Available online on www.ijppr.com
International Journal of Pharmacognosy and Phytochemical Research 2017; 9(2); 233-241

DOI number: 10.25258/phyto.v9i2.8068

ISSN: 0975-4873

Research Article

Pharmacognostical, Physicochemical and Phytochemical Standardization of *Petiveria alliacea* L.

Sathiyabalan G[1], Paulpriya K[2], Tresina P S[2], Muthukumarasamy S[3], Mohan V R[2]

[1]*Deparment of Pharmacognosy, College of Pharmacy, Madurai Medical College, Madurai, Tamil Nadu.*
[2]*Ethnopharmacology unit, Research Department of Botany, V.O. Chidambaram College, Tuticorin, Tamil Nadu.*
[3]*Department of Botany, Sri K.G.S Arts College, Srivaikundam, Tamil Nadu.*

Received: 5th Jan, 17; Revised: 31st Jan, 17; Accepted: 8th Feb, 16; Available Online: 25th February, 2017

ABSTRACT

There are the vast varieties of medicinal plants in the world with therapeutic properties. With increasing popularity of herbal medicine as a curative measure, the need for correct identification and standardization of the plant is also increased. Present work was performed to study the pharmacognostic and phytochemical characters of whole plant of *Petiveria alliacea*. The whole plant of *Petiveria alliacea* was investigated for its pharmacognostic parameters viz, macroscopic, microscopic, physicochemical attributes, fluorescence analysis and phytochemical screening and the salient diagnostic features were also documented. The preliminary phyochemical screening of methanol and ethanol extracts of *P.alliacea* whole plant revealed the presence of alkaloids, coumarins, flavonoids, saponins, steroids, phenols, tannins, terpenoids, glycosides and xanthoproteins. These studies provided referential information for identification of this crude drug.

Keywords: *Petiveria alliacea*, Microscopic, physicochemical, fluorescence, phytochemical.

INTRODUCTION

Plant based drugs have been used worldwide in traditional medicines for treatment of various diseases. India is the largest producer of medicinal herbs and appropriately called the Botanical garden of the world[1]. Medicinal plants being as an important natural resource and potentially safe drugs can play an important role in assuaging human health by contributing herbal medicines. The high cost of allopathic medicine and their potential side effects, encouraged the people to use the traditional medicine. The increasing demand of plant extracts to be used as cosmetics, foods and pharmaceutical industries suggests that systematic studies of medicinal plants are very important in order to find active compounds and their use as a medicine for curing various diseases[2].

There is a need for documentation of research work carried out on traditional medicines[3] and also it becomes extremely important to make an effort towards standardization of the plant material to be used as medicine. The process of standardization can be achieved by stepwise pharmacognostic studies. Simple pharmacognostic techniques used in standardization of plant material include its morphological, anatomical, physicochemical and phytochemical characteristics[4,5,6]. These studies help in identification and authentication of the plant material. Correct identification and quality assurance of the starting materials is an essential prerequisite to ensure reproducible quality of herbal medicine which will contribute to its safety and efficacy.

Petiveria alliacea L. (Phytolaccaceae) is claimed to have several medicinal properties. It is used in folk medicine to enhance memory and in the treatment of common cold, flu, other viral or bacterial infections, inflammation, diabetes and cancer[7,8,9,10]. Previous work on *P. alliacea* revealed the presence of triterpenoids, saponins, polyphenols, coumarins, benzaldehyde, benzoic acid, flavonoids, fredelinol, pinitol and allantonin, varying their concentrations in the root, stems and leaves[11,12].

There is no record of pharmacognostical work on the whole plant of *Petiveria alliacea*. The objective of the present study is to evaluate various pharmacognostic standards like microscopy, physicochemical constant, fluorescence analysis and qualitative preliminary phytochemical analysis of *Petiveria alliacea*. These findings would be helpful for authentication, purification, quality control and for better use in pharmaceutical herbal formulations.

MATERIALS AND METHODS

The plant specimen (*Petiveria alliacea* L.) for the proposed study were collected from Agasthiarmalai Biosphere Reserve, Western Ghats, and Tamil Nadu. The plant samples were identified with the help of local flora and authenticated by Botanical Survey of India, Southern Circle, Coimbatore, Tamil Nadu, India. A voucher specimen of the collected plant was deposited in the Ethnopharmacological Unit, PG & Research Department of Botany, V.O. Chidambaram College, Thoothukudi District, Tamil Nadu.

**Author for Correspondence: vrmohanvoc@gmail.com*

Macroscopical studies

The macroscopic characters like surface, shape, size, venation, phyllotaxy, length of the petiole, length of the leaf, etc., were noted.

Anatomical Studies

For anatomical studies, the required samples of root, stem and leaf were cut and removed from the plant and immediately fixed in FAA (formalin- 5 ml + acetic acid- 5 ml + 70% Ethyl alcohol- 90 ml). The specimens were left in the preservative for two days; then the materials were washed in water and processed further. Standard microtome techniques were followed for anatomical investigation[13]. Transverse sections of the materials were made. The microtome sections were stained with 0.25% aqueous Toluidine blue (Metachromatic stain) adjusted to pH 4.7[14]. Photomicrographs were taken with NIKON trinocular photo micrographic unit.

Physicochemical and fluorescence analysis

These studies were carried out as per the standard procedures[15]. In the present study, the powered whole plant was treated with various chemical reagents like aqueous 1N sodium hydroxide, alcoholic 1N sodium hydroxide, 1N hydrochloric acid, 50% sulphuric acid, concentrated nitric acid, picric acid, acetic acid, ferric chloride and concentrated HNO_3 + NH_3 These extracts were subjected to fluorescence analysis in day light and UV light (254nm and366nm). Various ash types and extractive values were determined by following standard methods[16].

Preliminary phytochemical analysis

Shade dried and powdered whole plant samples were successively extracted with petroleum ether, benzene, ethyl acetate, methanol and ethanol. The extracts were filtered and concentrated using vacuum distillation. The different extracts were subjected to qualitative tests for the identification of various phytochemical constituents as per the standard procedures[15,17].

RESULTS

Exomorphic Features

Petiveria alliacea is an herbaceous plant, stem cylindrical, erect up to 1 m tall, pubescent to glabrate. Leaves alternate, simple and entire, stipules 2mm; petiole 0.4 – 2 cm; blade ellpitci to oblong or obovate, to 20 x 7 cm, base acute to cuneate, acuminate or acute to obruse or rounded. Leaves and stems with garlic smell. Inflorescences terminal or supra axillary, often drooping distally, 0.8 – 4 dm, peduncle 1- 4cm. Pedicel 0.5 - 2 mm. Flowers are bisexual, zygomorphic, slightly imbricate to rather remote; sepals white or greenish to pinkish, linear – lanceolate to linear – oblong, 3.56 mm; ovary superior. Fruits are narrowly oblong achenes subtended by persistent bracts and perianth, 6-9 mm long, striate with recurved hooks, 1 seed. The roots and leaves have a strong acrid, garlic-like odour which taints the milk and meat of animals that graze on it[18].

Anatomy of Young (Thin) Root

The young root is circular and measures about 750 µm in thickness. It consists of a uniformly thick and continuous superficial periderm, a narrow homogeneous cortical zone and a wide, thick and circular vascular cylinder measuring about 600 µm in thickness (Plate – 1b). The periderm is fissured and irregular on the outer surface and the remaining periderm zone has 5 to 9 layers of tubular, suberized phellem cells. The cortical zone consists of 3 or 4 layers of wide, angular parenchyma cells which possess dense starch grains (Plate – Ic,f).

The secondary phloem looks like a narrow cylinder consisting of sieve elements and phloem parenchyma cells. The secondary xylem cylinder includes regular radial lines of vessels and fibres deviating from the centre. The vessels are sparse, either solitary or less frequently short radial multiples. The vessel elements are up to 25 µm wide. The xylem fibres are also very thick walled, lignified and have wide lumen. The xylem fibres are densely filled with starch grains (Plate - If).

Anatomy of Old (Thick) Root

The old root is measured about 1.9 mm thick. It is circular in outline and has a fairly well defined superficial, continuous periderm, a narrow cortex, a circular, discrete segment of outer vascular cylinder and a compact central vascular cylinder (Plate - Id). The periderm has 4 or 5 layers of thin and tubular cells. The cortex is narrow and is made up of 3 or 4 layers of thin walled parenchyma cells which are arranged compactly. The central vascular cylinder has radially oriented discontinuous, solitary vessels and radial layers of thick walled fibres (Plate – I d, e). The vessels are 30 µm in diameter.

The secondary phloem of the central vascular cylinder occurs along the outer circumference of central xylem cylinder. The phloem elements are narrow and polygonal in outline and include sieve elements and phloem parenchyma cells. The secondary xylem segments of the central vascular cylinder have radial files of lignified fibres and sparsely distributed vessels. The outer secondary xylem cylinder consists of wide and discrete secondary xylem segments with associated secondary phloem. The secondary phloem of the outer vascular cylinder occurs on the outer edge of each secondary xylem segment. The secondary phloem exhibits cambial derivatives of sieve elements and parenchyma cells. The ground tissue of the root contains a large accumulation of starch grains (Plate - If).

Crystals of The Root

Calcium oxalate crystals of prismatic type are sparsely distributed both in the xylem rays and in xylem parenchyma. The crystals differ in size; some of them are large and squarish and the others are small and irregular in shape. The xylem fibres are densely filled with numerous starch grains (Plate - If).

Anatomy of Stem

The stem is more or less circular in outline and measures 1.9 mm in diameter (Plate – II a). The stem consists of a continuous and distinct epidermal layer of circular thickly cutinized cells. The cortex is wide and it is differentiated into an outer cortex and an inner cortex. The outer cortex is made up of a few layers of collenchyma and the inner cortex is parenchymatous. There is a more or less continuous, thick and thin alternating portion of

sclerenchyma cylinders (Plate –II b, c, d). The sclerenchyma cylinders consist of highly thick walled and lignified cells with narrow lumen.

The vascular cylinder consists of an outer thin continuous cylinder of secondary phloem, an inner cylinder of secondary xylem and large parenchymatous pith (Plate – II c). The secondary phloem elements consist of narrow, angular and thin walled sieve elements and phloem parenchyma cells. The phloem rays are slightly dilated and consist of a single row of cells. The secondary xylem cylinder is circular with different thick and thin regions. The thick portion has solitary or short radial multiples of wide, circular or elliptical thick walled vessels and highly thick walled lignified fibres with wide lumen. The xylem vessels are up to 20 µm in diameter.

Anatomy of Petiole

In cross sectional view, the petiole appears shield shaped with shallow and wide adaxial concavity. It is 1.35 mm thick and 1.5 mm wide. Calcium oxalate crystals are fairly common in the ground tissue of the petiole. The crystals are prismatic type. The crystals are sparse in distribution and are located in singles with the ground parenchyma cells (Plate – II d).

The epidermal layer of the petiole is thin and continuous and it is undulate in outline. The epidermal cells are small, squarish and fairly thick walled. The ground tissue of the petiole consists of an outer thick zone of sclerenchyma cells and an inner zone of compact thin walled parenchyma cells. The central ground tissue is also parenchymatous (Plate – II f).

The vascular system consists of necklace shaped, deep and wide outline of about eight discrete vascular bundles. The vascular bundles are top shaped and collateral. They have circular, thick walled and diffuse cluster of vessels with an outer zone of phloem elements. The median vascular bundle is larger and the bundles become gradually reduced in size towards the lateral wing (Plate – II e, f).

Anatomy of The Leaf

The leaf has a thick and broad midrib and thin lamina (Plate – III a). The midrib is 1.2 mm thick and about 1 mm wide. It includes ground tissue and wide and deep bowl shaped vascular strand with incurved end margins (Plate – III a, b). The epidermal layer of the midrib is thin and continuous. The cuticle is thin. The ground tissue is homogeneous comprising of a circular or angular, less compact or compact parenchyma cells.

The vascular strand is bowl shaped with a wide opening. The marginal part of the bowl is incurved. The vascular strand is wavy with shallow ridges. There are five collateral wedge shaped vascular bundles; a thin continuous sclerenchyma line runs all along the outer part of the bowl shaped vascular strand. The vascular bundle has a wide cluster of circular, thick walled xylem elements. The phloem occurs in thin arcs along the outer boundary of the xylem masses.

Lamina

The lamina is dorsiventral, with smooth and even surfaces. It is 90 µm thick. The adaxial epidermis and abaxial epidermis are equally thick. The epidermal cells are cylindrical with thick walls. The mesophyll tissue includes an adaxial band of single row of compact and cylindrical cells and four or five layers of spherical and lobed spongy parenchyma cell (Plate III b).

Leaf Margin

The marginal part of the lamina is blunt and semi-circular. The epidermal cells along the leaf margin are much dilated into circular cells with thick cuticle. The marginal part measures 80 µm in thickness. The mesophyll tissue is undifferentiated into palisade and spongy tissues. Only a compact mass of circular thick walled cells is seen in the marginal part (Plate – III b, d).

Epidermal Cells and Stomata

The epidermal cells appear smaller in the surface view of the paradermal section of the lamina. They have thin and highly wavy anticlinal walls. The stomata are dense and diffuse. The stomata are paracytic type with two lateral subsidiary cells. One of the subsidiary cells may be smaller than the other. The guard cells are nearly circular in outline measuring 12 x 12 µm in size (Plate – III e). The stomatal aperture is elongated and with parallel ridges.

Venation of The Lamina

The lateral veins are fairly thick and straight. The vein-lets are thin and form wide rectangular or polyhedral vein-islets. The vein terminations are fairly well developed. The vein terminations are either unbranched or branched once or twice. The terminations are thin, slender and curved (Plate – III f, 8).

Crystals

Long and scale like calcium oxalate crystals are abundant in the lamina. They are of styloid type. The central part is broad and the terminal part is tapering. The styloids are random in distribution and are 200 to 250 µm long and 10 µm thick (Plate – III e,d).

Powder Microscopy

The powdered preparation of the sample includes vessel elements, fibres and parenchyma cells (Plate – IV a).

Vessel elements

The vessel elements are mostly narrow, long and cylindrical. The vessel elements have thick or thin long tapering tails (Plate – IV a, b, c, d). There are also vessel elements without tails. The perforation is mostly elliptical and oblique (Plate – IV b,d). The lateral wall pits are circular, multiseriate and prominent. The vessel elements are 180 to 220 µm long and up to 20 µm wide.

Fibres

The fibres either narrow type or wide type. The narrow fibres have reduced lumen and thick walls. They are 350 µm long and 10 µm thick.The wide fibres are comparatively thin walled with wide lumen. The wide fibres have some amorphous inclusions and they are nearly 300 µm long and 20 µm wide (Plate – IV g).

Parenchyma

The parenchyma cells are squarish or rectangular in outline. They are thin walled and they are seen in large masses. The protoplast and nucleus are dense in parenchyma cells (Plate – IVh).

Powder Analysis of the Whole Plant

Physicochemical constant

Table 1a: Ash values of the powdered whole plant of *P. alliacea**.

S.No.	Type of Ash	% of Ash values
1.	Total ash value of powder	10.86 ± 0.11
2.	Water soluble ash	3.64 ± 0.04
3.	Acid insoluble ash	3.16 ± 0.03
4.	Sulphated ash	11.02 ± 0.07

Table 1b: Extractive values of the powdered whole plant of *P. alliacea**.

S.No.	Nature of the Extract	% of extractive values
1.	Petroleum ether	5.68 ± 0.04
2.	Benzene	6.06 ± 0.02
3.	Chloroform	6.24 ± 0.02
4.	Acetone	6.68 ± 0.03
5.	Methanol	9.08 ± 0.04
6.	Ethanol	8.86 ± 0.04
7.	Water	7.96 ± 0.03

* All values are mean of triplicate determination

The physicochemical parameters like ash and extractive values, fluorescence analysis of whole plant of *P. alliacea* were determined. Preliminary phytochemical screening was also performed and results are presented below.

The powdered whole plant of *P. alliacea* was investigated for physicochemical constants like total ash value, water soluble ash, acid insoluble ash, sulphated ash and extractive values (Table 1 a & 1b). The total ash content of the powdered whole plant of *P. alliacea* is 10.86%. The extractive value of methanol is more than the solvents investigated in the present study.

Fluorescence Analysis

The results of fluorescent analysis of whole plant of *P. alliacea* are shown in Table 2. The powder from the whole plant of *P. alliacea* emitted pale green under day light, green under short and dark green under long UV light. The whole plant powder shows the characteristic fluorescent green colour when treated with 1NHCl, Conc. HCl, Conc. H_2SO_4, 50% H_2SO_4, Conc.HNO_3 +NH_3, 50%HNO_3, petroleum ether and acetone.

Preliminary Phytochemical Screening

Petroleum ether, benzene, chloroform, methanol and ethanol extracts of whole plant of *P. alliacea were* qualitatively analysed for the presence of different phytoconstituents and the results are presented in Table 3. The methanol and ethanol extracts of whole plant of *P. alliacea* shows the presence of alkaloid, anthraquinone, catechin, flavonoid, phenol, quinone, saponin, steroid, tannin, sugar, glycoside and xanthoprotein.

DISCUSSION

In recent years, there has been an emphasis in standardization of medicinal plants of therapeutic potential. Despite the modern techniques, identification and evaluation of plant drugs by pharmacognostical study is still more reliable, accurate and inexpensive. According to the World Health Organization[19], the macroscopic and microscopic description of a medicinal plant is the first step towards establishing the identity and the degree of purity of such materials and should be carried out before any tests are undertaken.

As a part of authentification of the sample, the macroscopical, microscopical, physicochemical and phytochemical examination of whole plant of *P.alliacea* was studied. Pharmacognostical evaluation of different parameters is the vital etiquette for standardization of herbs.

Salient Diagnostic Features

Young root exhibits a fairly thick superficial periderm, a wide, starch filled cortex and a circular, dense secondary xylem with thin layer of phloem. The old root has a central, wide and circular secondary xylem and secondary phloem and an outer circle of several discrete, thick

Table 2: Fluorescence analysis of the powdered whole plant of *P.alliacea.*

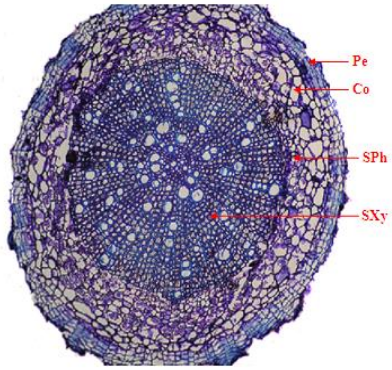
Treatment	Under Day Light	Under UV light	
		245 nm	365 nm
Powder as such	Pale green	green	Dark green
Powder + 1N Aqueous NaOH	Yellowish green	Greenish yellow	Dark green
Powder + 1N Alcoholic NaOH	Yellowish green	Greenish yellow	Dark green
Powder + 1N HCL	Green	Fluorescent green	Brown
Powder + Conc. HCL	Light green	Fluorescent green	Dark green
Powder + Conc. H_2SO_4	Green	Fluorescent green	Dark green
Powder + 50% H_2SO_4	Green	Fluorescent green	Black green
Powder + Con.HNO_3	Light green	Green	Dark green
Powder + 40% NaOH + 10% Lead Acetate	Pale green	Dark green	Dark green
Powder + Acetic acid	Green	Light green	Dark green
Powder + Ferric Chloride	Dark green	Dark green	Dark green
Powder + Chloroform	Yellowish green	Yellowish green	Brown
Powder + Benzene	Green	Pale yellow	Dark green
Powder + Petroleum ether	Green	Fluorescent green	Dark green
Powder + Methanol	Yellowish green	Pale Yellow	Dark green
Powder + Ethanol	Yellowish green	Green	Dark green
Powder + acetone	Dark green	Fluorescent green	Brown
Powder + HNO_3 + NH_3	Green	Yellowish green	Dark brown
Powder + 50% HNO_3	Yellowish green	Fluorescent green	Dark brown

Table 3: Preliminary phytochemical screening of powdered whole plant of *P.alliacea.*

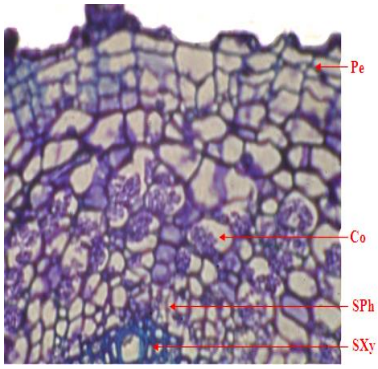
Tests	Petroleum Ether	Benzene	Ethyl acetate	Methanol	Ethanol
Alkaloid	-	-	+	+	+
Anthraquinone	-	-	+	+	+
Catechin	+	+	-	+	+
Coumarin	-	+	-	-	-
Flavonoid	-	-	+	+	+
Phenol	+	+	+	+	+
Quinone	+	+	+	+	+
Saponin	-	-	-	+	+
Steroids	+	-	-	+	+
Tannin	-	+	+	+	+
Terpenoids	+	+	+	-	-
Sugar	-	-	+	+	+
Glucoside	-	-	+	+	+
Xanthoprotein	+	+	+	+	+
Fixed oil	+	-	-	-	+

+ Present - Absent

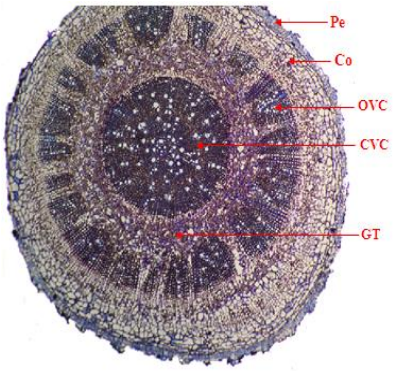
a. T.S. of Root



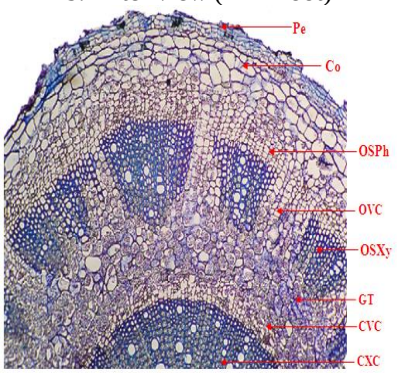
b. Enter view (Thin root)



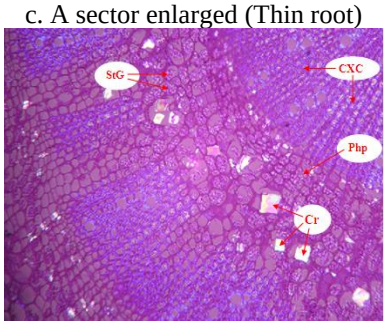
c. A sector enlarged (Thin root)



d. Enter view (Thick root)



e. A sector enlarged (Thick root)



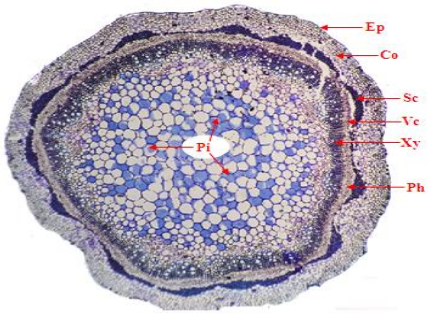
f. T.S. of thick root showing prismatic crystals and starch

(Pe – Periderm, Co – Cortex, SPh – Secondary phloem, SXy – Secondary xylem, OVC – Outer vascular cylinder, CVC – Central vascular cylinder, GT – Ground Tissue, OSXy – Outer secondary xylem, OSPh – Outer secondary phloem, CXC – Central xylem cylinder, ISPh – Inner secondary phloem, XF – Xylem fibre, Ve – Vessels, StG – Starch Grains, Cr – Crystals, Php – Phloem parenchyma)

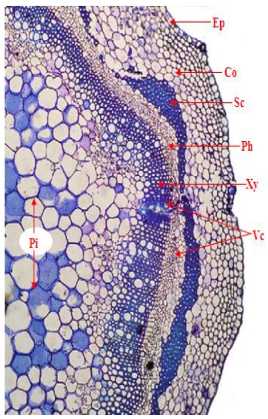
Plate 1: Anatomical Features of *Petiveria alliacea.*

segments of secondary xylem and phloem. The presence of successive cylinder of vascular tissues is an anomalous (unusual) feature. The stem is roughly circular in outline with discontinuous, thick arcs of sclerenchyma cells forming a ring, a prominent layer of phloem cylinder and a thin cylinder of xylem enclosing parenchymatous pith. Xylem elements include wide and narrow circular thick walled vessels and thick and lignified fibres. Calcium oxalate druses are fairly common in the ground parenchyma cells of the stem. The petiole is shield shaped with flat adaxial side. The vascular system is similar to that of the midrib. It consists of about nine collateral,

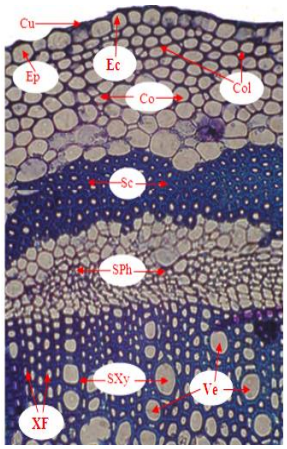
T.S. of Stem



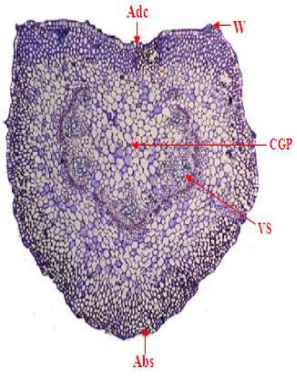
a. Entire view



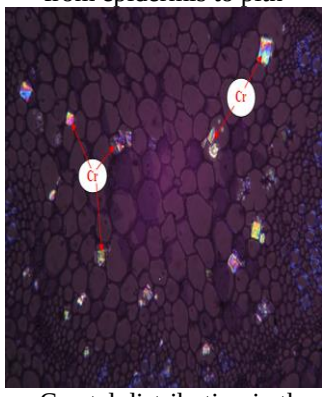
b. A sector enlarged showing distribution of various tissues from epidermis to pith



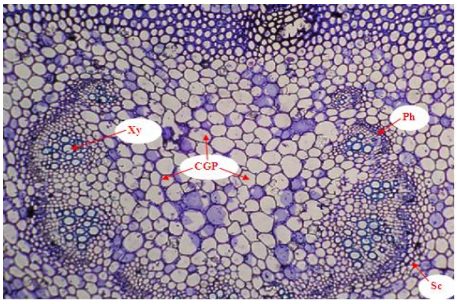
c. A sector enlarged showing, cortex, secondary phloem and secondary xylem



d. Entire view (Petiole)



e. Crystal distribution in the ground tissue of petiole



f. Vascular strands of the petiole enlarged

(Ep - Epidermis, Co – Cortex, Sc – Sclerenchyma, Vc – Vascular cylinder, Ph – Phloem, Xy – Xylem, Pi – Pith, Ec – Epidermal cell, Cu – Cuticle, Col – Collenchyma, SPh – Secondary phloem, SXy – Secondary xylem, Ve – Vessel, XF – Xylem fibre, Abs – Abaxial side, Adc – Adaxial cone, CGP – Central ground parenchyma, VS – Vascular Strands, W – Wing, Cr – Crystals

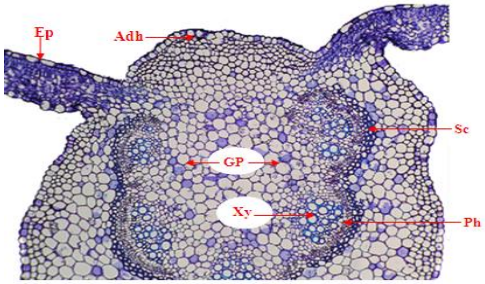
Plate 2: Anatomical Features of *Petiveria alliacea.*

discrete vascular bundles with urn shaped sclerenchyma layer bearing vascular bundles. The leaf has a thick and wide abaxial midrib which is pendent on the lower side of the lamina. The adaxial part of the midrib is wide and short with a hump measuring about 1.2 mm thick. The ground tissue of the midrib exhibits five wedge shaped collateral vascular bundles. Of the five vascular bundles one bundle median abaxial position, two bundles occupy lateral position and the remaining two occupy adaxial lateral position. The bundles are enclosed within deep, bowl shaped and undulate sclerenchyma layer. The lamina is smooth and even, measuring about 90 µm thick and possesses an adaxial, single horizontal row of columnar palisade cells and an abaxial zone of small, circular and less compact spongy parenchyma. Long, flat and conical scale like calcium oxalate styloid type crystals are common in the mesophyll tissue. The leaf margin has thicker epidermal cells and undifferentiated compact parenchyma cells. The epidermal cells of the lamina are small, thin walled and have highly wavy anticlinal walls. Stomata are of paracytic type with two unequal subsidiary cells which lie parallel to the lateral side of the guard cells. The stomata are circular in outline. Venation of the lamina is reticulate with wide rectangular vein islets which are either simple or dendroid type. Powdered preparation of the plant sample exhibits narrow and wide fibres; long, narrow cylindrical vessel elements with oblique circular perforations and with prominent circular lateral pits and clustered parenchyma cells with prominent nucleus.

Microscopical evaluation is the simplest and reliable tool for correct identification of herbs as well as small fragment of crude drugs or powdered drugs and determination of adultrants and substituents.

Physicochemical parameters are important for qualitative standards and useful in determining authenticity and purity of crude drugs. Ash determination is helpful to judge the uniqueness and the cleanliness of the crude material. Water soluble ash in the measure of physiological inorganic components of the crude drug. Elevated water soluble content probably because of hard water supply which has excess high mineral contents[20,21]. Acid insoluble ash gives an idea about the non-physiological ash produced due to the adherence of

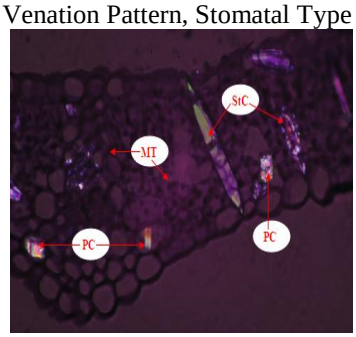
T.S. of Leaf



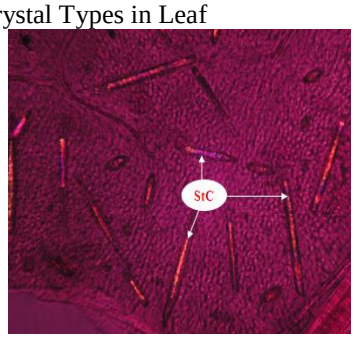
a. T.S. of midrib enlarged

b. T.S. of leaf margin

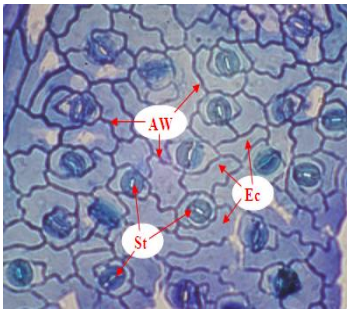
Venation Pattern, Stomatal Type and Crystal Types in Leaf



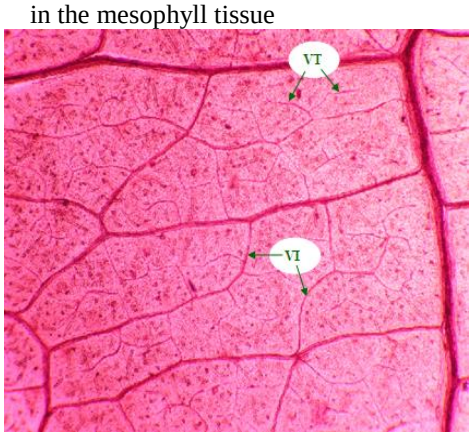
c. Calcium oxalate crystals found in the mesophyll tissue



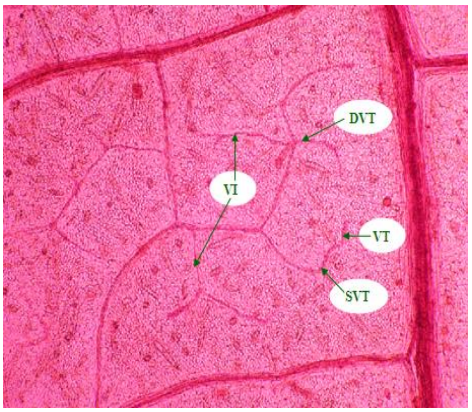
d. Distribution of styloid crystals in the mesophyll tissue



e. Abaxial epidermis showing stomata



f. Venation pattern of the lamina



g. Vein islets and vein terminations

(Adh – Adaxial hump, Abs – Abaxial side, Ep – Epidermis, Gp – Ground parenchyma, La – Lamina, MR – Midrib, VS – Vascular Strand, Ph – Phloem, Xy – Xylem, Sc – Sclerenchyma, AdE – Adaxial Epidermis, AbE – Abaxial Epidermis, Ec – Epidermal cell, PM – Palisade tissue, SM – Spongy mesophyll, St – Stomata, LM – Leaf margin, MT – Mesophyll tissue, PC – Prismatic crystal, StC – Styloid crystal, MT – Mesophyll tissue, AW – Anticlinal wall, VI – Vein islet, VT – Vein termination, DVT – Dendroid vein termination, SVT – Simple vein termination)

Plate 3: Anatomical Features of *Petiveria alliacea*.

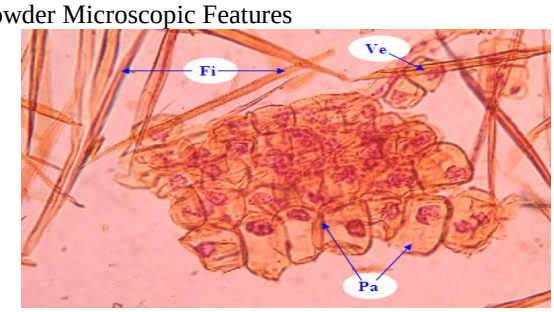
inorganic dirt, dust to the crude drug. Increased acid insoluble ash means adulteration due to dirt, soil or sand[22]. Extractive values are useful for the determination of exhausted or adulterated drugs. It gives an idea about the nature of the chemical constituents present in the crude drug.

Fluorescence study is an important parameter for the standardization of crude drugs. Many drugs fluoresce when their powder is exposed to ultraviolet radiation. It is important to observe to all materials on reaction with different chemical reagents under UV light.

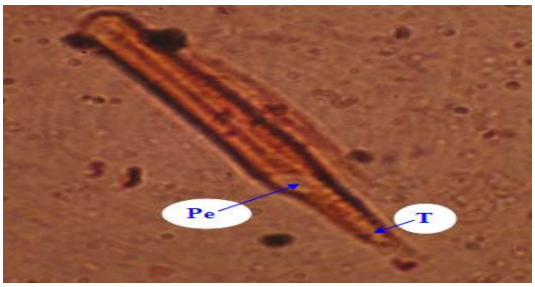
The phytochemical screening of the whole plant of *P.alliacea* showed the presence of alkaloids, coumarins, flavonoids, saponins, steroids, phenols, tannins, terpenoids, glycosides and xanthoproteins. The presence of these phytochemicals in the whole plant of *P.alliacea* confer them for their medicinal value[23]. The pharmaceutical and therapeutic potentials of plants and their products are as a result of the presence of these phytochemicals in them[24].

Evaluation of crude drug involves the determination of identity, purity and quality. Purity is the absence of extraneous matter, while the amount of active constituents present in the crude drug is referred to as quality. Macroscopic and microscopic evaluation is an important parameter in accessing the identity of herbal raw material. At the same time, qualitative screening of secondary metabolites focuses on quality of raw material. Moreover, therapeutic potential of plant is solely dependent on the nature and amount of phytoconstituents

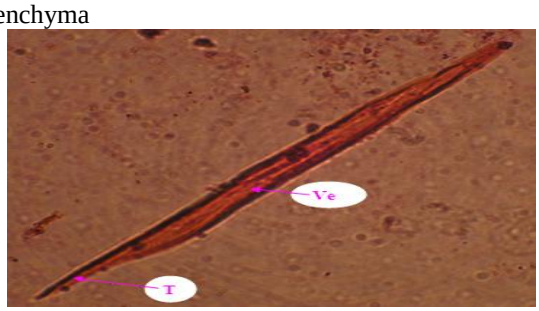
Powder Microscopic Features



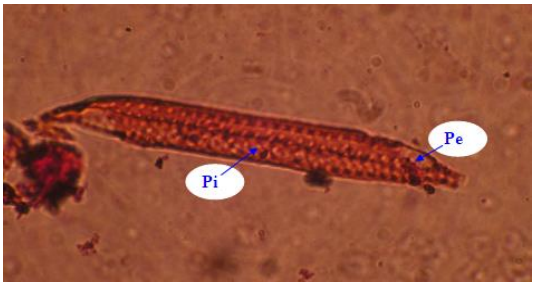
a. Powder showing vessel elements, fibres and parenchyma



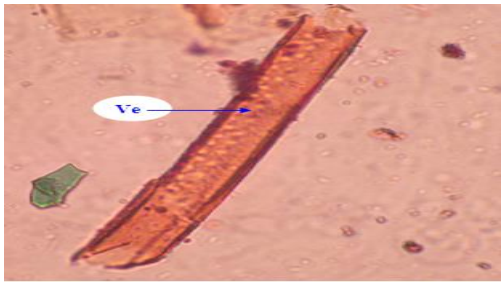
b. Vessel element with oblique end wall perforation



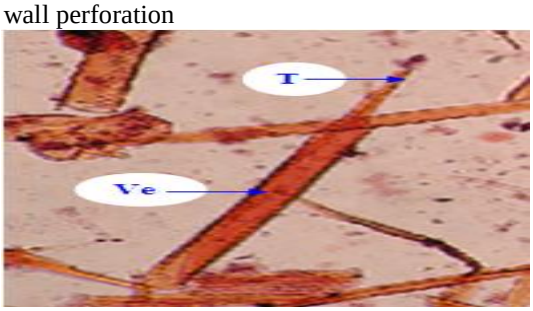
c. Vessel element with long thick



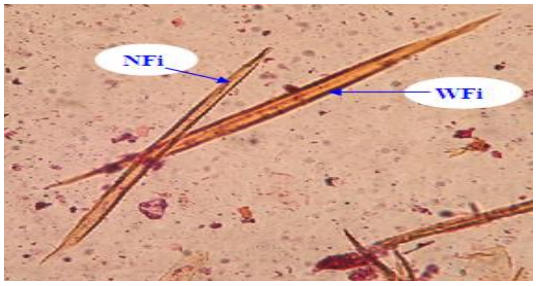
d. Vessel element with dense bordered pits and oblique end wall perforation



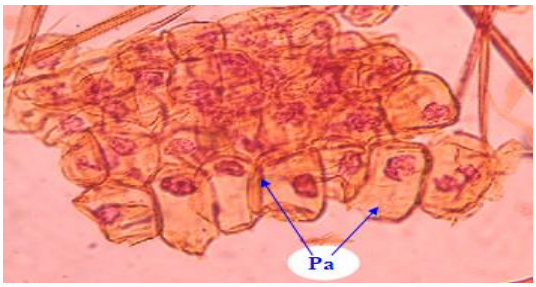
e. A fairly wide tail-less vessel element



f. A narrow long tailed vessel element with long thick tail



g. A wide fibre and a narrow fibre



h. A mass of parenchyma with darkly stained prominent protoplast

(Fi – Fibre, Ve – Vessel element, Pa – Parenchyma, Pe - Perforation, Pi – Pits, T – Tail, NFi – Narrow fibre, WFi – Wide fibre)

Plate 4: Anatomical Features of *Petiveria alliacea*.

in them. Hence, accessing the quality of herbal raw material in terms of their chemical composition becomes very imperative. To conclude, various macroscopic, microscopic, physical and phytochemical aspects/ parameters listed here for *P. alliacea* in the present work can be used with respect to its identification, authentication and standardization.

REFERENCE

1. Ahmedulla M, Nayer MP. Red data book of Indian plants. Volume- 4. Calcutta: Botanical survey of India. 1999.
2. Tewari D, Pandey HK, Saha AN, Meena HS, Manchandab A. Pharmacognostical and biochemical investigation of *Ocimum kilimandscharicum* plants available in western Himalayan region. *Asian J. Plant Sci. Res*. 2012; 2: 446-451.
3. Dahanukar SA, Kulkarni RA, Rege NN. Pharmacology of medicinal plants and natural products. *Indian J. Pharmacol*. 2000; 32: 81-118.

4. Anonymous. Macroscopic and microscopic examination.Quality control methods for medicinal plant materials, WHO. Geneva. 1998.
5. Karthiyayini R, Nithiya. Pharmacognostic and preliminary phytochemical studies of *Celosia argentea* L. leaf. *Int. J. Pharmacog. Phytochem. Res.* 2015; 7: 237-239.
6. Pingale R, Pokharkar D, Phadatare SP, Gorle A. Pharmacognistic evaluation of *Parkia biglandulosa* bark. *Int.J. Pharmacog. Phytochem. Res.* 2016; 8: 1160-1163.
7. Williams L, Rosner H, Levy H, Barton E. A critical review of the therapeutic potential of dibenzyl trisulphide isolated from *Petiveria alliacea* L (Guinea hen weed, anamu). *West Indian Med J*. 2007; 56: 17-21.
8. Kim S, Kubec R, Musah RA. Antibacterial and antifungal activity of sulfur-containing compounds from *Petiveria alliacea* L. *J. Ethnopharm*. 2006; 104:188-92.
9. Lopes-Martins R, Pegoraro D, Woisky R. The anti-Inflammatory and analgesic effects of a crude extract of *Petiveria alliacea* L. (Phytolaccaceae). *Phytomed*. 2002; 9: 245-248.
10. Gomes PB, Oliveira MMdS, Nogueira CRA, et al. Study of antinociceptive effect of isolated fractions from *Petiveria alliacea* L.(tipi) in mice. *Biol Pharm Bull*. 2005; 28: 42-46.
11. Kubec R, Kim S, Musah RA. S-Substituted cysteine derivatives and thiosulfinate formation in *Petivera alliacea* – Part II. *Phytochem*. 2002; 61: 675- 680.
12. Kim S, Kubec R, Musah RA. The lachrymatory principle of *Petiveria alliacea Phytochem*. 2003; 63: 37-40.
13. Johanson DA. Plant Microtechnique, 1st edition. McGraw Hill Book Co. Inc., New York & London. 1940; Pp 104 – 106.
14. O'Brien TP, Feder N, McGull. ME,. Polychromatic staining of plant cell walls by toluidine blue – O. *Protoplas.* 1964; 59: 368 – 373.
15. Lala PK. Lab manuals of Pharmacognosy CSI publications and Distributers, Kolkatta. 1993.
16. Anonymous. India pharmacopoea vol. I & II. Government of India, Ministry of Health and Family Welfare. The controller of Publications. Civil Lines, Delhi – 110054. 1996.
17. Brinda, P., Sasikala, P. and Purushothaman, K.K.. Pharmacognostic studies on *Murugan Kizhangu. Bull-Med. Ethnobot. Res*. 1981; 3: 84 – 96.
18. Johnson L, *Anamu: Petiveria alliacea*. 14 pages (paperback). *Woodland Publishing*. 1999; ISBN 1-58054-038-4 (In Spanish).
19. World health organization. Quality control methods for medicinal plant materials. (1998) Geneva, pp: 29.
20. Vadivu R, Krithika A, Biphab C, Dedeopya, P, Shoeb, Lakshmi KS. Evaluation of hepatoprotective activity of the fruits of *Coccinia grandis* Linn. *Int. J. Health Res.* 2008; 3: 163-168.
21. Pimple BP, Patel AN, Kadam P V, Patil. MJ. Microscopic evaluation and physicochemical analysis of *Origanum majorana* Linn leaves. *Asian Pac. J. Trop. Dis*. 2012; 2: 897-903.
22. Mukherjee PK, Quality control of herbal drugs an approach to evaluation of botanicals. Ist ed. Bussiness Horizons Pharmaceutical Puplishers. New Delhi. India. 2008; 379-412.
23. Edeoga HO, Okwu DE, Mbaebie BO. Phytochemical contituents of some Nigerian medicinal plants. *Afr. J.Biot.* 2005; 4: 685-688.
24. Bishnu JU, Sunil L, Anuja S.Antibacterial properties of different medicinal plants. *Ocimum sanctum, Cinnamomum zeylanicum, Xanthoxylim arimattum* and *Origanum masorana Kath: Uni. J. Sci. Eng. Tech.* 2009; 5: 143-150.