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Full Length Research Paper

Preliminary studies on the morphology and anatomy of the root of *Daniellia oliveri (*Rolfe*)* Hutch. and Dalz. (Caesalpiniaceae)

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A study was conducted on the morphology and anatomy of the root and powdered root bark of *Daniellia oliveri.* The root of *D. oliveri* is being used for the treatment of many ailment locally in some West African Countries especially Nigeria. Morphologically, the powdered root is brown in colour, astringent taste, short and fibrous fracture. The anatomical studies on the root and powdered root bark are presented. The result indicated the presence of calcium oxalate prisms (23.91 µm) and abundant starch grains (12.53 to 15 µm) found mostly on the cork cells and cortex, phloem fibers, sclereids and numerous groups of secretary cells (5 to 6 cells) and ducts. Vascular bundles with several proto and metaxylem with parenchymatous pith, cells thick walled and polygonal in shape. These features are diagnostic tools for the identification of the root and powdered root bark of *D. oliveri.*

Key words: *Daniellia oliveri,* anatomy, morphology, identification.

INTRODUCTION

Daniellia oliveri (Rolfe) Hutch. and Dalz. *(Caesalpiniaceae)* commonly known as African copaiba' balsam is an indigenous African tree found extensively in Benin republic, Cameroon, Chad, Gambia and Nigeria (Dalziel, 1955). The plant is particularly abundant in the Southern Guinea and derived Savanna Zones of Nigeria. It is known among the Hausa's as 'maje' Yoruba's as 'iya' and the Ibo's as 'ozabwa' (Keay et al., 1964). Traditionally, all parts of this plant are use in treatment of various ailments in Nigeria and some West African Countries. The leaves are used to treat diabetes, gastrointestinal disturbance, yellow fever, as diuretic and aphrodisiac (Ahmadu et al., 2003) and also for dressing wounds especially circumcision (Igoli, 2005). Root bark are used to treat rheumatism, lameness and inflammation (Mac Donald and Olorunfemi, 2000). The dried root and stem bark have been used in Ivory Coast as chewing stick (Bhat et al., 1990; Delaveau et al., 1979). There are many anatomical studies on the family Caesalpiniaceae (Hannah and Peter, 2000). However, these studies are mainly on the wood anatomy, there has been no information on the root anatomy of *D. oliveri.*

The aim of this paper is to present the morphological and anatomical features of the root of *D. oliveri.*

MATERIALS AND METHODS

Collection, identification and preparation of plant materials

The roots and leaves of the plant *D. oliveri* were collected in Zaria in April, 2007 and were authenticated in the Herbarium unit of the Department of Biological Sciences, Ahmadu Bello University, Zaria. This was assigned a voucher specimen number 7021. The roots bark were air dried at room temperature for about 2 weeks and some of the fresh roots of this plant collected were immediately fixed in FAA (formalin acetic acid) for microscopical studies.

Macroscopical examination of the root of *D. oliveri*

This was carried out based on the method described in African Pharmacopoeia (1986) and Brain and Turner (1975).

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Table 1. Macroscopical analysis of the root and powdered root bark of *D oliveri*.

Parameter	Result
Colour	Brown
Odour	Odourless
Taste	Astringent
Texture	Rough
Curvature	Double quill
Fracture	Fibrous
Fracture	Short
Outer surface	Rough
Inner surface	Smooth
Size range	33.7-34.2 mm

Microscopical examination

The anatomical sections of the fixed root were prepared for micromorphological studies as outlined by Donald (1940), the sections were observed under the light microscope and photomicrographs were taken. The method outlined in African Pharmacopoeia (1986) and Evans (2002) were used to view the anatomical features of the powdered root bark under the light microscope.

RESULTS

Macroscopical analysis of the root of *D. oliveri*

The macroscopical analysis of the root of *D. oliveri* are shown in Table 1.

Microscopical examination of the root of *D. oliveri*

The powdered root bark of *D. oliveri* when viewed under the microscope showed the presence of diagnostic features which are common to this plant. There are numerous groups of Phloem fibres, attached to it are some parenchyma cells, individual fibres are narrow with thick lignified walls, some with inconspicuous lumen and the size of the fibre is 220.82 µm. The calcium oxalate prisms have a high frequency of occurrence which are found scattered and also appear in “parenchyma cells”. The size of the calcium oxalate prism is 23.91 µm. The parenchyma is thin-walled, polygonal in surface view, some filled with dense reddish-brown contents while some contain crystals of calcium oxalate prism and starch grains. Numerous groups of secretary cells and ducts are present, the cells densely packed together which are found scattered in different cells and they are reddish brown in colour. Sclerenchyma cells are composed of doubled wall cells and tangentially arranged. Sclereids are few in number, the individual cells are round and the walls are thick. Small spherical starch grains which are numerous in number are also present. They are found in the cortex and cork cells and its size ranges between 12.53 to 15 µm (Figure 1). The transverse section of *D. oliveri* root (Figure 2) shows the arrangement of structures of the fixed root of *D. oliveri* viewed under a light compound microscope with magnification (x100). The “rhytoderm” which is the outer part of the root and outer part of the structures are lighter in colour (light brown) than the phellogen (polygonal cells which are continuous). They are dead and scattered tissues found on the surface. Directly below this is a protective tissue of the phellogen known as the phellem.

The phelloderm is below the phellogen. The cells of the phelloderm are radially flattened and form a continuous tangential layer made up of a single layer. The cortex parenchyma are found next after the cork cells, the sieve tube members and companions cells are also next to this layer and they are made up of three layers. Diffusely arranged axial canals which are as wide as the vessels are found. Separating the xylem vessels and the phloem is the cambium which are formed surrounding the xylem. Some of the xylems are made up of the proto and meta xylem. Secretory ducts are found on all part of the anatomical structures except the pith, they are more concentrated at the cork cells. The pith are mainly of parenchymatous cells, thick walled and polygonal in shape.

DISCUSSION

The odour and taste of the powdered root bark of *D. oliveri* are odourless and astringent respectively (Table 1). They provide the simplest and quickest indication for the identity, purity and quality of the root of *D. oliveri* Ali (2002) and Evans (2002) reported that tannins has astringent taste, therefore, the astringent taste of the powdered root bark of *D. oliveri* is as a result of the presence of tannins. Microscopically, the important diagnostic features of the root bark of *D. oliveri* include

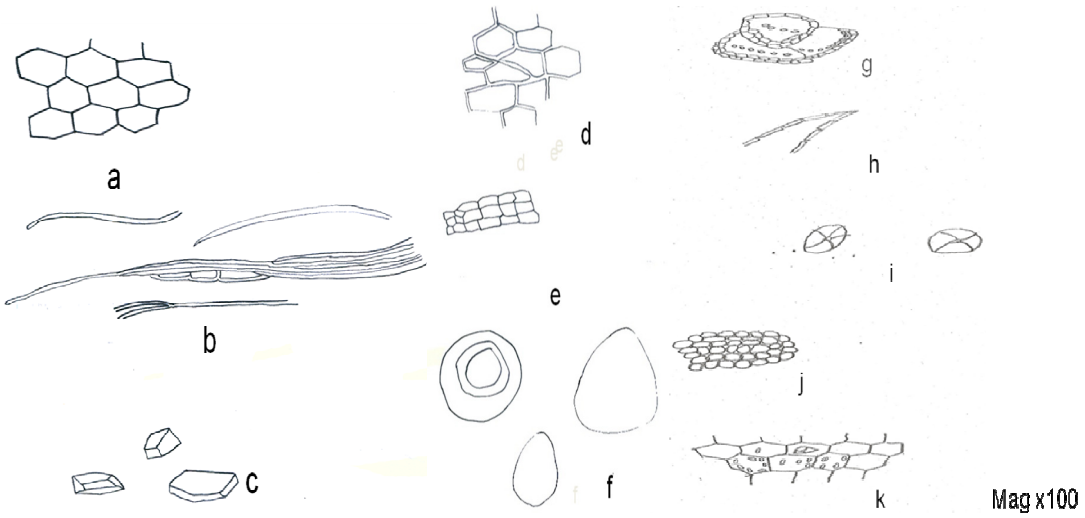

Figure 1. Micromorphological investigation of the powered root bark of D. oliveri (a) Parenchymal cells, (b) phloem fibres, (c) prisms of calcium oxalate, (d) sclerenchyma cells, (e) corck cells, (f) starch grains, (g) Secretary cells, (h) phloem fibers, (i) sclereids, (j) parenchyma cells of cortex and (k) parenchyma cells.

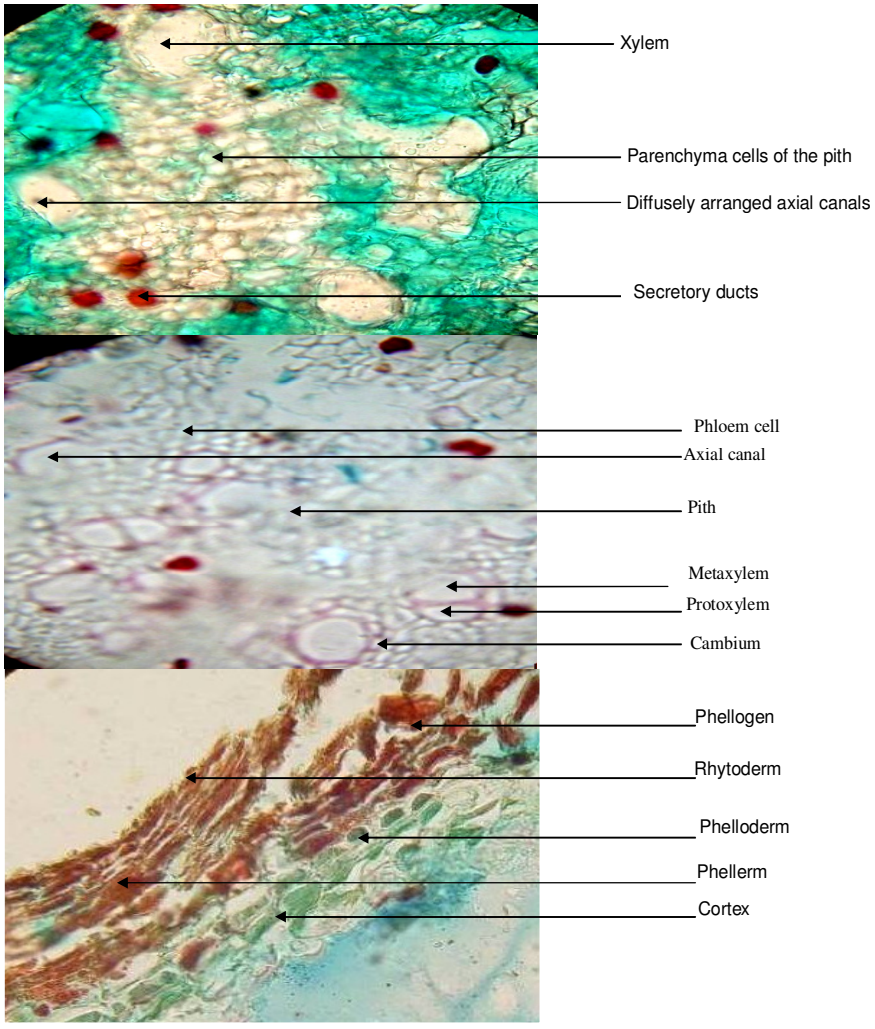

Figure 2. Transversections of *D. oliveri* root.

the abundant phloem fibres, calcium oxalate crystals, numerous groups of secretory cells and ducts, rounded sclereids and spherical shaped starch grains. Diffusely arranged axial canals present in the root of this plant was also reported by Baretta–Kuipers (1981) to be present in the wood anatomy of *Daniellia* and also in the wood anatomy of *Prioria, Oxystigma, Gossweilerodendron* and *Kingiodendron* (Hannah and Peter, 2000). Jegede et al. (2006) reported the presence of reddish brown content in the stem bark cork cells of *D. oliveri*. The stem bark cortex contain large and small groups of sclereids which are rounded, square or occasionally oblong in shape. The root bark also contain sclereids but very few in number. They are oblong in shape, narrow lumen with thick striated cell walls. The presence of few numbers of sclereids in the root bark of *D. oliveri* differentiate it from the stem bark.

The micromorphological studies which are diagnostic features can be use for proper identification of the root of this plant. Any alterations or deviations indicate the presence of inpurities, adulteration or misidentification of the root of *D. oliveri.*

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