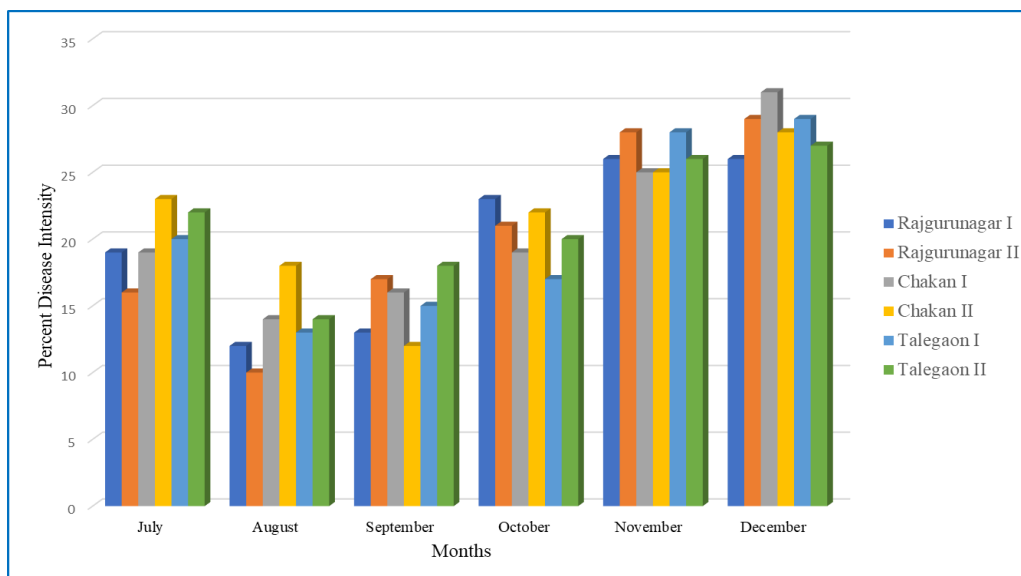


Fig 1: Survey on incidence of storage rot of onion during 2020

The results of present survey substantiate with the results obtained by Adongo *et al.* (2015) [1]. They reported more incidence of *Aspergillus niger* fungus during wet season in the markets of Anloga (31.30) in Kumasi Metropolis of Ghana. Ko *et al.* (2002) [3] reported the storage rot in onion were the main cause of storage losses up to 36 per cent. Mahmud and Monjil (2015) [5] reported maximum disease

incidence in Pusa Red (14.44%) followed by Faridpuri (11.81%) and Taherpuri (10.45%) varieties, in the month of September.

About 35 to 40% loss of onion due to damage caused by storage diseases and the fungal bulb rot, *A. niger* imparts to about 15 to 30% losses during storage of different varieties reported by Kumar *et al.* (2015) [4].

Physiological weight loss

The results presented in Table. 2 revealed that onion bulbs inoculated with *A. niger* exhibited loss in weight at 15, 30, 45 and 60 days after inoculation as compared to uninoculated

bulbs. Maximum physiological weight loss was recorded in white onion (11.25g and 22.87%) followed by red onion (10.27g & 10.41%), after 60 days of inoculation (DAI).

Table 2: Physiological weight loss of onion bulbs inoculated with *A. niger*.

Sr. No.	Cultivar	Average bulb wt. (g) before inoculation	Bulb wt. (g) after inoculation at				Physiological weight loss (g)				Per cent physiological weight loss			
			15 DAI	30 DAI	45 DAI	60 DAI	15 DAI	30 DAI	45 DAI	60 DAI	15 DAI	30 DAI	45 DAI	60 DAI
1	Red onion	98.65	97.55	95.31	91.25	88.38	1.10	3.34	7.40	10.27	1.11	3.38	7.50	10.41
2	White onion	49.18	48.31	45.41	42.03	37.93	0.87	3.77	7.15	11.25	1.76	7.66	14.53	22.87

DAI = Days after inoculation

White onion variety seems to be more susceptible to the storage rot disease as infection of the fungus was at greater intensity compared to red variety. Same results were obtained by Clark and Lorbeer (1973) and concluded that catachol (phenol) was less in white onions as compare to red, yellow

and brown varieties which responsible for inhibiting the growth of fungi. It was observed that physiological weight of red and white onion bulbs inoculated with *A. niger* progressively decreased as the incubation period is increased over control.



From the results presented in Table. 2 it was observed that physiological weight of red and white onion bulbs inoculated with *A. niger* progressively decreased as the incubation period is increased over control. The outcomes of this study are in agreement with the results

obtained by Prajapati (2016) [6]. He revealed that the onion bulbs inoculated with *A. niger* showed loss in weight as compared to uninoculated bulbs at 15, 30, 60 and 90 days after inoculation. He recorded highest per cent physiological weight loss in Gujarat Anand white onion-3 variety (10.48g

and 16.70 %) followed by Nasik yellow (11.54g and 14.45 %) and Nasik red (11.73g 10.59%) 90 days after inoculation.

Conclusion

It can be concluded from the findings of the present study that, *Aspergillus niger* is responsible for storage rot or black mold disease in onion and it is one of major threat to onion storage. Physiological weight loss of bulbs, occurs over a period of time inoculated with *Aspergillus niger*.

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