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PHARMACOGNOSTIC STUDIES OF THE LEAVES AND ROOTS OF *MONDIA WHITEI* (HOOK.F.)

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ABSTRACT

Mondia whitei (Hook.F.) (Apocynaceae) also known as White ginger or Mondia and Isirigun by the Yoruba ethnic group of Nigeria, is a vigorous climber (3–6 m high). It is widely distributed in tropical Africa from Guinea through Cameroon to East Africa. The plant has been used in ethnomedicine to manage malaria, erectile dysfunction and loss of appetite, gonorrhoea, paediatric asthma, and gastrointestinal disorder. Mondia whitei has been reported to have several pharmacological activities such as aphrodisiac, antimicrobial, anti-inflammatory, anti-tyrosinase, antioxidant, and anti-sickling. 2-hydroxy-4-methoxybenzaldehyde, isovanillin, coumarinoligan and loliolide are compounds reported to have been isolated from the plant. This study is designed to evaluate the pharmacognostic parameters which will be helpful to ensure the purity and safety of this medicinal plant. Pharmacognostic studies including microscopy, chemomicroscopy, proximate analysis and Thin Layer Chromatographic finger printing were conducted. Microscopic analysis of M. whitei lower leaf epidermal surface revealed wavy epidermal cell wall, diacytic stomata and unicellular trichomes. The upper epidermal surface showed irregular epidermal cell wall with striations, stomata and trichomes were absent. Microscopic analysis of the leaf powder revealed the presence of unicellular trichomes, and epidermal cell wall showing diacytic stomata, sieve tubes and irregular epidermal cell wall with striations. The root powder analysis revealed tetragonal and prismatic type of calcium oxalate crystals, starch grains, parenchyma, cork and fibre cells. The chemo-microscopic analysis of the leaf and root of Mondia whitei revealed the presence of lignin, cellulose, tannins, starch, oils and proteins. Mucilage was present in the root but absent in the leaf. The physicochemical parameters evaluated for the leaf and root were: Moisture content for leaf and root were 10.9 % and 10.02%, total and acid- insoluble ash values for the leaf were 11.8 % and 1.2%, root 10.8% and 1.7% respectively. Alcohol-soluble and water -soluble extractive values of the leaf were 3.1% and 6.0% while the root had 9.9% and 7.1% respectively. Chromatographic fingerprints of ethanol (70 %) extracts of the leaves and roots showed three (3) and two (2) spots respectively. The results from this study have provided information on anatomical and physicochemical parameters of M. whitei for proper identification and quality control.

KEY WORDS

Mondia whitei, pharmacognostic studies, proximate analysis, chromatographic fingerprints.

INTRODUCTION

Medicinal plants are used worldwide as an alternative or complementary medicine to treat various conditions and as a result, interest in medicinal herbs is increasing as precursors of pharmacological actives (1). Herbal medicines are often used to provide first-line and basic health services, both to people living in remote areas

where it is the only available health service and to people living in poor areas where it offers the only affordable remedy (2). Medicinal plants have for long been used as a source of relief either in the form of traditionally prepared concoctions or in the form of pure active principles (3).

The rise in the use of herbal products has given rise to various forms of abuse and adulteration of the products leading to fatal consequences in some instances. Pharmacognostic studies ensure plant identity, lays down standardization parameters which help to Prevent adulteration, ensures reproducible quality of herbal products which will lead to safety and efficacy of natural products (4).

Mondia whitei (Hook.F.) (Apocynaceae) also known as White ginger or Mondia, and Isirigun" by the Yoruba ethnic group of Nigeria, is a vigorous climber (3–6 m high) with attractive heart-shaped leaves and vanilla aroma. The flowers are arranged in panicles, yellow and reddish-purple. It is widely distributed in tropical Africa from Guinea through Cameroon to East Africa (5, 6). The plant has been used in ethnomedicine to manage malaria, erectile dysfunction, loss of appetite, gonorrhea, pediatric asthma, and gastrointestinal disorder [7, 8,9,10]. *Mondia whitei* has been reported to have several pharmacological activities such as aphrodisiac (11), antimicrobial (12, 13), anti-inflammatory 14), anti-tyrosinase (15), antioxidant (16, 13), Antisickling (17) and androgenic properties (18). 2-hydroxy-4-methoxybenzaldehyde (19), isovanillin, coumarinoligan (20) andloliolide (21) are compounds reportedto have been isolated from the plant.

This study is designed to evaluate the pharmacognostic parameters which will be helpful to ensure the purity and safety of this medicinal plant.

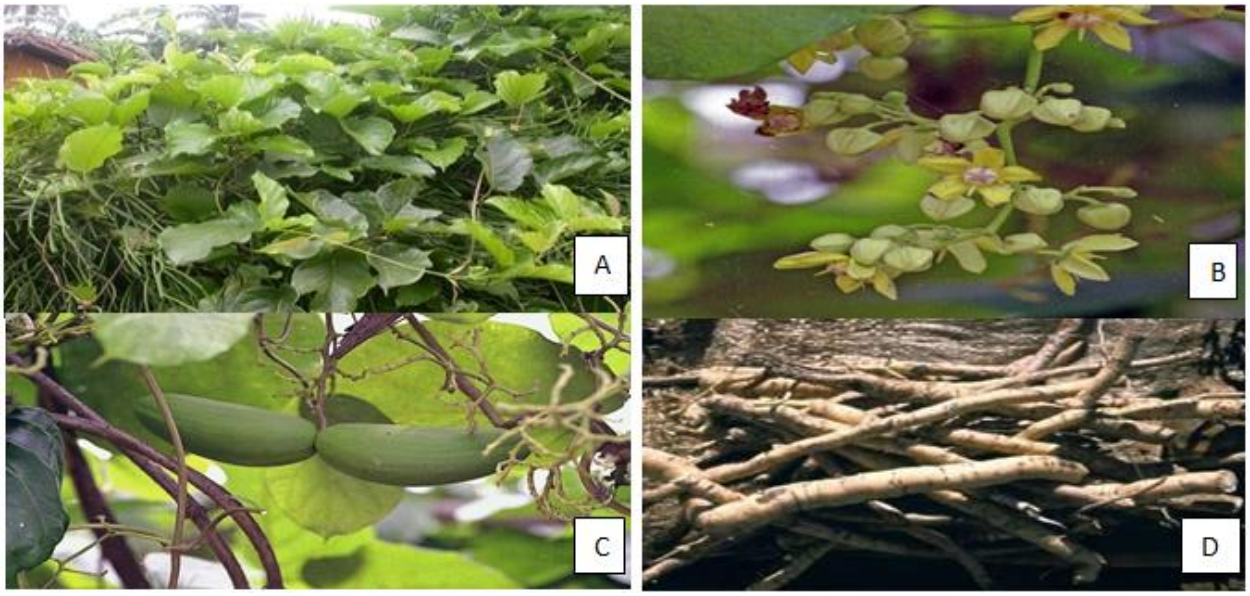

Figure 1. *Mondia whitei*: (A) young leaves (B) flowering part (C) stem and fruits (D) root

MATERIALS AND METHOD

Collection

Mondia whitei leaves and roots were collected from Iminijo, Oyo State, Nigeria in August 2016. The plant was identified by a taxonomist and voucher specimen was deposited at NIPRD herbarium, Abuja with voucher number NIPRD/H/6885.

Chemicals, reagents and solvents

All chemicals, reagents and solvents used during the experimentation were of analytical grade.

Microscopy

Microscopic analysis was carried out on the pulverized root and leaf samples and the adaxial and abaxial epidermal surfaces of the leaf. A quantity of each pulverized sample was cleared in chloral hydrate, mounted in glycerin: water (1:1) and viewed under the microscope at different magnifications (x 100 and x 400). The method of Ugbabe and Ayodele (22) was used to prepare epidermal surfaces of the leaf. About 5 mm^2 – 1 cm^2 leaf fragments were obtained from the standard median portion of the leaf and macerated in

concentrated nitric acid in petri-dish for a period of 18-24 hrs. The appearance of air bubbles indicated the readiness of the epidermises to be separated. The fragments were transferred into water in a petri-dish with a pair of forceps. The upper, lower epidermises and mesophyll were separated and cleaned using forceps and carmel hair brush. Each surface was transferred into 50% ethanol to harden and later stained with safranin O for 5 minutes. The excess stain was washed off in water and the epidermal peel was mounted on a slide with glycerin.

Chemomicroscopic studies

Chemomicroscopic studies of the pulverized leaf and root samples were carried out using reagents and stains like iodine, concentrated sulphuric acid, concentrated hydrochloric acid, ferric chloride, Sudan III, ruthenium red and phloroglucinol: conc. HCl (1:1) to test for presence of various metabolites (22, 23).

Physicochemical Evaluation

Various physicochemical parameters vis moisture content, total ash values, acid-insoluble ash value, water and alcohol -extractive values were carried out following WHO guidelines (23, 24).

Chromatographic fingerprinting

Analytical Thin layer chromatography was done on silica gel G60 F_{254}, 0.2 mm layer and KC18 silica gel 60A, 200 µm. 2 applications of ethanol $_{(70\ \%)}$ extracts of the plant parts were made at the origin, the plates were developed using CH_2Cl_2:CH_3OH (7:3) and CH_2Cl_2:CH_3OH:NH_4OH (5:4:1). Detection was in daylight, UV_{366} and 10% aqueous H_2SO_4 spray reagent at 100°C. The different retardation factors (R_f) of each spot were calculated (25).

Microphotography

Photomicrographs of different sections were taken using Leica CME microscope with digital microscope eyepiece attachment and Photo Explorer 8.0 SE Basic software at different magnifications (x100 and x400)

Statistical analysis

The data obtained were expressed as mean ± SEM (standard error of mean), and n represents the number of replicates in an experiment.

RESULTS

Table 1 Chemomicroscopic evaluation of *Mondia whitei* leaf and root

Parameters	Results	
	Leaf	Root
Lignin	+	+
Cellulose	+	+
Tannins	+	+
Mucilages	-	+
Starch	+	+
Oils	+	+
Proteins	+	+

Table 2 Physiochemical evaluation of *Mondia whitei* leaf and root

Parameters	Results (%)	
	Leaf	Root
Moisture Content Value	10.9 ±0.07	10.02 ±0.1
Total Ash Value	11.8 ± 1.4	10.8 ± 0.7
Acid-Insoluble Ash Value	1.2 ± 0.2	1.7 ± 0.0
Alcohol -Extractive Value	3.1 ±0.2	9.9 ±0.1
Water- Extractive Value	6.0 ±0.3	7.3 ±0.1

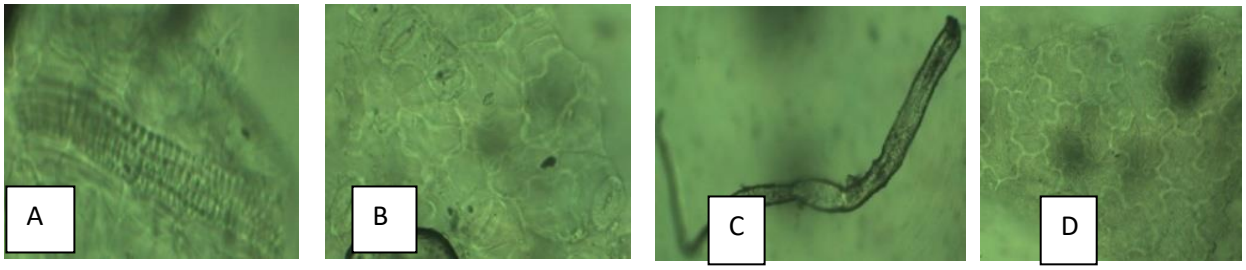

Figure 2: Leaf Powder Microscopy of *Mondia whitei* (A) Sieve tubes (B) Epidermal cell showing diacytic stomata (C) Unicellular trichome (D) Irregular epidermal cell wall

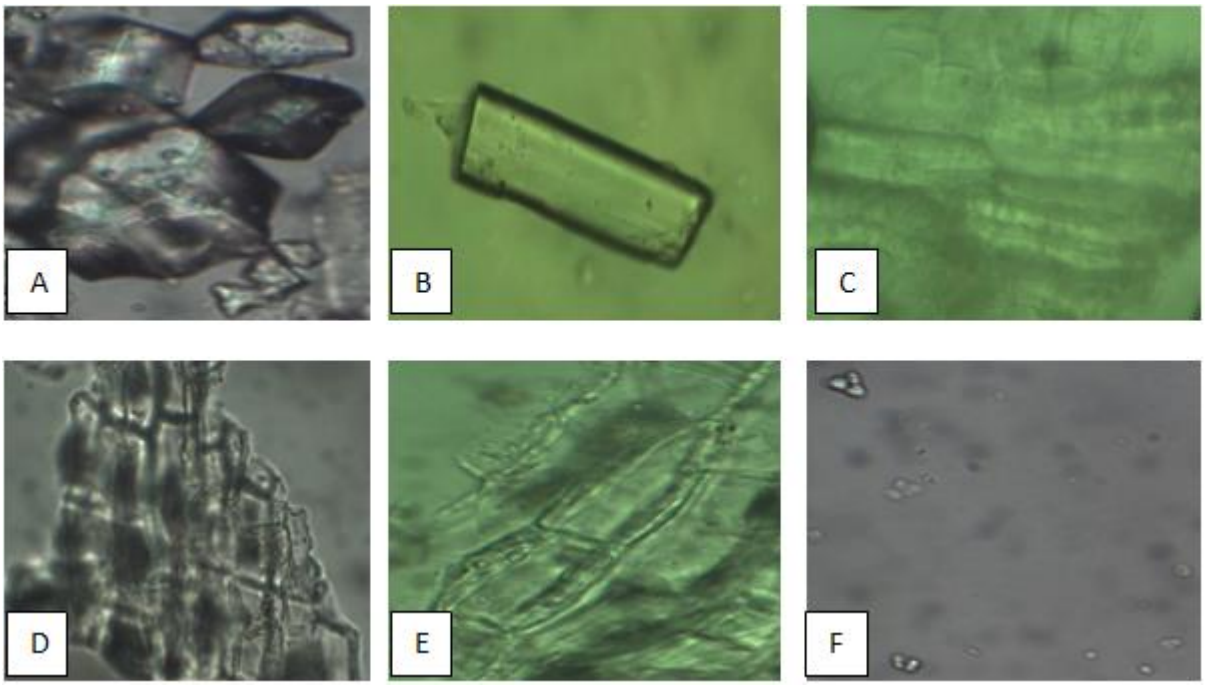

Figure 3: Root Powder Microscopy of *M. whitei* (A&B) Prismatic/tetragonal calcium oxalate crystals (C) Fibre (D) Parenchyma cells (E) Cork cells (F) Starch grains

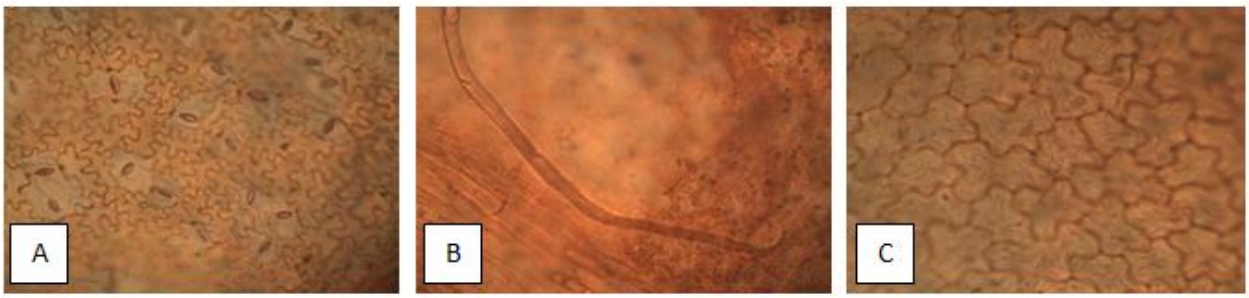

Figure 4: Microscopy of Leaf Epidermal Surfaces of *Mondia whitei*: Lower Epidermal Surface- (A) Wavy epidermal cell wall with diacytic stomata and (B) unicellular trichome. Upper Epidermal Surface - (C) wavy epidermal cell with striations

Table 3: Chromatographic fingerprinting of *M.whitei* leaf and root powder

Extract	R_f	Daylight	UV_{366nm}	10% v/v aq H_2SO_4 Spray
Root	0.60	-	Fluorescence	Dark brown
CH_2Cl_2:CH_3OH (7:3)	0.96	-	Fluorescence	Light pink
Root	0.41	Light brown	Fluorescence	Dark brown
CH_2Cl_2:CH_3OH: NH_4OH (5:4:1)	0.96	Light brown	Pink	Pink
Leaf	0.80	Greenish yellow	Pink	Colourless
CH_2Cl_2:CH_3OH (7:3)	0.85	Greenish yellow	Pink	Colourless
Leaf	0.40	Green	Pink	Colourless
CH_2Cl_2:CH_3OH: NH_4OH (5:4:1)	0.45	Greenish yellow	Pink	Colourless
	0.93	Greenish yellow	Pink	Colourless

DISCUSSION

Pharmacognostic parameters must be established to ensure the quality, purity and safety of any crude drug. Moisture content obtained for leaf and root of *M. whitei* were 10.9 % and 10.02% respectively. These values suggest that the water content is within acceptable limit (8-14%) for water content of vegetable drugs (African Pharmacopoeia, 1986). This also indicates that the crude drug will have a longer shelf life. Ash values of drug give an idea of earthly matter or the inorganic composition and other impurities present in the crude drug. The result shows that total and acid-insoluble ash values for the leaf were 11.8 % and 1.2% while for the root 10.8% and 1.7% respectively. This result is suggestive of low inorganic content in the sample. The extractive values showed that alcohol-soluble and water- soluble extractive values of the leaf are 3.1% and 6.0% while the root had 9.9% and 7.1 respectively (Tab.2). This is an indication that there are more alcohol soluble phyto constituents than water phyto constituents in the crude drug. The values obtained for moisture content and ash value of the root agrees with the report of Armand et al (26), who reported moisture content of 10.5% and slightly lower ash content of 8.7%. The difference in the ash content of the root may be due to differences in location and or habitat (samples were collected in Cameroun), time of collection and mineral content in the soil.

Microscopic analysis of *M. whitei* lower leaf epidermal surface revealed wavy epidermal cell wall, diacytic stomata and unicellular trichomes. The upper epidermal surface showed wavy epidermal cell wall with striations, stomata were however absent (Fig 4). Leaf powder microscopic analysis revealed the presence of unicellular trichomes, epidermal cell showing diacytic stomata, sieve tubes and wavy epidermal cell with striations (Fig. 2). The root powder microscopy revealed tetragonal and prismatic type of calcium oxalate crystals, starch grain, parenchyma cells, cork cells and fibres (Figure 3). The chemo-microscopic analysis of both leaves and roots of *Mondia whitei* revealed the presence of lignin, cellulose, tannins, starch, oils and proteins. Mucilage present in root but absent in leaf sample (Tab. 1).

The result of thin layer chromatography is as shown in Table 3. Detection was in daylight, UV_{366nm} and 10% v/v aqueous H_2SO_4 spray reagent. Plates were dried at 100°C after spraying.

CONCLUSION

The pharmacognostic evaluation of leaf and root of *M. whitei* is being reported for the first time and results from this study have provided information on the anatomical features and the physicochemical parameters of leaf and root of *M. whitei*. These parameters can be used for identification and quality control of the plant drug and preparation of a monograph for *M. whitei* plant.

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