

Litchi: Floral Biology and Fruit Set

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SUMMARY

Litchi (*Litchi chinensis* Sonn.) is a subtropical fruit crop that belongs to the Sapindaceae family. It is grown extensively in China, India, Israel, Australia, Thailand, Taiwan, Vietnam, and areas of Africa and South America. China is the world's largest producer of litchi. It was introduced to India in the 18th century. The litchi tree is an evergreen tree that can reach heights of more than 20 metres. The litchi fruit is a drupe that is 3–4 cm long and 3 cm in diameter, with a pink/red coarsely textured peel covering an internal layer of sweet and sour, translucent white flesh that surrounds the inner seed.

INTRODUCTION

Litchi's delectable and delicious aril contains various vitamins and minerals that are useful to diabetes patients. Litchi aril includes various vitamins and minerals that are beneficial to diabetes patients. The inflorescence is generated on terminal branches and is composed of many-branched panicles that can range in length from 10 to 40 cm depending on cultivar and growing conditions. Panicles produce hundreds of yellowish white blooms that blossom in alternate male and female cycles. Cultivars with a large number of female flowers have the potential to produce a large amount of fruit.

Flower Types and Anatomy

Litchi flowers are classified into three types:

- Flowers that is male or staminate. The pistil is absent from these blooms.
- Female or a hermaphrodite functioning as female. The flower is functionally female, with an ovary and stigma that have grown fully.
- A hermaphrodite flower that acts as a male.

On most cultivars, all types are on the same panicle and develop at different times throughout a two-to-six-week period. The proportion of different flower types varies between cultivars and can influence the amount of fruit set over the season.

Three Stages of Flower Development in Litchi:

- Male flowers open, releasing viable pollen.
- Female hermaphrodite flowers open, producing fruit if fertilised.
- Male hermaphrodite flowers open to release viable pollen.

A hermaphrodite flower is one that contains both male and female parts. The pollen that fertilises the females is produced by the male and male hermaphrodite flowers, while the male flowers in the third stage are more responsible for fertilisation since their anthers shed the most viable pollen. Abortive seeds may develop from non-viable or damaged pollen. The resulting seed is tiny and shrivelled, and is commonly known as a "chicken tongue seed."

Types of Litchi Flower

Male flowers

Male flowers typically contain 7 - 9 stamen filaments attaching to the base. The pollen-bearing anthers are linked to these long filaments. When the pollen ripe, the anthers turn yellow and break open to release the pollen to fertilize the female flowers. Each anther may produce several thousand grains of pollen. When the pollen comes into contact with the stigmatic surface of the female flower the pollen germinates and forms a tube which penetrates into the stigma and then the ovary. Litchi flowers open primarily during the daytime from 8 am to 4 pm.

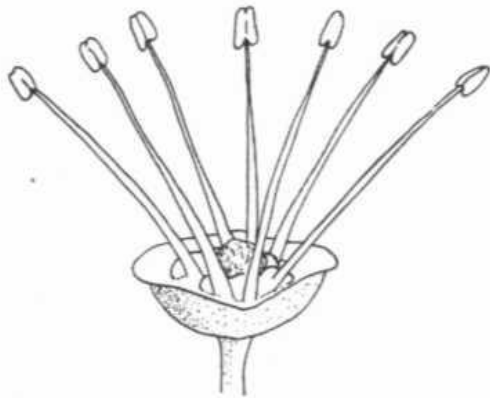


Fig. 1: Male Flower

Hermaphrodite Female Flowers

The female flower also has stamens with pollen sacs that never open and degenerate, release pollen. Female flowers often open in the early morning between 7 and 8 a.m., and again in the afternoon between 2 and 5 p.m. The stigmatic surfaces are sticky and responsive right after they open. Figure 2 shows fully developed hermaphrodite female flowers with three distinctly differentiated well developed female parts: ovary, style and stigma. There are notable two distinct atria on most of the female ovaries.

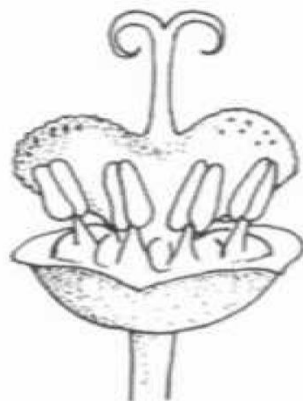


Figure 2: Female Flower Diagram Showing the Distinctive Parts: Stigma, Style, Ovary and Pollen Bearing Anthers

Hermaphrodite Male Flowers

Hermaphrodite male flowers have degenerated pistils (the receptive female component with a stigmatic surface that receives pollen), undeveloped ovaries, and no stigma on their styles. These are unable to produce fruits. Figure 3 shows an example of this sort of male flower. The male flowers to the left and right of the already fertilised female bloom at the top of the photo clearly show degenerated pistils and undeveloped ovaries.

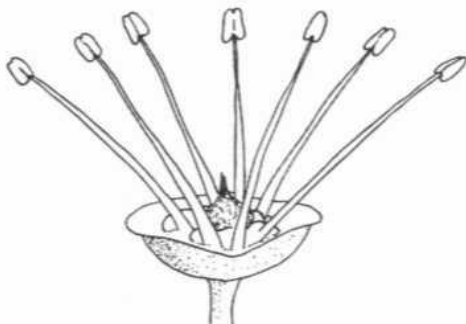


Figure 3: Hermaphrodite Flower Diagram Showing the Distinctive Parts: Stigma, Style, Ovary and Pollen Bearing Anthers

Flower Pollination

Male flower, female hermaphrodite flowers that set fruit, and male hermaphrodite flowers that do not set fruit are the typical flower opening sequence, which happens during a 2-to-6-week period. In the first and third stages, the male flowers discharge pollen, which fertilizes the female flowers. As a result, there must be some overlap between the male and female stages. The third stage male hermaphrodite blooms often supply the majority of the pollen utilized for fertilization. Wind pollination may occur in litchi, however flowers are widely considered as self-sterile, and insects are important because they may transport pollen from anther to stigma, allowing fruit to set. Because only partial overlapping of male and female flowering occurs within a cultivar, at least two different cultivars must be interplanted for adequate fruit set. The honey bee is widely acknowledged as the primary pollinator. Bees are drawn to the nectar secreted in the morning by a gland within the flower's base (calyx), to which the stamen and pistils are attached. Many studies have demonstrated that honey bee pollination enhances litchi crop output significantly, with fruit set being three times greater when inflorescences were open to honey bees when compared to trees that were bagged to exclude them. Litchi yields can be unpredictable, variable, and rarely exceed the tree's capacity. In litchi, yields in rows with two cultivars near to each other have been proven to be 36% greater. Lychee necessitates at least one other cultivar and an abundance of insect pollinators for pollen transfer to aid in wind pollination. Bringing in honey bee colonies may be required to enhance pollinator populations, increase cross-pollination between varieties, and generate a high-quality harvest. As a result, it is advised that 2-3 hives per ha be sufficient for optimal litchi pollination.

Fruit Setting

After the flower has been successfully pollinated, the ovary undergoes a burst of expansion, and the formation of a fruit begins. This is frequently accompanied by wilting and abscission of the petals and, in certain cases, stamens. Not all of the blooms that bloom on the panicles bear fruit. Because the majority of flowers are either male or pseudohermaphrodite, only a small proportion of female flowers are formed, and only a small number of flowers are pollinated and fertilised successfully. Depending on the cultivar, nature of the tree, vigour, and environmental circumstances, fruit set ranges from 1 to 48 percent. In litchi, a higher amount of IAA in the shoot enhances flower bud initiation and fruit set (Liang *et al.* 1987), and a high auxin: gibberellins ratio promotes flower bud differentiation and fruit set (Das *et al.* 2004). Zinc resulted in increased fruit weight, length, diameter, and length/ diameter ratio (100 ppm). Three sprays are administered: during flower opening, 15 days after the first spray, and again 15 days afterwards.

CONCLUSION

Studying flowering and fruit patterns allows us to better understand the plant and expand its production. The area under cultivation has risen dramatically as a result of the increased demand. However, there is a need to increase productivity while simultaneously broadening the genetic base. Various climatic situations necessitate the use of appropriate cultivars. It is also critical to create promising lines/hybrids with greater fruit sizes, small/chicken-tongued seeds, and a range of maturity groupings. In this scenario, information exchange between countries might be advantageous. It is gaining prominence in the international market and is a profitable crop. Litchi also holds a unique position due to its great nutritional value.

REFERENCES

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