DETERMINATION OF DIFFERENT DECLINE DISORDERS IN MANGO ORCHARDS OF THE PUNJAB, PAKISTAN

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Abstract

A planned study was conducted to assess the prevalence incidence and intensity of different decline disorders prevailing in mango growing areas of the Punjab, Pakistan. Sixteen locations were visited in four districts of the Punjab with the objective to confirm the status and update the existing statistics for future management and planning. Four disorders *viz.* twig blight, tip dieback, gummosis and bark cracking/ splitting were noted with 55.0, 50.0, 25.0 and 25.0 % prevalence, respectively. Incidence percentage in the same order was 3.17, 4.43, 0.62 and 1.25 % while intensity ranged from 16.0-50.0 %. Maximum intensity of 5.17 % for quick decline was noted in Sahiwal district. Chaunsa proved to be the most susceptible cultivar with 6.95 and 3.14 % incidence and intensity, respectively. Prevalence of the decline syndromes in the mango orchards suggests to devise an integrated strategy to combat the problem in future.

Introduction

Mango (*Mangifera indica* L.) is the most important and delicious fruit grown in many tropical and subtropical regions of the world. It is a unique species with respect to growth, nature and diversity. It is the most favourite fruit of Indo-Pakistan subcontinent and is called as the king of fruits. Mango is attacked by several animate and inanimate diseases. Out of these problems, mango decline is gaining significant proportion by which mango plants may collapse gradually or suddenly (Sial, 2002). Mango decline is a general term which is used for several disease symptoms and these are generally referred as decline disorders. Decline complex is manifested in the form of twig blight, tip die back, gummosis and bark splitting. As a preliminary symptom, drying of the tip, discoloration and darkening of the bark some distance from the tip becomes visible. It progresses downward involving bigger branches. As a result the leaves are shed. Sometimes gum exudates from the diseased portions. Bark splitting or cracking may also be noticed in severe cases. These symptoms are found alone or in combination with each other in different mango orchards. In addition to decline complex, a new disease named as quick decline or collar rot has become the most destructive hazard in mango orchards of Pakistan (Mahmood *et al*., 2002). It has emerged as a new threat of extinction as mango trees are becoming victim at an alarming ratio. This is a serious situation as the menace is increasing day by day.

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Almost all the commercial mango varieties are susceptible to this disease (Mahmood & Gill, 2002). Al-Adawi *et al.*, (2003) reported quick decline as a new disease of mango affecting 60 % of the trees in Al Batinah region in Oman. Trees were characterized by gummosis from the trunk, wilting and eventual browning of leaves on a single branch. Tree death occurred approximately 6 months after the first appearance of the symptoms. The estimation of this disease has yet not been conducted seriously. The present assessment was imperative to determine different decline disorders in the orchards of the Punjab and record prevalence, incidence and severity of symptoms diversity. The results of the present work will provide a base to manage the decline complex in future.

Materials and Methods

Disorder assessment: Mango decline disorders were evaluated in four districts of the Punjab *viz.*, Multan, Sahiwal, Pakpattan and Faisalabad. In every district four orchards were visited. A total of 16 orchards were visited and data on prevalence, incidence and diversity of each disorder were recorded. The basic and relevant information about the visited orchards and trees was recorded on prescribed *proforma*. The plants were noted with keen observation and placed in their respective disorder according to the following characteristic symptoms (Figs. 1 & 2) of each disorder:

Twig blight: Drying of the twigs/ branches with scorch appearance. Attachment of leaves with twigs/ branches (Ragab *et al.*, 1971).

Die back: Drying of the tips/twigs from top to downward (Pathak, 1987).

Gummosis: Profuse oozing of the cell sap of honey color on the surface of the bark of the trunk and also on larger branches. Droplets of cell sap trickle down on the surface (Prakash, 1996).

Bark splitting/ cracking: Visible longitudinal cracks or splits in the barks of main limbs or trunk (Rios-Castano & Reuther, 1967-68).

Quick decline/Collar rot: Rotting of bark at collar portion, attachment of flaccid leaves, partial or complete drying of the tree (Mailk *et al.*, 2005).

The extent of the area under diseased plants and total number of plants of the respective variety in that area were noted to quantify true disease estimation. Disease intensity was calculated as product of incidence and severity as described by Iqbal *et al.*, (2004).

Results and Discussion

Twig blight, tip dieback, gummosis and bark splitting/ cracking were the common decline (other than quick decline/ collar rot) disorders noted in the orchards of the Punjab with prevalence ranging from 25 to 55%. Maximum prevalence of 55% was shown by twig blight while tip die back ranked 2nd with 50% prevalence in 16 surveyed orchards (Table 1). Maximum and least incidence of twig blight was observed in Sahiwal (4.25%) and Faisalabad (2.20), gummosis in Sahiwal (1.0%) and Faisalabad (0.25%), tip die back in Faisalabad (4.5%) and Sahiwal (3.75%) and bark splitting in Multan (3.0%) and Sahiwal (0.5%). Among four disorders, tip die back showed maximum average disease incidence and intensity of 4.43 and 50.0%, respectively.

Table 1. Decline disorders associated with mango in four districts of the Punjab.

Disorder	Incidence (%)				Mean	Prevalence (%)	Intensity (%)
	Multan	**Pakpattan**	**Sahiwal**	**Faisalabad**			
Twig blight	3.25cd	3.0 d	4.25 b	2.20 e	3.17 b	55.0 a	45.0 a
Tip die back	4.0 bc	5.50 a	3.75 bcd	4.5 b	4.43 a	50.0 a	50.0 a
Gummosis	0.5 f	0.75 f	1.0 f	0.25 f	0.62 d	25.0 b	25.0 b
Bark splitting	3.0 cd	0.75 f	0.5 f	0.75 f	1.25 c	25.0 b	16.0 b

Means followed by the same letters are not significantly different at p<0.05 by LSD test.

Table 2. Intensity of quick decline in mango orchards of four districts of the Punjab.

S. No.	District	Incidence (%)	Intensity (%)
1.	Multan	7.16 ab	4.28 b
2.	Pakpatan	7.51 a	4.54 b
3.	Sahiwal	8.22 a	5.17 a
4.	Faisalabad	5.66 b	4.15 b

Means followed by the same letters are not significantly different at p<0.05 by LSD test

Table 3. Susceptibility of different cultivars to quick decline of mango.

S. No.	Cultivar	Incidence (%)	Intensity (%)
1.	Chaunsa	6.95 a	3.14 a
2.	Langra	5.49 ab	2.49 ab
3.	Dusehri	4.34 b	1.36 b
4.	Seedling mango (Desi)	3.88 b	0.95 b

Means followed by the same letters are not significantly different at p<0.05 by LSD test.

Incidence and intensity of quick decline among assessed districts of the Punjab were significant. Sahiwal was the most affected district with 8.22% disease incidence followed by Pakpattan with 7.51% incidence while least affected among four districts was Faisalabad (5.66%) (Table 2). Intensity values among four districts descended in the same order. Sahiwal ranked first with 5.17% intensity while least intensity of 4.15% was observed in the orchards of Faisalabad.

The disease incidence and intensity among cultivars were also significant (Table 3). Maximum incidence of 6.95% was recorded in Chaunsa cultivar followed by 5.49% in Langra. Seedling mango (Desi) showed least incidence of 3.88%. Highest and 2nd highest disease severity of 3.14 and 2.49% were noted on Chaunsa and Langra cultivars while least value of 0.95% was shown by Seedling mango. Chaunsa proved to be the most susceptible among the four tested cultivars.

Decline syndromes are recognized in virtually all mango-production regions. Symptoms are diverse and include all or some of the following: dieback, twig blight, defoliation, gummosis, vascular discoloration, marginal chlorosis, necrosis of leaves, nutritional deficiencies and root degeneration. Although fungi are the implicated incidents at many locations, abiotic stresses, such as host nutritional deficiencies, are thought to play roles in other situations (Ploetz *et al*., 1997). Different decline disorders may be noted individually but in most of the orchards, combined forms of these disorders are manifested. In the present study, tip die back, twig blight and gummosis were evident in two or more combinations. Bark splitting or cracking also shared these symptoms in many orchards. Similarly presence of severe tip die back gradually turned to defoliation and drying of small and large limbs. On combination of these symptoms with root degeneration caused by soil borne pathogens, plants are ultimately destined to complete drying. Plant once predisposed to preliminary decline symptoms due to weak vigour and presence of inoculum becomes prone to even weak or secondary colonizers.
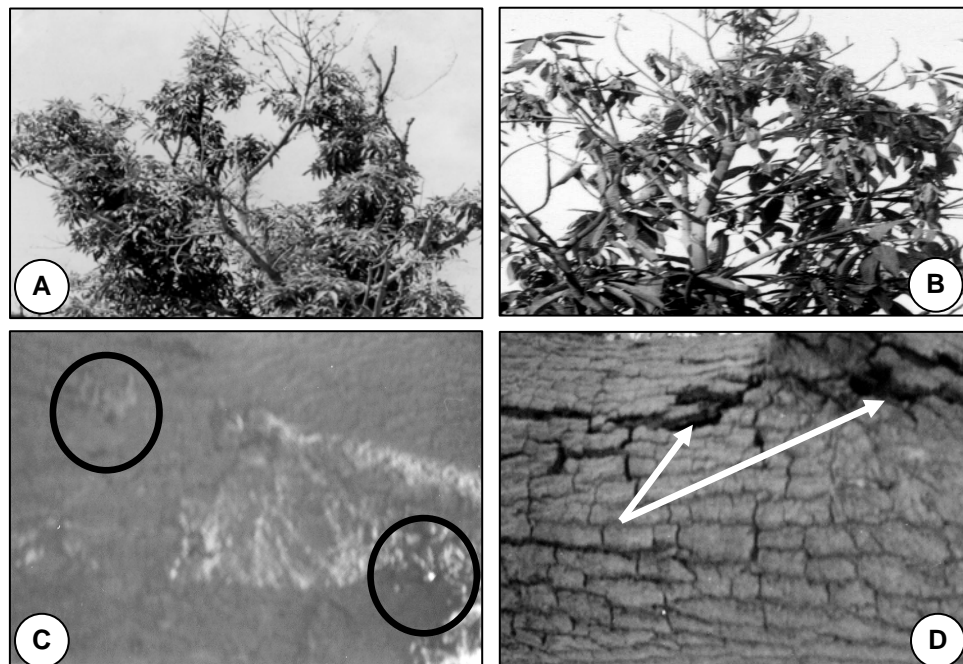
Fig. 1. Symptoms diversity of decline complex: **A.** Tip die back, **B.** Twig blight, **C.** Gummosis (magnified in circles), **D.** Bark splitting (Arrows).
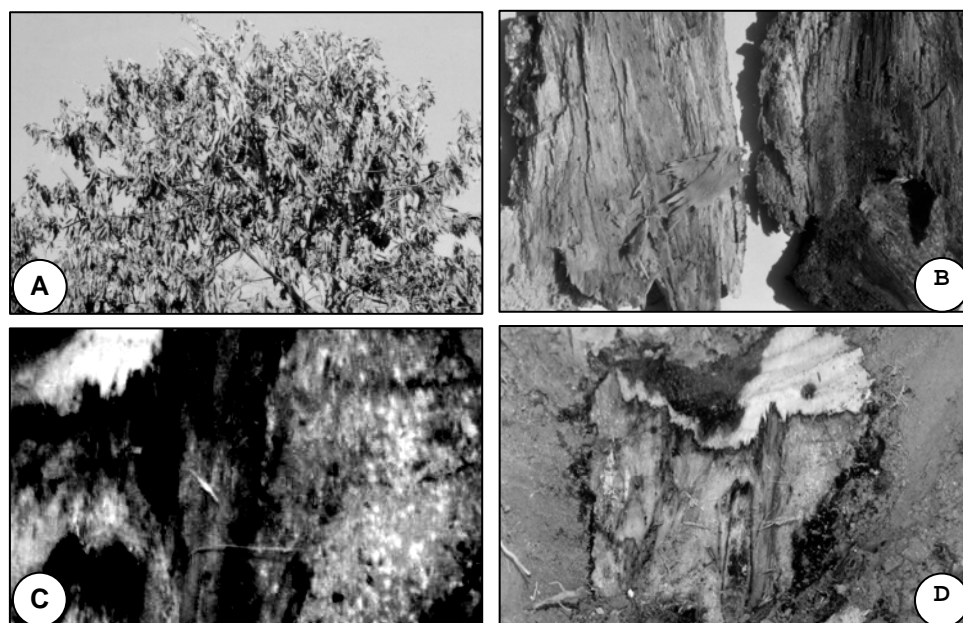

Fig. 2. Field symptoms manifested by quick decline (Collar rot) of mango: **A.** Dried canopy of a mango plant with flaccid leaves. **B.** Inner side of the bark scrapped from the collar rot affected stem of mango. Healthy (left) and rotted bark (right) are quite visible. **C.** Gum grains (arrows) on the collar rot affected stem. **D.** Collar rot affected stem where from rotted bark has been scrapped. Arrow shows cankerous symptoms on stem underneath the affected bark area.

Gummosis is the characteristic symptom of severe dieback, twig blight and bark splitting/cracking as already described by Prakash & Singh (1976). Gummosis may increase as the severity of the disease advances. This observation was also similar to earlier workers (Prakash, 1996). In severe cases of infection, droplets of gum ooze out on stem and bark turns dark brown with longitudinal cracks. Bark rots completely and mango tree dries up quickly because of cracking, rotting and girdling (Parakash & Srivastava, 1987). Maximum combinations of gummosis were noted with diversity of disorders, which indicates that all these disorders might share common inoculum. Rodriguez & Mathos (1988) observed dieback, floral necrosis and gummosis on 10-year-old trees of mango at Huar. A fungus *Lasiodiplodia theobromae* was found associated with all the disorders. Ragab *et al.*, (1971) described the same fungus as an aggressive and vigorous pathogen causing various type of disease symptoms like tip dieback and twig blight. Eventually a complex mango decline form severely damaging the mango plant is produced. Conventional practices of farming, poor orchard and disease management, improper cultural, plant protection measures and non recommended intercropping predispose mango trees to decline complex.

Quick decline of mango has assumed an alarming position due to increasing losses day by day in the orchards of Pakistan. The problem is intensified due to dearth of reliable information and suitable control strategies. In the present study, all the traditional and commercial mango cultivars were found more or less affected with quick decline. Chaunsa proved to be most susceptible to quick decline with 6.95 and 3.14% incidence and intensity, respectively. Least intensity was observed on Seedling mango. Probably seedling mango has naturally some defence mechanism. These findings are in conformity with the findings of Mailk *et al*., (2005).

It is concluded from the present study that different mango decline disorders *viz.*, tip dieback, twig blight, gummosis and bark splitting occur independently or in combination with each other in mango orchards of the Punjab. The frequency of the symptoms is observed in neglected or poorly managed orchards. The plants affected with these problems are not properly managed and resultantly, they become reservoir for inoculum of various fungi disseminating infection to nearby trees or neighbouring orchards. Superimposed on this is the attack of quick decline/ collar rot, which once established, kills the plants within days.

Studies are underway to elucidate the species complex and its population structure associated with quick decline. Epidemiology and different conducive conditions need to be studied in detail, which render the plant susceptible to the decline complex. This will be helpful to devise a model for disease prediction and management. The studies on integrated strategy to combat decline complex are also imperative to save a precious asset like mango and avoid its extinction in future.

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