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Storage diseases of onion under variable conditions

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Abstract

Onion (*Allium cepa* L.) is an important and familiar spice as well as vegetable crop throughout the world. Storage rot due to various diseases caused by bulb rotting fungi is a major constrain for storing onion year-round in Bangladesh. The fungi associated with onion collected from different markets of Mymensingh, Naogaon and Sathkhira districts of Bangladesh were studied aiming to record the incidence of storage diseases as well as storage variability and conditions on disease incidence of onion. Disease incidence was recorded from storage of the retailers in two local varieties of onion,viz.,Taherpuri, Faridpuri and one Indian variety Pusa Red. Initially, infected onion bulbs were found maximum in Faridpuri and minimum amount was found in Pusa Red. Month-wise disease incidence showed that highest number of infected onion bulbs was found in Pusa Red and lowest number of infected bulbs was found in Taherpuri. Similarly highest disease incidence (%) was recorded in Pusa Red and lowest disease incidence (%) was recorded in Therpuri. Among the different markets average number of fungal infected bulbs was highest in the samples collected from Dhamoirhat bazaar of Naogaon district and lowest in the samples collected from Natun bazaar of Mymensingh district. Highest infected bulbs were found in onions stored in cold room (6°C) followed by Free floor and Bamboo basket. Lowest infected bulbs were found in onions stored in dried sands followed by net-bag and jute bag. Thus, the fungal diseases in storage are higher in large sized onion bulbs than indigenous small sized onions and in cold room (6°C) than net-bag or jute bag.

Key words: Onion, Variety, Storage condition, Disease incidence

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Introduction

Onion (*Allium cepa* L.) is an important spice as well as vegetable crop in Bangladesh. The major onion growing districts are Faridpur, Comila, Dhaka, Dinajpur, Jessore, Pabna, Rajshahi, Mymensingh and Rangpur (BBS, 2013). Onion is one of the most familiar spice crop throughout the world. It is also used as popular vegetable in Australia, Belgium, India, Japan, UK, USA and many other countries of Asia.

A good number of diseases have been reported in onion and cause production loss in the field and in storage (Munoz et al., 1984; Ahmed and Hossain, 1985; Meah and Khan, 1987). There are many factors behind the losses of onion bulbs in the storage. Under storage condition, onion bulbs naturally loss it's weight due to continuous loss of water. The most serious loss arises from storage rots due to various diseases caused by bulb rotting fungi (Jones and Mann, 1963). About 15 different fungal species and 5 bacterial species are found responsible for the onion diseases in the storage and transit all over the world. The loss due to these diseases is considerable and may go up to 40% (Aiyer, 1980). In storage various diseases destroy the onions such as Black mould rot (*Aspergillus niger*), Blue mould rot (*Penicillium* spp.), Fusarium bulb rot (*Fusarium* spp.), Basal rot (*Fusarium moniliforme*), Aspergillus rot (*Aspergillus* spp.), Dry rot (*Macrophomina pha-*

siolina), Soft rot (*Erwinia* spp.), Smudge (*Colletotrichum circinans*), Grey neck rot (*Botrytis allii*), Green mold rot (*Penicillium* spp.),White rot (*Sclerotium cepivorum*) and Anthracnose (*Colletotrichum chardonianum*) (Rangaswami and Mahadevan, 2004). Among these, black mould rot (*A. niger*) is more severe in storage. *A. niger* and *A. flavus* infect onion at high temperature and high relative humidity. Whereas *Penicillium* spp. destroys onion at low temperature. Sometimes *Penicillium* spp. produces mycotoxin, Penitrem A, which has been previously implicated in tremorgenictoxicosis (Overy *et al*., 2005). It is reported that the predominant fungal pathogens associated with the storage diseases of onions were *Aspergillus* sp., *Penicillium* sp. and *Fusarium* sp. (Velez et al., 2004, Raju and Nail, 2006). But fewer work have been done on intensity and severity of stored onion diseases in the country. The present research has been undertaken to study the fungi associated with onion bulb collected from different markets of Mymensingh, Naogaon and Sathkhira districts of Bangladesh to record the incidence of storage diseases of onion and to know the storage variability and conditions on disease incidence of onion.

Materials and Methods

Onion bulbs were collected from three retailer markets of three districts, namely, Natun bazaar of Mymensingh, Dhamoirhat bazaar of Naogaon and Sadar bazaar of Shatkhira of the country. The clinical experiment was carried out in the MS Laboratory, Department of Plant Pathology and in Seed Pathology Centre (SPC), Bangladesh Agriculture University (BAU), Mymensingh. Two local varieties of onion,viz.,Taherpuri, Faridpuri and one Indian variety Pusa Red were selected for this research work. Taherpuri is medium in size with very high pungency; Faridpuri is smaller in size and reddish in color; Pusa Red is large in size with fleshy scales and slight pungent odor.

Collection and storage of onion samples

Unbiased samples were collected from the stored bag of the retailers. Before storing in the cotton bag each sample of collected onion was sorted out into two categories, viz. healthy looking onions and symptom bearing onions. Onion of all samples were counted, weighted, bagged and labeled. Storage of healthy onions was spread out at room temperature. Five indigenous storage containers were used to store onion, viz., bamboo basket, jute bag, plastic net bag, keep on sand and free floor along with controlled temperature (cold room) at 6°C.After one week of storage, such a stored sample was spread on a working table and the onion bulbs were sorted out into different categories, such as, i) Healthy looking bulb (with no symptoms/ sign on the bulbs), ii) Black mould rot symptom bearing bulbs, iii) Bulb mould rot symptom bearing bulbs, iv) Fusarium bulb rot symptom bearing bulbs and v) others (having symptom/ sign).The total number of onion in each category were counted and weighted. All these exercise was done on the basis of direct inspection with/ without the aid of a 5× hand lens.

Percent weight loss and disease incidence

Percent weight loss was calculated by the following formula:

Weight loss (%) = (Initial weight of onion bulbs- Final weight of onion bulbs) ×100/ Initial weight of stored onion bulbs

The percentage of disease incidence was calculated using following equation:

Disease incidence (%) = No. of diseased onion×100/ Total no. of onion

Experimental design and statistical analysis

The laboratory experiment was laid out in a completely Randomized Design (CRD) with three replications. The recorded data on various parameters under the present study were statistically analyzed using MSTAT statistical package program. The level of significance and analysis of variance along with the Least Significance Difference (LSD) were done following Gomez and Gomez (1984).

Result and Discussion

In the preliminary survey, it was observed that no shopkeepers records any/small systematic information of the actual storage loss and the shop

operators do not know any accurate way of assessing it under prevailing conditions. The losses are mainly due to black mould rot, Fusarium bulb rot, blue mould rot etc. in the markets. Occurrence of the storage diseases of three varieties of onion bulbs viz., Taherpuri, Faridpuriad Pusa Red at three different markets was studied. At initial stage of survey, weight of different categories of onion was recorded (Table 1). Highest amount of both apparently healthy bulbs (Kg) and open bulbs were found in Pusa Red

Table 1. Weight of different categories onion at initial stage

Varieties	Name of the markets	Sample size (Kg)	Apparently Healthy bulb (Kg)	Open Bulb (Kg)	Infected bulb (Kg)
Taherpuri	M	1	0.75	0.10	0.15
	N	1	0.80	0.12	0.10
	S	1	0.70	0.08	0.20
Total		3	2.25	0.30	0.45
Faridpuri	M	1	0.77	0.12	0.11
	N	1	0.70	0.13	0.17
	S	1	0.68	0.10	0.22
Total		3	2.15	0.35	0.50
Pusa Red (Indian)	M	1	0.85	0.05	0.10
	N	1	0.75	0.10	0.15
	S	1	0.75	0.12	0.13
Total		3	2.35	0.27	0.38

M, Natun bazaar of Mymensingh; N, Dhamoirhat bazaar of Naogaon and S, Sadar bazaar of Shatkhira

variety and lowest amount of both apparently healthy (Kg) bulbs and open bulbs was found in Faridpuri. Infected onion bulbs were found maximum in Faridpuri and minimum amount was found in Pusa Red. Currah and Proctor (1990) surveyed on specific problems on onion production and storage in tropical and sub-tropical regions and indicated that storage losses were serious in 44 out of 72 tropical countries and 19 Asian countries out of 21. Ara et al. (2008) reported that among the five variety tested, artificial inoculation resulted maximum disease in onion bulbs of Indian Pusa Red. Onion bulbs of small sizes with strong skin have good storability (Ko et al., 2002).

Frequency, occurrence of disease onion bulbs collected from three markets of Mymensingh, Naogaon and Shatkhira dristrict in the month of September were measured in respect to variety and different markets of collection (Table 2). Highest average number of fungal infected onion bulbs was found in Pusa Red and lowest average number of fungal infected onion bulbs was found in Taherpuri. Similarly highest disease incidence (%) was recorded in Pusa Red and lowest disease incidence (%) was recorded in Taherpuri. Among the different markets average number of fungal infected bulbs was highest in the samples collected from Dhamoirhat bazaar of Naogaon district and lowest in the samples collected from Natun bazaar of Mymensingh district. Similar results were observed in percent disease incidence.Ara et al. (2008) mentioned fungi associated with storage diseases of marketed onions belonging to cultivars Taherpuri, Faridpuri, Kalashnagari, Zitka and Pusa Red. The disease development was significantly different among the varieties. The cultivar Pusa Red was found more susceptible to disease than the bulbs of other cultivars and the cultivar Zitka was found rather resistant (Ara et al., 2008). Visser (1999) published that injury to the bulb incurred before or during storage and this was the key factor in storage disease development causing storage loss. The results of this present study indicate that the fungal diseases in storage are higher in large sized onion bulbs than indigenous small sized onions. Effect of different varieties on onion bulb infection during October/08 to May/09 differed significantly (Table 3). Highest

infected bulbs were found in onions stored in Faridpuri variety. Lowest infected bulbs were found in Pusa Red. During October/08 to May/09, highest bulb infection was recorded in October/08 and gradually decreased from October to May.

Table 2. Frequency, occurrence of disease onion bulbs collected from three markets of Mymensingh, Naogaon and Shatkhira district in the month of September

Varieties	Name of the markets	Number of collected onions	No. of fungal infected bulb	Average No. of fungal infected bulb	% disease incidence	Average % disease incidence
Taherpuri	M	127	13	13	10.23	10.45
	N	125	14		11.20	
	S	121	12		9.92	
Faridpuri	M	132	15	16	11.36	11.81
	N	138	17		12.31	
	S	136	16		11.76	
Pusa Red (Indian)	M	132	18	19	13.63	14.44
	N	136	20		14.70	
	S	144	19		15.00	

M, Natun bazaar of Mymensingh; N, Dhamoirhat bazaar of Naogaon and S, Sadar bazaar of Shatkhira

Table 3. Effect of different varieties on onion bulb infection during October/08 to May/09

Variety	Weight (Mean) of infected bulbs (gm) /Kg							
	October	November	December	January	February	March	April	May
Taherpuri	69.67	62.28	58.00	54.67	48.50	44.50	34.33	31.50
Faridpuri	78.67	74.67	73.17	66.33	63.17	59.83	52.67	46.17
Pusa red	61.17	58.39	53.00	47.67	41.33	37.50	34.17	32.00
LSD	0.7303	0.8966	1.115	0.9426	1.503	1.371	1.990	1.033
CV (%)	1.55	2.048	2.69	2.48	4.36	4.29	7.29	4.18

Table 4. Effect of different storage conditions on onion bulb infection during October/08 to May/09

Storage Condition	Weight (Mean) of infected bulbs (gm) /Kg							
	October	November	December	January	February	March	April	May
Jute bag	71.00	66.00	60.00	54.00	50.00	44.67	36.33	33.67
Net bag	68.33	60.66	57.67	51.33	49.33	45.00	34.67	30.33
Bamboo basket	70.33	65.55	62.67	60.00	52.67	49.00	37.67	33.33
Keep on sand	65.00	60.00	54.67	47.33	41.67	37.33	30.67	26.00
Free floor	71.66	67.77	65.67	61.67	55.67	52.33	50.00	44.67
Refrigerator	72.66	70.66	67.67	63.00	56.67	55.33	53.00	51.33
LSD	1.033	1.268	1.577	1.333	2.126	1.938	2.815	1.460
CV (%)	1.55	2.04	2.69	2.48	4.36	4.29	7.29	4.18

Among the different months, lowest infection was recorded in May/09. Storage losses were significantly influenced by storage duration, cultivar, storage condition and interaction between storage condition and cultivar (Ko et al. 2002). Effect of different storage conditions on onion bulb infection

during October/08 to May/09 differed significantly (Table 4). Highest infected bulbs were found in onions stored in cold temperature (6°C) followed by Free floor and Bamboo basket. Lowest infected bulbs were found in onions stored in dried sands followed by net-bag and jute bag. Consistence month-wise results were obtained. During October/08 to May/09, bulb infection was recorded in October/08 and gradually decreased from October to May. Among the different months, lowest infection was recorded in May/09. Provision of optimum curing and storage condition may enhance the storage performance of onion bulbs (Maw et al., 1997). Storage onion at 0 to 2°C and 65% relative humidity (RH) will minimize storage losses (Handenburg et al., 1986). Srinivasan and Shanmugam (2006) evaluated the efficacy of six types of containers/methods viz., jute gunny bags, polythene lined gunny bag with perforations, bamboo basket, bamboo bins, wooden rake and hanging method in reducing the spoilage in stored onions. They reported that containers used for storage of onion bulbs showed significant influence on the incidence and development of *Aspergillus niger* rot. Chavan et al. (1992) found hanging method of storage was effective upto 45 days, cage method was effective even upto 90 days in minimising black mould disease of onion.

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