

Prevalence of important post harvest diseases of mango

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Abstract: The prevalence of post harvest diseases viz. stem-end rot and anthracnose of 12 mango (*Mangifera indica* L.) varieties were investigated at 139 storage depots at the level of wholesalers and retailers category under 5 major districts of Bangladesh. Out of 1,64,336 inspected mangoes, average fruit infection was 11.92% and 9.10% for stem-end rot and anthracnose, respectively. Among the mango varieties, the highest disease incidence was recorded in Fazli, Aswina, Gopalbhog and Gootee. *Botryodiplodia theobromae* was consistently isolated from stem-end rot, while anthracnose infected fruits yielded *Colletotrichum gloeosporioides*. Nine mango varieties were tested for determining susceptibility to *B. theobromae* and *C. gloeosporioides*. Most of the varieties were found to be more or less susceptible to the above pathogens.

Keywords: Prevalence, Post harvest diseases, Mango

Introduction

Mango (*Mangifera indica* L.) is one of the most important and popular fruit in the tropical and sub-tropical countries as well as in Bangladesh. It is widely produced and considered as the class one fruit of Bangladesh, although the better quality mangoes are solely concentrated in the north-western parts of the country, especially in the greater Rajshahi, Dinajpur and Rangpur districts (Karim, 1985). Post harvest loss of fresh fruits is one of the important problems in the tropics. A huge quantity of fruits goes waste due to lack of proper post harvest handling, storage and ripening. A considerable quantity of fruit goes waste through post harvest decay. The magnitude of post harvest losses in fresh fruit is estimated to be 5-25% in developed countries and 20-50% in developing countries (Khader, 1985). In the neighboring country India, total post harvest losses of certain mango varieties like Totapuri and Alphonso are 17.9% and 14.4%, respectively (Srinivas *et al.*, 1996). Quroshi and Meah (1991) recorded post harvest losses of mango ranging from 0 to 16.3% with an average loss of 12.5% in Bangladesh.

There are a number of fungi that attack mango fruits at maturity after removal from the tree. These fungi causes infection during storage and transit, and losses sustained due to fungal infections during these periods are quite heavy. *Colletotrichum gloeosporioides* and *Botryodiplodia theobromae* are the two major fungi that have been reported to cause damage to mango fruits. Anthracnose caused by *C. gloeosporioides* is the major pre and post harvest disease of mango in all mango producing areas of the world and is associated with high rainfall and humidity (Fitzell *et al.*, 1984 and Dodd *et al.*, 1992). The highest disease incidence has been observed in mango variety Aswina (37.165) and Gootee (37.8%) in Nawabgonj district (Anonymous, 1990). *C. gloeosporioides* forms quiescent infections on fruit which develop further upon ripening during the post harvest period (Muirhead and Grattidge, 1986) This widely distributed fungus causes well-known diseases of other subtropical fruit plants, such as wither -tip of citrus and ripe rot of papaya and avocado. Fruit rot is particularly a serious concern when mango fruit is desired to be stored for consumption or is required to be shipped to

long distances. Considering this fact, the present study was designed to survey the prevalence of stem-end rot and anthracnose of mango in 5 major mango growing and marketing districts of Bangladesh and to assess the varietal response of mango to post harvest diseases.

Materials and methods

Survey for the prevalence of post harvest stem-end rot and anthracnose diseases of mango caused by *B. theobromae* and *C. gloeosporioides*, respectively were conducted in the market storage depots known as *arots* at wholesaler and retailer category under 5 major mango growing and marketing districts of Bangladesh viz. Mymensingh, Dhaka, Rajshahi, Chapainawabganj and Dinajpur. In the year 2002, the inspection of fruits continued for 7 days beginning from their first display after unpacking the transported fruits carried from their production areas.

An intensive survey was conducted at 14 *arots* of 2 spots (Nutan bazar and Shadashi bazar) of Mymensingh town during May-August, 2002. Survey in Dhaka was conducted at 54 *arots* of 6 spots (Farm gate, Kawran bazar, New market, Mirpur, Santinagar and Badarntali) during June-August, 2002. In Rajshahi 28 *arots* of 6 spots viz. Shaheb bazar, Bagha, Charchat, lalpur, Ahmedpur and Banasshar bazar were surveyed during July-August, 2002. In Chapainawabgonj, 28 *arots* of 5 spots viz. Kanshat Shibgonj', Volarhat, Nawabgonj, Gomostapur and Rahmpur, were surveyed during July-August, 2002. In Dinajpur, 15 *arots* of 5 spots (Bahadur bazar, Dasli mile, Ranir bondar, Chirir bondar and Fulbari bazar) were surveyed during May-August, 2002.

In the study, 12 mango varieties viz. Fazli, Aswina, Langra, Himsagar, Chosa, Mohanbhog, koapahari, Lakkhanbhog, Gopalbliog, Gootee, Kisanbhog and Khirsapat, were inspected for the prevalence of stem-end rot and anthracnose diseases. In the *arots*, symptoms on all the varieties were studied under natural environmental conditions whereas development of diseases and symptom expression was observed under laboratory conditions in inoculated mango fruits. Baskets of fruits available in the market on the day of observation were checked for disease incidence and severity. In the market fruit baskets, on the basis of visual observation anthracnose and stem-end rot diseased fruits of mango were individually identified

and counted and calculated into percentage in relation to the total number of mango fruits and the average were recorded for estimation of disease incidence (percent fruit infection). Diseased portion of an individual fruit was recorded from 10 randomly selected fruits considering the total portion of an individual fruit as 100% and the average value gave the percent disease severity. For the assessment of fruit loss, the disease incidence and severity was assessed on the varieties available in the markets as per cent fruit infected and surface area diseased. In a retailing spot, total number of healthy and stem-end rot and anthracnose infected fruits of mango in each fruit basket were observed on the basis of totality of healthy and diseased fruits. Fruits showing 2% or less SAD (surface area diseased) were counted healthy. Fruits with above 2% SAD were considered unfit for consumption and calculated as loss (Spalding and Reeder, 1986). In order to isolate the causal organism, diseased fruit samples were taken to the plant pathology laboratory of the Bangladesh Agriculture University and the organisms were isolated on Potato Dextrose Agar (PDA) plates by planting sterilized pieces of diseased tissues. The causal fungi were identified by observing colony characters, linear growth, colour and sporulation (Singh, 1984).

For pathogenicity test, matured and healthy mangoes of variety Fazli collected from Mymensingh *arots* were inoculated by placing mycelial blocks (6 mm diameter) of *Botryodiplodia theobromae* and *Colletotrichum gloeosporioides* from 7 days old culture. Observations were made for initiation of infection and disease development. The infected fruit parts of the inoculated fruits were collected for reisolation of the pathogens. Nine mango varieties *viz.* Fazli, Aswina, Gopalbhog, Langra, Kbirapat, Gootee, Koapahari, Chosa, Lakbanbhog were evaluated for their susceptibility to anthracnose and stem-end rot causal organisms under laboratory conditions. To serve the purpose, fresh mature hard mangoes were inoculated with mycelial block of 6 mm diameter containing spores of *C. gloeosporioides* and *B. theobromae* by wounding the surface of mango with sterile needle. After placing the mycelial block on the wounded place, the inoculated block was covered with sterilized water soaked cotton

for conserving moisture. After 3 days of inoculation, the lesion size, length of diseased area (LDA), percent fruit infection, percent fruit area diseased (FAD) and percent fruit diseased index (PDI) were recorded to evaluate the varietal susceptibility to these 2 pathogens. For each variety 3 fruits were inoculated by *C. gloeosporioides* and 3 fruits were inoculated by *B. theobromae*. Data were collected upto 7 days after inoculation.

Results and Discussion

Symptoms of the 2 post harvest mango diseases, stem-end rot and anthracnose were visually observed during the study and were compared to those described by Meah and Khan (1987). In the current study, a total of 1,64,336 mangoes were inspected in 5 major districts of Bangladesh during May-August, 2002 of which 22,093 mangoes were infected due to stem-end rot with an average loss of 11.92% (Table 1). The number of mangoes surveyed in Dhaka was maximum (49,561) with a maximum prevalence of stem-end rot (14.61%) followed by Mymensingh (13.51%) while the minimum prevalence (9.6%) was in Chapainawabganj (Table 1). Out of 164,336 mangoes, 16,754 were found infected due to anthracnose disease and the average losses were 9.10%. The maximum (10.211%) and minimum (8.6%) disease incidence of anthracnose were observed in Mymensingh and Rajshahi, respectively (Table 1). Stem-end rot disease started at the stalk-end of the fruits just alike supported by the reports of Pathak and Srivastava (1967). Anthracnose lesions developed anywhere on the fruit surface, but often appeared around the pedicel of the fruit.

Among the 12 varieties of mango, most popular varieties, Fazli, Gootee, Aswina, Langra, Lakkhan bhog, Himsagar, Khirsapat, Gopal bhog and Mohan bhog were infected largely. Among the varieties investigated, per cent stem-end rot infected mangoes were maximum (16.25) in Aswina followed by Fazli (15.69) whereas the minimum stem-end rot infected mangoes (8.9) was found in Lakkbanbhog (Table 2). Anthracnose had an average infection of 9.1% where the maximum (11.6%) infected mangoes were found in Fazli followed by Gootee (10.651%) and the minimum (6.5%) was found in Chosa (Table 2).

Table1. Prevalence of mango stem-end rot and anthracnose disease in 5 major districts of Bangladesh during 2002 (June- July)

Districts	Mangoes inspected (no.)	No of diseased mangoes (stem-end rot)	Per cent of diseased mangoes (stem- end rot)	No of diseased mangoes (anthracnose)	Per cent of diseased mangoes (anthracnose)
Dhaka	49,561	8,128	14.61	5588	9.91
Mymensingh	19,270	2,804	13.51	2423	10.21
Rajshahi	33,115	4,355	11.60	3195	8.60
Chapainawabganj	42,340	4,530	9.61	3378	8.25
Dinajpur	20,050	2,276	10.31	2170	9.96
Total	1,64,336	22,093	11.92 (average)	16,754	9.10 (average)

Table 2. Prevalence of mango stem-end rot and anthracnose on 12 varieties in different locations in Bangladesh during 2002

Variety	Total no. of mangoes inspected	Total no. of diseased (stem-end rot) mangoes	% diseased (stem-end rot) mangoes	Total no. of diseased (anthracnose) mangoes	% diseased (anthracnose) mangoes
Fazli	45,430	7,128	15.69	5,270	11.60
Gootee	22,775	3,291	14.45	29426	10.65
Aswina	319650	5,143	16.25	3,101	9.8
Langra	16,325	2,335	14.30	1,453	8.9
Mohan bhog	31510	478	13.62	415	7.8
Gopal bhog	9,810	952	9.70	1,025	10.45
Himsagar	3,707	543	14.65	315	8.5
Kisan bhog	287	38	12.99	20	6.9
Chosa	19,735	2,782	14.85	1,222	6.5
Khirsapat.	2,235	240	10.75	204	9.1
Koapahari	692	88	12.65	53	7.6
Lakkhan bhog	732	65	8.9	729	9.95
Total	1,64,336	23,083	13.23 (average)	16433	9.10 (average)

The prevalence of anthracnose was comparatively lower than stem-end rot throughout the survey. Meah and Khan (1987) reported that the average incidence of stem-end rot was 15.21% in their survey throughout the country. Quroshi and Meah (1991) found that the average losses of mango caused by stem-end rot were 12.5% through a survey during 1987. Jadeja and Vaishnar (2000) observed 5.5% stem-end rot incidence in markets of the neighboring country India.

District wise prevalence of stem-end rot in 12 varieties showed that the maximum and minimum infected mangoes belonged to Gootee (20.5%) and Mohanbhog (9.5%) in Dhaka, Gootee (16.5%) and Chosa (10.0%) in Mymensingh, Aswina (15.5%) and Khirsapat (7.5%) in Rajshahi, Aswina (12.5%) and Khirsapat (6.0%) in Chapainawabganj and Fazli (13.5%) and Chosa (6.0%) in Dinajpur (Table 3). In case of anthracnose, the maximum and minimum infected mangoes were found in Fazli (13.5%) and Mohanbhog (6.0%) in Dhaka, Gootee (13.0%) and Mohanbhog and Chosa (7.5%) in Mymensingh, Aswina (12.0%) and Kisanbhog (5.0%) in Rajshahi, Lakkhanbhog (11.4%) and Chosa (5.0%) in Chapainawabganj and Goyalbhog (12.8%) and Mohanbhog (7.5%) in Dinajpur, respectively (Table 3).

Varietal susceptibility to stem-end rot and anthracnose of 9 mango varieties were studied in controlled laboratory conditions. Mangoes of different varieties were inoculated with causal organisms of these 2 diseases. Among those selected varieties maximum lesion size (cm) and percent fruit area diseased (FAD) were found in variety Koapahari as 7.17 cm and 42.13%, respectively at 3 days after inoculation, followed by Gopal bhog (5.85cm, 38.90%) and Fazli (4.58 cm, 25.47%) and the lowest lesion size and % FAD were found in Langra as 2.17cm and 11.42%. Percent fruit areas diseased were statistically similar to variety Gootee, Lakkhan bhog, Chosa, Aswina and Langra (Table 4). Fazli was found to be the most susceptible variety among the tested 9 varieties of mango. Average lesion size and percent fruit area diseased were found 3.91cm and 23.03%, at 3 days after inoculation, followed by Gootee (3.08cm, 18.13%) and Gopal bhog (2.75cm and 16.17%). The lowest lesion size and percent fruit area diseased were found in variety Lakkhan bhog (1.67 cm, 6.87%). The average lesion size and percent FAD were found statistically similar to variety Langra (1.33 cm, 7.83%), and Khirsapat (1.67cm, 9.80%) (Table 4).

Table 3. Prevalence of mango stem-end rot and anthracnose on 12 varieties in 5 districts during 2002

Variety inspected	Dhaka				Mymensingh				Rajshahi				Chapainawabganj				Dinajpur			
	Total mangoes surveyed		% infection		Total mangoes surveyed		% infection		Total mangoes surveyed		% infection		Total mangoes surveyed		% infection		Total mangoes surveyed		% infection	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
1. Fazli	15162	15162	18.0	13.5	4720	4720	14.0	12.8	6150	6150	13.5	11.0	8785	8785	12.0	8.8	10613	10613	13.5	12.0
2. Gootee	8225	8225	20.5	10.8	4310	4310	16.5	13.0	3765	3765	14.5	8.5	4423	4423	9.5	9.0	2052	2052	9.5	12.0
3. Aswina	7680	7680	14.5	11.0	2632	2632	13.75	10.5	7780	7780	15.5	12.0	8730	8730	12.5	7.0	3828	3828	10.0	8.5
4. Langa	4981	4981	13.0	11.0	3106	3106	12.5	8.5	4346	4346	9.5	7.0	4330	4330	11.0	9.0	1188	1188	9.0	9.0
5. Mohan bhog	665	665	9.5	6.0	955	955	12.0	7.5	2530	2530	10.0	9.5	995	995	8.5	8.5	165	165	9.0	7.5
6. Gopal bhog	4621	4621	16.5	10.5	1885	1885	15.0	11.0	1730	1730	15.0	9.5	950	950	11.0	8.5	624	624	8.0	12.8
7. Himsagar	-	-	-	-	-	-	-	-	1299	1299	11.0	9.5	2408	2408	7.5	7.5	-	-	-	-
8. Kisan bhog	-	-	-	-	-	-	-	-	105	105	9.0	5.0	182	182	9.5	8.8	-	-	-	-
9. Chosa	8730	8730	12.0	6.5	2225	2225	10.0	7.5	1910	1910	12.5	7.5	5350	5350	11.5	5.5	1580	1580	6.0	8.0
10. Khirshapat	310	310	16.0	10.0	250	250	14.4	11.0	945	945	7.5	7.3	730	730	6.0	8.0	-	-	-	-
11. Koapahari	-	-	-	-	-	-	-	-	420	420	7.8	8.0	272	272	6.3	7.2				
12. Lakkhan bhog	1000	1000	11.0	10.0	-	-	-	-	2135	2135	13.5	8.5	4185	4185	10.0	11.4	-	-	-	-
Total	49561	49,561	14.6	9.91	19270	19,270	13.5	10.21	33115	33,115	11.6	8.60	42340	42,340	9.6	8.25	20050	20,050	10.3	9.96

A = Stem end rot; B = Anthracnose

Table 4. Comparative stem-end rot and anthracnose incidence and severity on 9 varieties of mango when artificially inoculated in the laboratory at 3 Days after inoculation (DAI)

Varieties	Stem-end rot			Anthracnose		
	Average lesion size (cm)	Percent fruit area diseased (% FAD)	Percent disease Index % PDI	Average lesion size (cm)	Percent fruit area diseased (% FAD)	Percent disease Index (PDI)
Gopal bhog	5.8 5 b	38.90 a	73.33	2.750 be	16.17 be	40.0
Gootee	2.93 d	19.50 c	93.33	3.083 b	18.13 b	40.0
Khirshapat	6.67 ab	39.22 a	73.33	1.667 ef	9.80 ef	26.66
Koapahari	7.17 a	42.13 a	93.33	0.00 g	0.00 g	0.0
Lakhan bhog	2.08 d	12.27 d	33.33	1.167 f	6.87 f	26.66
Chosa,	2.92 d	16.17 cd	40.0	2.250 cd	13.23 cd	40.0
Aswina,	3.0 d	15.80 cd	40.0	2.0 de	11.77 de	33.33
Fazli	4.58 c	25.47 b	53.33	3.917 a	23.03 a	46.66
Langra	2.17 d	11.42 d	33.33	1.33 f	7.833 f	26.66
LSD (0.05)	0.993	5.803		0.533	3.139	

DAI = Days after inoculation. Figures having common letter do not differ significantly at P= 0.01

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