

Anatomical Studies on The Roots Of Some *Vigna* Savi Species (Leguminosae – Papilionoideae)

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Abstract: Anatomical studies on the roots of eight *Vigna* sp. namely *V. ambacensis*, *V. gracillis*, *V. racemosa*, *V. reticulata*, *V. subterranea*, *V. triloba*, *V. unguiculata* and *V. vexillata* are reported in this study. An analysis of the features of the internal arrangement of the roots shows that these taxa possess vital taxonomic characters that could be used to establish interspecific relationships among these taxa. An interesting aspect of the root anatomy of these taxa is the presence of 3 – prominent epidermal hairs in *V. vexillata* which distinguished this taxon from the rest of the taxa studied. Their vessels varied in size and number, they are small and numerous in *V. subterranea*, *V. ambacensis* and *V. reticulata* but big and few in *V. gracillis*, *V. vexillata* and *V. unguiculata*. In this studied, there is concentration of vascular bundles at the central part of the root cortex hence the endodermis is not clearly differentiated. *V. subterranea* is characterized with crystal sand and two or three vessels that appear together at different locations.

Key words: Anatomy, *Vigna*, roots, Leguminosae-papilionoideae, taxa

INTRODUCTION

The genus *Vigna* savi belongs to the dicotyledonous family, Leguminosae – Papilionoideae of the order Leguminales and tribe Phaseoleae. The family are mostly herbs but include also shrubs and trees^[1]. They comprise one of the largest families of flowering plants, numbering some 400 genera and 10,000 species^[2]. They are dicotyledonous plants bearing pods with one or more seeds whose pods dehisce along both dorsal and ventral sutures^[3]. This family can be identified by the shape of their leaves and by structures called stipules. Their leaves, apart from being stipulate, are nearly always alternate, and range from pinnately or palmately compound to simple. Majority of them are normal plants while others are switch – plants with the principal photosynthesizing functions transferred to stems and leaves^[4].

In recent years it has been observed that there is discrepancy in the number of species recognized by different authorities. Daniel^[5], recognized 37 species, Hutchinson and Dalziel^[6] recognized 25 species while Burkill^[7] recognized 22 species. The reason for the contradictions in estimation of the number of taxa in these groups of plants is due to the perceived similarities in structural and reproductive biology.

The usefulness of utilizing vegetative, anatomical features in the taxonomic and systematic consideration of different taxa has been reported^[8-11]. In spite of the availability of these studies, no specific investigation has

been conducted on the anatomical features of the root of *Vigna* sp. especially as it relates to the interrelationships of the *Vigna* sp.

This paper therefore reports the anatomical characters of the roots of eight species of *Vigna* as observed with a light microscope. It assesses the relevance of, and discusses the extent to which, root anatomical features might be utilized in the systematic consideration of the eight *Vigna* species in view of their perceived similarities in structural and reproductive biology.

MATERIALS AND METHODS

Mature and fresh roots of the *Vigna* sp. were obtained from living samples collected from different parts of Eastern Nigeria. Sections of 26 mm thick prepared from the roots were fixed in FAA (1 : 1 : 18) glacial acetic acid: 40% formaldehyde: 70% ethanol (V/V) for 48-72 h. These were then rinsed in several changes of distilled water and passed through alcohol series (30, 50, 70, 95 and 100%). The dehydrated materials were infiltrated with wax by passing through different proportions of alcohol and chloroform (3 : 1, 1 : 1, 1 : 3 V/V). As the chloroform and wax gradually replaced the alcohol, pure chloroform and wax were put in the bottles to gradually infiltrate the tissue with wax which would be hard enough for microtomy.

The bottles were left on a hot plate (37-40°C) for 24 h before transferring to the oven (58-60°C). This step was

designed to evaporate the chloroform. The wax having reached its melting point completely infiltrated the tissues in it. After a period of 2-3 days with constant addition of wax the specimens were embedded in paraffin melted wax. This was accomplished by a quick orientation of the specimens in the mould with a hot mounted needle and forceps and quick cooling on ice-block. The metal moulds were later trimmed and sectioned on Reichert rotary microtome at 20 – 24 μm following a slightly modified method of Cutler^[12].

The ribbons were placed on clean slides smeared with a thin film of Haupt's albumen and allowed to dry and drops of water added prior to mounting. The slides were placed on a hot plate at 40 °C for a few min to allow the ribbons to expand and were stored overnight. The slides were immersed in pure xylene for 2-5 min in a solution of xylene and absolute alcohol with 1 : 1 ratio (V/V) for 5 min. The slides were then transferred to another solution of xylene and alcohol in the ratio 1 : 3 (V/V) for 5 min to 95, 90, 70 and 50% alcohol. Drops of alcian blue were added to the specimens for 5 minutes, washed off with water and counter – stained with safranin for 2 min, then dehydrated in a series of alcohol 50, 70, 80, 90% xylene / absolute alcohol solution (i.e. 1: 3 and 1: 1 V/V) and pure xylene at intervals of few seconds and mounted in Canada balsam. Photomicrographs of the specimens were taken from the permanent slides (Fig. 1 and 2 (a -c)), using a Leitz Wetzlar ortholux microscope fitted with vivitar-V-335 camera.

RESULTS AND DISCUSSION

The anatomical characteristics of the roots of the eight *Vigna* sp. is illustrated in Fig. 1-2 and Table 1. The number of vascular bundles in the roots of the eight taxa varied markedly. In *V. ambacensis*, the vascular bundles are small and numerous with small and many vessels (Fig. 2.a), they are big and numerous in *V. gracillis*. There are concentration of vascular bundles at the central part of the root cortex in *V. racemosa* while *V. reticulata* has

many small vessels that are evenly scattered within the root cortex. (Fig. 1.a). *V. subterranea* is characterized with crystal sand and two or three vessels that appear together at different locations (Fig. 2.c). In *V. triloba*, the cells within the root cortex are small and compacted with 3 – 4 vessels within the cortex. (Fig 1.c) while *V. unguiculata* has 3 – 4 layers of cells with many vessels and *V. vexillata* is distinct with 3 – prominent epidermal hairs (Fig 1.b) and the cells within the cortex are closely arranged. An interesting aspect of the root anatomy is the concentration of vascular bundles at the central part of the root cortex hence the endodermis is not clearly differentiated in all the taxa studied.

The *Vigna* sp. studied possess variable characters in the anatomy of the root that could be vital in establishing interspecific relationships among the taxa studied. The presence of many vascular bundles in *V. ambacensis*, *V. gracillis* and *V. racemosa* separates these taxa from the other species investigated. This observation supports earlier studies^[3] which showed how the stellar arrangement has exhibited constancy in different plants and plant organs and thus play a role in their systematic groupings. Similarly, the presence of many vascular bundles in these taxa could be an ecological advantage that enables these plants to survive as perennial plants. The presence of prominent epidermal hairs in *V. vexillata* is a distinctive character of this taxon and thus separates it from the other taxa. *V. subterranea* is also distinct with crystal sand and two or three vessels that appear together at different locations (Fig 2.c) and this character separates it from the rest of the taxa studied. The presence of vessels in the pith of some of the *Vigna* species is a diagnostic attribute of these taxa. The endodermis and cortex of the roots in these *Vigna* sp. also exhibit features of biological importance in these taxa. The concentration of vascular bundles at the central part of the root cortex hence the endodermis is not clearly differentiated in all the taxa is unique since these taxa could be characterized on this basis. From this study, the similarities in structures

Table 1: Anatomical features of the roots in the eight *Vigna* sp. investigated

Characters	<i>V. ambacensis</i>	<i>V. gracillis</i>	<i>V. racemosa</i>	<i>V. reticulata</i>	<i>V. subterranea</i>	<i>V. triloba</i>	<i>V. unguiculata</i>	<i>V. vexillata</i>
Size and number of vascular bundles	Size and number numerous	Big and numerous	Small and numerous	Big and very few	Big and numerous	Small and very few	Big and very few	Big and numerous
Size and number of vessels	Small and numerous	Big and numerous	Small and numerous	Small and very few	Big and very few	Small and numerous	Big and numerous	Big and numerous
Crystals and crystal	Absent	Absent	Absent	Absent	Present	Absent	Absent	Absent
Epidermal hairs	Absent	Absent	Absent	Absent	Present	Absent	Absent	Present
Endodermis	Poorly differentiated	Poorly differentiated	Poorly differentiated	Poorly differentiated	Poorly differentiated	Poorly differentiated	Poorly differentiated	Poorly differentiated

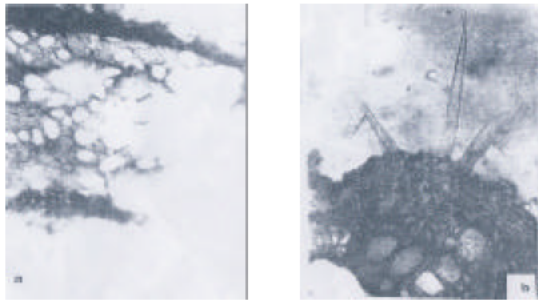


Fig. 1(a-c) T.S of Roots of *V. reticulata*, *V. vexillata* and *V. triloba*.

- a) *V. reticulata* with many small vessels
- b) *V. vexillata* with three prominent epiderma hairs (arrowed)
- c) *V. triloba* with few big vessels. (X 100)

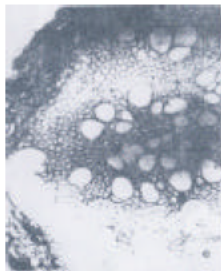
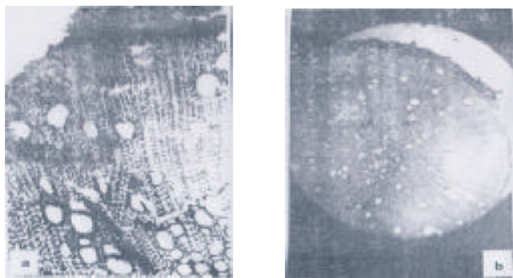


Fig. 2(a-c): T.S of Roots of *V. ambacensis*, *V. racemosa* and *V. subterranea*

- a) *V. ambacensis*,
- b) *V. racemosa*
- c) *V. subterranea* with crystal sand (around) (X 100)

showed reasons for these taxa being in the same genus while difference in structures showed reasons for the taxa being in different species.

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