

Chapter 2

Geographical Distribution of Mango Malformation

World Scenario Mango probably originated in the Indo-Burma region (Mukherjee 1953). Similarly, the pathogen of mango malformation, a physiological strain of *Fusarium moniliforme* Sheldon. var. *subglutinans* Wollenewb and Reinking (*F. mangiferae* Britz, Wingfield and Marasas *sp. nov.*) (Britz et al. 2002) has been assumed to have originated in India (Zheng and Ploetz 2002). The disease was first reported from India by Watt (1891). Mango has been under cultivation in the Indian Sub-continent for more than 4,000 years. From here it was taken to other Asian regions, Africa and America. The movement of grafted mangoes apparently started after 1860 (Purseglove 1968) and that must have been how mango malformation started spreading through inadvertent propagation of diseased plants. This is substantiated by the occurrence of the disease on Indian cultivars in Israel (Malo and McMillan 1972). The vegetative compatibility tests and the PCR assay of random amplified polymorphic DNA suggest that the isolates of the *Fusarium* pathogen from Florida, India, Israel and South Africa are closely related (Steenkamp et al. 2000). Britz et al. (2002) observed close uniformity in sequences of Histone *H3* and β -tubulin genes of isolates of *F. mangiferae* from South Africa, USA, Israel, Egypt and Malayasia and grouped these isolates into ‘Asian Clade’. They viewed that *F. mangiferae* of different geographical areas was most probably introduced from India and *F. mangiferae* has introduced into areas such as South Africa and Israel as single genets (Marasas et al. 2006). The disease has already registered its presence in the continents like Asia (India, Pakistan, Bangladesh, Israel, Malaysia, and United Arab Emirates), Africa (South Africa, Egypt, Sudan, Uganda, and Swaziland), America (Brazil, El-Salvador, Mexico, Nicaragua, USA, Venezuela, and Cuba) and Australia (Table 2.1). In Egypt it was first noticed during 1934 and it became severe by 1958. Similarly, in Mexico the disease was first recorded in 1958 in many plantations of the States of Morelos, Guerrero and Veracruz. But by 1999, its occurrence was recorded from most of the states where mangoes are grown (Noriega-Cantu et al. 1999). In America, the disease was first noticed in southern Florida in 1969 from where it was distributed during 1970–1972 throughout Central America with infected planting materials (Malo and McMillan 1972). In Florida, malformation affected

Table 2.1 The countries where mango malformation is prevalent

Year of first report	Country	Authors
1891	India	Watt
1944	Egypt	Hassan
1960	Pakistan	Khan and Khan
1961	Mexico	Morales and Rodriguez
1968	South Africa	Schwartz
1970	Brazil	Flechtmann et al.
1971	Sudan	Minessy et al.
1972	USA	Malo and McMillan
1972	El Salvador	Malo and McMillan
1972	Nicaragua	Malo and McMillan
1972	Venezuela	Malo and McMillan
1983	Cuba	Padron
1985	Malayasia	Lim and Khoo
1985	Swaziland	Crookes and Rijkenberg
1986	Australia	Peterson
1991	United Arab Emirates	Burhan
1992	Bangladesh	Meah and Khan
2008	Sultanate of Oman	Kvas et al.
2008	Spain	Kvas et al.

orchards were widely separated from each other confirming the spread of the disease through planting material. In United Arab Emirates also malformation was noticed for the first time on mango cultivars of Indian origin in 1989 in Dahid and Aweer areas. Schlosser (1971) did not find malformation in Bangladesh although mangoes are grown there extensively. The disease was noticed there in 1992.

Indian Scenario A survey of orchards of 18 districts of Western and eastern Uttar Pradesh (U.P.) was carried out. The survey revealed the disease was present all over U.P. In general the intensity of the disease was higher in western districts than in eastern (Prasad et al. 1965). Varma et al. (1974) found maximum incidence in the north-west region of India where nearly 50% of the plants were affected whereas in the north-east and south the incidence was less than 10%. Singh and Jawanda (1961) observed greater incidence of malformation in sub-mountain districts of the Punjab than in drier areas of the plains. Sharma and Badiyala (1990) surveyed the disease incidence at four different heights (500–850 m) above sea level of Himachal Pradesh in India. The disease incidence gradually decreased with increase in elevation. The disease has also been reported to make an appearance in Madras city, parts of Salem and Coimbatore (Prakash and Srivastava 1987). In Jammu or Himachal Pradesh the malformation was noticed on north Indian varieties like Chausa, Dashehari and Langra. Similarly in Malda mango belt of West Bengal, the outbreak of the disease was observed over the north Indian mango hybrids, Amrapali and Mallika

Table 2.2 The Indian states from where the disease has been reported

Year of first report	State	Author
1891	Bihar (Darbhanga)	Watt
1910	Maharashtra (Bombay)	Burns
1935	Uttar Pradesh (Varanasi)	Singh and Chakravarty
1940	Punjab	Singh et al.
1953	Uttar Pradesh (Saharanpur)	Nirvan
1961	Karnataka (Bangalore)	Puttarudriah and Channa-Basavana
1962	Gujarat	Desai et al.
1962	Delhi	Nariani and Seth
1973	Haryana (Hissar)	Khurana and Gupta
1975	Madhya Pradesh (Jabalpur)	Sharma and Tiwari
1975 (1973)	Jammu	Puttoo et al.
1975 (1972)	West Bengal (Burdwan)	Chattopadhyay and Nandi
1977	Uttarakhand (Pantnagar)	Bhatnagar and Beniwal
1979	Andhra Pradesh (Sangareddy)	Kulkarni
1989 (1985)	Orissa (Bhubanesar)	Das et al.
1990	Himachal Pradesh (Kangra, Solan, Hamirpur, Una, Bilaspur)	Sharma and Badiyala

The data in the parenthesis denote the year for first time of observation

(Chakrabarti and Kumar 1997). Singh and Jawanda (1961) recorded appearance of the disease on varieties (Bombay Green) in States of south India introduced from Bombay. The Indian States where the disease has been located are listed in the Table 2.2.



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