Root Anatomical Studies On Salanum Macrocarpum and Solanum Nigrum (Solanaceae)

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Abstract: The anatomical characteristics of the roots of *Solanum macrocarpum* and *Solanum nigrum* were investigated to acertain the relevance of these characters in establishment of interspecific similarities and differences in these two taxa. The results showed that there is concentration of vascular bundles at the central portion of the root cortex hence the endodermis is not well differentiated in both taxa. Again the epidermal cells are big and well differentiated in *S. macrocarpum* but small and well differentiated in *S. nigrum*. The epidermal cells range from pentagonal to hexagonal in *S. macrocarpum* but irregularly shaped in *S. nigrum*. The cells outside the cortex are thick and big in *S. macrocarpum* but thin, small and elongated in *S. nigrum*. Although, the size and number of vascular bundles are small and few in both taxa, the presence of one or two oxalate crystals that characterized *S. macrocarpum* but absent in *S. nigrum* is an interesting aspect of the root anatomy. The similarities in structures showed reasons for the two taxa to be in the same genus while the differences in root anatomical structures showed reasons for them to be as different species. [The Journal of American Science. 2007;3(3):1-4]. (ISSN: 1545-1003).

Keywords: Anatomical features, roots, *S. macrocarpon, S. nigrum,* Solanaceae, taxa

Introduction

The genus *Solanum* belongs to the family Solanaceae. Members of this family are mostly herbs and twinners with about 70 genera and 2,000 species (Willis, 1985). Some workers recorded about 85 genera and 2,200 species (Ahmed, 1964, Patel 1969). Solanaceae is represented in West Africa by 53 species contained in 8 genera (Hutchinson and Dalziel 1963). *S. macrocarpon* and *S. nigrum* are edible. They serve as foliage for feeding livestock but excess intake of *solanum* plants especially those with bitter taste may lead to fruit toxicity and spinal bifida i.e. non joining of spinal bones due to ingestion of two much solanine (Schippers, 2001).

Literature searches revealed that the scientific importance and implications of anatomical features in different groups of plants have been indicated by different authors. They include Dioscoreaceae, where certain anatomical features were used in the characterization of *D. alata* L and *D. smilacifolia* l. (Edeoga, 2002). In Costaceae, where differences in features of vegetative anatomy suggested a separate specific status for *C. afer* and *C. lucanusianus* as opposed to the conspecific treatment given to them by previous researchers (Edeoga and Okoli, 1997). In Leguminosae-Caesalpinoideae, where the nature of unicellular and multicellular trichomes are described in certain species of *Senna* Tourn ex Mill and *S. hirsuta* was reported to be diagonostic in acquisition of these two types of trichomes (Edeoga and Osawe, 1996). Other studies of interest relating to anatomy of different angiospermous groups could be found in Curcurbitaceae (Okoli, 1987), Dicotyledons as a whole (Metcalf and Chalk, 1950) Leguminosae-Papilionoideae (Mbagwu and Edeoga, 2006) etc.

Through information on the anatomy of different groups of plants are available, there is no specific investigation conducted specifically on the root anatomy of *S. macrocarpon* and *S. nigrum* thus to the author's knowledge, the description of the anatomical features of the roots of these two taxa have not been documented. The objective of this investigation is to describe the root anatomical characters of the two *Solanum* species and to assess the relevance of and the extent to which root anatomical features could be utilized in the biosystematic consideration of the two species in view of their perceived similarities in structural and reproductive biology.

Materials And Methods

Fresh roots from the two *Solanum* species were collected from the Agricultural Garden of Imo State University, Owerri, Nigeria. This investigation was conducted at the Crop Science laboratory at University of Nigeria, Nsukka in January, 2007. The most healthy roots were collected and fixed in FAA (1:1:18) glacial acetic acid: 40% formaldehyde: 70% ethanol (v/v) for 48-72 hours. The roots were washed several times in distilled water then with two changes of 30% ethanol and dehydrated in the order 30%-50%-70%-95%-absolute alcohol. To infilterate wax into the specimens, they were placed for 3 hours in each of the following solutions containing a ratio of absolute alcohol to pure chloroform (v/v: 3:1, 1;1, 1;3) and then pure chloroform. At the stage of pure chloroform, wax pellets at 60^{o}c melting point were added and the wax changed with new ones at intervals. The specimens were left in the oven for 2-7 days to remove the chloroform. To embed in wax, the contents of the vials were transferred into moulds and the specimens kept in place with hot needles. As the wax solidified, it was transferred to a cold water bath for hardening and later stored for two days in a refrigerator.

For sectioning, a reichert rotary microtome was used and 10-20 mm thick sections were made. The ribbons were placed on clean slides smeared with a thin film of Haupt's albumen, allowed to dry and drops of water added prior to mounting. The slides were placed on a hot plate at 40^{o}c for few minutes for the ribbons to expand and were stored overnight. The slides were immersed in pure xylene for 2-5 minutes in a solution of xylene and absolute alcohol with 1;1 ratio (v/v) for few minutes. The slides were then transferred to another solution of xylene and alcohol in the ration 1:3 (v/v) for few minutes, to 95%, 90%, 70% and 50% alcohol. Drops of alcian blue were added on the specimens, washed off with water and counterstrained with safranin for two minutes, then dehydrated in 50% alcohol, 70%, 80%, 90% xylene/alcohol solution and mounted in Canada balsam. The slides were dried on a hot plate at 30^{o}C. Then photomicrographs of the specimens were taken from the permanent slides (Figures 1 and 2) using a Leitz Wetzler ortholux microscope fitted vivitar-V-335 camera. (Cutler, 1978).

Results And Discussion

The root anatomy of the two *Solanum* species studied is presented in Figure 1 a and b. An interesting aspect of the root anatomy is the concentration of vascular bundles at the central portion of the root cortex, hence the endodermis is not clearly differentiated in the two taxa studied (Figures 1a & b). Again, the epidermal cells of the root cortex in *S. macrocarpum* are big with different shapes ranging from pentagonal to hexagonal but they are small with irregular shapes in *S. nigrum*. The cells outside the cortex in *S. macrocarpum* are thick, big with 4-5 layers of cells while they are thin, small and elongated in *S. nigrum*. In both taxa, the size and number of vascular bundles are small and few, the size and number of vessels are small, many and appeared together within the cortex and the epidermal cells are well differentiated. The presence of one or two calcium oxalate crystals in the root of *S. nigrum* is also an interesting feature as the use of crystals in solving taxonomic problems is not a new thing since most researchers have applied it in some plant families for examples, Okoli (1988) used it in Curcurbitaceae, Edeoga and Okoli (1995) in Dioscoreaceae and Mbagwu (2005) in Leguminosae-Papilionoideae. The similarities in root anatomical structures such as the size and number of vascular bundles that are small and few, the size and number of vessels that are small, many and appeared together within the cortex and the well differentiated epidermal cells in both taxa showed strong interspecific relationships among the two taxa and therefore suggest reasons for the two species to belong to the same genus *Solanum*. Also, the differences in the root anatomical features of the two taxa distinguished the taxa and suggest reasons for the two taxa to be as different species. These differences strengthen the reliability of anatomical characters in systematic botany as stated by Ayensu (1970b) in *Dioscorea rotundata*, Poir and *Dioscorea cayenensis* Lam, Mbagwu and Edeoga (2006) in *Vigna* species, Edeoga (2002) in *Dioscorea* species, Edeoga and Okoli (1997) in Costaceae etc.

Finally, this investigation covered only the anatomical features of the root of the two taxa but does not carry along other lines of evidence such as genetics, palynology, histochemistry, molecular biology etc of these taxa, so there is the need for further research on these areas for a total delimitation of these two species.

Table 1. Anatomical features of the roots of the *Solanum* species studied.

Characters	***S. macrocarpum***	***S. nigrum***
Nature of the endodermis	Not clearly differentiated	Not clearly differentiated
Epidermal cells	Big and well differentiated	Small and well differentiated
Shape of epidermal cells	Pentagonal to hexagonal	Irregular
Cells outside the cortex	Thick, big and 4-5 layers	Thin, small and elongated
Size and number of Vascular bundles	Small and few	Small and few
Size and number of vessels	Small and many	Small and many
Oxalate crystals	Absent	Present

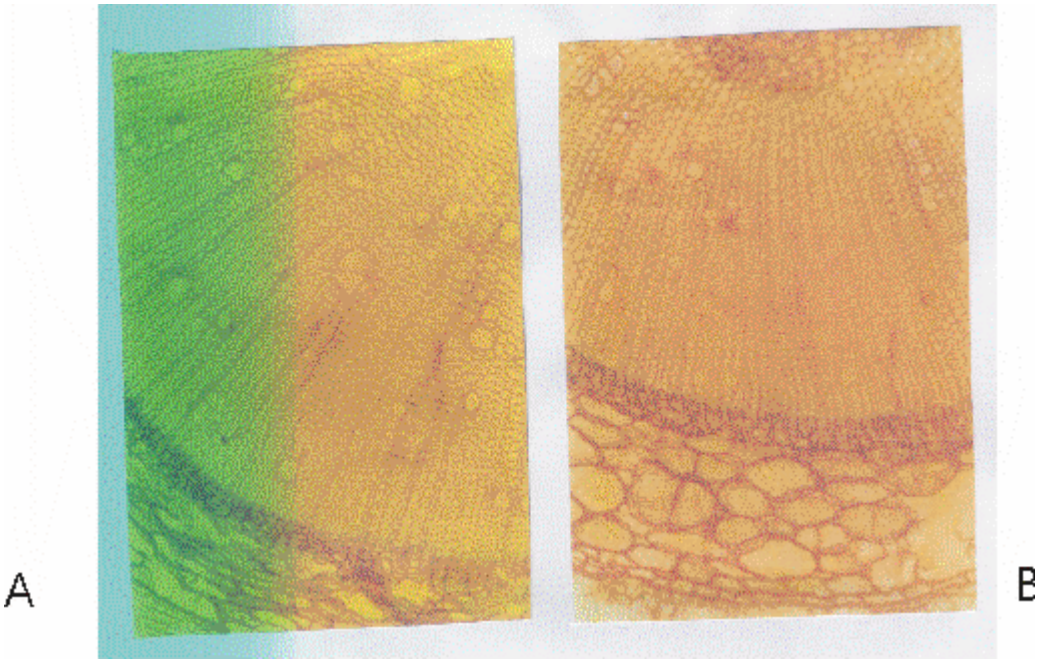

Figure 1 (a-b). T/S of the roots of the two Solanum species studied

A ***Solanum nigrum***
B ***Solanum macrocarpum***

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