Doum Palm Habit and Leaf Collecting Practices in Niger

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1. Arborescent habit of the Doum palm, *Hyphaene thebaica.*

Intensive harvesting of juvenile leaves strongly affects the development of the Doum palm, *Hyphaene thebaica*. The arborescent habit changes into a subterranean-creeping habit, and palm stands are reduced to dense carpets of leaves emerging from the ground. A description of the growth pattern of this palm species makes it possible to understand better this singular phenomenon.

The importance of Doum palms in the local and regional economy in Africa, as well as the impact of human use on the groves of these palms, or their improvement as agro-forestry and agro-pastoral systems, is emphasized for several species of the genus *Hyphaene*. These include *H. compressa* in Kenya (Amwatta 2004, Barrow 1991, Hoebeke 1989), *H. petersiana* in North-Central Namibia (Konstant et al. 1995, Sullivan et al. 1995), *H. coriacea* in South Africa (McKeana 2003) and *H. thebaica* in Djibouti (Audru et al. 1987). Some data on the nutritional composition of the fruit of *Hyphaene* spp. are also available (Atchley 1984, Bonde et al. 1990).

Hyphaene thebaica is a very common palm species in Niger where its remarkable crown shape marks the landscapes of the Sudan-Sahelian regions between the 400–700 mm isohyets. It can grow to heights of over 15 m and forms a dichotomously branching tree with 2, 3 and even 4 orders of aerial branches (Fig. 1). In the most arid regions of the country, *Hyphaene thebaica* forms dense groves in depressions and in the oases. Most of its parts are used by local people. The leaves are intensively used as detailed below. The trunk makes good construction material, the poles being especially well adapted with their forked branches to support the cross-beams. The ripe fruit with its fleshy mesocarp is appreciated everywhere in Niger. The gelatinous albumen contained in the green fruit is a prized food that is marketed through essentially national circuits. In the region of Agadez, it is dried and the local production is known by the name of "*togodaray*". The dead parts of the palm tree are frequently used for firewood. In addition, the leaves also serve as green fodder for cattle in the dry season.

The economic importance of *Hyphaene thebaica* and the need for sustainable management of its groves are dealt with in several unpublished reports and degree dissertations (Adamou 1993, Anonymous 1989, Brah 1995, Dadé 2000, Ganda 2005, Harouna 2005, Ousmane 2003, Ousseini no date, Saley 1994). During the last few years, the protection of the Doum palm and the development of a commercial network have been the objectives of development projects at Government level.

Leaf harvesting is very intensive throughout the country, but collecting practices differ from one region to another, as shown by comparing those of the Aïr region, north of Agadez, with those of the Dalol Bosso region, south of Birni Ngaoure in the Niger River valley. Through the description of the growth pattern of *Hyphaene thebaica*, we propose here to explain how the intensive collection of the juvenile leaves has a spectacular effect on the palm habit.

Economic importance of the Doum palm

The leaves mainly provide a commercial network on a large scale. First, the segments are separated and detached from their insertion in the short rachis. Then the central veins are taken out; tied in bundles of 400 to 500, they serve as brooms. The parts of the leaf blade without the central vein are then regrouped by bundles of approximately 300 pieces of an average length of 35 to 50 cm according to

2. Doum palm after leaf collection in the Aïr mountains.

3. Field of Doum palms for the production of leaves in the Dalol Bosso region.

whether the material originates from the adult or juvenile leaves. Sold at an average price of 25 francs cfa (4–5 US cents), the bundles are purchased by craftswomen to make mats, commonly used in these semi-arid regions, which serve essentially to sit on and to make the walls and roofs of dwellings. The segments of leaves are used for basketry for different uses, trays, boxes and containers. Ropes of different diameters are woven according to the strength needed – the thickest are used for drawing water from very deep wells (up to 70 meters), the medium for animals and to tie together the different parts of dwellings and granaries or to tie up bundles of millet spikes, while the finest are used for the most common purposes; sewn together they are used as padding for packsaddles.

4 (left). Juvenile palm before branching. 5 (right). Juvenile palm with two axes from dichotomous branching.

6. Juvenile palm with 8 axes from dichotomous branching.

7. Branch developing with greater vigor; it will produce the aerial dichotomous structure of the palm.

The sale of the leaves and derived products, such as mats, basketry and ropes, is highly developed in the regional markets all year long. Networks of producers and dealers in Doum palm leaves and baskets are organized from the Niger River valley towards the semi-arid zones of the North or towards the neighboring countries (Benin, Ivory Coast, Nigeria). In other regions that produce these leaves, similar networks, national and international, have been organized since pre-colonial times, such as, for example, the circuits operating in the Aïr mountains from a very heavy production in the oases towards the regions that have no palm trees, and since the years 1872–73 towards Europe. Nowadays the Handicrafts Service in Agadez markets the craft production of 3 000 women organized into cooperatives for a total revenue of 60 million francs cfa (ca. 115,000 US dollars) per year.

Two ways of harvesting leaves

In the oases of the Aïr region: The palms are most commonly subject to harvesting when they are short-trunked or still stemless with the leaf base entirely emerged from the soil. Just before opening, the new leaf is cut at two-thirds of its height by the harvesters, who collect the free segments. When the leaf amputated in this way opens out, the basal part of the blade forms a fan (Fig. 2). This method of harvesting the leaves does not seem

significantly to affect the growth of the palm tree.

In the Dalol Bosso region: Women harvest especially the juvenile palmate leaves, the bases of which still remain buried in the soil. The shoots have not yet formed a trunk above ground. With a knife, they cut off the stalks of the leaves right at ground level, a few centimeters below the leaf blade. When the women conduct these harvests regularly and intensively, the landscape takes on a very singular appearance. The ground is covered in dense and more or less circular patches of juvenile palmate leaves (Fig. 3). There are no trunked palms, or only some rare tall individuals can be seen far away on the horizon; the field resembles a nursery of Doum palms.

This second way of harvesting Doum palm leaves is much more traumatic for the palm than that described from the Aïr region. However, to understand better the phenomenon, we must first consider the way in which *Hyphaene thebaica* grows.

Morphological features and habit in *Hyphaene thebaica*

Germination, leaves, inflorescence: Only 17 of the 60 seeds put in a plot of sandy soils on 2 April 2004 at the end of the dry season had germinated by 29 July during the rainy season. The eophyll and the first leaves are entire and lanceolate. The juvenile leaves are palmate; the leaf sheath with a part of the petiole is still underground. Costapalmate leaves will be formed when the trunk starts emerging from the soil. The inflorescences are produced from lateral buds and remain in the crown between the leaf bases. Flowering takes place in February–March. The fruits ripen in October–December.

Dichotomous branching: The main stages in the growth of this palm tree are described here from observations *in situ* after excavation of the underground apparatus of individuals at different stages of development. The dichotomous branching expresses early in the soil and in succession forms 2, 4, 8 branches and so on (Figs 4–6). Not all the branches divide at the same time and intermediates are most often observed. Then one or several branches grow more vigorously than the others (Fig. 7). These prominent stems will develop into the aerial dichotomous structure, while the others persist at the base of the cluster.

Basal axillary branching: The basal axillary branching is expressed later among older plants or when the trunks have been cut. Old stocks can regenerate in this way.

Specificity of Hyphaene thebaica *habit*: Hallé and Oldeman (1970) have defined the dichotomous growth mode of trees as Schoute's model. However, they contest the dichotomous nature of branching in *Hyphaene thebaica*, i.e. the fact that the apical meristem divides into two equal parts, each producing a new axis. For these authors, the apical meristem after dying is replaced by two lateral

8. Doum palm habit under regular harvesting of juvenile leaves.

buds, each of them producing a new branch. Uhl and Dransfield (1987, see diagrammatic drawings p. 4) describe four different habits in dichotomously branching palms: (i) dichotomous branching and basal axillary branching in *Hyphaene coriacea*, (ii) upright, dichotomously branching stem in *Hyphaene compressa*, (iii) prostrate, dichotomously branching stem in *Nypa fruticans*, and (iv) erect, dichotomously branching stem – in which one half of the dichotomy ends in a terminal inflorescence and the other half continues as a vegetative axis which may branch again in a similar dichotomous fashion – and basal axillary branching in *Nannorhops ritchiana*.

The habit of *Hyphaene thebaica* differs from the four forms defined above in the following ways: (i) a very precocious underground dichotomous branching; (ii) the differential growth in dichotomy ends leading to the prominence of one or a few axes which then produce the aerial dichotomous structure; and (iii) the late basal axillary branching which may play a role in the regeneration of palm groves.

A dwarfing process as a function of leaf collecting practices

How can we understand the different palm habits observed in the Dalol Bosso region, where women intensively harvest the juvenile palmate leaves? The excavation of the subterranean apparatus clearly shows that all the shoots issued from dichotomous branching develop equally and soon divide into two new short shoots of equal size (Fig. 8). Prominent axes with higher vigor are not observed any more. The aerial structure of the palm cannot be built as a result. The palm pursues its development underground, spreading out in a centrifugal way and forming patches of leaves which emerge from ground at the periphery. This process goes on while women maintain their collecting pressure. The Doum palm is then condemned to creep underground and to produce only juvenile palmate leaves, the most prized for making mats and baskets.

A similar dwarfing process has been noted among *Nannorrhops ritchiana*, the Mazari palm in Pakistan (Gibbons & Spanner 1995).

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