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Pharmacognostic studies on *Plectranthus amboinicus* Lour

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ABSTRACT

Plectranthus amboinicus Lour. (Lamiaceae) has got high reputation in traditional medicinal practice for its remarkable medicinal properties. The entire plant, especially the leaves are recognized as valuable drugs and frequently used by many ancient physicians. The present paper highlights the exomorphology and histomorphology of leaf, petiole, stem, root and phytochemical study of the whole plant. These observations will enable to standardize the botanical identity of the drug in crude form.

Keywords: Laminaceae, *Prectranthus amboinicus* lour, Pharmacognosy.

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INTRODUCTION

Plectranthus amboinicus Lour. (Lamiaceae) known as country borage, Indian borage in English and Patta ajrayin, Patharcur in Hindi. Leaves roots and stems are used as carminative, digestive, stomachic, anthelmintic, espectorant, diuretic, otalgia, anorexia, diarrhea and cholera especially in children, convulsions epilepsy, chronic asthma, bronchitis, renal and vesical calculi and malarial fever [1-4]. Earlier workers reported oleanolic acid, betulin and other triterpenoids from leaf extracts [5]. The plant yielded during the present investigation barbatusol and β sitosterol [6].

MATERIALS AND METHODS

The plant *Plectranthus amboinicus* Lour, was collected from the surroundings of Tirunelveli district of Tamilnadu state, India. The plant was identified and authenticated by the botanist, Dr.P.Jeyaraman, Plant Anatomy Research center, Medicinal Plant research unit, Chennai. The voucher specimens were preserved for future reference.

The paraffin embedded specimens were sectioned with the help of rotary microtome. Dewaxing of the sections was done by customary procedure [7]. The sections were stained with toluidine blue [8] and also stained with safranin fast green and iodine in potassium iodide. The diagnostic characters of the structure were studied [9] and photographs were taken with NIKON labhot-2 microscope. Histochemical studies were carried out to localize the cemical compounds in the tissue using specific stains [10]. Quantitative microscopic characters such as stomatal number, stomatal index, palisade ratio, vein islet number and vain termination number of leaf were studied. The preliminary phytochemical studies like powder analysis, physico chemical constants, fluorescence analysis and preliminary qualitative phytochemical analysis with extracts were carried out [11-14].

RESULTS AND DISCUSSION

Exomorphology

Plectranthus amboinicus is a large succulent perrenial herb (Fig. 1). The leaves are fleshy, soft and densely tomentose, opposite, ovate, cordiform; margins are crenulate-serrate; Petiole prominent. The flowers are shortly pedicelled, in dense whorls at distinct intervals in a long slender raceme; fruits orbicular or ovoid, nutlets, smooth.

Microscopic Features

The microscopic features of the plant are specific and highly characteristic. It has some anatomical features common to Lamiaceae such as angular cross-sectional outline of the stem, discrete masses of collenchyma along the periphery of the stem, presence of glandular and non glandular trichomes, simple vascular system of the midrib and petiole, diacytic type of stomata and normal type of secondary growth in the stem and root. Among these features, there are some characters that are specific for *Plectranthus amboinicus.* The

mid-rib has a single prominent vascular bundle (Fig.2.1,2), while the petiole has abaxial band of larger bundles and adaxial band of smaller bundles (Fig.3.1-3). No sclerenchyma elements are associated with the vascular bundles. The stem has a continuous, uniformly distributed periderm tissue (Fig. 4); there are small groups of sclerenchyma on the outer boundary of the phloem in the stem. The root has diffusely distributed, wide, angular thin walled vessels and thin walled ground tissue of xylem parenchyma (Fig. 5.1-3).

Powder Microscopy

The elements of the powder of the plant show some specific features of diagnostic values. The vessel-elements of the stem are long, narrow and cylindrical with simple oblique perforation plate (Fig.6.1,2) . The root powder shows short, wide, tailed vessel elements (Fig.7.1,2). The xylem fibres are either narrow and nonseptate or wide and septate (Fig.7.1,2).

Histochemistry or cytochemistry

Is another technique to localize the chemical compounds in the tissue due to colour reactions of the compound with specific stains. The technique helps not only to find out the nature of the compound but also to locate them in the plant tissues. In Plectranthus amboinicus, protein stained with coomassie brillient blue appear in dark blue in the mesophyll tissue. Protein was also found in the basal cells of the epidermal trichomes, and phloem parenchyma of the stem (Fig. 8.1-3).

Polyphenols are specifically stained by toludine blue - O. They were localized in the leaf epidermis, and in the petiole they occur in the epidermis and in the ground tissue (Fig. 9.1-3).

Starch was found abundant in the xylem fibres (stained with iodine in potassium iodide).

Lipids are stained by **sudan**. Lipids were found in the trichomes and in the phloem parenchyma (Fig. 10.1,2).

Leaf Constant characters include measurement of cells and frequency or density of certain specialized cells like stomata (Fig. 11.1,2). It is useful to segregate different species of the same genus. The quantitative microscopic characters include stomatal number stomatal index, palisade ratio, veinislet number and vein termination number. These values are constant for a species. The values are given in table: 1 for *Plectranthus amboinicus* Lour.

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Fig. 1: *Plectranthus amboinicus* Lour.

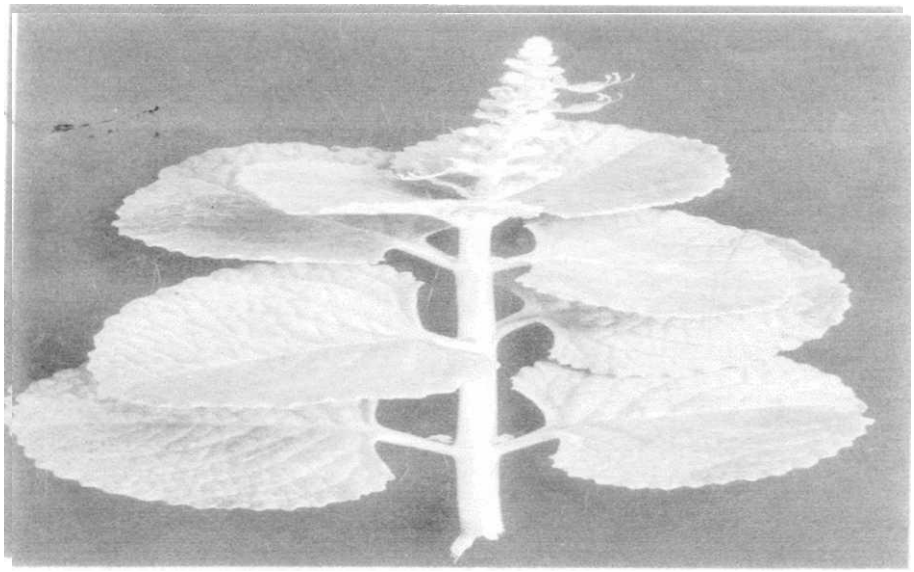

Fig. 1 : A flowering shoot

Fig.2.1,2 *Plectranthus amboinicus* Lour.

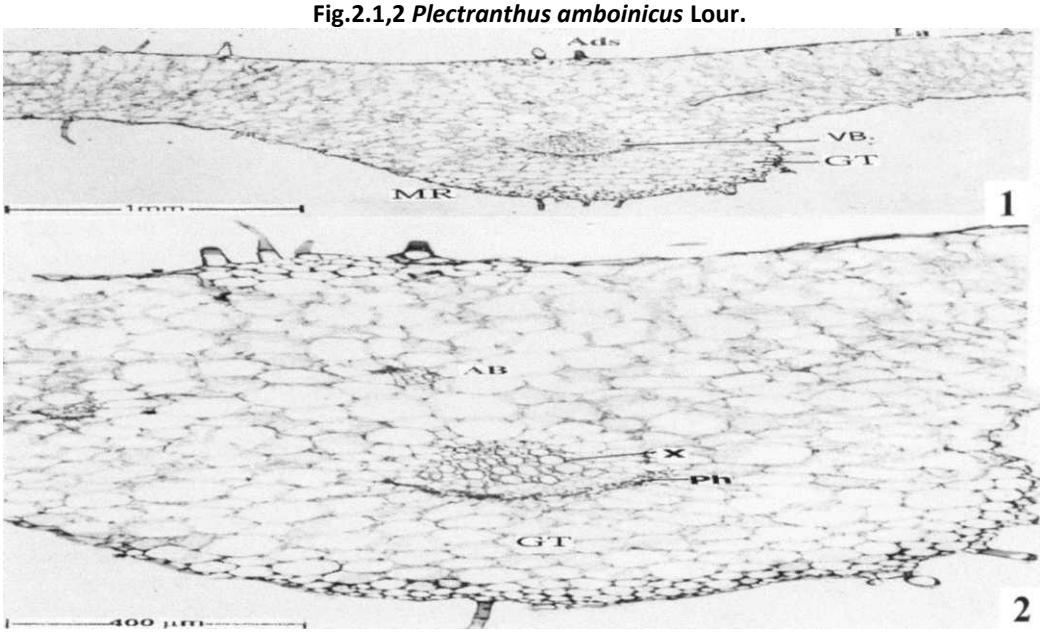

Fig. 2 : Anatomy of the leaf

1. T.S of leaf through midrib with lamina.
2. T.S of midrib - enlarged.
   [AB - Abaxial bundle; Ads - Adaxial aside; GT-Ground tissue; la-lamina; MR - Midrib; Ph - Phloem; VB - Vascular bundle; X - Xylem].

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Fig. 3.1-3 *Plectranthus amboinicus* Lour.

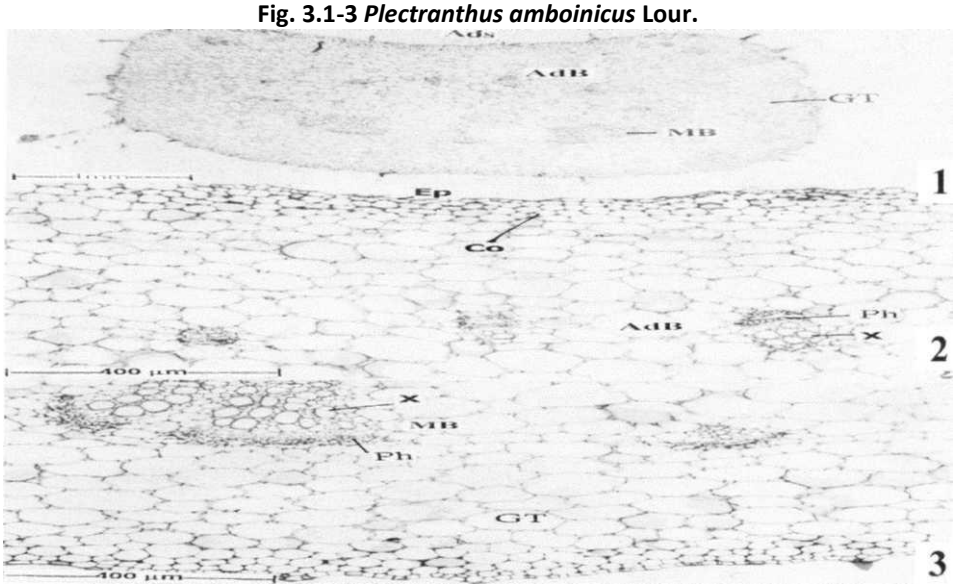

Fig. 3: Anatomy of the petiole

1. T.S of petiole entire view.
2. T.S of petiole a portion enlarged.
   [Ads - Adaxial bundle; Ads - Adaxial side; co-collenchyma;
   GT-Ground tissue; MB - Median bundle; Ph - Phloem; X - Xylem].

Fig. 4: *Plectranthus amboinicus* Lour.

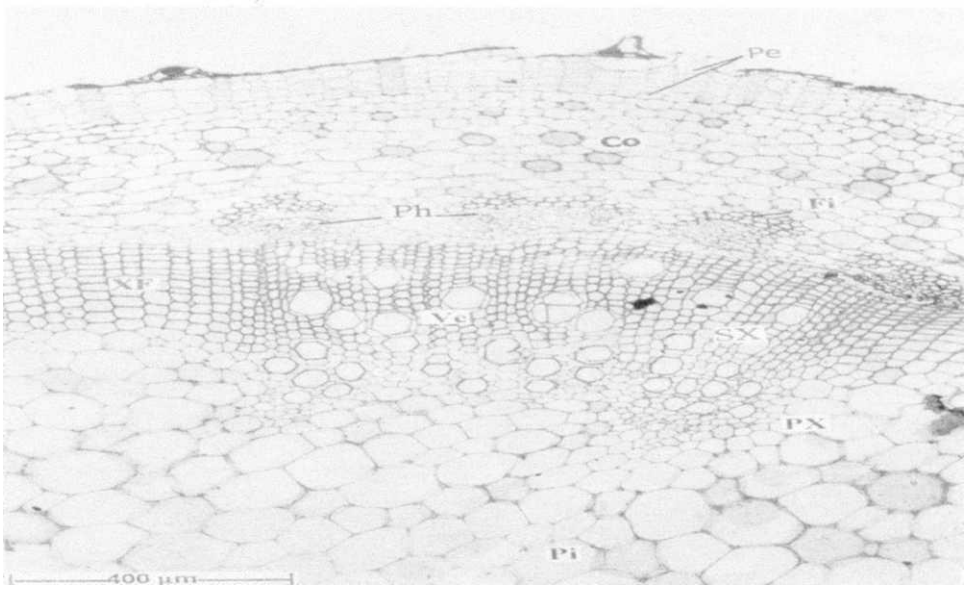

Fig. 4 : T.S of stem - a sector enlarged

[Co-cortex; Fi - Fibres; Ph - phloem, Pi - pith; Px - Primary xylem;
Sx - Secondary xylem; Ve - Vessel; Xf- xylem fibres]

Fig.417.1-3 *Plectranthus amboinicus* Lour.

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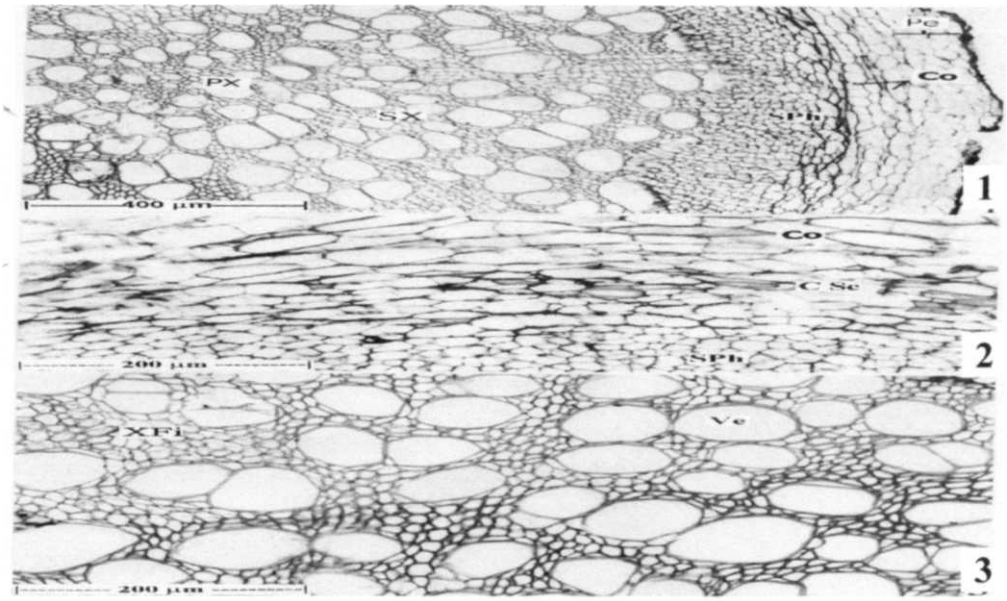

Fig. 5 : Anatomy of the Root

1. T.S of root - a sector enlarged.
2. T.S of root - cortex and secondary phloem enlarged.
3. T.S of root - Secondary xylem enlarged.

[Co-cortex; CSc - cortical sclereid; Sph - Secondary phloem, Sx-Secondary xylem; Ve - Vessel; Xfi - Xylem fibres].

Fig.6.1,2 *Plectranthus amboinicus* Lour.

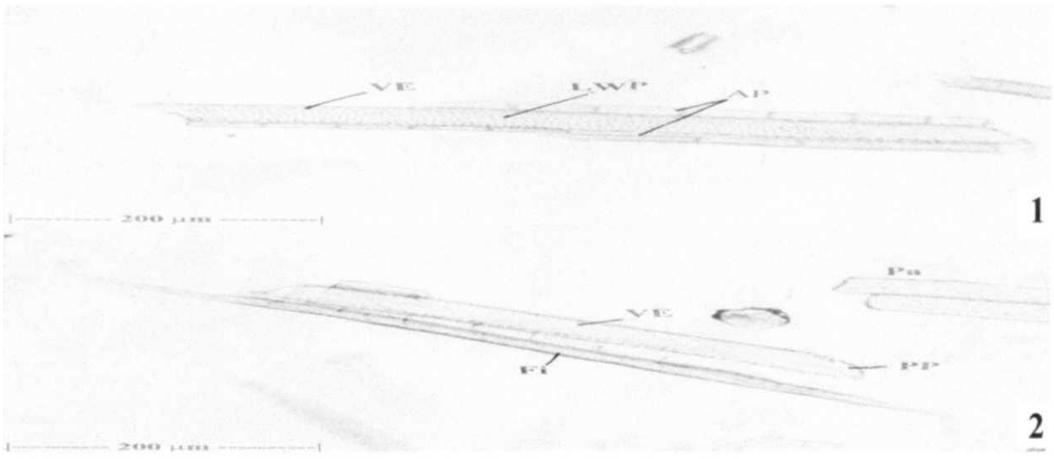

Fig. 6 : Powder microscopy of the stem

1. Vessel element with axial parenchyma
2. Vessel element and fibres

[AP - Axial parenchyma; Fi - Fibres; VE - Vessel element]

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Fig.7.1,2 *Plectranthus amboinicus* Lour.

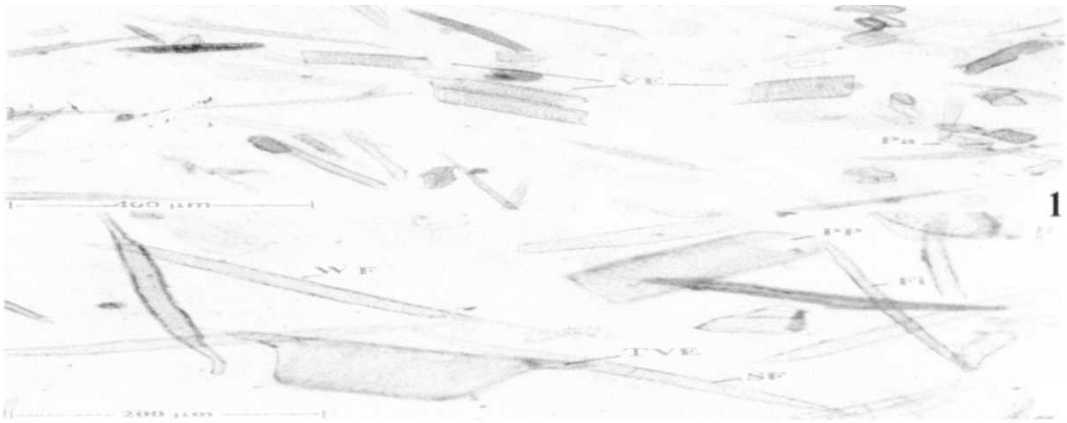
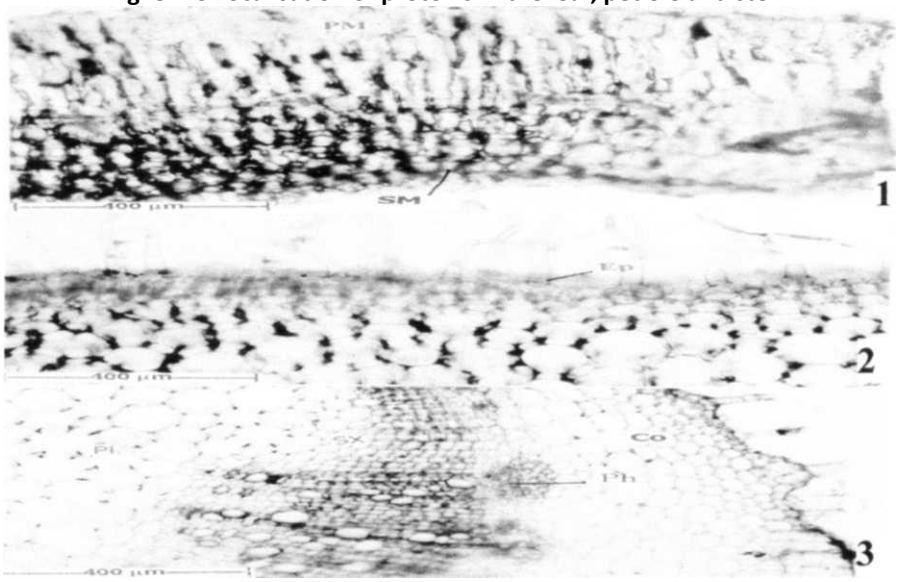


Fig. 7: Powder microscopy of the root

1. Vessel elements and fibres
2. Tailed vessel element and fibres enlarged

[Fi - Fibres, PP - Perforation plate, SF - Septate Fibre,
TVE - Tailed vessel element; VE - Vessel element, WF - Wide fibre].

Fig. 8.1-3 Localisation of proteins in the leaf, petiole and stem



1. T.S of leaf showing proteins in the mesophyll tissues as dark blue masses. (SM-spongy mesophyll; Palisade mesophyll).
2. T.S of petiole showing purple colour in the epidermal layer, especially the basal cells of the trichome (Ep-Epidermis).
3. T.S of stem showing the proteins in the outer cortex and phloem masses. (Co-cortex; Pi-Pith; Ph-Phloem; Sx-Secondary xylem).

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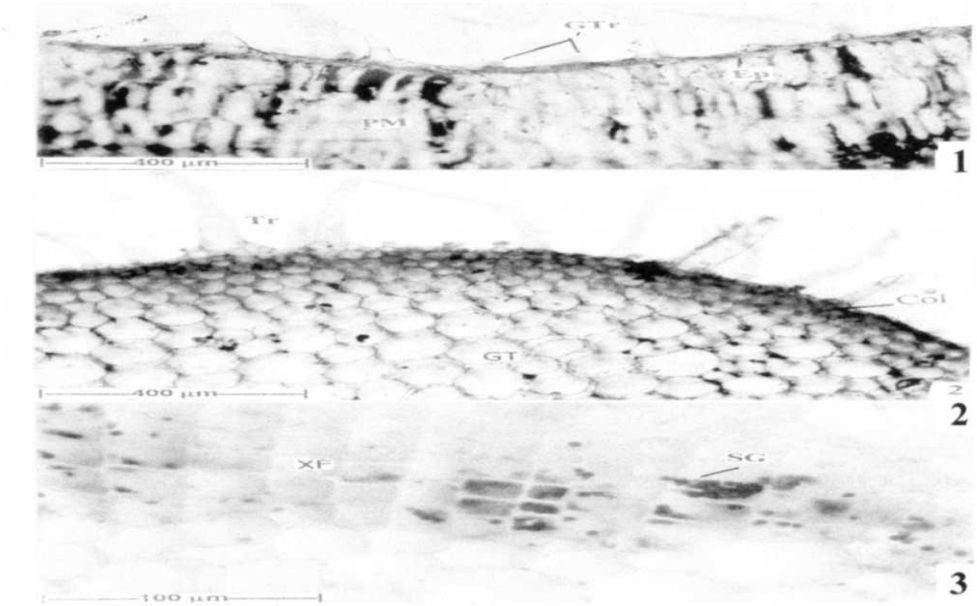
Figs.9.1-3 Localisation of polyphenols in the epidermal trichomes, petiole and stem



1. T.S of leaf showing polyphenols in the glandular trichomes and epidermal cuticle.
2. T.S of petiole showing polyphenols in the epidermis and outer ground tissue in the stem.
3. Starch grains in the xylem fibres of the stem (Co-cortex; Ep-Epidermis; G.T-Ground tissue; GTr-Glandular trichome; PM-Palisade mesophyll; SG-Starch grains; Tr-Trichome XF-Xylem fibres).

Figs. 10.1,2 Localisation of lipids in the epidermal trichomes and stems (Phloem elements)

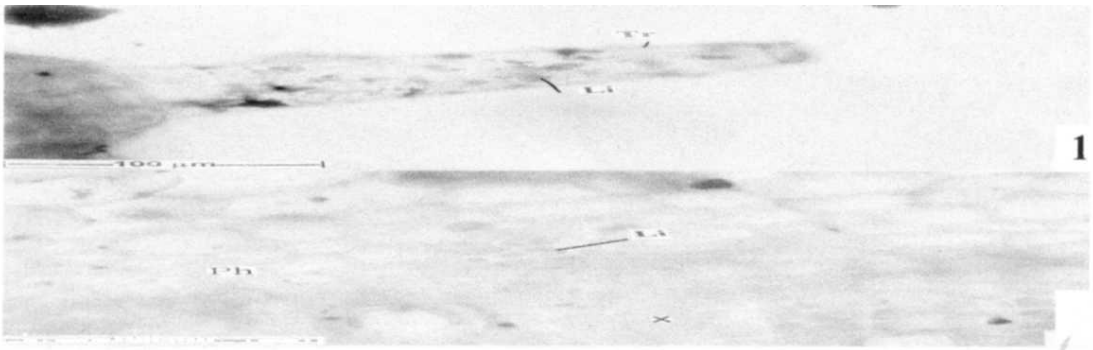


Fig. 10 :

1. Epidermal trichome of the leaf showing lipidmasses.
2. T.S of stem showing lipids inside the fibers. (Li-Lipid; Ph-Phloem; X-Xylem).

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Fig.11.1,2 *Plectranthus amboinicus* Lour.

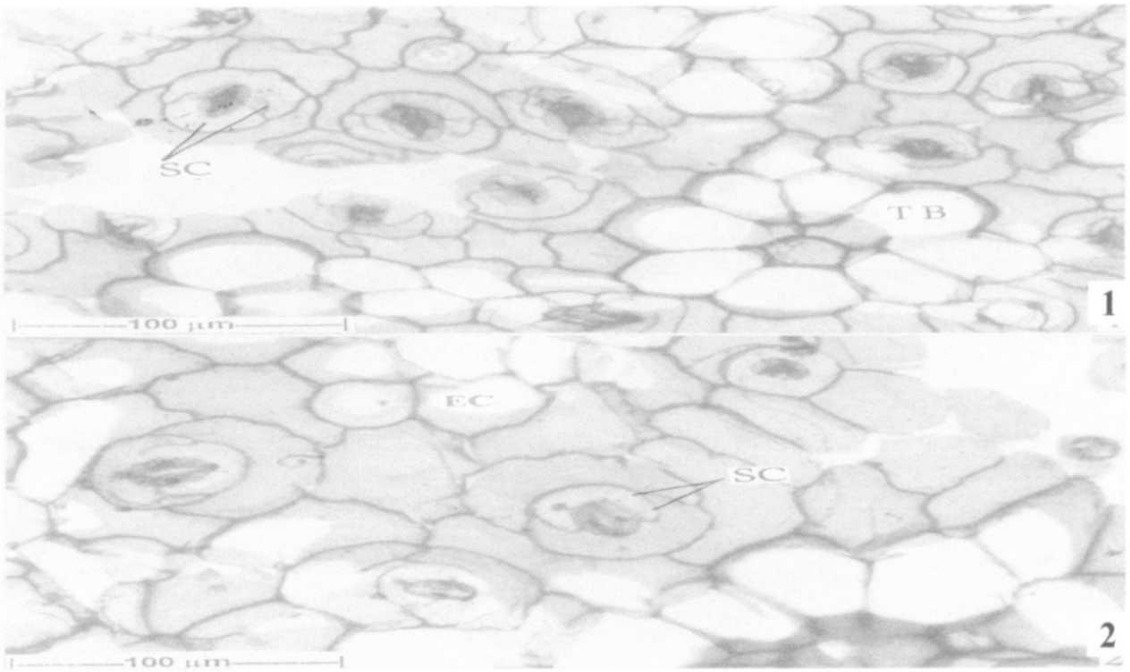

Fig. 11 : Stomatal Morphology

1, 2. Stomata and epidermal cells.

[Ec - Epidermal cells; SC - Subsidiary cells; TB - Trichome basal cells]

Table 1: Powder analysis of *Plectranthus amboinicus (Lour.) Spreng.*

Parameters	Value
Stomatal number	27/mm^2
Stomatal Index	35.06%
Palisade Ratio	10
Vein islet number	8.8
Vein termination number	7.6

Table 2: Powder analysis of *Plectranthus amboinicus Lour.*

Parameters	Observation
Colour	Light brown
Appearance	Coarse powder
Odour	Characteristic strongly aromatic
Taste	Caraway like taste
Powder treated with water	No Sticky in nature
Powder shaken with water	No Foam appears
Powder treated with 5% aqueous NaOH	Brown colour

Powder treated with 60% aqueous sulphuric acid	Reddish brown colour
Powder pressed between filter paper for 24 hours	No oil stain

Table 3: Physico chemical constants of *Plectranthus amboinicus Lour.*

Parameters	Value
1. Ash value	
a) Total ash value of powder	14.915%
b) Water soluble ash value	5.795%
c) Alkalinity of water soluble ash	10.589ml
d) Acid insoluble ash	0.21%
2. Extractive value	
a) Alcohol (Methanol)	2.25%
b) Water (Aqueous)	19.85%

Table 4: Fluorescence analysis of *Plectranthus amboinicus Lour.*

Experiments	Visible/Day Light	UV Light	
		254 nm	365 nm
Drug powder	Pale brown	Pale yellow	Dark brown
Drug powder+ 1 N NaOH (aq.)	Reddish brown	Fluorescent Green	Black
Drug powder+ 1 N NaOH (alc.)	Reddish brown	Fluorescent Green	Black
Drug powder+ 1 N HCl	Yellow	Yellow	Black
Drug powder+ 50% sulphuric acid	Reddish brown	Fluorescent Green	Black
Drug powder+ 50% Nitric acid	Pale brown	Fluorescent Green	Pale green
Drug powder+ Picric acid	Yellow	Fluorescent Yellow	Fluorescent Yellow
Drug powder+ Acetic acid	Pale brown	Green	Black
Drug powder + Ferric Chloride	Brown	Green	Pale green
Drug powder + HNO_3+NH_3	Brown	Green	black

Table 5: Fluorescence analysis of extracts of *Plectranthus amboinicus Lour.*

Extract	Day Light	Short UV (254nm)	Long UV (365nm)
Alcohol (Methanol) (pH:5)	Pale Green	Green	Pink
Water (pH:5)	Brown	Green	Light Green

Table 6: Preliminary Qualitative Phytochemical analysis of *Plectranthus amboinicus Lour.*

Sr. No.	Name of the test	Water Extract	Methanolic extract
1	Anthra-quinones	-	+
2	Flavonoids	-	+
3	Terpene	-	+
4	Gum	-	-
5	Alkaloids	+	+

6	Saponins	+	+
7	Tannins	+	+
8	Carbo-hydrates	+	+
9	Starch	-	+
10	Fixed Oil or Fat	-	-
11	Phytosterol	-	+
12	Protein	+	+
13	Coumarins	+	+
14	Phenol	+	+
15	Catechins	-	-
16	Glycosides	+	-

(+ Present; - Absent)

The preliminary phytochemical studies for the plant *Plectranthus ambionicus* Lour. Given in the table 2-6, which throw light on many quality aspect of the drug. The powder analysis revealed the characters and nature of the powdered drug are presented in table – 2. Physicochemical constants such as ash values, extractive values as shown in table – 3 and other parameters of the drug are corroborative evidences in drug standardizations. Fluorescence analysis of drug powder as well as drug extract is the other test for standardizing the drug for the presence of chromophores are shown in table 4 and 5. As showed in the table 6, both water and methanol extracts of the drug were found to contain alkaloids, saponins, tannins carbohydrates, proteins and coumarins while in methanol extract flavonoids terpenes, phytosterol, and glycosides were also detected additionally. Thus the anatomical characters coupled with preliminary phytochemical results are specific for the plant drug. *Plectranthus amboinicus* Lour.

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