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Pharmacognostic standardization of *Andrographis paniculata.* Nees. (Acanthaceae)

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Abstract

Andrographis paniculata Nees. Is an annual herb used in traditional medicine for the treatment of gastrointestinal and upper respiratory infections, fevers, herpes, sore throat and a variety of other chronic and infectious diseases. The plant is also used as an anti-inflammatory, hepatoprotective, antirival and immune boosting herbal medicine. Microscopical and chemomicroscopical studies were carried out on powdered leaves, anatomical sections and floral parts of the plant to determine its pharmacognostic profile. These investigations revealed the presence of a characteristics distribution of cystoliths (specialized cells containing chemical constituents) on both epidermal layers; a layer of palisade cells below the upper epidermis containing oil globules, paracytic stomata, uniseriate trichomes, glandular trichomes, non-granular pollens grains, and cutin. These findings could serve in the identification and preparation of a monograph on the plant.

Key words: Pharamacognostic standardization, *Andrographis paniculata.* Plant anatomy.

Introduction

The plant *Andrographis paniculata* Nees, family Acanthaceae, is an annual, erect herb growing between 0.5 to 1 meter in height. It is indigenous to Southern Asia but has been successfully domesticated in Nigeria. It grows in evergreen and deciduous forests as well as in soil type where almost no other plant can be cultivated. The plant has been used for centuries in China and Thailand where it is extensively cultivated. In traditional medicine, the plant is used as an anti tuberculosis, analgesic, anti-inflammatory, antiviral, immune enhancer, hepatoprotective and antimicrobial herbal medicine. 12345 Reported phytochemical screening of the plant indicated presence of arabinogalactan proteins, paniculide, 14-deoxy-11-dehydroandrographolide, andrographolide 6,7. Macroscopical, microscopical and chemomicrosopical studies were carried out on the powdered, anatomical sections of the leaves and floral parts of the plant grown in Nigeria, to determine its pharmacognostic profile, with the aim of producing a monograph on it.

Materials and method

Plant collection and identification

The leaves and floral parts of the *A. paniculata* were collected in April 2004 from the medicinal plant garden of the National Institute for Pharmaceutical Research and Development (NIPRD) Abuja. The plant was identified and confirmed by Mrs. A. J. Ibrahim of the Institute's herbarium unit, with a deposited voucher specimen.

Macroscopic investigation
The macroscopic description of the plant was according to the terms outlined in African Pharmacopoeia (8).

Macroscopic investigation
Anatomical sections and powdered samples of the leaves and floral parts of the plant were prepared and examined to determine the diagnostic profile of the plant. Quantitative leaf microscopy was also carried out to determine some physical leaf constants.

Chemomicroscopic investigation
Chemomicroscopic investigations were carried out on powdered leaf samples of the plant as well as anatomical sections to determine the presence or absence of various chemical constituents[8].

Results

Macroscopic investigation
The following are description of the observable features of the plant:

Stem -	(i) Height of the whole plant:	50-100cm
	(ii) Shape:	Angular
	(iii) Surface:	Green in color and glabrous
	(iv) Growth direction:	Upwards/Erect
Leaf -	(i) Arrangement	Opposite and decussate
	(ii) Type	Simple
	(iii) Petiole	Sessile
	(iv) Shape	Lanceolate to narrowly elliptic
	(v) Size	5.0-7.5cm long; 1.0-1.5cm broad
	(vi) Margin	Entire
	(vii) Apex	Acute
	(viii) Base	Cunnate
	(ix) Venation	Reticulate
	(x) Surface	Green (upper surface darker than lower). Glabrous to touch.
Flowers -	(i) Inflorescence	arising from leaf axils in panicles
	(ii) Color	white and tinted purple
	(iii) Size	2cm long (small and pedicellate)
	(iv) Calyx	Gamosepalous, 5 divisions
	(v) Corolla	Gamopetalous, 4 divisions.
Fruits:	(i) Kind	Simple
	(ii) Dimension	2cm long
	(iii) Shape	Flattened
	(iv) Insertion	Superior
	(v) Dehiscence	Dehiscent capsule

(vi) Pericarp colour	Green
(vii) Seeds	About 12 in number and small

Organoleptic Features

Leaf taste - Very bitter
Leaf odour - Pleasantly characteristic

Microscopic investigation

Leaf

The epidermal strips of the leaf show presence of roughly polygonal epidermal cells on the upper surface; few short uniseriate trichomes with a rounded base towards the lamina and a few glandular trichomes with labiates (multicellular) head. The lower surface indicated presence of markedly wavy anticlinal cells with abundant paracytic stomata (nearly 1 stomata to 3 epidermal cells), specialized oblong cells (Cystoliths) scattered through out the leaf surface with more on the lower surface, along with glandular trichomes.

The transverse section of the leaf across the midrib indicated presence of a cutin layer on both epidermis, a layer of palisade cells below the upper epidermis, abundant distribution of oil glands scattered in the palisade layer; sub-epidermal layers of collenchyma tissues below both epidermises in the midrib region; and a diffuse layer of mesophyll below the lower epidermis. The leaf anatomy also indicated lignified proto and metaxylem veins and veinlets made up of lignified spiral vessels; sieve plates; a circular calcium oxalate crystals in the parenchmatous cells of the stem pith.

Flower

The anatomy of the floral parts presented a corolla lobe made up of a variety of trichomes. This include long thin-walled, whip like multicelluar clothing trichomes with labitate heads; short thin walled, whip like, unicellular and multicellular clothing trichomes without heads, with all the trichomes containing oil glands and occasional short stalked glandular trichomes.

The calyx is made up of anticlinal epidermal cells on both surfaces; parastitic stomata; abundant characteristic warty walled mono and bicellular covering trichomes (all pointing upwards); a fair distribution of glandular trichomes; oil glands a few long whip-like multicellular trichomes with labitate heads.

Anther

The anther wall of the bi-lobed pollen sac is made up of a fibrous layer in surface view, enclosing numerous spherical to ellipsoidal, pollen grains with a nearly smooth exine surface. The grains posses a network of fine pits (radiating from the poles); a relatively uniform size 32-35 um in diameter; a triple furrow and pore, lacking spines. The anther is suspended by a pair of filaments made up of polygonal cells; a cluster of long whip-like unicellular trichomes, with wide lumen; double stranded non-branching spiral vessels on each side of the filament; oil glands and a characteristic distribution of short stalked thin walled trichomes with enlarged round base occurring towards the base of the filament. The epidermis of the style has elongated polygonalcells along with thin walled multicellular clothing trichomes. Also occurring at the base of the filament are few distinguishing unicellular thin walled spiral trichomes occurring along side short stalked multi-cellular

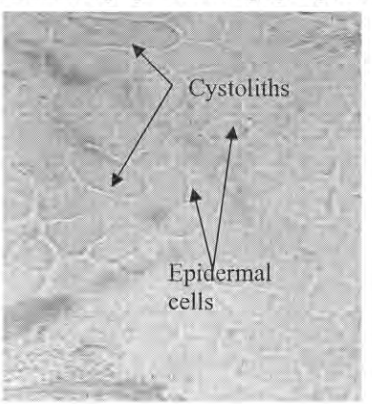
glandular trichomes.

Chemomicroscopic investigation

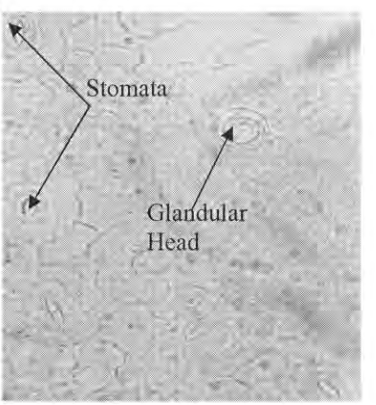
Table 1: Result of chemo microscopic investigation of *A. paniculata* leaf

Test Reagent	**Observation**	**Conclusion**
Phloroglucinol +cone.Hcl	Xylem vessels showed Red coloration	Lignin present
Sudan IV solution	Abundant oil glands in the palisade layer of the leaf calyx, corolla and floral components like trichomes turned red	Oil present
Picric acid solution Tannins	No yellow colour observed	Aleurone grains absent
Ferric chloride solution	No greenish-black Colour observed	Tannins absent
80% cone. H_2SO_4	Disappearance of needle like acircular crystals in the pith of the stem.	Calcium oxalate crystals present
Few drops of Sudan red Solution	Red coloration on the epidermises of the leaf	Cutin present

Photomicrographs of *Andrographis paniculata.*

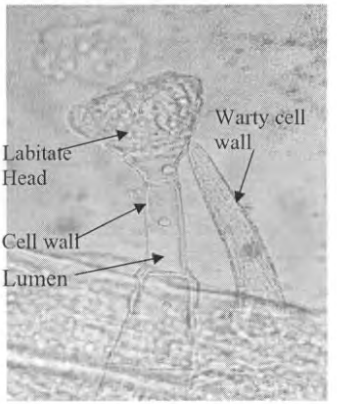


Upper Epidermis

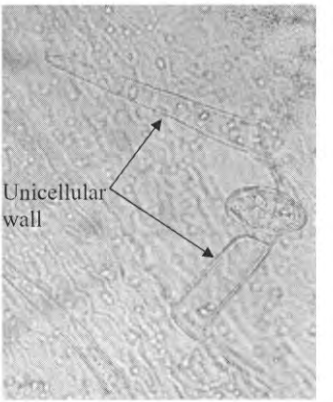


Lower Epidermis

Fig. 1: Epidermal Micromorphology of Andrograhis panicculata x 400

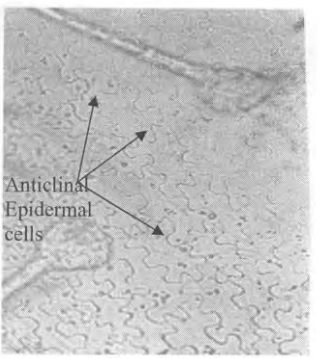


Calyx

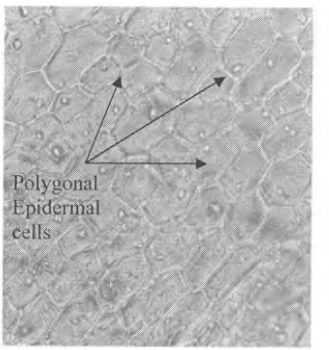


Corrola

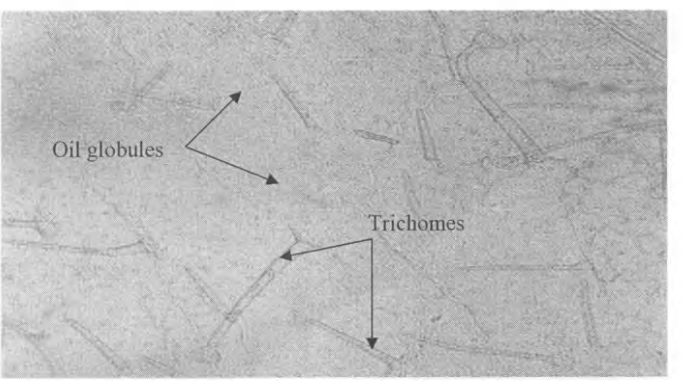
Fig.2: Floral Micromorphology of A. Paniculata X 400



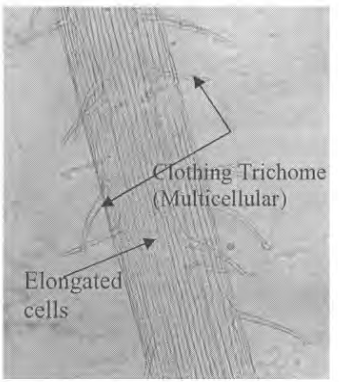
Aerial Part of Corrola



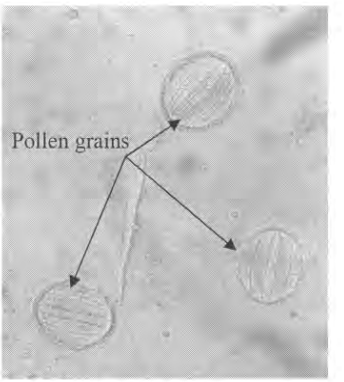
Base Part of Corrola



Surface view of Corrola

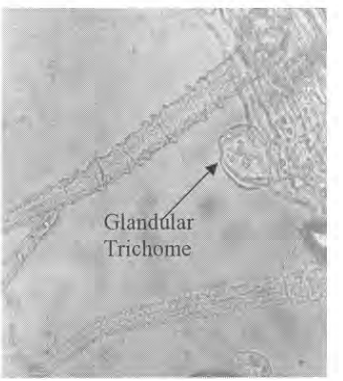


Style



Pollen grains

Cluster of Trichomes on
Pollen Sac



Peculiar Spirial Trichomes on
Anther Wall

Fig. 3: Microscopic Features of Floral parts of A. Paniculata (x 400)

Discussion

The plant *Andrographis paniculata* is a plant that is being intensively investigated for new plant drugs for the treatment of disease conditions ; cancers, malaria, cardiovascular diseases, tuberculosis, and HIV/ AIDS amongst other debilitating diseases. This is attested to by the volume of research findings on the plant involving determination of its active ingredient (andrographolide); mechanism of actions, safety level, contraindications and confirmation of its efficacy. [9,10, 11,12] It is therefore obvious, that the establishment of the Pharmacognostic profile on the plant towards its standardization is a necessity. More so as the plant is being cultivated in different regions of the world including Nigeria, apart from its indigenous environment.

A. paniculata from our investigations has dorsiventral leaf arrangement, with a layer of palisade tissue below the upper epidermis. The deposition of Calcium carbonate in elongated

ovoid cells (cystoliths) on both epidermis confirms the classification of the plant in the Acanthaceae family, to which Hypoestes species also belong as Cystoliths are common occurrence in the family.

The calyx (sepal) and to a lesser extent corolla (petal) exhibited typical leaf structure yielding elements such as stomata, glandular and covering trichomes, mesophyll, oil glands, etc; while epidermal cells of the corolla lack the typical papillose structure. The different types of trichomes, their distribution and oil contents as found in *A. paniculata* are of major diagnostic value. The determination of these diagnostic features amongst other parameters is of importance in judgment of identity, purity and often general quality of the plant as it is an introduced plant. This is the first time of reporting the results of pharmacognostic analysis of the plant and these are needed towards the standardization of the plant which is currently gaining relevance in plant drug research.

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