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Turning Over Old Leaves: Palm Leaves Used in South Asian Manuscripts

ABSTRACT

On the Indian subcontinent and throughout Southeast Asia, palm leaves were used as a writing and painting support. This paper focuses on the identification of four types of leaves.

INTRODUCTION

On the Indian subcontinent and in many areas in Southeast Asia, palm leaves are a traditional support for inscribed decoration and script or painted illustration and ink. Much has been written about the preparation of leaves for use in manuscripts; however, very little attention has been focused on methods of leaf identification, except for mention of qualities such as leaf color and flexibility. Since leaf color and degree of flexibility alter radically over time, this project proposed to explore the identification of palm leaves based on knowledge of manuscript origin, leaf thickness, and observation of the leaf surface aided by magnification and contextualized with botanical sources.

Research concentrated on the leaves of four palms often mentioned in conservation literature: *Borassus flabellifer*, *Corypha umbraculifera*, *Corypha taliera*, and *Corypha utan*. As the trees have many common and indigenous names, scientific names are used in this presentation.

METHODOLOGY

In an effort to determine which species of leaves were commonly used, research began with a brief survey of literature from the fields of conservation and ethnobotany, coinciding with an examination of leaves in collections of the San Diego Museum of Art and the Los Angeles County Museum of Art. This assessment revealed that, as recorded in conservation literature, at least four types of leaves appeared to be used, and leaves with thick epidermal surfaces and evenly spaced veins were preferred for inscribed work, while thinner leaves were preferred for paint and ink.

In an effort to further clarify the differences between the leaves, research continued at the Fairchild Tropical Botanic Garden Botanical Research Center in Coral Gables, Florida. Leaves, positively identified because they were harvested from known specimens in the Fairchild's collection of live plants, were examined with both the naked eye and the aid of a stereomicroscope. Leaflet length, width, and thickness were recorded. Three leaves were measured per specimen and sizes given here are average dimensions.

GENERAL NOTES ON PALM LEAVES

The leaves used in manuscript production are from fan palms from the *Arecaeae* family, and only a small portion of each leaf is used. A leaf is composed of leaflets (fig. 1) that are separated from one another by a thick rib. The rib extends from the hastula along the leaflet, creating a corrugated structure, which contributes to overall mechanical strength. On a live tree, reduced wind resistance is advantageous, so the ends of the leaflets separate from the surrounding leaflets at approximately one- to two-thirds of their total length.

Under magnification (120x or greater), key elements of the leaf structure become evident. Stomata, structures that regulate gas exchange between the leaf and surrounding environment, can be seen in the epidermis. If the epidermis is not intact, it is often possible to observe venation, the arrangement of veins (fig. 2). Longitudinal veins and bundle sheaths run the length of the leaflet. Transverse veins connect with the longitudinal veins, providing mechanical support and serving a circulatory function. As the leaves dehydrate, the epidermal tissue shrinks around the veins, making venation easily discernable with raking

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Fig. 1. Fan palm leaf showing leaflets and hastula.

illumination. The significance of venation in leaf identification cannot be overstated.

THE TREES AND THE LEAVES

Borassus flabellifer (Fairchild specimen #87660) has an extensive growth range and is cultivated throughout most of tropical and subtropical Asia. The trunk, fruit, sap, and leaves have over eight hundred recorded uses. Leaves were approximately 41 in. long and as much as 1-1/4 in. to 1-1/2 in. wide. Leaflets were fairly thick, ranging from 0.019 in. to 0.024 in., with an average thickness of 0.021 in. The most identifiable feature of the *Borassus flabellifer* leaf is its veins (fig 3). Longitudinal and transverse veins approach right angles at junction points, forming a pattern similar to the mortaring of a brick wall. The veins of trees from the *Corypha* genus are not as orderly, thus making *Borassus flabellifer* easy to distinguish.

Unfortunately, all leaves of the *Corypha* species have similar venation patterns. The transverse veins branch out from the midrib toward the leaf tip. They tend to wander and cross longitudinal veins at acute angles.

Corypha utan (Fairchild specimen #105695) has a large growth range and may be found from northeastern India to northern Australia. According to Lawson (1987), it is the preferred palm for manuscript production in Southeast Asia. Other recorded uses for this palm include an edible heart and sap for sugar and alcohol production. The leaves of *Corypha utan* were greater than 70 in. in length. The specimen examined at the Fairchild was approximately 2

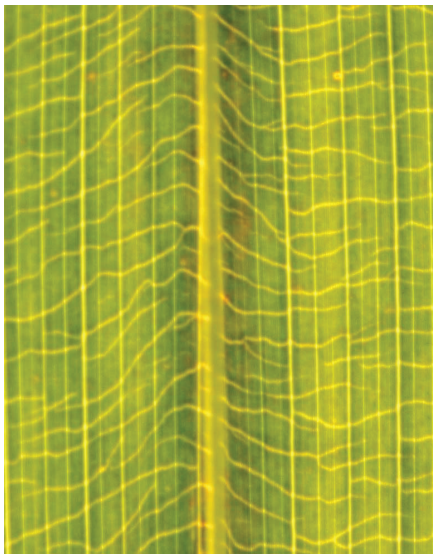

Fig. 2. Palm leaf from a live palm in transmitted light, showing midrib in the center of the image, longitudinal veins, and wandering transverse veins.

Fig. 3. *Borassus flabellifer* leaf epidermis. Note the orderly venation pattern. Microscale is 5 mm, with each division equal to 0.1 mm. Herbarium, Fairchild Tropical Botanic Garden.

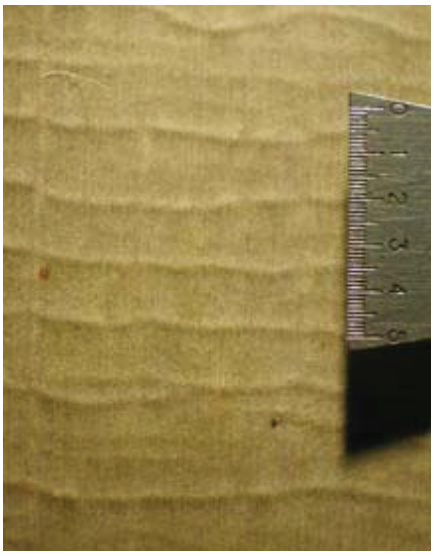

Fig. 4. *Corypha utan* leaf epidermis in raking light. Herbarium, Fairchild Tropical Botanic Garden.

in. wide at the midpoint. Like all *Corypha* palms, the leaves were thin with an average measurement of 0.018 in., ranging from 0.020 in. close to the hastula to 0.013 in. at the tip. Longitudinal fibers are closely spaced with some fiber bundles appearing thicker and lighter than their neighbors (fig. 4). Transverse veins appear in high relief and seem to displace longitudinal structures.

Corypha umbraculifera (Fairchild specimen #117578) is a giant in the world of palms. A mature tree can reach a height of seventy feet. After a growth period of thirty years or more, it produces a massive inflorescence (flower stalk), and quickly blooms, fruits, and dies. Agrawal (1984, 25) has stated that this is one of the most common leaves used in Indian manuscript production, but it is actually a fairly rare tree with a growth range limited to southwest India, Sri Lanka, western Myanmar, and Thailand. The leaves from the specimen examined at the Fairchild Tropical Botanic Garden were greater than 74 in. in length, and up to 2-1/4 in. wide. They ranged in thickness from 0.025 in. close to the hastula and 0.015 in. at the tip, and averaged approximately 0.018 in. in the middle. The venation pattern for *Corypha umbraculifera* (fig. 5) closely resembles that of *Corypha utan*, except that vein structures are more numerous than those of *Corypha utan* and *Corypha taliera*.

Corypha taliera (Fairchild specimen #64420) is also a giant palm, and is currently found only in cultivation; its range is limited to west Bengal, India, Bangladesh, and western Myanmar. The leaves of this palm measure greater than 66 in. in length. Leaflets were up to 2-1/2 in. wide. Leaf thickness varied from 0.013 in. at leaf tip to 0.020 in. close to the hastula. Average leaf thickness was 0.016 in. The morphology of the leaf (fig. 6) is similar to *Corypha umbraculifera*.

PITFALLS IN LEAF IDENTIFICATION

Preparing the leaves for writing, wear associated with use, and traditional preservation techniques can alter the appearance of the leaves—often dramatically. Stomata are often visible on manuscript leaves; however, these structures were not as obvious on leaves in the herbaria collection of the Fairchild Tropical Botanic Garden. This may be due to the fact that the manuscript leaves are often rubbed with oils, which then oxidize, imparting staining properties and making the stomata on manuscript leaves visible. Abrasion from contact with other leaves or manuscript covers often erodes epidermal tissue where longitudinal and transverse veins cross. Often a very small portion of vein is exposed and looks deceptively like a stoma.

Palm leaves do not exhibit fluorescence. Sometimes leaves are lacquered or varnished during manuscript production. These leaves will exhibit fluorescence when exposed to UVA. Occasionally, an unvarnished leaf exhibits fluorescence as well, but this fluorescence may be due to the presence of turmeric powder, which was occasionally rubbed into the leaves during processing (Agrawal 1984, 27).

CONCLUSIONS AND RECOMMENDATIONS FOR FURTHER STUDY

Although it is easy to differentiate between leaves of *Borassus flabellifer* and those from the *Corypha* genus, differences among *Corypha* species are yet to be fully explored. Hopefully, further examination of leaf structures will illuminate these differences and make true identification a possibility. Research may also identify the use of leaves from many other trees. The origin of the manuscript should be considered when trying to identify the palm leaf support, because the distribution of some trees is limited.

Fig. 5. *Corypha umbraculifera* leaf epidermis. Longitudinal bundle fibers are prominent, as are a greater number of transverse veins. Herbarium, Fairchild Tropical Botanic Garden.

Fig. 6. *Corypha taliera* leaf epidermis. Herbarium, Fairchild Tropical Botanic Garden.

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REFERENCES

Agrawal, O. P. 1984. *Conservation of manuscripts and paintings of South-east Asia*. Boston: Butterworths and Co. (Publishers) Ltd.

Lawson, Peter. 1987. Palm leaf books and their conservation. *Library Conservation News* 16: 4-7 and 17:4-5. Reprinted in *Conservation News* 36 (July, 1988): 14-19.

EQUIPMENT

0.0001" standard micrometer, C57650, Precision Graphic Instruments.

Stereoscopic microscope with 10X oculars, Wild Heerbrugg.

Miniscale, 4828M, 5 mm range with divisions of 0.1 mm, Bioquip Products.

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