THE RARE SPECIES OF CACTI AT THE ROYAL BOTANIC GARDENS, KEW: PITAYA

Skorokhod Daryna
Student of Faculty of Science Education and Ecology
Pet'ko Lyudmila
Ph.D., Associate Professor
(Dragomanov National Pedagogical University)

Fig. 1. Pitaya (Yellow Dragon Fruit) ***Hylocereus megalanthus***

Fig. 2. Pitaya (Red Dragon Fruit) ***Hylocereus undatus***

Fig. 3. Costa Rican pitahaya *Hylocereus costaricensis*

Kew botanist Daniela Zappi writes, that Cacti have a wide distribution in the Americas and a single epiphytic species that also reaches Africa and Asia. Apart from two poorly known species have assessed all other 1,478 species recognised in the family in terms of their distribution and threats in a series of workshops focusing on the different centres of endemism and diversity (Mexico and US, Caribbean, Western South America and Brazil) *(https://www.kew.org/read-and-watch/most-threatened-cacti)*.

We study a fruit of cactus species, known around as "dragon fruit", a name used since 1993, apparently resulting from the leather-like skin and prominent scaly spikes on the fruit exterior, native to the Americas. Known also as "moonflower", the flowers exude a sweet, heady floral aroma when in bloom.

A **pitaya** (/pɪˈtaɪ.ə/) or **pitahaya** (/ˌpɪtəˈhaɪ.ə/) is the fruit of several different cactus species indigenous to the Americas. **Pitaya** usually refers to fruit of the genus *Stenocereus* (Fig. 1), while **pitahaya** or **dragon fruit** (Fig. 2) refers to fruit of the genus *Hylocereus*, both in the Cactaceae family. The dragon fruit is cultivated in Southeast Asia, Florida, the Caribbean, Australia, and throughout tropical and subtropical world regions *(https://en.wikipedia.org/wiki/Pitaya)*.

The name "dragon fruit" has its origins in Asia and probably was formed as a way to describe the bright coloured fruit with a chunky scaled skin resembling large dragon scales, and white or red flesh with tiny black

seeds. This plant is pretty well known in Asia and grown extensively throughout the region, dragon fruit actually originated from Mexico and South America [16].

Hylocereus costaricensis, the **Costa Rican pitahaya** or **Costa Rica nightblooming cactus (Fig. 3)**, is a catus species native to Costa Rica and Nicaragua. The species is grown commercially for its pitahaya fruit, but is also an impressive ornamental vine with huge flowers *(https://en.wikipedia.org/wiki/Hylocereus_costaricensis).*

Fig. 4. A Dragon fruit farm.

Fig. 5. Pitahaya buton.

Scientific Names: *Hylocereus undatus* (Red Pitahaya) (Fig. 2), *Stenocereus megalanthus, now Hylocereus megalanthus* (Yellow/Sour Pitahaya) (Fig. 1), *Hylocereus costaricensis* (Fig. 3)

Family – *Cactaceae.*

Preferred Common Name: Dragon fruit. *In English*: Belle of the night, Night-blooming cereus, Pitahaya, Queen of the night, Red pitahaya, Strawberry pear. *In Spanish:* Pitahaya roja, Pitahaya dulce, Pitahaya blanca. In French**:** Fruit du dragon, Pitaya. *In Portugese:* Cardo-ananaz, Cato-barse [9].

Thus, Yellow Dragonfruit (Fig. 1), see video [11], Pitahaya has a thick layer of skin covered in large, fleshy bright yellow hue. Their flesh is spongy and juicy white flesh speckled with petite edible and non-sourish black seeds. Pitahaya offers more juicy texture and tropical flavor much sweeter than any red or white-flesh pitaya (*https://momobud.sg/product/yellow.dragonfruitpitaya/*).

Fig. 6. Pitahaya flowers.

The yellow skinned (with a white flesh) dragon fruit (*see video [15]*) are not as commonly grown as the red variety mainly because of its nasty thorny protection, which needs to be removed before handling (more about that later). Also, the yellow variety is significantly smaller than the red in size. However, out of the two colours the yellow (Fig. 1) has a better taste (sweeter) than the red variety (Fig. 2, 3) [16].

Hylocereus undatus (White-fleshed Pitahaya) is a species of Cactaceae (Fig. 2) and is the most cultivated species in the genus. It is used both as an ornamental vine and as a fruit crop – the Pitahaya or Dragon fruit. *Hylocereus undatus* is a sprawling or vining, terrestrial or epiphytic cactus (Fig. 4). They climb by use of aerial roots and can reach a height 10 meters or more growing on rocks and trees.

Dragonfruit stems are scandent (climbing habit), creeping, sprawling or clambering, and branch profusely (*http://m.extbg.cas.cn/resources/201509/t20150923_152885.html*)

Pitahaya flowers are so stunningly beautiful that they are nicknamed "Nobel Woman" and "Queen of the night" (Fig.1, 2), *see video [17].* The juicy flesh of the fruit has a very delicious flavor.

Dragon fruit bears fruits for five months every year *(see video [12])*, usually from early summer through mid-fall. It begins flowering in early summer, typically in June, with fruit formation occurring shortly afterward. Dragon fruit flowers are open in the evening and last only one evening. The flowers first form as small buttons, or buds [Fig. 5], with two or three buds flowering [Fig. 6] within 13 days of their formation. It takes the fruits about 50 days to reach maturity after flowering and pollination occurs, and the dragon fruit continues to flower and set new fruits throughout its fruit-bearing season (https://homeguides.sfgate.com/long-dragon-fruit-bear-fruit-102059.html).

Fig. 7. Dragonfruit pollination

One spectacular feature of this cactus is its large, beautiful, perfumy flowers, which blossom for only one night (video [20]). We should pay special attention to a flower's pollinatio strategy. A pollinator's view into the flower's throat is shown in the Fig. 7.

The numerous yellow items looking like tiny frankfurters dangling on slender filaments are the flower's male parts, the stamens. Notice how some hang from the corolla's "ceiling," while most mass on the "floor." A couple of tiny native bees gather pollen from the hanging ones. Are these small bees pollinating the flower? We don't believe they are the blossom's main pollination agent because the flower's greenish stigma extends beyond the stamens where probably the small bees seldom would land, and the stigma is the female part where pollinators are supposed to deposit their pollen. In he picture, the many-lobed stigma looks like an upside-down, greenish octopus emerging from beneath the stamen bunch on the floor. A better view of the stigma shown from the side is provided in the Fig. 8. (video [13; 10]).

Fig. 8. **A classic bat-pollinated flower**

This looks like a classic bat-pollinated flower. Evidence supporting that idea include that the blossom opens at night, is the right size for a bat, and one can visualize how a bat might pollinate this flower. The approaching bat first touches the greenish stigma with its chest, which bears pollen from another flower, so from the first the flower gets pollinated. Then the bat scrambles over the bed of stamens and through the diffuse curtain of dangling stamens, getting doused with pollen grains to be carried elsewhere, and finally the bat receives its reward of nectar at the flower's back. If this night-blooming blossom were pollinated by nocturnal

moths, the corolla would narrow to a tube through which the moth's straw-like proboscis can be inserted, but a bat could never squeeze through *(https://www.backyardnature.net/mexnat/cereus1.htm).*

The dragon fruit is a fast-growing, epiphytic or xerophytic, vine-like cactus (videos [7; 8]). The stems are triangular, 3-sided, although sometimes 4- or 5-sided, green, fleshy, jointed and have many branches. Each stem segment has 3 flat wavy ribs; the corneous margins may be spineless or have 1-3 small spines. The stems are scandent, creeping, sprawling or clambering and grow up to 10 metres in height. Aerial roots which are able to absorb water are grow on the underside of the stems and provide anchorage for the stems on vertical surfaces. The flowers are 25-30 cm long, 15-17 cm wide, nocturnal, scented and hermaphroditic; however, some cultivars are self-compatible. The flowers are usually white in color, fragrant and bell-shaped; the stamens and lobed stigmas are cream-colored. The flowers open suddenly, starting between 6:30 to 7:00 pm, and are fully opened by about 10:00 pm. At about 2:00 pm the flowers close after pollination and after that the flowers will begin to wilt. The fruit of the plant is a fleshy berry, oblong to ovoid and up to 6-12 cm long, 4-9 cm thick and red with large bracteoles. The pulp is white, edible and embedded with many small black seeds. The average fruit weighs 350-400 g, although large fruits weigh up to 900 g [9].

At last, Hylocereus megalanthus is a cactus species in the genus Hylocereus that is native to northern South America, where it is known, along with its fruit, by the name of Pitahaya. The species is grown commercially for its yellow fruit, but is also an impressive ornamental climbing vine with perhaps the largest flowers of all cacti. The yellow fruit has thorns, unlike the red dragon fruits (H. undatus, H. polyrhizus, H. costaricensis). Origin and habitat: Venezuela to Peru, including Colombia, Bolivia, Ecuador, in tropical riparian forests [11].

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