Short Communication

Phenology of Dragon Fruit Crop Grown in Kerala

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Abstract

Dragon fruit (*Hylocereus* spp.), also referred to as pitaya or pitahaya in various countries is a perennial climbing vine belonging to the Cactaceae family.The fruit has its origin in the tropical and subtropical regions of Central and South America, but now its cultivation has spread widely in Asian countries. With the increase in health consciousness, the popularity and demand for dragon fruit is showing an increasing trend. Though it is found to be a potential future crop of Kerala, the extent of available information on its cultivation and related aspects in our state is very scarce. Hence, the present work was taken up with the objective of studying the phenology and growth pattern of dragon fruit (*Hylocereus* spp.) genotypes grown under the humid tropical conditions of Kerala. The phenology of dragon fruit grown in ten different locations within four districts (Thiruvananthapuram, Pathanamthitta, Ernakulam, and Thrissur) of Kerala was studied. The commercially grown dragon fruits in Kerala were the dark pink and purple fleshed ones (*Hylocereus costaricensis*). Plants were found to bear within 1.5 to 2 years of planting when stem cuttings were used as the planting material. The duration from flower bud initiation to anthesis was 12-15 days and anthesis took place during the night time after 10 p.m. If the pollination was successful, fruit could be visible after 5 to 7 days of anthesis and the harvest was possible in 23-25 days from fruit set *i.e.,* one month after anthesis. Flowering started in the month of March in two locations (Athikkayam and Vaniyampara) under study, whereas in all the other locations, it started in the month of April. The flowering season was observed to extend till October. The fruiting season started exactly one month after the commencement of flowering and ceased one month after the cessation of flowering *i.e*., April to November.

Key words: Dragon fruit, *Hylocereus*, Kerala, Phenology.

Dragon fruit (*Hylocereus* spp.), also referred to as Pitaya or Pitahaya in various countries is a perennial climbing vine belonging to the Cactaceae family. It is a crop which has received recognition as an ornamental plant initially and later as a fruit crop (Kristanto, 2003). Though dragon fruit originated in the tropical and subtropical regions of Central and South America, it is now under cultivation in Asian countries like Vietnam, China, Malaysia, Indonesia, Philippines, Thailand, India, and Sri Lanka. In India, dragon fruit is mainly grown in Gujarat, Maharashtra, Andhra Pradesh, Telangana, Karnataka, Tamil Nadu, West Bengal, Kerala, and Andaman and Nicobar Islands. Now dragon fruit is in cultivation throughout the Kerala state.

Dragon fruit plants are fast-growing climbers with triangular or rarely four or five-sided stems (Gunasena et al., 2007). Dragon fruit belongs to a group of epiphytic, hemi-epiphytic or climbing cacti (Korotkova et al., 2017). The plant is hermaphrodite in nature, producing large and showy flowers. Bees are the main agents of pollination. Assisted pollination helps in obtaining increased fruitset. The plants can be propagated through seeds and stem segment cuttings. Growth of the seedlings is very slow and starts bearing only after two to three years of planting, whereas the plants from stem cuttings have less juvenile phase and bear fruits within one to two years of planting.

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The crop is well adapted to the tropical climate with well distributed annual rainfall of 100-150 cm and can be grown upto an altitude of 1500m. Dragon fruit is known to grow in any type of soil with good drainage and a pH ranging from 5.5 to 6.5. However, heavy rainfall and extremely low or high temperatures are not suitable for the growth of this fruit crop. The phenological aspects of dragon fruit were found to vary from type to type. The commercially grown dragon fruit in India (purple or white fleshed with pink peel) exhibited a general pattern of ripening where a duration of one month was recorded from flowering to fruit ripening. Fruits have to be harvested within 4 to 5 days, when the first colour change is noticed on the fruit. Presently dragon fruits from the domestic orchards are found to reach the market from May-June and continue till September - October.

With the increase in health consciousness, the popularity and demand for dragon fruit are showing an increasing trend, as the fruit is known to have numerous health promoting properties like anti-cancerous, anti-diabetic, anti-microbial, anti-oxidant and anti-ageing. In urban horticulture, dragon fruit plants are gaining importance due to their large showy nocturnal flowers which can be used in moon gardens. A webinar on "Farmers constraints in dragon fruit cultivation", conducted by the National Institute of Abiotic Stress Management (NIASM), Baramati, Pune on 1st September 2020, revealed that there has been a sudden upsurge in the production of dragon fruit in India which can even lead to a glut in the market. Hence, the need for strong marketing strategies and post-harvest technologies for export is the need of the hour for benefiting the farmers and also for reducing the cost of fruits, so that it will be affordable and easily available to the common man.

The crop is highly remunerative, as the fruits are highly priced and hence the potential for commercialization of this crop is also very high. Though it is found to be a potential future crop of Kerala, the extent of available information on its cultivation and related aspects in our state is very scarce.

A total of ten locations, where dragon fruit was in cultivation, distributed in the four districts of Kerala (Thiruvanathapuram, Pathanamthitta, Ernakulam and Thrissur) were selected. These locations were identified after consultation with the agriculture department, followed by discussions with the concerned farmers. The locations selected were Karette (Thiruvanathapuram), Adoor, Keerukuzhy, Thatta, Aikkad, Kozhenchery and Athikkayam (Pathanamthitta), Muvattupuzha and Perumbavur (Ernakulam) and Vaniyampara (Thrissur). After conducting a preliminary survey, ten plants from each of these ten locations were selected for studying the phenological parameters of dragon fruit plants.

The ten plants selected from each location were numbered as P1-P10 and for easy identification, as a prefix to the plant number, the first two letters of the location (first letter capital and second one small) were added in the following format.

Ka: Karette; Th: Thatta; Ke: Keerukuzhy; Ko: Kozhenchery; Ai: Aikkad; At: Athikkayam; Ad: Adoor; Mu: Muvattupuzha; Pe: Perumbavur; Va: Vaniyampara.

The flowering season was recorded in months from the beginning of development of flower bud to the end. The number of days upto which the flowering continued from bud initiation to anthesis and from flowering to visible fruitset, were recorded. The duration (number of days) from fruitset to harvest was also recorded. The number of days taken from flowering to harvesting of the mature fruits were recorded and the fruiting season was recorded in months from the beginning to the end of fruiting.
The commercially grown dragon fruits in Kerala were the dark pink and purple fleshed ones (*Hylocereus costaricensis*). Plants came into bearing within 1.5 to 2.0 years of planting when stem cuttings were used as the planting material which

was in accordance with the work of Perween et al. (2018) who observed that dragon fruit started yielding within 14-16 months of planting the stem cuttings. The average duration from flower bud initiation to anthesis in different locations was 12 to15 days and anthesis took place during the night time after 10 p.m. If the pollination was found to be successful, fruit could be visible within 5 days of anthesis and the harvest was possible in 25 to 29 days from fruit set *i.e.,* about one month after anthesis. Heavy rain and cloudy weather were found to delay the fruit set. When the phenology of the plants were studied, flowering started in the month of March in two locations (Athikkayam and Vaniyampara) where as in all the other locations, it started in the month of April. The flowering season extended up to September to October. The fruiting season started exactly one month after anthesis and ceased one month after flowering has stopped, *i.e.,* April to November (Table 1). Similar results were reported in Sri Lanka by Gunasena et al., (2007), wherein flowering started in April and extended up

Table 1. Location-wise phenological parameters observed in dark pink/purple fleshed dragon fruit

Location	Flowering season	Average duration of flowering (days)	Average duration from flowering to fruit set (days)	Average duration from fruitset to harvest (days)	Average duration from flowering to harvest (days)	Fruiting season
Athikkayam	March-October	15	5	29	32	April-November
Thatta	April-September	12	5	27	30	May-October
Karette	April-October	15	5	27	30	May-November
Kozhenchery	April-September	12	5	25	28	May-October
Aikkad	April-October	15	5	27	30	May-November
Muvattupuzha	April-September	15	5	25	28	May-October
Vaniyampara	March-October	15	5	29	32	April-November
Keerukuzhy	April-September	12	5	27	30	May-October
Perumbavur	April-September	12	5	27	30	May-October
Adoor	April-October	15	5	27	30	May-November

Table 2. Descriptive statistics of the phenological parameters of dark pink/purple fleshed dragon fruit

Particulars	Duration from flower bud initiation to anthesis (days)	Duration from flowering to fruit set(days)	Duration from fruit set to harvest (days)	Duration from flowering to harvest(days)
Mean	13.80	4.62	26.15	30.77
Median	14.00	5.00	26.00	31.00
Range	4.00	4.00	5.00	7.00
Minimum duration (days)	12.00	3.00	24.00	28.00
Maximum duration (days)	16.00	7.00	29.00	35.00
Standarddeviation	1.50	1.07	1.53	1.72
Coefficientof variation(%)	11.00	23.00	6.00	6.00

Table 3. Frequency distribution of the duration taken for reproductive growth in dark pink/purple fleshed dragon fruit

Duration of flowering (days)	Frequency (%)	Duration from flowering to fruit set (days)	Frequency (%)	Duration from fruit set to harvest (days)	Frequency (%)	Duration from flowering to harvest(days)	Frequency (%)
12	34	3	17	24	16	28	11
13	09	4	27	25	24	29	14
14	12	5	38	26	18	30	19
15	33	6	13	27	21	31	25
16	12	7	05	28	13	32	11
			29	08		33	15
						34	04
						35	01

to November, and also in Taiwan, Tran and Yen, (2014) reported that the fruiting season started in May and extended till first week of September.

The minimum and maximum duration recorded from flower bud initiation to flowering was 12 days and 16 days respectively with a mean value of 13.80 days and coefficient of variation (CV) of 11%. The duration from anthesis to visible fruit set ranged from 3.00 to 7.00 days with an average duration of 4.62 days and CV of 23%. From fruit set to harvestable maturity, it took 24 to 29 days in different locations with an average duration of 26.15 days and CV 6%. It took 28 to 35 days from flowering to harvest of the fruits with a mean value of 30.77 days (one month duration) and CV of 6% (Table 2). The duration taken for different stages of reproductive growth in dark pink/purple fleshed dragon fruits are recorded in Table 3.

Yah et al. (2008) reported that 25-31 days were required for fruit maturation from anthesis in dragon fruit. Tel-zur et al. (2011) stated that *Hylocereus* spp. except *H. megalanthus* took only 28-41 DAA to mature into a fully ripe fruit when the experiment was done in Israel. Jiang et al. (2012) observed the long-day nature of dragon fruit and stated that the flower bud formation depended on the duration of light hours. Kishore (2016) observed that flowering in dragon fruit relied upon the availability of favourable weather conditions like longer days (more than 13 hours), humidity (above 80%), moderate annual rainfall (100-150 cm) and temperature (around 28°C).

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