

Thaumatococcus daniellii

Thaumatococcus daniellii is a plant species from Africa, known for being the natural source of **thaumatin**, an intensely sweet protein which is of interest in the development of sweeteners. It is a large, **rhizomatous**, flowering herb native to the rainforests of western Africa from Sierra Leone to Zaire.^[1] It is also an introduced species in Australia and Singapore.^[2]

Thaumatococcus daniellii grows three to four meters in height, and has large, papery leaves up to 46 centimeters long. It bears pale purple flowers and a soft fruit containing a few shiny black seeds. The fruit is covered in a fleshy red aril, which is the part that contains **thaumatin**. In its native range, the plant has a number of uses besides flavoring. The sturdy leaf **petioles** are used as tools and building materials, the leaves are used to wrap food, and the leaves and seeds have a number of traditional medicinal uses.^{[3][4]}

Common names for this species include **miracle fruit** (but the unrelated species *Synsepalum dulcificum* is better known by that name) and **miracle berry**;^[5] also **katamfe** or **katempfe**, **Yoruba soft cane**, and **African serendipity berry**.

A gene from *Thaumatococcus daniellii* has been inserted into a cucumber plant to increase its perceived sweetness in human eaters by the Warsaw University of Life Sciences.^[6]

1 Description

Thaumatococcus daniellii is a **rhizomatous**, perennial herb, up to 3-3.5 m high. The ovate-elliptic leaves (up to 60 cm long and 40 cm wide) arise singly from each node of the rhizome. Inflorescences are single or simply branched spikes' and emerge from the lowest node. The fruit is fleshy, trigonal in shape and matures to a dark red/brown colour when fully ripe. At maturity each fruit contains three black, extremely hard seeds. The seeds are enveloped by a sticky thin, pale yellow basal aril, which contains the sweetening protein, **thaumatin**.^{[7][8][9]}

Varieties^[1]

1. *Thaumatococcus daniellii* var. *daniellii* - western + central Africa from Sierra Leone to Zaire
2. *Thaumatococcus daniellii* var. *puberulifolius* Dhetchuvi & Diafouka - central Africa (Zaire, Gabon,

Congo-Brazzaville, Cameroon, Central African Republic)

2 Uses

2.1 Fruit

The most popular use of *T. daniellii* is as sweetener. The aril contains a non-toxic, intensely sweet protein named **thaumatin**, which is at least 3000 times as sweet as sucrose. In West Africa, the aril is traditionally used for sweetening bread, over-fermented palm-wine and sour food. When the seeds are chewed, for up to an hour afterwards they cause sour materials eaten or drunk to taste very sweet. Since the mid-1990s, **thaumatin** is used as sweetener and flavour enhancer by the food and confectionery industry. Substituting synthetic sweeteners, it is used as a non-caloric natural sweetener. **Thaumatin** is not a carbohydrate thus it is an ideal sweetener for diabetics.^{[7][10]}

The seeds of *T. daniellii* also produce a jelly that swells to 10 times its own weight and hence provides a substitute for agar.^[11]

T. daniellii is also used in traditional medicinal uses in the Ivory Coast and Congo. The fruit is used as a laxative and the seed as an emetic and for pulmonary problems.^[7]

2.2 Leaves

In West Africa, *T. daniellii* is mostly cultivated for the leaves. The lamina of the leaves is used for wrapping foods. The petiole is used to weave mats and as tools and building materials. The entire leaf is also used for roofing.^[7]

In traditional medicinal use the leaf sap is used as antidote against venoms, stings and bites. Leaf and root sap are used as sedative and for treating insanity.^[11]

3 Cultivation

There is not a lot known about the physiological and agronomic aspects of this plant.^[8] However, a few studies have been made to examine the factors affecting growth and reproductive development of *T. daniellii*.

3.1 Planting and weed control

It is relatively easy to propagate *T. daniellii* from rhizome fragments bearing one or two stools each. Due to the low percentage of germination and the slow growth of the seedling, for commercial propagation, the plant should be established from rhizomes and not from seeds.^[11]

Within the first few months after planting, the rhizomes from adjacent plants intermingle and soon the space between the plants will be covered with shoots and leaves. Since the foliage covers the ground completely, weeds are suppressed and weeding is no longer necessary. Therefore, weeding is only essential in the first few months after planting. After soil is covered weeding should be abandoned to avoid damage to flower buds. Weeding should be shallow since the rhizomes and roots are close to the soil surface.^{[8][11]}

Spacing of about 1x1m between plants at planting should be sufficient. Planting in rows is not essential. Closer spacing between the plants results in even quicker ground coverage, which reduces the period of weed control. Trials have shown, that plantation with lower inner-plant spacing (28 cm) show higher inflorescence production than wider spacing (72 cm). A compromise between planting density for maximizing flower production, weed control and ease of fruit collection may be essential.^{[8][11]}

The plant should be grown under shade to prevent severe plant losses during the dry season. In addition growing under shade results in higher fruit yield. Prior shade at planting time is essential if planting is done in the dry season. Enhanced fruit yield can as well be achieved by irrigation during the antecedent dry season.^{[8][11]}

3.2 Flowering and fruiting

Vegetative growth of *T. daniellii* is seasonal with flowering and subsequent fruit-set. Main flowering occurs at the beginning of the rainy season, from March to August. Occasional flowers may arise before or after this main season. The duration from flower opening to fruit ripening averages about 13 weeks. Experiments of pollen germination of *T. daniellii* have shown that self-pollination is almost impossible. Each inflorescence only produces between one and three fruits, formed at or below the ground. *T. daniellii* plants must attain a certain minimum age after planting before they set fruits. Flowers set during the first year after planting don't produce any fruits.^{[8][11]}

3.3 Harvesting

Since fruits are formed at or below the ground harvesting involves searching in the substratum. It would therefore be helpful if the leaves could be clipped at or just before harvesting. Moreover, those leaves could also be used for wrapping or for mat making. Experiments have shown

that plants, harvested regularly for leaves and/or petioles, flower less frequently and also set fewer fruits than plants that stay undisturbed. Hence, defoliation of the crop to facilitate fruit collection may have bad consequences for subsequent harvests. Other experiments however showed that in plants where the leaves were clipped in the dry season there was no decline in subsequent fruit yield. Plants trimmed as late as April have been observed to fruit well the same year. In plots, which are not irrigated, most of the leaves actually die during the dry season. Harvesting the leaves for sale just before the dry season should therefore be economical.^{[8][11]}

4 References

- [1] "World Checklist of Selected Plant Families".
- [2] "Csurhes, S./Edwards, R. 1998. Potential environmental weeds in Australia: Candidate species for preventative control. Canberra, Australia. Biodiversity Group, Environment Australia. 208 pp" (PDF). Weeds.gov.au. 2013-06-12. Retrieved 2014-06-04.
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5 External links

- *Thaumatococcus* on www.wikiphyto.org
- *Thaumatococcus* on eol.org/

- Aluka Species Profile
- PIER Species Profile
- GRIN Species Profile
- "*Thaumatococcus daniellii*". Integrated Taxonomic Information System.
- Gateway to African Plants

- *Thaumatococcus daniellii* in West African plants – A Photo Guide.

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