WOOD AND BARK ANATOMY OF BALANITES AEGYPTIACA IN RELATION TO
ECOLOGY AND TAXONOMY*

by

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Summary
The anatomy of wood and bark of Balanites aegyptiaca (L.) Del. has been studied in detail. In
addition the wood anatomical characteristics of three further species, Balanites dawei, B.
maughanii and B. wilsoniana were examined. The length variation of wood fibres, vessel
members and parenchyma cells was determined with respect to the distance from pith to cambium.
Further an attempt was made to correlate climatic factors and annual rhythm of growth of the tree as well as ecological factors
and anatomical features. The results obtained seem to support the placement of the genus Balanites
in a separate family Balanitaceae, with close affinities to the Zygophyllaceae.

Introduction
Within the framework of an agroforestry programme in the Sahel-zone diverse trees and shrubs were examined by Von Maydell (1981)
with respect to their utilisation. In this connection Balanites aegyptiaca, a major component of the flora in Upper Volta, was also collected and analysed. Since the anatomical properties of the species as well as those of other taxa are only poorly known and since the taxonomic status of the genus is still disputed, it was deemed appropriate to examine in detail the wood and bark of this species with special reference to ecology and taxonomy.

Synopsis of the species
The species Balanites aegyptiaca is one of about 28 species growing especially in the arid zones in Africa and the Near East. The tree has
an economic importance on certain sites like the Sahel-zone, inasmuch as it provides diverse products in the form of edible fruits, twigs and leaves. The wood has been mainly used for tool-handles, fencing, posts, shafts, etc., and most importantly for fuel-wood.

The general distribution of B. aegyptiaca is Omni-Sudanian and includes tropical and subtropical deserts and savannas from Tanzania
and Guinea through the western and central Sahara, Egypt, Yemen and Iran to the dry parts of India and Burma. B. aegyptiaca attains a
height of 6—10 meters (max. 17 m, Adams, 1967) and a diameter of 30—50 cm at breast height. The bole is mostly fluted (Fig. 2); the bark is smooth in young trees and develops fissures in older ones (Fig. 1). Through frequent pruning or nibbling by animals the tree may attain only a height of 1—2 m. The branches are numerous, thin, green and mostly hanging down. Leaves are also numerous, and variable in size on the same tree. On moist sites B. aegyptiaca appears evergreen, though without leaves for at least 4 weeks in the dry period. The root system is strongly developed and is hemispherical. On the whole the species is very slow in growth. It is supposed to be resistant towards fire hazards (Adams, 1967). Reproduction is probably through seeds and budding from stumps and roots (Karschon, 1973). Because of the long roots the plantation of the tree is difficult in the Sahel-zone; it is not suitable for afforestation purposes. The tree, however, coppices prolificously after cutting. Dead trees remain standing for a long time and constitute a favourable nesting place for vultures (Von Maydell, private communication).

Materials and Methods
Wood and bark samples of Balanites aegyptiaca (L.) Del. were collected from 6 different

In addition the following wood samples were also examined: B. aegyptiaca, Sudan, For. Dept.
Kartoum (RBHw 4586), Togo, Kersting A 533 (RBHw 6832), E. Africa, F. von Neumann s.n.
(RBHw 7803); B. dawei Sprague, E. Africa, Schlieben 5364 (Bw 394); B. maughanii Sprague,
Tanzania, Univ. Lourenzo Marco, s.n. (RBHw 16086); B. wilsoniana Dawe & Sprague,
Belg. Congo, INEC 463 (RBHw 9940).

* Dedicated to the memory of B.G.L. Swamy.
Fig. 1. Scaly bark surface of *Balanites aegyptiaca*. — Fig. 2. Fluted stem disc (breast height diameter 25 cm) with distinct ring-like markings.

Fig. 3. Cross-section of secondary xylem showing a broad earlywood zone (Ew) with only few vessels in the latewood (Lw). — Fig. 4. Cross-section of secondary xylem with a broad latewood zone (Lw); all cells highly lignified. — Fig. 5. Tangential section of secondary xylem with broad multiseriate wood rays and storeyed arrangement of vessel elements and axial parenchyma cells. — Fig. 6. Radial section of secondary xylem with a homocellular wood ray (R); crystals both in the ray cells and chambered axial parenchyma cells (arrows).

Fig. 7. Cross-section of secondary phloem with sieve elements arranged in groups near to the cambium (S), tangentially grouped fibres (F) and a broad phloem ray dilating towards the periderm (R); phloem ray projecting into wood as a wedge. — Fig. 8. Tangential section of secondary phloem with broad multiseriate rays undergoing partial cross divisions as well as storeyed sieve elements and axial parenchyma cells. — Fig. 9. Tangential rows of grouped phloem fibres, partly containing gelatinous layers. — Fig. 10. Longisection of sieve elements near the cambium showing scalariform arrangement of lateral sieve areas (double arrows) and simple horizontally placed sieve plate (single arrow). — Fig. 11. Two successive periderms (arrows) with thin-walled phellem cells (Ph) and sclerotic phelloderm cells (P) with crystalliferous inclusions in inflated cells (arrow heads).

Fig. 12. Cross-section of secondary xylem with a tangential row of traumatic resin canals (arrows) in the earlywood zone. — Fig. 13. Typical broadening of the wood rays in the earlywood zone (arrow); note thick-walled vessel elements and distribution of axial parenchyma. — Fig. 14. Radial surface of secondary xylem exhibiting a tangentially displaced vessel with simple perforation and rim provided with vestigial vestures (arrows). SEM. — Fig. 15. Alternate to opposite arrangement of intervacular pits revealing their vestured nature. SEM. — Fig. 16. Vessel wall with a dense warty layer. W-rim of the simple perforation. SEM. — Fig. 17. Radial view of secondary xylem with vessel elements (V) displaced 90° to the vertical axis due to the wood rays (R). SEM.