Pharmacognostic and physico-chemical investigation of *Palisota hirsuta* (K. Schum) (Commelinaceae)

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ABSTRACT

Palisota hirsuta(Family Commelinaceae) is synonymously known as Palisota maclaudii and Dracena hirsuta. It is grown as an ornamental and also a hedge. Ethnopharmacologically, the plant leaf and stem are used as an aphrodisiac, analgesia, antiseptic and in some cases used to treat gonorrhea. The present study was done to develop standardization parameters for the pharmacognostic identification of Palisota hirsuta. All paramters were established according standrd proceedure. The plant is a robust herb with a fleshy or woody rigid stem bearing soft brown hairs at the base. The leaves are arranged in rosettes with obovate to oblanceolate shape. Transverse sections of the midrib of leaf displayed a double layer of epidermal cells on the adaxial surface and a single layer of epdidermal cells on the abaxial side. Powder microscopy of the leaves and stems revealed the presence of abundant acicular calcium oxalate crystals and starch grains. A number of spiral xylem vessels were also present. The ash values, solvent extractives and mineral content of P. hirsuta stem and leaves have also been established. Thus the present studies have established parameters for the correct identification of P. hirsuta.

Keywords: *Palisota hirsuta,* standardization, physicohemical, extractive values, herbal medicne, quality control.

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INTRODUCTION

The uses of herbal medicines is on the ascendency in recent years, being sought out as medicinal products, nutraceuticals and cosmetics and are available in health food shops and pharmacies over the counter [1]. Globally, a large number of people are returning to natural therapies and this may in part explain the increased attention in recent times [2]. Their use is very high in developing countries where about 80% of the population relies on them for their health care needs due to their ready availability, cost, purported safety and perceived side effects of synthetic drugs [3].

In most African countries, where access to primary health care is hampered by non-existence of health facilities and cost of conventional medicines, herbal medicines are the first point of call for their primary health care needs [4]. In Ghana, for example, herbal medicine use is wide spread with the government currently piloting the integration of herbal medicine to mainstream orthodox healthcare in all the regional capitals of the country. Our cultural disposition and traditional belief systems have made it easier for the average citizen to believe his 'herb' and shun what is perceived to the 'white man's poison' (synthetic drugs). This has brought in its wake a growing demand for herbal raw materials, by the herbal industries, which are mainly collected from the wild by unskilled personnel. Therefore the correct identification of these medicinal plants is critical to production of quality herbal products.

However, most of the medicinal plants used in many herbal therapies in Ghana do not have established pharmacognostic parameters for their correct identification [5]. One of such plants is *Palisota hirsuta*. *Palisota hirsuta* is a robust, perennial herb growing to 3 m high as an ornamental and or as a component of hedges [6]. In Ivory Coast a plaster of pulped stems or the sap in a compress is applied as a dressing to furuncles, contusion, fractures and arthritic pains. The plant sap is taken for cough, bronchitis and chest-pains [7]. A decoction of the leafy stems and whole plant is used in baths for oedema and for urethral discharge respectively. In Ghana and Nigeria the stem is chewed as a sedative for cough; the dried leaves are smoked for toothache; the roots are added to soup taken by pregnant women. It is again used in Ghana for stomach-pains, with a leaf-infusion taken for piles and given to babies to heal the navel. In superstitious practice in Ghana, it is regarded as a deterrent against spiritually induced plague and epidemics. It is placed on paths, during epidemics and believed that the plague cannot pass [7]. Despite the wide spread used in traditional medicine, there are no established standardization parameters for the correct identification of the plant. Therefore this study sought to establish the pharmacognostic parameters of *P. hirsuta* for the correct identification of the plant.

MATERIALS AND METHODS

Collection and Authentication and processing of plant material

Fresh leaves of Palisota hirsuta (Commelinaceae) were collected on the 1st of November 2015 around the faculty of Pharmacy and Pharmaceutical Sciences at the Kwame Nkrumah University of Science and Technology Kumasi and authenticated by Dr George Henry Sam of the Herbal Medicine department, where a herbarium sample has been deposited (BHM/PH/023/15). The leaves collected were properly cleaned of foreign matter and other contaminants. These were chopped into pieces, dried for three days and milled into powder for various examinations.

Figure 1: Palisota hirsuta leaves and stem.

Macromorphoogical examination
The fresh leaves of Palisota hirsuta were examined for its color, shape, odour, margin, texture, base symmetry etc. per the guidelines outlined by Kokate[8].

Micromorphological examination
Thin sections of the midrib of the fresh leaves were made, cleared for about an hour and mounted in chloral hydrate solution. Photomicrographs of were taken with the aid of a microscope camera Leica ICC50 HD (Jos Hansen and Soehne Gmh Germany). Sections of the midrib were mounted in chloral hydrate. Ergastic cell contents and other structures such as fibres, starch grains, calcium oxalate crystals were observed and photomicrographs taken according to standard procedures [8]. The stomatal index and stomatal number were also studied according to the standard procedures [8].

Physicochemical evaluation

Ash values
The total ash, water souble and acid insoluble ash were evaluated according to standard procedures [8].

Extractive values

Four grams of the powdered leaf were accurately weighed into a conical flask. 100 mL of water was added to separate conical flasks containing the leaf samples with frequent agitation for 24 hours. It was then filtered and 25 ml's of the filtrate evaporated to dryness on a water bath. The residue was then weighed and recorded. The water soluble extractable matter was calculated in mg/g of the material. The procedure was repeated for 95% ethanol and chloroform to obtain the ethanol and chloroform soluble extractives [8].

Thin Layer Chromatography

Chloroform extracts of the leaves and stem of P. hirsuta were prepared and concentrated to a small volume (5 mL). This was then spotted on a precoated silica gel plate and allowed to dry and developed using chloroform/ethyl acetate (9:1) as the mobile phase. The plate was removed and the solvent front marked. It was then air-dried and sprayed with anisaldehyde sulphuric acid reagent. It was the heated at 105°C for 10 minutes for color development and the Rf values calculated.

RESULTS AND DISCUSSION

Medicinal plants have certain signatures which are specific to them and can be used as diagnostic tools for their identification and evaluation [9]. These features are established by pharmacognostic studies. Pharmacognostic identification is indispensable in establishing quality control parameters for the determination of the identity, purity, consistency, efficacy and safety of herbal products [10]. This helps researchers and manufacturers to be confident on the quality of herbal raw materials and products they are dealing with. In this study, the pharmacognostic features of Palisota hirsuta were established.

Palisota hirsuta of the family commelinaceae, is a robust herb in forest re-growths of about 2-4 m high, reproducing from the seeds. It has a fleshy or woody rigid stem bearing soft brown hairs at the base. The leaves are arranged in rosettes with obovate to oblanceolate shape. The leaves are green, having a characteristic odour and taste. The leaves have acute to acuminate apex with a symmetrical base. The leaf is 14-38 cm long and 5-10 cm wide. It bears densely hairy petioles measuring 2-3 cm at the base. The margin is entire with a papery texture and pubescent surface. The plant bears white to purplish inflorescence.

Micromorphology

Transverse sections of the midrib of leaf displayed a double layer of epidermal cells on the adaxial surface and a single layer of epdidermal cells on the abaxial side (Figure 2). A number of simple brownish covering hairs emerged from the abaxial surface. The vascular bundles were scattered in the cortex filled with collenchyma cells. The cleared leaf surface revealed the presence of straight walled polygonal epidermal cells with paracytic stomata and a number of coveirng hairs (Figure 3). The stomatal number of the abaxial surface ranged 8-14.

Powder microscopy of the leaves and stems revealed the presence of abundant acicular calcium oxalate crystals and starch grains (Figure 4a,b). A number of spiral xylem vessels were also present (Figure 4a).
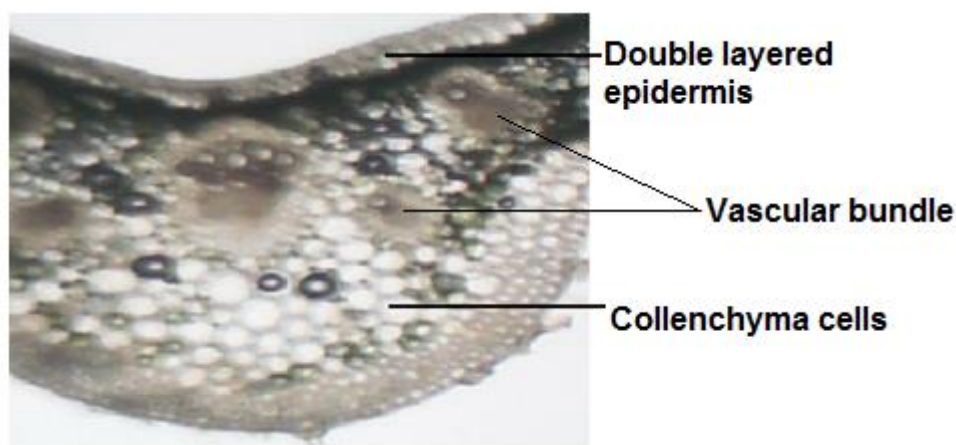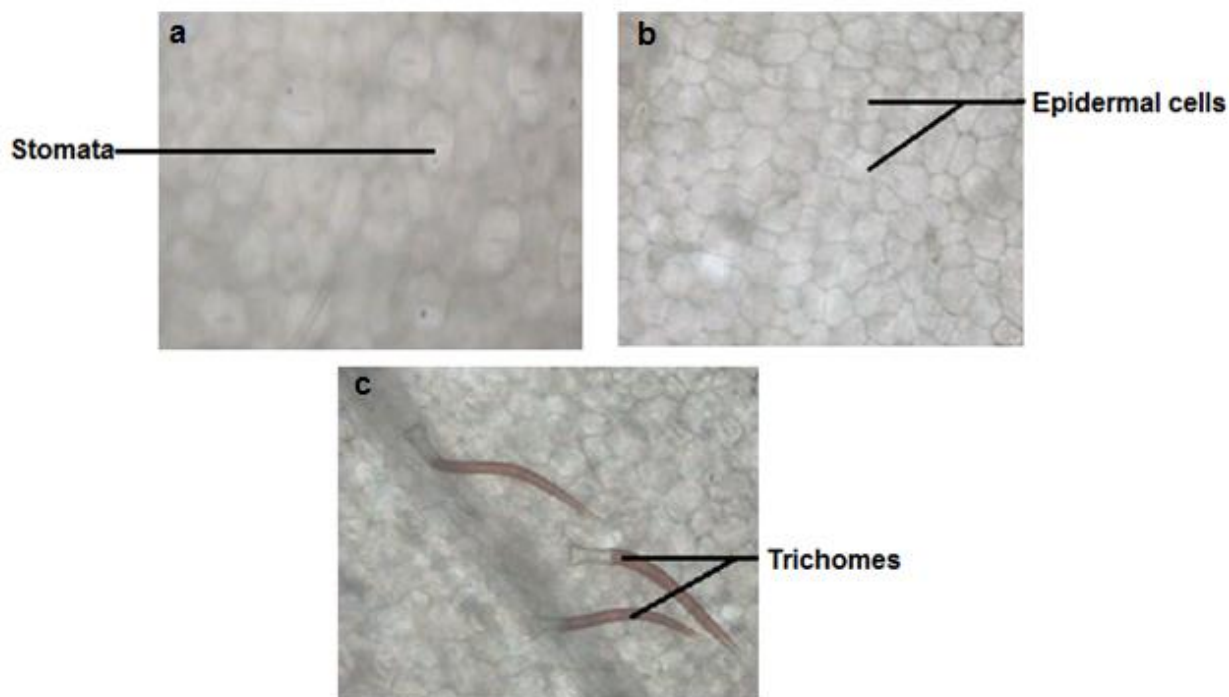

Figure 2: T/S of midrib of *P. hirsuta* leaf.

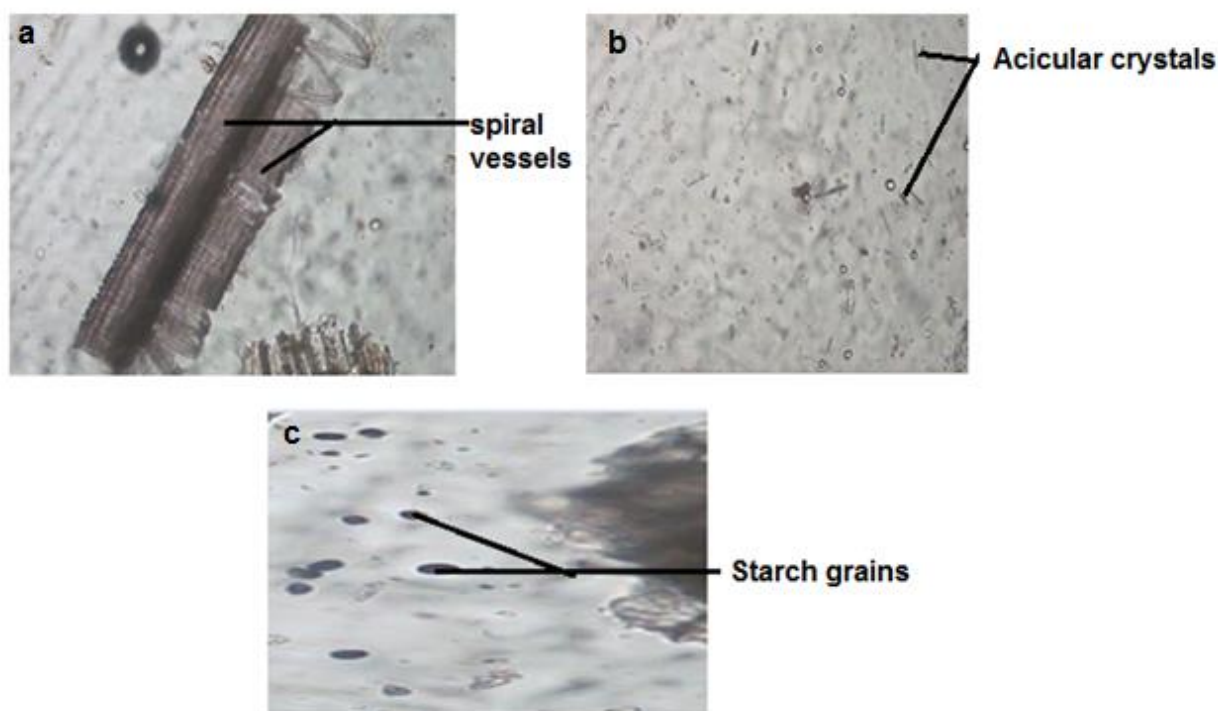**Figure 3: Leaf surface features of *P. hirsute*.**

Figure 4: Powder microscopy of P. hirsuta leaves.

Physicochemical parameters

The ash values and solvent extractives are shown in Table 1. The total ash of the stem was about the same as the leaf. However with the extractive values, ethanol soluble extractive of the leaf was about four times that of the stem. Water is the best solvent for extracting most of the constituents of the stem whereas ethanol was the most suitable for the leaves. Ash values of crude drugs give an indication of earthy matter or the inorganic composition and other

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impurities present along with it. Extractive values are primarily useful for the determination of exhausted and adulterated drugs [11]. Extractive values are also useful to evaluate the chemical constituents present in the crude drug and also help in estimation of specific constituents soluble in particular solvents [12].

Table 1: Ash and extractive values of *P.hirsuta* leaf and stem.

Physical Parameter	Leaves	Stem
Total ash ($\%^w/_w$)	8.7$\pm$0.38	8.3$\pm$0.12
Water Soluble Ash ($\%^w/_w$)	2.0$\pm$0.36	0.8$\pm$0.17
Acid-Soluble Ash ($\%^w/_w$)	4.0$\pm$0.37	3.1$\pm$0.15
Water Soluble Extractive (mg/g)	7.4$\pm$0.13	7.8$\pm$0.98
Ethanol Soluble Extractive (mg/g)	9.1$\pm$2.4	2.1$\pm$0.01
Chloroform Soluble Extractive (mg/g)	1.8$\pm$.30	1.1$\pm$0.14

Since *P. hirsuta* is used both for medicinal and nutritional purposes for both humans and livestock, it was important to establish mineral and toxic metals which could be present. The presence of nine mineral and heavy metals, as established by AAS, are presented in Table 2. Mineral analyisis of the powdered leaves and stem afforded the presence of potassium, calcium and magnesisum in substantial amounts (Table 2). Some of these inorganic elements play an important role in physiological process involved in human health whereas some heavy metals such as asernic may be detrimental [13].

K is important as diuretic and it takes part in ionic balance of the human body and maintains tissue excitability. It is the principal intracellular cation critical in the transmission of electrical impulse in the nerve cells and in maintaining the fluid balance of the body [14].

Calcium gives strength and rigidity to bones and teeth. It is invaluable in neuromuscular transmission, in excitability of nerves for normal excitability of heart, in clotting of blood and promoting muscular contraction. Acts as a cofactor for enzymes such as phospholipase, arginine kinase, adenosine triphosphatase and adenyl kinase. Low calcium levels have been associated with spontaneous discharge of nerve fibers.

Magnesium is the fourth most abundant cation in the body. It functions as an activator for enzymes involved in carbohydrate metabolism and synthesis of nucleic acids (DNA and RNA). It also acts as an important binding agent of ribosomal particles where protein synthesis takes place. Increased extracellular concentration of magnesium depresses skeletal muscle contraction. On the other hand, low Magnesium concentration causes increased irritability of the nervous system [13]. Elements such as lead and arsenic which are harmful were found to be in trace quantities.

Table 2: Mineral content of *P. hirsuta* leaf and stem.

Sample(mg/g)	Na	P	K	Ca	Mg	Pb	Zn	Fe	As
LEAF	1.74	1.30	4.50	8.00	5.60	0.0141	0.1047	0.5347	0.0089
STEM	2.13	2.20	6.00	7.80	4.80	0.0187	0.0291	0.1357	0.0059

Phytochemical Analysis

Phytochemical screening of the plant parts revealed the presence of tannins, triterpenoids, phytosterols, flavonoids, coumarins and glycosides (Table 3). These phytochemical constituents may be responsible for the biological activities usually observed by traditional medicine users for various health issues.

Table 3: Phytochemical constituents of *P. hirsuta* leaves.

Secondary metabolite	*P. hirsuta* leaf
Tannins	+
Triterpenoids	+
Alkaloids	-
Phytosterols	+
Flavonoids	+

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Coumarins	+
Reducing sugars	+

Key: +=present, - = absent

TLC chromatogram of the leaf and stem of P. *hirsuta*
TLC chromatogram of the leaves and stem of *P. hirsuta* developed in chloroform/ethyl acetate (9:1) revealed the presence of prominent spots in both parts of the plants (Figure 5). The stem extract showed more prominet compounds than the leaf extract.
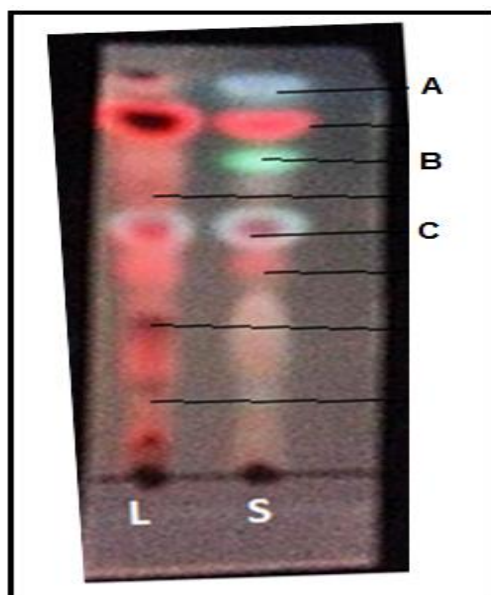

Figure 5: TLC chromatogram of the leaf and stem of *P. hirsuta* visualised under UV (365nm); L: leaf extract, S: stem extract.

CONCLUSION

The pharmaognostic parameters established in the current research can serve as a means for assessing the quality and purity of *Palisota hirsuta* used in Ghanaian folklore medicine for the treatment of pain and inflammatory conditions. These characteristic features may be used as standards for setting up a monograph of the plant.

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