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Guava: Floral Biology and Hybridization

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Guava (*Psidium guajava* L.) is an important fruit crop of tropical and sub tropical regions of the world. It is also known as "Apple of the tropics" and "Super fruit". It belongs to the order Myrtales and family Myrtaceae. The other important members of this family are allspice (*Pimento dioica* L.), cinnamon (*Cinnamomum aromaticum* Nees), clove (*Syzygium aromaticum* L.), bottle brush (*Callistemon lanceolatus*) and jamun (*Syzygium cumini* Skeels). There are 150 species of small trees and shrubs in this family. About 20 species have edible fruits, of which the most important and commonly cultivated is guava. Guava is indigenous to tropical America, perhaps from Mexico to Peru where it still occurs in both wild status and cultivated form. The plant was reported to be introduced to India by the Portuguese during early 17th century and as it is well acclimatized, it indicates that it might possibly be indigenous to India as well. It is having the typical characteristics of family Myrtaceae like the closed vein pattern of leaves, the leaves having leather like feel, the bark of trunk in mottled, the flowers having lots of anthers and the showiest part of the flower etc.

Floral biology: The flowers of guava are cyme or single. The most common colour of guava is white but pink or mixed coloured flowers are also found in it. The receptacle of guava is hollow and is united to ovary and the flower is epigynous. In epigynous flower, the hypanthium is fused to the gynoecium, and the free parts of the sepals, petals, and stamens appear to be attached to the top of the gynoecium. The buds are green in colour and when the flower starts to open the buds cracked showing the white coloured corolla (petals) slightly. This stage is termed as calyx splitting stage. The stamens are of different sizes and are arranged over the ovary. The gynoecium consists of an inferior ovary and is syncarpous (carpels are fused at the base of the ovary) with axile placentation. The style is longer than the filaments and is bent over the stamens in the bud stage. In rare cases the stigma is bilobed. The androecium consists of 160-400 thin filament having bilobed anthers. The time required to complete development of a bud, duration of flowering, stigma receptivity depends on the flowering season and the weather conditions of locality. In India, guava flowers three times in a year. Firstly, during April-May flowering produces fruits in rainy season (*Ambe bahar*). Secondly, during July-August (*Mrig bahar*) which produce winter season fruits and lastly during the September-October (*Hasth bahar*) which produces fruits during February. The timing of flowering in guava can be slightly variable again subjected to prevailing weather conditions. The most important botanical feature of guava is that it bears on current season shoots.

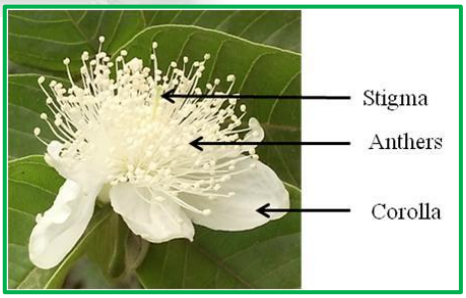


Fig. 1: Flower structure of guava

Hybridization: Hybridization means crossing between desirable male and female parent. It is a very old tool to create variability, combine desirable traits and then make selection for the

most desired one. In fruit crops although the selection is most common due to their heterozygous nature but still hybridization has its own advantages over other methods; not only to develop a superior variety but also for various genetic and molecular studies. The first prerequisite for hybridization is the very clear vision with respect to breeding objective(s). The second prerequisite is the selection of the parents. The third need is to develop a protocol for hybridization and for seed extraction and germination. Proper record keeping is a must thing at every stage.

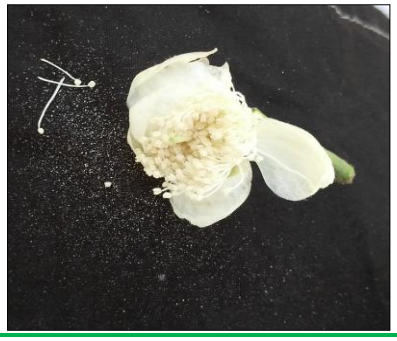
Breeding objectives: Fruit breeding is the matter of decade or more. So, the first important thing one has to keep in mind is that the breeding objective should be very clear and there should not be any deviation from that in between the running of the project. In guava breeding, our objective is to develop pink pulped and soft seeded guava variety. The other steps in future all depends on it.

Selection of the parents: Breeding objectives decides the selection of the parents. The selected parents should already be characterized for their respective traits. In guava breeding program, the pink pulped guava parents were already characterized for lycopene content and the soft seeded genotypes for softness of seeds. The genetics of the characters under the study should be well understood. Self and cross incompatibility is another issue which should be addressed at the beginning.

Protocol for hybridization: The correct timing of hybridization is very important, which is again depends on the prevailing temperature. Early morning hours (7 AM to 9 AM) are good for hybridization during summer (April-May) flowering. However, during September suitable time for hybridization is generally after 8.30 AM (again subjected to prevailing temperature). In guava, the perfect stage for emasculation is the calyx splitting stage. The pollens can be collected from the parents showing white powdery mass of pollens on touching the anthers. Before emasculation select only one healthy bud (at calyx splitting stage) on a single shoot and remove the remaining others. Emasculation performed with the help of a forceps (preferable blunt ended to avoid injury to stigma). Pollination is performed by rubbing the flower of male parent over stigma or a brush can be used for dusting of pollens. So, the pollen can stick on the surface of stigma. Pollination should be done just after emasculation for more success of hybridization. After pollination, the pollinated flower should be covered with a butter paper bag (having some holes for ventilation). Tagging should be done properly providing information like parents (example Punjab Pink x Shweta), date of hybridization. One coloured tag can also be used along with the steel tag. It helps to locate hybrid fruit during their counting and harvesting. The butter paper bag can be removed and replaced with net bag to protect hybrid fruit from insects and birds in the next day of hybridization. It is our observation is that although the number of flowers crossed was more during April-May flowering but the number of hybrid fruits harvested were more in September-October flowering under Delhi condition. Keep proper record of hybridization work. There should not me any moisture stress for plant following hybridization.

a. Calyx splitting stage of guava

b. Emascualtion in guava



c. Flower suitable for pollination

d. Pollination in guava

e. Net bagging of hybrid fruit of guava

Fig. 2: Hybridization in guava

Development of protocol for seed extraction and germination: After harvesting of hybrid fruits remove the seeds immediately. Dry them properly and store them in air tight container with proper labelling. The correct sowing time for guava seed is last fortnight of August to first week of September. They should be sown in pro trays containing media of mixture of soil: cocopeat: vermiculite (2:2:1). Guava seeds should be soaked in distilled water 48 hours prior to sowing. Sowing is done by placing 2-3 seeds per cell of pro tray. They should be irrigate when require. During winter months they need protection from low temperature. Hence, covering during night with polythene is beneficial. Hard water should not be used for irrigation. If termite attack is present at the base of pro trays the ground surface can be flooded with water containing chloropyriphos for termite control. Otherwise, there will be seedling mortality due to termite attack. Drenching of Bavistin (0.1%) is beneficial at monthly interval. When the seedlings are having 4 to 6 leaves they should be transferred to polybags.

Fig. 3: Germinated hybrid seeds of guava in a cell of pro tray

Fig. 4: Low temperature protection structure for hybrid guava seedlings during winter

At any event of harsh weather the care of plants must be taken. During all this phase proper tagging is required. If the transplanting is delaying due to any reason they can be shifted in bigger pots. Care should be taken for control of weeds, pests and diseases.