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Phenological Stage of Dragon Fruit

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Native to Central American rainforests, dragon fruit (*Hylocereus spp.*) is a hemi-epiphytic climbing cactus that blooms at night and is a member of the Cactaceae family (Britton and Rose, 1963). Because of its scaly peel, which resembles dragon skin, dragon fruit received its name. Additionally, it is referred to as Jesus in the Cradle, Strawberry Pear, Pitaya, Buah Naga, and Cinderella Plant. Because it produces huge, eye-catching, and edible flowers at night, it is utilized as an ornamental plant in night gardens under the names Night Blooming Cereus and Belle of the Night. The three primary varieties of dragon fruit are red skin with white pulp (*Hylocereus undatus*), red skin with red pulp (*Hylocereus monacanthus*, formerly known as *H. polyrhizus*), and both. and white pulp on yellow skin (*Hylocereus megalanthu*s, formerly Selenicereus megalanthus). Antioxidants are comparatively abundant in dragon fruit types with red flesh. In addition to neutralizing harmful chemicals like heavy metals and lowering blood pressure and cholesterol, it is known to prevent diabetes and colon cancer. It is high in calcium, phosphorus, and vitamin C.

Fruits have an ideal Brix value of 15–180Bx and are low in fat and high in minerals. A variety of industrial goods, including juice, jam, syrup, ice cream, yogurt, jelly, preserve, candies, and pastries, can be made from it. It offers several benefits, including as minimal water and nutrient requirements, comparatively cheap resources needed for orchard establishment and upkeep, several fruit harvests annually, the ability to maintain high output for up to 20 years, and a high benefit to cost ratio. These characteristics enable the production of high-quality products to satisfy consumer demand, offer opportunities for international export, and draw growers from all over the world to start and build dragon fruit farms. It may grow in a variety of agroclimatic conditions, including hot and dry locations, because it is a crassulacean acid metabolism (CAM) plant with xerophyte characteristics. There are several obstacles to the commercial production of this crop, despite its potential and opportunities. Being a new introduced crop, it is very crucial to study and understand the crop in terms of its growth, phenology, reproduction, floral biology and pollination requirements etc. to get full potential of the crop.

Longitudinal Section of Floral Bud of Dragon Fruit at the Beginning of Anthesis


Night blooming of Dragon fruit flowers


Bud Initiation Stage


Bud Growth Stage


Flowering Stage


Fruit set stage


Fruit set and development stage


Fruit maturation

Phenology of dragon fruit

Vegetative growth: It is a climber that grows quickly and has triangular or, in rare cases, four or five-sided stems. The thick, vine-like stalks include several branching segments. Three wavy wings or ribs with corneous borders and one to three spines—or perhaps none at all—are present on each segment. These create aerial roots that stick, ascend, and remain upright. Depending on the growth environment, the stems might grow up to 6 meters. The plant generates shoots in different segments, and each segment takes two to three months to fully mature. The maturity period, which lasts for an additional three to four months, comes after the shoot growth. The reproductive phase starts once shoot maturation is complete. Nonetheless, the stages of vegetative development occur concurrently with those of reproduction.

Reproductive growth: Three to five spherical buttons appear from the stem margins at the beginning of blooming, and two to three of these may mature into flower buds in around thirteen days. According to phenological research, Hylocereus species blossom seasonally, with four to seven cycles year, from April to November. It takes around 30 days from the floral bud stage to anthesis. On the same day, bisexual dragon fruit blooms open at 6:30 p.m. and close at 10:00 p.m. However, if they are not pollinated, they stay open until noon on the next day. By daylight, all of the petals had closed (Pushpakumara *et al.*, 2005). Fruit takes 30 to 35 days to mature following anthesis, depending on the variety, pollination method, pollen load, and quality, among other factors.

Floral biology : According to Mizrahi *et al.* (1999), the enormous, actinomorphic, hermaphrodite, nocturnal flowers are part of the long-day plant, which naturally blooms and produces during the warmer months. Cream-colored stamens provide a striking fringe at the thick perianth tube's apex and in the middle. The hollow style is around 26 cm long and has a cream color. Stigma has an average of 15 lobes and is also creamy white in color. The amount of pollen generated by a single dragon fruit bloom with many anthers was enormous.

Fruit development : A non-climacteric fruit is dragon fruit. The fruit is an epigenous berry that is medium to big and oblong in form. The berry is identified by its big, red scales on its skin. Depending on the species or variations, the fruit pulp might be juicy and white, red, or yellow. 30 to 50 days following flower opening (pollination), fruits begin to mature. Both the ovary (pulp) and the container that encloses it (peel) give rise to fruits. While the scales stay green, the green skin becomes red throughout the ripening process. About 26 days after anthesis, the fruit's skin color changed, and 4-5 days after the initial color shift, the skin color completely became red. During this time, fruit firmness also diminished. Forty to fifty days following anthesis (pollination), peak ripening occurred.

Conclusion

Therefore, it takes an average of 46 days from flower opening (pollination) to harvest ripe fruits. (Pushpakumara *et al.*, 2005 and Nerd *et al.*, 1999) The tiny, black seeds are buried in the pulp and measure only 1 mm in length. The fruit pulp can be juicy and either red (*Hylocereus spp*., potentially polyrhizus) or white (H. undatus). Both within and between *Hylocereus species*, seed viability varies. Although it has no effect on pitaya seed germination, the pollination period influences the fruit's physical and chemical properties as well as the kind of manual pollination that is employed (self pollination and cross pollination) (Menezes *et al.*, 2015). Fruit size and seed count are intimately correlated, and effective pollination with an adequate quantity of pollen grains is the primary determinant.

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