



CHAPTER – 4

CONCLUSION

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Following are some of the conclusions derived obtained from the present study.

- From the present studies, it was possible to identify the 30 different varieties of *M.indica* on the basis of morphological characters. Not only the fruit morphology but also the vegetative characters and inflorescence characters can be used for identification of varieties. Three different Keys to the identification of the varieties have been prepared on the basis of leaf, inflorescence and fruit morphology.
- In *M.indica*, the flower has a single stamen and 4 staminodes but in the present study, it was found that varieties Desi, Langdo, Aambadi, Neelum and Gajariyo with one longer stamen, one medium sized stamen and 3 staminodes, a condition not reported earlier in the above mentioned varieties.
- Micromorphological studies included stomata, trichome and vein architecture. Other than common stomata like anisocytic, tetracytic, staurocytic, cyclocytic, hemiparacytic and polocytic, unusual stomata were observed. Unusual condition observed was stomata polar contiguity, lateral contiguity, polar subsidiaries, and pole to side contiguity. This was reported in mango for the first time. Vein architecture studies included many parameters on the basis of which, an identification key was prepared to identify the 30 varieties on the basis of characteristic features as described by Hickey. So it can be concluded that not only morphological but also micromorphological studies can be useful for identification of the variety.
- Anatomical studies indicated variation occurring between varieties which could be useful tool in identifying the varieties. Anatomy of petiole in mango leaf has been not studied earlier. An identification key has been prepared solely on the basis of anatomical features of the petiole.

- Leaf anatomy also showed variation in the thirty varieties. It varied mainly in the number and arrangement of palisade layers, location and number of resin ducts in the midrib and location and intensity of inclusion like sphaeraphides and crystals.
- Mangiferin is well known to be present in the different parts of *M.indica*. Its content was determined in the leaves of thirty varieties. The present study demonstrated that the leaves of all the thirty variety are interesting source of the pharmacologically active c-glycosyl xanthone mangiferin. It can be used as a health beverage especially because of its antioxidant properties. Variety Desi Ladvo showed the maximum content of mangiferin. This is a widely grown common variety not of much value for its fruit because it is not very sweet and has less pulp content. The fruits can be used for preparation of other products like pickles but the leaves showing high content of mangiferin can be used as a rich source of obtaining it.
- Macronutrients and micronutrients levels in leaves of *M.indica* at different growing stage were studied. It was found that macro (N, P, K) and micronutrients (Cu, Zn, Mn, Fe) showed decrease in levels from flowering to fruiting stage clearly indicating the nutrients shifts from leaves to fruits during its development.
- The three varieties could be distinctly identified morphologically. The shape and fruit symmetry of Alphonso of both regions was found to be oval and oblique while Kesar and Rajapuri of both regions had ovate shape of the fruit and it was asymmetrical. Flesh of the fruits was similar in both regions (Junagadh and Navsari). Alphonso and Kesar had a soft flesh and delightful flavor but Rajapuri had firm flesh and aromatic flavor. Endocarp/ stone was medium sized, oblong in Alphonso covered with dense, soft fibre located on the ventral edge and short fibre on the rest of the surface in both the regions. Veins on the stone were parallel and slightly depressed in Junagadh Alphonso while the veins were forked and prominently raised in Navsari Alphonso. Stone in Junagadh and Navsari Kesar was medium, oblong covered with dense, short and soft fibre all over with parallel and slightly depressed veins. Stone was large and

oblong oval in Junagadh and Navsari Rajapuri. Fibers were sparse, short, stiff all over but soft dense fibres were found on the ventral edge in Junagadh Rajapuri while in Navsari Rajapuri, stone was covered with sparse, short and soft fibres all over the endocarp surface. Veins on the stone were parallel and prominently raised in Rajapuri of both the regions.

- Total sugars were recorded highest in Navsari Alphonso and Junagadh Kesar at ripe and unripe stages. Reducing ranged from 1 to 2.5%, where Navsari Alphonso had maximum amount (2.47%) and non reducing sugars ranged from 1 to 2.2%, with the maximum found in Junagadh Alphonso. HPTLC analysis of sugars for glucose, sucrose and fructose was done. Glucose was maximum in Navsari Alphonso, sucrose was more in Junagadh Alphonso and fructose was found more in Junagadh Rajapuri.
- Percentage of acidity was found to reduce during the fruit ripening. Sugar acid ratio was found maximum in Navsari Alphonso followed by Junagadh Alphonso. It was minimum in Rajapuri. Acidity of the fruit pulp decreases with maturity due to breakdown of starch into more sugars thereby lowering down the percentage of acidity in fruits.
- Proteins were more in Alphonso and Kesar of both the regions. Sugar acid ratio is responsible for the taste and flavor of the variety. Alphonso and Kesar was having more sugar acid ratio.
- Phenolic acids have antioxidant properties which are important in determining their role as protective agents against free radical mediated disease process (cancer, arteriosclerosis). Total phenols were detected maximum in Navsari Kesar, however other varieties Alphonso and Rajapuri had sufficient amount of phenolic acids. HPTLC studies detected four different phenolic compounds. Comparison with the R_f of standards reveals the possibility of compound I as astragalin, compound II as quercetin, compound III as gallic acid and compound IV to be coumarin.

- Enzymes amylase, catalase, invertase, Peroxidase, cellulase, polygalacturonase and pectinmethylesterase were analyzed. Amylase was found maximum in Junagadh Kesar, catalase was highest in Navsari Kesar, invertase in Navsari Alphonso, Peroxidase in Junagadh Alphonso, cellulase in Junagadh Kesar, polygalacturonase in Navsari Kesar and pectinmethylesterase was found maximum in Junagadh Rajapuri.
- 12 Amino acids (alanine, asparagine, aspartic acid, Glutamic acid, glycine, isoleucine, leucine, phenylalanine, serine, Threonine, tryptophan, tyrosine) were detected in *M.indica*. Aspartic acid was not detected in Junagadh and Navsari Alphonso and Stage IV of Junagadh Rajapuri, phenylalanine was not detected in stage III of Navsari Alphonso, Threonine was not detected in stage IV of Navsari Alphonso and Rajapuri, tryptophan was not detected in stage IV of Navsari Kesar. Other amino acids were found in all the varieties. Amino acids are basis of all life processes as they are absolutely essential for every metabolic process. Alanine was maximum in Navsari Rajapuri, asparagine was more in Junagadh Kesar, aspartic acid in Navsari Kesar, Glutamic acid in Navsari Kesar, glycine in Navsari Rajapuri, isoleucine in Junagadh Kesar, leucine in Junagadh Rajapuri, phenylalanine in Junagadh Rajapuri, serine in Navsari Rajapuri, Threonine was in same amount in all the varieties, tryptophan was maximum in Junagadh Kesar and tyrosine was maximum in Navsari Rajapuri.
- Dietary fiber is medicinally important, it helps in digestion, reduces the rate of obesity, for treatment of bowel problems, regulates blood sugars which may reduce glucose and insulin levels in diabetic patients and may lower risk of diabetes. Dietary fiber increased from unripe to ripe stage of *M.indica*. Dietary fiber was exceptionally high in Junagadh and Navsari Rajapuri compared to the other two varieties collected from the two different regions.
- Developmental anatomy of fruit of *M.indica* was done in detail. The development of exocarp, mesocarp and endocarp along with lenticel and resin duct development has

been given in detail. Exocarp is single layer covered with cuticle and interrupted by lenticels followed by mesocarp which is parenchymatous embedded with many resin ducts. Next layer is endocarp which consists of sclereids, fibres and vascular elements which develops from the periclinal division taking place in sub-epidermal layer. Lenticel development was found to be of two types: one developing below the stomata, found in Navsari Alphonso and the second type is the lenticel developing from the hypodermal cells, found in all other variety. Resin duct developed lysigenously and the surrounding parenchyma cells form epithelial cells.