Characterization of symptoms severity on various mango cultivars to quick decline of mango in district Multan

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Abstract

Quick decline of mango caused by Lasiodiplodia theobromae is among numerous diseases which are responsible for low production of mango crop in Pakistan. Symptoms of mango quick decline can be characterized as drying of twigs, drying of branches, gummosis, bark splitting, and root rotting, which were the most commonly prevailing symptoms of the disease and could be observed alone or in combination with two or more than two symptoms in the orchards. In the present study characterization of the symptoms severity of quick decline of mango in Multan region was addressed to find out the current status of disease symptoms of disease on commonly cultivated varieties in mango grooves at different surveyed locations. Besides the most commonly occurring symptoms, other diseases on leaves and inflorescence were also addressed. Maximum defoliation, drying of twigs, drying of branches and gummosis was observed on east plane with 9.83, 15.75, 9.08 and 13.32 % respectively, while maximum bark splitting 14.08 % was recorded at south plane. Similarly maximum root rotting 12.83 % was observed in north plane and the higher infection 16.66 % on flowers was calculated in east plane. All the varieties showed the infestation of characteristic symptoms of disease whereas, Chaunsa Summer Bahisht was found to be the most susceptible variety to disease and all of the major disease symptoms were widely exposed on this variety. These investigations provide current status about the prevailing symptoms severity of mango quick decline in mango growing zone of Pakistan i.e., Multan.

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Introduction

Mangos (*Mangifera indica* L.) are regarded as the delicious fruits and are one of the important fruit crops in tropical and subtropical regions of the world. India, Pakistan, Brazil, are among the top three major producers of mango crop (Morton, 1987). It is national fruit of Pakistan, India and Philippines, while it is the national tree of Bangladesh (Anonymous, 2011). Pakistan produces 1732 thousands tones of mango fruit per year having the second superior fruit crop of country to earn foreign exchange (Anonymous 2013, Tahir et al., 2003). Pakistani mangos are considered to be the greatest due to the excellent taste, luscious flavor and highly nutritive value (Muhammad et al., 1999). They are nutritionally rich in proteins, carbohydrates, vitamins, fatty acids and amino acids (Saleem and Akhtar, 1989). The fruit yield of mango plants can be drastically decreased by the numerous factors and due to the negligence of mango growers. Eighty three diseases of mango fruit crop as well as mango tree have been reported to be present in the world i.e., 52 fungal, 3 bacterial, 3 by parasitic nematodes whereas 25 are considered as miscellaneous diseases and disorders (Pernezny and Simone, 2000). A total of 27 mango diseases of fruit and tree have been reported so far to be occurring in Pakistan (Ghaffor and Khan, 1976).

Out of total 27 diseases prevailing in Pakistan, quick decline of mango caused by *Lasiodiplodia theobromae* (Pat.) formerly known as *Botryodiplodia theobromae* is the most drastic one to cause huge losses in Pakistan (Ahmed et al., 1995). Various researchers have reported *Ceratocystis fimbrirata* Ellis & Halst, as the first plant pathogen associated with quick decline of mango in Oman, Pakistan and Brazil (Ribeiro, 1980; Malik et al., 2005; Al Adawi et al., 2006; Saeed and Moasood, 2008; Masood et al., 2010). The onset of quick decline of mango becomes evident by discoloration and darkening of twigs from tip to downward. The dark area advances and young green twigs wither and leaves started drying along the veins at edges and affected leaves turned brown and its margins rolled upward (Khanzada et al., 2004). The typical symptoms of disease like dying of twigs and branches from the top to downward, blackening and defoliation were reported by Leghari, (2005). Quick decline of mango can be assessed as twig blight, partial or complete tip die back, gummosis, and bark splitting (Malik et al., 2005). Drying of branches, drying of twigs, bark splitting, gummosis and root rotting were the common symptoms of the disease which could be observed alone or in combination (Ploetz, 2003; Iqbal et al., 2007). The apparent symptoms can be observed on both vegetative and reproductive structures (Naqvi et al., 2014).

Previous research workers have established the fact that the pathogen remained in soil due to the die back of shesham which is caused by same species of the fungi (Ploetz, 2003). Masood et al., (2010) observed these characteristic symptoms of disease on numerous mango cultivars in Pakistan. Al Adawi et al., (2006) reported the drying of twigs, gummosis bark splitting were the most visible symptoms of disease on various mango cultivars. Keeping in view of above, the present study was carried out to characterize the symptoms severity of quick decline of mango in Multan region and also to determine the current status of symptoms severity of disease on most commonly grown commercial cultivars of mango in the orchards in different surveyed areas of Multan.

Materials and methods

Disease survey for symptoms characterization

A survey was carried out in March-April 2013 in mango orchards of Multan region (30° 11′ 52″ N, 71° 28′ 11″ E, 410 ft elevation above sea level), divided into four separate planes viz. East, West, North and South. In each plane, 4 worst hit locations for disease symptoms were surveyed with heedful eyes irrespective of any stage of pathogenesis, to determine the current status of the symptoms severity. Some plants were found almost near to death due to the severity of disease while some were observed to show the initial symptoms of the disease. A total of forty eight (48) orchards, i.e. 12 orchards in each plane on east, west, north and south localities.
were visited to characterize the symptoms of disease.

**Symptoms severity percentage**

Obvious symptoms of quick decline of mango were drying of twigs, drying of branches, gummosis, bark splitting, root rotting, defoliation, curling or drying of leaves, nutritional deficiency, disease on leaves, salt injury and insect infestation were observed on each plant to calculate the symptoms severity percentage and overall symptoms intensity by the scale for field experiments (Table 1), and disease severity was computed by the formula (Masood *et al*., 2010).

\[
\text{Disease Severity} = \frac{\text{All the score of individual plant} \times 100}{\text{Total No. of Plants Observed}}
\]

**Statistical analysis**

Data regarding symptoms severity percentage of all surveyed areas in four planes were subjected to statistical analysis by using the analysis of variance (ANOVA). Treatments means were compared by the least significant difference test (LSD) at \( P \leq 0.05 \), via., SAS (Statistical Analysis System, version 9.1).

**Results**

**Symptoms severity percentage in all surveyed areas**

The main and visible symptoms of disease were defoliation, drying of twigs, drying of branches, gummosis, bark splitting, root rotting, flowers infection, insect infestation, nutrient deficiency on leaves and salt injury were kept as the potential sources of disease severity in mango orchards. All the plants showed dried and almost wilted canopy in the mango orchards. The leaves were found flaccid and wilted in almost 80% plants at advance stages of disease and remained attached to the plants after dying due to the severity of symptoms. Maximum defoliation, drying of twigs, drying of branches and gummosis was observed on east plane with 9.83, 15.75, 9.08 and 13.32% respectively, while maximum bark splitting 14.08% was noted in south plane. Similarly, maximum root rotting 12.83% was recorded on north plane and the higher infection 16.66% on flowers was calculated in east plane. Insect infestation, nutrient deficiencies on leaves and salt injuries were also examined yet they were not considered directly as the main characteristic symptom of the disease (Table 2).

**Table 1.** Scale for quick decline of Mango for field experiments.

<table>
<thead>
<tr>
<th>Score</th>
<th>Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No Infecion Observed</td>
</tr>
<tr>
<td>1</td>
<td>1–10 %</td>
</tr>
<tr>
<td>2</td>
<td>11–20 %</td>
</tr>
<tr>
<td>3</td>
<td>21–30 %</td>
</tr>
<tr>
<td>4</td>
<td>31–40 %</td>
</tr>
<tr>
<td>5</td>
<td>41–50 %</td>
</tr>
<tr>
<td>6</td>
<td>51–60 %</td>
</tr>
<tr>
<td>7</td>
<td>More than 60 %</td>
</tr>
</tbody>
</table>

**Symptoms severity percentage on various cultivars of mango**

Disease severity of mango plant could be assessed easily by the occurrence of symptoms severity. The severity of symptoms characterization was observed on different cultivars of mango to assess the maximum defoliation, drying of twigs, drying of branches, gummosis, bark splitting, root rotting, flowers infection, insect infestation, nutrient deficiencies on leaves, disease on leaves and salt injury on all common cultivars of mango, which was observed on cutivar chaunsa summer bahisht with 1.37, 2.56, 1.78, 2.14, 1.97, 0.25, 1.87, 3.89, 2.97, 3.01 and 1.58% respectively while some varieties showed response of resistance to the disease (Table 3).

All the means followed by the same letter in each column are not statistically different from one another at \( P = 0.05 \).

**Plane** = Each plane (Area) consisted of four further location showing the average percentage of the symptoms of disease on mango plants in the visited orchards.

**Flowers infestations** = All type of disorders prevailing on mango flowers/inflorescence, i.e., malformation, powdery mildew.

Anthracnose, blossom blight and any other biotic or abiotic factor.
Insect infestation = presence of mango insects like mango midges, thrips, mango leaf hoppers, mango weevils, fruit piercing moths, helopeltis, mango shoot caterpillar, mango stem miner, fruit spotting bug.

Nutrient deficiencies = Deficiencies of nitrogen, phosphorus, potassium, zinc, copper, iron, manganese, molybdenum, boron, Magnesium.

**Table 2.** Symptoms severity percentage of quick decline of mango recorded at different Planes in Multan region.

<table>
<thead>
<tr>
<th><strong>Flowers Infection</strong></th>
<th><strong>Root Rotting</strong></th>
<th><strong>Bark Splitting</strong></th>
<th><strong>Gummosis</strong></th>
<th><strong>Drying of twigs</strong></th>
<th><strong>Drying of branches</strong></th>
<th><strong>Defoliation</strong></th>
<th><strong>Salt Injury</strong></th>
<th><strong>Deficiency of leaves</strong></th>
<th><strong>Disease on leaves</strong></th>
<th><strong>Plane</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>East</td>
<td>9.83 a</td>
<td>12.75 a</td>
<td>4.74 a</td>
<td>12.27 a</td>
<td>14.08 a</td>
<td>2.00 a</td>
<td>3.00</td>
<td>5.00</td>
<td>0.00</td>
<td>8.33</td>
</tr>
<tr>
<td>West</td>
<td>8.58 a</td>
<td>12.25 a</td>
<td>6.99 a</td>
<td>15.25 a</td>
<td>13.66 a</td>
<td>1.75 a</td>
<td>2.00</td>
<td>3.00</td>
<td>0.00</td>
<td>9.07</td>
</tr>
<tr>
<td>North</td>
<td>7.83 a</td>
<td>11.91 a</td>
<td>6.99 a</td>
<td>12.16 a</td>
<td>12.83 a</td>
<td>1.75 a</td>
<td>2.00</td>
<td>3.00</td>
<td>0.00</td>
<td>8.33</td>
</tr>
<tr>
<td>South</td>
<td>7.07 a</td>
<td>11.58 a</td>
<td>4.74 a</td>
<td>12.27 a</td>
<td>14.08 a</td>
<td>1.66 a</td>
<td>2.00</td>
<td>3.00</td>
<td>0.00</td>
<td>7.33</td>
</tr>
</tbody>
</table>

**Total %** = The average of all the characteristic symptoms of the disease observed in surveyed locations in the different orchards showing the overall picture of the symptom severity in Multan.

**Discussion**

Mango quick decline is among the complex problems of mango crop and inflicting substantial losses to mango plantation throughout Pakistan and especially in Multan (Mahmood et al., 2002). Death of young and adult mango plants showed a serious threat of disease and its results for future would not be good for the mango growers (Mahmood and Gill, 2002). Plant infected with mango quick decline proved the characteristics symptoms of drying of branches, drying of twigs gummosis, bark splitting, and curling.
of leaves (Masood et al., 2010; Al Adawi et al., 2006, Al Subhai et al., 2006). The disease symptoms were observed in all surveyed areas in four planes of Multan region with the varying degrees of symptoms severity. Symptoms severity percentage was found to be maximum in the surveyed areas of east plane, west plane, north plane and south plane respectively for the characteristic symptoms of disease observed with the naked eye. Maximum defoliation, drying of twigs, drying of branches and gummosis was observed on east plane with 9.83, 15.75, 9.08 and 13.32 % respectively, while maximum bark splitting 14.08 % was noted in south plane.

Similarly, maximum root rotting 12.83 % was recorded on north plane and the higher infection 16.66 % on flowers was calculated in east plane. Bose et al., (1993) observed drying of twigs and branches as the most important symptoms of the disease which started from the top of the plant and gradually progressed to the lower parts. Parkash (1996) observed gummosis from branches and main stem as an apparent symptom at initial and advance stages of the disease. The plants showing the bark splitting on branches either at initial or advance stages of the disease was also noted with the infection on the plant (Parkash and Srivastav, 1987). Severe infection of disease was observed with root rotting which on scraping the rotted portions emitted the foul smell (Lime and Khoo, 1985).

Mango cultivars present in orchards were viz. Chaunsa, Dsehri, Fajri, Sindhri, Malda, Langra, Anwar Ratole, Ratole No. 12, Mahmood Khan, Shan e Ali, Shan e Mustafa, Armughan, Tota Pari, Sensation, Siroli, Ghulab e Khas, Chaunsa white and black, which showed the characteristic symptoms of quick decline of mango. All the cultivars were evaluated at each mango orchard individually on the basis of symptoms severity percentage at the surveyed areas. Maximum defoliation was assessed on cultivar chaunsa with 1.37 symptom severity percentage followed by Anwar ratole. Maximum drying of twigs was also noted on cultivar chaunsa with 2.56 % symptoms severity followed by dushri. Maximum drying of branches was also noted on cultivar chaunsa with 1.78 % followed by dusehri and anwar ratole. Maximum bark splitting, root rotting was also observed on the cultivar chaunsa. During the survey, cultivar chaunsa, the susceptible one to quick decline of mango, was recorded to predominant variety planted in mango orchards and accounting for high disease intensity values. All the varieties showed the characteristic symptoms severity of the disease with the varying degree and no variety was found to be free from the symptom severity of the disease.

**Conclusion**

It is concluded that the main and visible symptoms of quick decline of mango were drying of branches, twigs and leaves which gives an appearance of fire scorch. Chaunsa variety proved to be the most vulnerable to quick decline symptoms severity throughout the covered area. All of the major disease symptoms were widely exposed on this variety.

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