

Editorial

Priority and complex diseases of mango and guava

In India fruits are very important for food and nutritional security. The most common and important nutritive fruits are mango and guava, which are available throughout India with great genetic diversity. In recent years the production of these fruits have increased and moreover, with growing awareness, people have now understood the importance of fruit in their normal diet for nutritional security and now these are in great demand too. But both fruits are affected by several complex and pre and post harvest important diseases which affect the national fruit production.

Mango (*Mangifera indica* L.) is a most liked crop of our country. India's contribution to the world's mango production is highest i.e., 21,822,320 MT from 2,258,130 ha with the average productivity of 9.66 MT/ha. About 49180.46 MT of mango is exported of approximate value of 38234.02 lacs Rs (Horticulture Statistics at a glance 2018). It is found that over 140 pathogens are known to cause damage to the mango crop besides disorders and nutritional deficiency and toxicity etc. These diseases affect all parts of the plant right from seedling stage to full grown up stage.

Out of these diseases, mango malformation is considered as the disease of national importance and loss due to this disease is estimated from 10-90 per cent depending on the variety and area. Disease was first reported from Darbhanga, Bihar during 1891. Though, the disease is known for more than 130 years and *Fusarium moniliforme* var. *subglutinans* is considered to be the cause of the disease, still tons of literature are available for several other reasons of the disease. Prof. Anupam Varma and Dr. A.S. Summanwar worked extensively on this problem and proposed the association of *Fusarium moniliformae* var. *sublutinance* for the cause of the disease; however Dr. T.K. Nariani and Dr. M.L. Seth successfully induced the disease on young seedlings by introduction of eriophyid mites, but it was not certain whether these mites were vectors of some pathogen or is a direct cause. Prof. Varma was of the opinion that these mites are carrier of the pathogen. Hormonal imbalances are also considered as the reason for mango malformation but it is always a question, whether these are reasons or consequences and it needs to be understood. Hence, this complex problem of mango still requires to be understood with complete picture, though much advances are made to unlock the complexity of the problem.

Powdery mildew of mango is another very important disease of mango and every year loss due to disease is estimated up to 90 per cent. Though, both foliar and floral infections are important but floral infection some years results in the complete failure of the crop. In recent years forecasting models have been developed and if timely action is taken, the crop can be saved with chemical management, which significantly improves production. Wettable sulphur and Hexaconazole are some of the chemicals presently used for the effective management of the disease.

In recent years wilt of mango has assumed severe proportion and is becoming threatening problem for mango production. Even the fully grown old trees suddenly wilt in a period of few days, resulting in complete loss. This disease is considered to be caused by *Ceratocystis fimbriata*, but it seems that this disease is also of complex nature. There may be role of beetles in the spread of the disease as these are reported in the wilting tree. The disease is difficult to manage, as by the time symptoms are visible, damage already reaches beyond control. It is also not possible to predict the disease in advance that which plant will be affected, so that management can be initiated in time. Sincere efforts are now made to understand the disease fully.

Another big problem in mango is the post harvest diseases, which cause enormous loss during transit and storage. Post harvest diseases alone are considered to cause overall approximately 25.5 per cent

loss in mango crop which is a huge loss. Important post harvest diseases of mango are anthracnose, stem end rot and Aspergillus rot besides several other fruit rots. Latent infection of anthracnose starts right in the field stage and develops during transit and storage. While for anthracnose, management starts in field as pre harvest spray or bagging and followed by post harvest hot water treatment. For stem end rot and Aspergillus rot, bagging, careful harvesting, hot water treatment and clean handling and storage are important.

Spongy tissue is another very important disorder besides other disorders like black tip, clustering (jhumka), internal necrosis etc., which are serious problems of mango production in the country. Spongy tissue is the real threat, especially in Alphonso variety, which is the prime variety for the export of mango from India. Though large number of publications are made on this problem but still needs to be fully understood.

If pre and post harvest management with proper chemicals and cultural practices are done in time, careful harvesting, safe and clean handling, modern clean packaging, efficient and cool chain transportation are implemented, losses can be reduced and can boost the production to feed the growing population. Chemical disease management are comparatively safe in case of mango, as either the chemical are used on foliage, blossom, branches trunk etc. and generally not used on fruits except pre-harvest sprays for the management of anthracnose, which is also about a month earlier to harvest, by the time the residual effect diminishes. Moreover, the peel of mango fruit is removed for consumption and hence generally the fruits are safe to consume. For post harvest treatment hot water treatments are well worked out, which is a very safe practice to manage the post harvest diseases. So, for the post-harvest disease management in mango hot water treatment should essentially be done.

Similarly, guava (*Psidium guajava* Linn.) is an important fruit of our country. It is called poor man's apple, as it is nutritious, rich in vitamin C and cheap and available in all places. In India, it is grown in an area of approximately 264.85 thousand ha with a total production of 4053.51 thousand MT and average productivity of 15.30 MT/ha. From India 1229.75 MT of guava is exported of approximate value of 553.26 lacs Rs (Horticulture Statistics at a glance 2018). Guava though considered hardy crop, but it also suffers with about 177 pathogens on various parts of guava plant or are associated with guava fruits, of which, 167 are fungal, 3 bacterial, 3 algal, 3 nematodes and one epiphyte. About 91 pathogens are reported on fruits, 42 on foliage, 18 on twigs, 18 on roots and 17 fungi are reported with surface wash of fruits. These cause various diseases viz. pre and post harvest rots of fruits, anthracnose, canker, wilt, die back, twig drying, leaf spot, leaf blight, red rust, sooty mould, rust, seedling blight, damping off, etc.

Wilt is one of the most destructive diseases of guava in India and loss due to this disease varies from 5-60 per cent in different guava growing areas. Efforts to manage wilt by chemicals generally fails and the disease poses challenge for its management. The disease is so devastating that it is said that the average productivity can at least be doubled, if wilt disease is managed effectively. The true Allahabad Safeda variety of guava seems to have disappeared from famous Allahabad guava growing area due to high incidence of wilt and only divergent types of Allahabad Safeda are now available.

Wilt of guava was first reported in 1935 from Allahabad. As the disease is soil born in nature, it is challenging to manage. Even after 85 years of it's first report, it is not fully understood. Initial work was done at Allahabad Agricultural Institute, Naini under the leadership of Dr. J.C. Edward and at Bidhan Chandra Krishi Vishwavidyalay, Kalyani under the leadership of Prof. S.B. Chattopadhyay. In recent past efforts were made to understand the disease at institute of ICAR-CISH, Lucknow and ICAR-RCER, Ranchi. Symptoms of wilt in guava are generally complex. Any guava plant dying cannot be termed as wilt. General perception is that any plant dying is a wilt and the word is generally loosely used. It is necessary to discriminate the two i.e. wilt and death of the plant. Death of the plant may be due to several factors, such as heavy infestation of insect-pests like stem borer, bark eating caterpillar, termite or white grubs etc., it can also be due to root rotting fungi like *Pythium*, *Phytophthora*, *Rhizoctonia* or *Macrophomina* etc. or it can be due to cultural reasons/operations/water deficiency etc. or physiological

or soil reasons. It is also to be understood that guava wilt is a disease of grown up plants and not the disease of guava seedlings or young guava plants. In pathological term, true wilt is that, when the xylem vessels are affected and movement of water and nutrition are restricted and finally plant dies. Xylem vessels are blocked with the physical presence of pathogen mycelium/spores, gums or formation of tylose etc. or effect of toxin production by the pathogens. Hence, it is essential to understand the basic concept before understanding the wilt in guava. Various pathogens are reported as causal organism by different workers at different centers but only few may be causal organism, while others are merely associated with the affected plants. It is possible that one or more pathogens may be responsible for the disease. Some may help as cofactor or predisposing factor for the wilt syndrome. It was found in recent studies that *Fusarium oxysporum* f. sp. *psidii* and *F. solani* are the predominant pathogen of guava wilt. These pathogens are highly variable pathogens and has strain variations. Different strains cause wilting at a variable period of time indicating difference in their relative aggressiveness or virulence. The association of nematode *Helicotylenchus dihystera* was also found with wilt. It was interpreted that *Helicotylenchus dihystera* make entry point in guava root and then pathogen enters, develops and cause wilting. Recently, *Meloidogyne mayaguensis* is also found associated with the death of guava plants. Under the heavy pressure of this nematode, slow death of plants takes place. It is a different problem and cannot be called wilt.

Hence, for wilt disease of guava, it can be said that the disease is complex. Several pathogens may be responsible for wilt of guava, however, *Fusarium oxysporum*, *F. solani* play major role. Presence of *Helicotylenchus dihystera* aggravates the disease. Degree of severity depends on the aggressiveness of the strain. Complete IPM need to be adopted for the successful effective management of the disease. Plants need to be prepared on resistant root stock (*Psidium molle* x *P. guajava*), bioagents viz. *Aspergillus niger*, *Trichoderma* spp. or *Penicillium citrinum* etc. (freshly/self prepared) need to be applied every year with FYM. Cultural practices need to be adopted (viz. minimum tillage especially during monsoon/ after rain, avoidance of flood irrigation and adoption of either separate basin irrigation or drip irrigation, soil amendment with neem cake and gypsum, mulching, intercropping with marigold or turmeric and general sanitation). Maintenance of plant population is also a practical solution and the gap made by wilted plants immediately need to be filled. In West Bengal crop rotation has proved effective. As generally chemicals are not very effective, biological management is important, as these bioagents multiply itself in the soil and provide protection from the pathogens. It is essential to adopt IPM in totality to combat the complex problem of guava wilt, which generally is not done by the guava growers.

Due to the perishable nature of the guava fruit and very short shelf life, guava fruits suffer badly from different rot pathogens. Fruit rots in field (pre harvest rots) or during transit and storage (post harvest rots) are the most serious problem of guava, which cause maximum loss in guava production. As the fruits are consumed raw with peel, no chemical treatment can be recommended or very safe chemicals to be used, especially during later part of the fruit maturity. Careful harvesting, safe and clean handling, bagging of fruits are the limited options for the management of fruit diseases of guava.

Hence, if the priority and complex diseases of mango and guava are managed effectively, the production can be increased significantly and nutritional security can be achieved for Indian citizens.

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