STEM-END ROT OF "KARUTHACOLOMBAN" MANGO AND POSSIBLE CONTROL MEASURES

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Stem-end rot is the most serious post harvest disease of 'Karuthacolomban' mango, which cause rapid decay of fruits. Symptoms of this disease initiate as the fruits start to ripe. A dark brown lesion appears first at the stem-end of the fruit and then rapidly spreads over the fruit within 3 to 7 days. The mesocarp of the fruit underneath the affected skin turns brown. Flesh of affected fruit has an unpleasant flavour (Johnson *et al.*, 1989). Therefore, the affected fruits cannot be marketed.

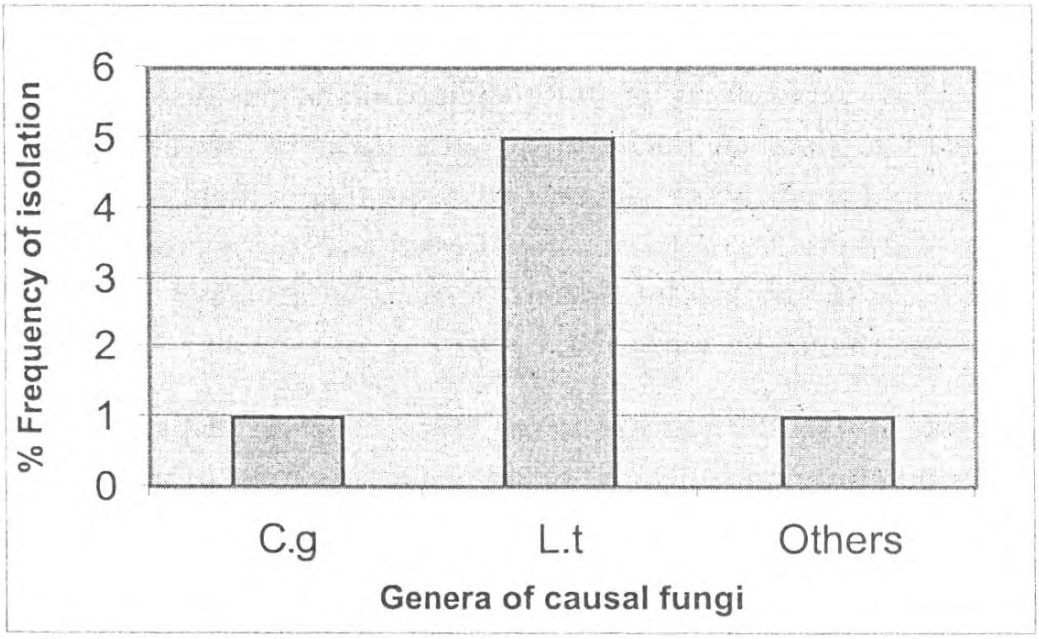
Major problem of this disease is the latent infection of pathogens in the fruits. Very often unripe fruits do not show the symptoms of this disease. Unripe but fully matured fruits are exported and when they reach the destination ripening commences; so does the disease development. Stem-end rot of 'Karuthacolomban' is therefore, a serious problem for its export and for local market.

CAUSAL ORGANISMS

All reported causative organisms of stem-end rot of mango are pathogenic fungi. Among them *Lasiodiplodia theobromae, Dothiorella dominicana* and *Phomopsis mangiferae* cause the disease much more frequently (Johnson *et al.*, 1992). In addition, *Colletotrichum gloeosporioides* (Snowdon, 1990), *Cytosphaera mangiferae, Pestalotia mangiferae, Aspergillus niger* and *Alternaria alternata* also cause stem-end rot in mango fruits (Ploetz *et al.*, 1994).

In order to find out the causal organisms of stem-end rot of 'Karuthacolomban' mango, an experiment was conducted to isolate pathogens responsible for the rot. Infected fruits were collected from the retail outlets

and tissues from disease progressing area were surface sterilized using 2.5% Clorox. Tissue pieces were aseptically transferred to Potato Dextrose Agar (PDA) medium. Isolated pathogens were identified based on morphological features of conidia and colony characters. Results showed that *L. theobromae* was the major causative organism. In addition, *Colletotrichum gloeosporioides* was also formed in very much less frequency (fig. 1)



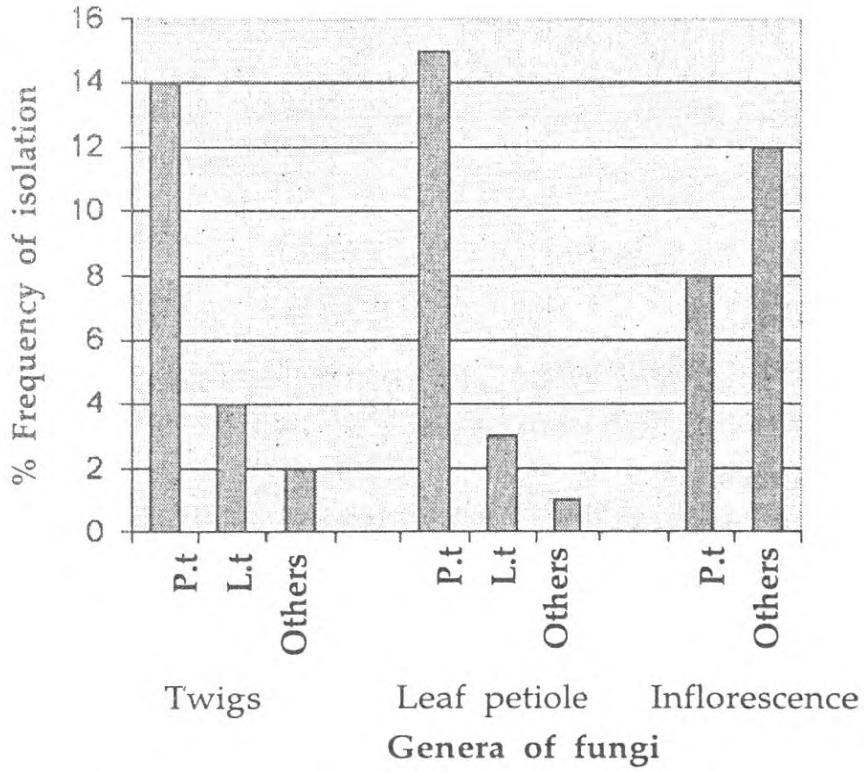
C.g = *Colletotrichum gloeosporioides*
L.t = *Lasiodiplodia theobromae*
Others = Non stem-end rot causing fungi.

Figure: 1. Isolated fungi from stem-end rot affected mango fruits

Stem-end rot causing pathogens can be transmitted through internal plant tissues, which is termed as endophytism (Johnson *et al.*, 1992). Therefore, an experiment was carried out to find the possibilities of having endophytic pathogen in tree twigs, leaf petioles and inflorescence of 'Karuthacolomban' mango.

Tissues were subject to triple sterilization isolation procedure which involves following steps. About 2 cm tissue pieces were dipped in 90% Ethyl Alcohol for 1 minute and transferred aseptically into 2.5% Clorox for 3 minutes. Finally tissues were dipped in 95% ethyl Alcohol for 30 seconds for the complete elimination of superficial flora of the tissue (Johnson *et al.*, 1992). Alcohol on the surface of the tissues were removed by a blotting paper, they were cut into small pieces and transferred to PDA.

The highest frequency of endophytic isolation was observed for *Pestalotia mangiferae* in all three parts used for isolation (fig. 2). Among recorded pathogenic fungi, the frequency of endophytic isolation of *Lasiodiplodia theobromae* was very much lower than that of *Pestalotia mangiferae.*



P.t =*Pestalotia mangiferae*

L.t = *Lasiodiplodia theobromae*

Others = Non stem-end rot causing fungi.

Figure: 2 % Frequency of isolation of endophytic fungi in mango trees

To test the virulency of these two pathogens, stem-end of 'Karuthacolomban' mango fruits were inoculated with *Pestalotia mangiferae* (highest frequency of isolation) and *Lasiodiplodia theobromae* (least frequency of isolation). Of these 02 fungi, *L. theobromae* caused severe fruit rot indicating that this fungus cause the rot under inoculated conditions. Reisolation from rotted fruits revealed that *L. theobromae* was responsible for the rot.

Further studies were done with fully matured 'Karuthacolomban' mango fruits to check the presence of endophytic fungi in the stem-ends of those fruits. Flesh of stem-ends were cultured on PDA to determine the frequency of isolation of endophytic fungi. Results are given in the table 1.

Table 1. Isolation frequency of fungi from matured raw fruit stem-ends of variety Karuthacolomban'.

Causal agent	Percentage frequency
C. gloeosporioides	45.65
Phomopsis mangiferae	17.39
D. mangiferae	15.21
Pestalotia mangiferae	8.69
L. theobromae	6.52
Other species	4.34
Fusarium spp	2.17

Of the fungi reported causing stem-end rot, *C. gloeosporioides* was isolated at very high frequency compared to that of *L. theobromae*. These results also confirmed presence of causative fungi as endophytes in the mango tree. These results show clearly that the major causative organism of stem-end rot is *L. theobromae* and it can be present in the mango tree stem, which is later transmitted to the fruit stem-end endophytically.

SAP INJURY

Sap injury during harvesting causes physical damage to the fruit skin by making it thin (Hare, 1992). The degree of sap injury therefore, can be related to the volume of sap flow of each variety. The largest volume of sap flow was observed in variety 'Karuthacolomban' compared to that in other commercially important varieties (table 2). Oil fraction of the sap causes more damage than the protein polysaccharide fraction (Hare, 1992). Very high oil fraction in the sap of 'Karuthacolomban' compared to other two varieties (table 2) confirms the high latex burn in 'Karuthacolomban' fruits which renders the stem-ends of these fruits more susceptible to rot caused by fungi.

Table 2. Total sap flow of different mango varieties

Variety	Total sap flow (ml) from one fruit	Oil fraction (ml)
Karuthacolomban	16.8	1.8
Vellaicolomban	8.3	0.8
Willard	4.2	0.5

POSSIBLE CONTROL MEASURES OF STEM-END ROT

Based on these results it can be concluded that stem-end rot causing fungi of 'Karuthacolomban' mango colonize endophytically in plant parts and also in stem-ends of green mango fruits. This information is very important for managing the stem-end rot of 'Karuthacolomban' mango fruits. If stem-end rot causing fungi grow endophytically in inflorescence, twigs, leaf petiole etc., there is a very high possibility for these fungi to move into the fruit tissue even at very early stage. Stem-end rot of 'Karuthacolomban' is therefore must be controlled using integrated disease control approach.

The following management practices therefore, will help to reduce the damage caused by stem-end rot disease.

- Regular pruning and training must be carried out to avoid dense foliage growth of 'Karuthacolomban' mango trees. This allows sunlight penetration into tree canopy, which discourages the superficial growth of fungi.

- Spraying of fungicides before flowering and after fruit set may also help to reduce the fungal population of the tree.
- Harvesting fruits at correct stage of maturity minimizes the latex flow.
- Improved picking poles must be used to harvest fruits with stalk and stalk of the fruits must be separated form naturally falling point while holding the fruits stem-end downwards. This method reduces the risk of latex burn in fruits.
- Immerse fruits in hot water (52°C for 3-5 minutes) together with Ethral (1 ml Ethral/ lit. of water) to ripe fruits within 3-5 days, before infected fungi multiply to show symptoms.

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