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Physiological Disorder of Fruit Crops

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Fruits have been a part of the human diet since the beginning of humanity and there is strong evidence that our ancestors were primarily frugivorous (fruit-eaters). In fact, they have been in existence since the inception of mankind (even Adam and Eve ate apple - the 'forbidden fruit'!). In many religions, fruits have been given the status of the 'food of Gods'. Fruits, whether fresh or dried, have always formed a part of the staple diet of human beings. The reason for this is that they are rich in nutrients and provide some of the essential minerals, vitamins, and the like, to our body. Apart from that, they also help in curing a number of diseases. The health promoting and disease curing properties of fruits depend on environmental conditions in which the particular fruit is grown and the post-harvest management practices adopted (Arpaia *et al*., 2004). Various pre- and post-harvest disorders and diseases not only reduce the marketable yield and quality of fruits but may also become endangered to human health. Therefore, in order to get the maximum benefit from fruits/vegetables one should produce the healthy fruits and follow appropriate post-harvest practices so that fruits can be available for a longer period of time with optimum quality. Yield reduction and/or quality deterioration of fruits and vegetables occurred primarily because of biotic and abiotic factors. Biotic issues include insects, pests, etc. whereas abiotic aspects of deterioration consist of environment, nutrition and growth regulators. The action of environmental factors that are outside the optimum ranges leads to the deterioration of physiological process during the pre- and post-harvest periods, which, in its turn, leads to the incidence of physiological disorders. Thus, physiological disorder may be defined as the abnormal growth pattern or abnormal external or internal conditions of fruits caused by adverse environmental conditions (such as deviation from normal state of temperature, light, moisture, nutrient, harmful gases and inadequate supply of growth regulators) during growth in fields or orchards or during harvest, storage, and marketing. Whilst the symptoms of physiological disorders may appear disease-like, they can usually be prevented by altering environmental conditions. However, once a plant/plant part shows symptoms of nutrient deficiency it is likely that that season's yields and quality will be affected adversely.

Spongy Tissue of Mango

Cheema and Dani initially observed the occurrence of "spongy tissue" in mangos in 1932 in the cultivar Alphonso. In Maharashtra, the coastal Konkan region is where sponge tissue is more common. The market demand for mangoes has decreased as a result of the development of spongy tissue in these fruits. Mango sales have declined both domestically in India and internationally as a result of it. The following kinds are also impacted by this disorder: Dashehari, Neelum, Pairi, Kesar, Olour, Vellaikolumban, Swarnarekha, Vanraj, Jamadar, and

Fernandin. Development of a non-edible yellow sponge like patch in the mesocarp of the ripening fruit. Higher percentage of damage is found around stone (55-60%) and lower part of fruit. The fruit pulp remains unripe and starchy because of unhydrolyzed starch owing to histological and biochemical disturbance caused by heat in mature fruit at pre-and post harvest stages. Affected fruits are low in pH beta carotene, vitamin C, and sugars but high starch and citric acid.External symptoms of the fruit affected by this disorder are not noticed at the time of picking or at the ripe stage. These can only be detected when the mango is cut open. The affected fruits will produce bad odour, which are unfit for human consumption. Spongy tissue-affected fruits can be detected by the non-destructive X-ray imaging technology.

Black tip of mango

Black tip was reported by Woodhouse in 1908 from Bihar (Zhang *et al*., 1995). It is a serious disorder that occursin orchards located close to brick-kilns and causes considerable set back to the growers. The infection of fruits starts right at marble stage, which is characterized by yellowing of tissues at the distal end. Slowly the color intensifies into brown and finally black. At this stage, further growth and development of the fruit is impeded and the black ring at the tip extends toward the upper part of the fruit.

Alternate bearing in mango

The tendency of mango trees to produce a large harvest in one year (the "on year") and little to no crop in the following year (the "off year") is known as biennial, alternate, or irregular bearing. One of the biggest issues facing mango growers is alternate bearing. A tree that yields a lot of fruit in one season becomes nutritionally depleted and unable to create new growth, which prevents it from producing the following season. Pruning, fertilization, watering, pest management, and bloom induction with paclobutrazol can all help these trees become more regular. Genetic, physiological, environmental, dietary, and hormonal factors have all been implicated in the disease (Bhargava *et al*., 2011).

Chilling injury in Citrus

Chilling Injury (CI) is a common disorder affecting citrus fruits stored at low temperatures. Symptoms include surface pitting, discoloration, water-soaked areas, and internal browning. CI is particularly problematic in cold-sensitive citrus varieties, such as oranges and grapefruits, and can lead to the loss of quality and marketability (Schirra *et al*., 2011). The sensitivity to chilling varies among citrus species and cultivars. CI can lead to off-flavors and texture changes, reducing consumer appeal and market value. The economic impact can be substantial, particularly for exported fruits (Otsuki *et al*., 2001).

Bronzing of Guava

It is caused due to deficiency of Zn, P and K. Purple to red specks on leaves, Leaf turn yellow and Fruit show brown coloured patterns on skin.

Pulp gellification of papaya

In the first reports of the occurrence of this disorder in a plantation in the Brazilian municipality of Linhares. It is due to Ca and Mg deficiency. “Affected tissue by an intense red coloring in the pulp with characteristic translucence. The disorder begins in the endocarp and advances to the epicarp”.

Peel Browning of Banana

Peel browning is a physiological disorder occurring during maturation process when the fruit is handled. Some varieties seem to be more sensitive than others. Peel browning is caused by a stress related at low temperature or relative humidity (Nguyen *et al*., 2003). Peel browning can be assessed by storing ripened bananas in a room at ambient temperature (20 °C) and low relative humidity (50%). Fruit handling will promote browning if the variety is sensitive. Bananas peel browning is reflected in a brown discoloration of the peel triggered by a peel

handling. Browning intensity increases day after day when bananas are stored in dry conditions.

Finger Drop of Banana

Finger drop occurs during banana ripening. Susceptibility varies according to the cultivar and has been reported in the diploid, triploid and tetraploid cultivars. However, it seems that tetraploid cultivars were more sensitive than others. Post-harvest environmental conditions impact this physiological disorder intensity. High relative humidity stimulates finger drop. Bananas are generally marketed by 5 or 6 fingers attached together, called cluster. Finger drop is a process leading, during fruit maturation, to a finger break off from the cluster crown.

Hens and chicks/Millerandage

Due to deficiency of boron. Normal fruit set produces hen berries (larger with seeds), while seedless chicken berries form as smaller and distinct entities. The fruits has sour in taste.

Fruit Necrosis of Aonla

It is caused due to deficiency of Boron. Browning of mesocarpic tissue during endocarp hardening, brownish-black areas on the fruit surface and Corky and gummy pockets on the fruit.

Fruit cracking of pomegranate

It is caused deficiency of Calcium and Boron. It is more likely to occur in desert regions like Rajasthan and Gujarat. Due to increased exposure to the cracked fruit, the fully developed, mature cracked fruits lose their keeping quality and become unsuitable for marketing, albeit still being tasty. It results from an imbalance in calcium (Ca), boron (B), potassium (K), and moisture during the fruit growth stage. Besides, fruit cracking is also relying on varietal character.

Internal breakdown of Pomegranate

Internal breakdown or blackening of arils refers to the disintegration of arils in pomegranate fruit that has reached maturity. The arils are soft, light creamy brown to dark blackish brown, and inappropriate for human eating due to this intrinsic abnormality. This condition began to manifest 90 days after anthesis, and its severity grew 140 days after the tree's fruit set.

Conclusion

Physiological and nutritional diseases have a higher impact on the yield and quality of horticultural crops. Worldwide, horticulture crops' quality, productivity, and marketability are significantly impacted by physiological problems. Normal plant growth and development are disrupted by these disorders, which are caused by complex interactions between genetic predisposition, cultural traditions, and environmental factors. Many problems that arise before and after harvesting can reduce the quality and market output of horticulture products, which may be harmful to human health. Physiological disorders encompass a range of abnormalities, including fruit cracking, blossom-end rot, tip burn and physiological fruit drop. These disorders often arise due to imbalances in essential nutrients, moisture stress, temperature fluctuations, and hormonal irregularities. Genetic factors can also contribute to the susceptibility of certain crops to specific disorders.

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Spongy Tissue	**Black Tip**	**Bronzing of Guava**	**Papaya Gellification**
			
Brown Peeling	**Fruit Cracking**	**Hen & Chiken of grape**	**Fruit Necrosis**