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IMPACT OF MANGO SUDDEN DECLINE DISEASE IN SINDH, PAKISTAN

Ahmed Panhwar*, S. M. Nizamani, R. D. Khuhro, Q. D. Abbasi and Muhammad Mithal Jiskani
Faculty of Crop Protection, Sindh Agriculture University, Tandojam, 70060, Pakistan
*Email: ahmedpanhwar@yahoo.com

Abstract

Present studies were conducted on recording diagnostic symptoms and severity index of sudden decline disease in major mango growing districts of Sindh, Pakistan. The most characteristic symptoms were black cankers inside the barks of main trunk, roots, stem, branches and twigs of mango tree with or without oozing out of gum that resulted in decaying of barks followed by sudden decline of the severely affected part or tree. The results further showed that the disease was observed in all the surveyed major mango growing districts of Sindh. The bark decay area was observed at different heights of mango trees in all the districts. Maximum mean decaying of barks was observed in Hyderabad (6.89%) followed by Tando Allahyar (6.61%) and Mirpur Khas (6.20%); whereas, minimum in Naushahro Feroze (3.14%) and Khairpur (3.39%) respectively. The data also showed that maximum mean decaying of barks in all the districts occurred on 0-2´ stem (6.94 cm) followed by root (6.25 cm), 2-4´ stem (5.93 cm) and 4-6´ stem (1.71 cm) respectively. Overall mean decaying of barks for all the districts and heights was $(4.96\ cm)^2$. The disease severity index recorded for all the districts was with the mean of 3.13%. Maximum disease severity index occurred in Hyderabad (4.78%) followed by Tando Allahyar (4.18%) and Mirpur Khas (3.94%); whereas, minimum in Naushahro Feroze (1.32%) and Khairpur (1.46%) respectively.

Key words: Mango, sudden decline, decaying of barks, disease severity index, Sindh.

INTRODUCTION

Mango (*Mangifera indica* L.), an important fruit crop of the tropical and subtropical regions of the world is grown on large area in Pakistan, India, Java, Philippines, West Indies, Hawaii, Mexico and Florida. In Pakistan, mango stands second in area and production after citrus (Chaudhary, 1994). Pakistani mangoes are the best of all due to their excellent taste and superb flavor (Muhammad et al., 1999). The soil and climatic conditions of Pakistan are highly suitable for mango cultivation (Akhtar and Alam, 2002). The mango is nutritionally rich in carbohydrates, and vitamin A and C. Its favorite, commonly consumed recipes, desserts etc are relished and liked by everyone for its flavor, dietetic and medicinal value. There are numerous varieties of mango, each differing in fruit characters, viz. taste, flavor, colour, tinge, shape and size, which determine

the quality of the fruit and its market value at home and overseas (Jiskani et al., 2000; Jiskani, 2002).

At present mango is grown over an area of 151.5 and 49.2 thousand ha with production of 1637.9 and 349.6 thousand tonnes in Pakistan and Sindh respectively. The area under mango cultivation has increased but unfortunately the rise in production is slow (Anonymous, 2006). The main reasonable factors which affect the vitality and yield of mango are shortage of water, insect pests and various diseases (Talpur and Khuhro, 2003). Presently about all mango orchards, especially in Sindh have been suffering from the decline disease complex that is a complicated case caused by combined attack of several different fungi. High temperature, high relative humidity, shortage of irrigation water and weak plants in the neglected orchards are main contributing factors that help to grow, develop and spread more disease causing organisms (Jiskani, 2002). Al-Adawi et al. (2003) reported that *Diplodia theobromae* (*Botryodiplodia theobromae*) was associated with sudden decline of mango in Oman, characterized by gummosis from the trunk, wilting, tree death, wood staining, spreading from a point of infection. Pathan et al. (2005) reported that mango gummosis is caused by *B. theobromae.* However, sudden decline disease in mango orchards was a question for growers, traders as well as for researchers in Sindh, Pakistan. Therefore, present studies were undertaken on impact of mango sudden decline disease in Sindh, Pakistan.

MATERIALS AND METHOD

Survey and record of diagnostic symptoms

The surveys were conducted to record diagnostic symptoms and to calculate severity index of sudden decline disease in major mango growing districts of Sindh, Pakistan. The most characteristic symptoms of the disease were recorded on different parts of mango tree. Severely diseased mango trees located in different districts showing typical symptoms of the disease were observed to identify severe point of infection/decaying of barks. Three bark samples measuring 10x10 cm of each tree were cut from different heights viz. 0-2´ stem, 2-4´ stem, 4-6´ stem and root of each three trees per locality. Length and breadths of decayed portion of the bark was measured in cm; whereas, the decaying of barks (cm) for each district was calculated by using the recorded length and breadths of decayed barks at different heights due to the disease through the following formula:

$$\text{Decaying of barks (cm)} = \frac{\text{Sum of lengths and breadths of decayed barks}}{\text{Total number of lengths and breadths studied}}$$

Record of Disease severity index

The data regarding severity for calculating severity index of the disease were recorded from orchards located at 12 different districts of Sindh. All the healthy and infected mango trees standing in the studied orchards were recorded. Freshly infected, partially dead and totally dead trees were considered as infected. However, the severity of mango decline disease was assessed by using the already decided following key, previously described by Bajwa et al. (2003) for extent of Shisham decline:

Whereas, the severity index of mango decline disease was calculated from raw severity data, using the following formula:

$$\text{Disease severity index (\%)} = \frac{\text{Sum of all disease ratings}}{\text{Number of trees observed} \times \text{Maximum disease grade}} \times 100$$

Key/ Scale	Disease rating	Description of symptoms	Disease severity (%)
0	No disease	No signs of disease	0.0
1	Very mildly diseased	Gum traces oozed out/few smaller branches became dry	10.0
2	Mildly diseased	Oozing of gum started/few branches became dry	25.0
3	Moderately diseased	Upto 35% of the tree became dead	50.0
4	Highly diseased	More than 35% of the tree became dead	75.0
5	Dead	Foliage of whole tree wilted to decline the tree	100.0

RESULTS AND DISCUSSION

Symptoms of mango sudden decline disease

The most diagnostic symptoms were black cankers inside the barks of main trunk, roots, stem, branches and twigs of mango tree with or without oozing out of gum that resulted in decaying of barks. The wood underside the decayed barks stained yellow and brown to black followed by blockage of the vascular system that caused decline of the associated part or the whole tree. Infections on basal/color portion blocked translocation of the full tree and were found suddenly killer of the whole tree.

Pernezny and Ploetz (2000) listed several different diseases of mango, including blight, canker, gummosis, twig blight, tip die-back and stem bleeding under the general term decline. Nizamani et al. (2005) reported that tips dieback disease suddenly dried mango trees completely as scorched by fire after oozing out of gummy substance on the main trunk. Khuhro et al. (2005) reported that in diseased trees, the flow of nutrients in phloem and xylem vascular bundles was blocked. Concurrently, the gum oozed out from the trunk and branches, ultimately causing plant mortality within a few days.

Decaying of barks on mango trees

The results recorded in Table 1 on decaying of barks in 12 different districts at all heights revealed that decaying of barks occurred on all studied districts. Maximum mean decaying of barks at all heights was observed in Hyderabad (6.89%) followed by Tando Allahyar, Mirpur Khas, Tando Muhammad Khan, Jamshoro, Karachi, Sanghar, Nawab Shah, Matiari, Badin, Khairpur and Naushahro Feroze (3.14%) respectively. The data further shows that the decaying of barks in all districts occurred with maximum mean on 0-2´ stem (6.94 cm) followed by root (6.25 cm), 2-4´ stem (4.93 cm) and 4-6´ stem (1.71 cm) respectively. The overall mean decaying of barks for all varieties and heights was 4.96 cm.

Khanzada et al. (2004) isolated *Lasiodiplodia theobromae* and *F. solani* from root, stem and shoot samples of infected mango plants showing symptoms of dieback, gummosis and decline. Shahbaz et al. (2005b) reported that all the fungal isolates of *B. theobromae* causing quick decline of mango originated from cultivars of different districts infected with collar/stem rot.

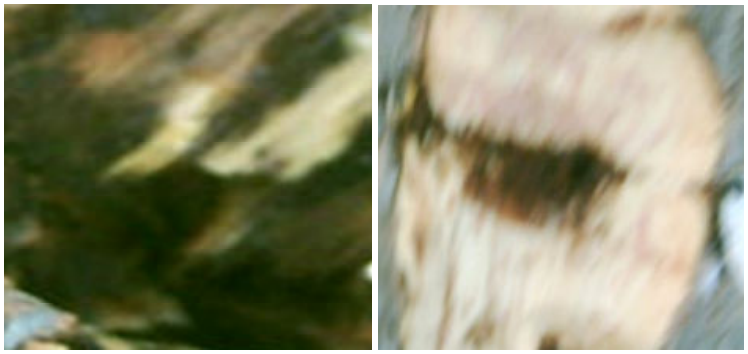

Figure 1: Decaying of barks, the diagnostic symptom of mango sudden decline disease in Sindh

Table 1: Decaying of barks caused by sudden decline disease in major mango growing districts of Sindh

Locality	Decaying of barks at different tree heights (cm)*				
	0-2´ stem	2-4´ stem	4-6´ stem	Root	Mean
Hyderabad	8.99	6.53	3.37	8.70	6.89
Tando Allahyar	8.62	6.33	2.95	8.58	6.61
Mirpur Khas	7.91	6.20	2.72	7.99	6.20
Matiari	7.37	5.74	2.39	6.99	5.62
Sanghar	7.32	5.24	2.08	6.37	5.25
Tando Muhammad Khan	6.99	4.99	1.70	6.37	5.01
Nawab Shah	6.74	4.87	1.33	6.12	4.76
Jamshoro	6.70	4.70	1.12	5.62	4.53
Badin	6.49	4.41	0.91	5.20	4.25
Karachi	5.91	3.91	0.78	4.74	3.83
Khairpur	5.32	3.33	0.62	4.33	3.39
Naushahro Feroze	4.99	2.99	0.54	4.08	3.14
Mean	6.94	4.93	1.71	6.25	4.96

*Decaying on 10x10 cm barks cut from different heights of each 3 trees/locality.

Disease severity index in Sindh

The data in Table 2 revealed that the disease index occurred in all the districts of Sindh. The disease severity index range in different districts varied from 1.32-4.78%. The maximum disease severity index occurred in Hyderabad (4.78%) followed by Tando Allahyar, Mirpur Khas, Tando Muhammad Khan, Jamshoro, Karachi, Sanghar, Nawab Shah, Matiari, Badin, Khairpur and Naushahro Feroze (1.32%). The mean disease severity index for all the districts was 3.13%.

Al-Yahani et al. (2005) reported that mango sudden decline has devastated mango production in Oman. The pathogen was especially virulent on local mango cultivars and local material used as rootstocks for exotic scions. They also reported the impact of similar diseases in USA, Brazil, Pakistan, Sicily and Iran. Khanzada and Shahzad (2005) reported that most of the mango orchards in Sindh were suffering from the decline disease with maximum disease incidence at Tandojam followed by Mirpurkhas and minimum in Hala. Shahbaz et al. (2005a) assessed 100% prevalence of decline disease in mango orchards and indicated the increasing severity of quick decline in the Punjab (Pakistan). Decline disorders were noted as twig blight, gummosis, bark splitting/cracking and wilting with 3.17, 0.62, 1.25 and 0.37% incidence respectively.

CONCLUSION

On the basis of present studies, it is concluded that decaying of barks was the most characteristic and diagnostic symptom of the disease. Maximum mean decaying of barks was observed on 0-2′ stem followed by root, 2-4′ stem and 4-6′ stem respectively. Mango orchards in all the 12 surveyed major mango growing districts of Sindh were suffering from the disease. Maximum mean decaying of barks and disease severity index occurred in Hyderabad followed by Tando Allahyar and Mirpur Khas; whereas, minimum in Naushahro Feroze and Khairpur. Rootstock of the trees suffered the most. Infections on basal (lower) parts of trees were sudden killer of the whole tree.

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Table 2: Severity index (%) of mango decline disease in major mango growing districts of Sindh

Locality (Treatment)	Total trees observed (number)	Number of trees/disease grade						Sum of all disease ratings	Disease severity index (%)
		0	1	2	3	4	5*		
Hyderabad	249	227	6	2	4	6	4	66	4.78
Tando Allahyar	326	301	4	8	8	2	3	67	4.11
Mirpur Khas	080	074	1	2	1	0	1	30	3.94
Tando M. Khan	152	141	5	2	1	2	2	31	3.85
Jamshoro	143	133	2	6	1	0	1	45	3.73
Karachi	085	080	4	0	0	0	1	26	3.35
Sanghar	161	149	6	1	3	1	2	13	3.25
Nawab Shah	155	144	6	2	0	4	0	22	3.07
Matiari	241	223	4	6	4	3	1	10	2.66
Badin	075	070	3	0	1	1	0	9	2.11
Khairpur	301	289	3	8	1	0	0	22	1.46
N. S. Feroze	408	392	9	4	2	1	0	27	1.32
Mean	198	185.25	4.41	3.41	2.16	1.66	1.25	30.66	3.13

*Maximum disease grade

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