Journal of Innovations in Pharmaceuticals and Biological Sciences
www.jipbs.com
JIPBS
ISSN: 2349-2759

Research Article

Studies on *Ipomoea Cairica* (L.) Sweet - A Promising Ethnomedicinally Important Plant

Sutapa Choudhury[1], Chowdhury Habibur Rahaman[1], Sudhendu Mandal*[1]

[1]Department of Botany, Visva-Bharati, Santiniketan-731235.

Abstract

The drug evaluation and bioassay of traditional herbs of various herbal systems is now getting more momentum throughout the world. It is the high time now to evaluate scientifically the information stored in different herbal medicine systems of the world in terms of their pharmacognostic, phytochemical and pharmacological characterization. So knowledge of pharmacognosy of individual medicinal plant is very important aspect for herbal based drug discovery. Therefore in this study, an attempt has been made to evaluate such ethnomedicinally important plant, pharmacognostically along with antimicrobial and phytochemical analyses which are still unexplored. In this study different pharmacognostical parameters of *Ipomoea cairica* (L.) Sweet of Convolvulaceae, an ethno botanically important medicinal plant have been investigated. The plant is commonly known as 'Railway creeper' or Morning glory. The plants are medicinally used as an antioxidant, anti-inflammatory, antiviral and highly potent against malaria. Palisade ratio is 6. Leaves are amphistomatic. Stomatal index is 11. Trichomes show an assortment of both nonglandular, multicellular and glandular, multicellular, sessile types. These two types are recorded on both surfaces. Vessel elements are moderately long with simple and transverse or obliquely placed perforation plates. Pits are simple and tails are frequently present with some vessel elements. In the leaf extract, the detected phytochemical groups are alkaloids, flavonoids, steroids and triterpenoids, reducing sugars, tannins, gums and saponins, etc. In the stem extract flavonoids, steroids and triterpenoids, reducing sugars, tannins and saponins are present. Different histochemical localizations have been identified in the stem which contain some specific phytochemical groups like lignins, celluloses, suberins, proteins and alkaloids. Ash value and moisture content of the leaf are 35.88 % and 89.25 % respectively. The highest inhibition zone was found against *Salmonella typhi* ATCC 19430 and *Klebsiella aerogenes* W70 (inhibition zone, 15 mm) in the methanolic extract. Ethyl acetate extract showed the maximum inhibition on *Pseudomonas aeruginosa* NCTC10662 (inhibition zone, 19 mm). This study will be very helpful to herbalists and pharmacologists for proper evaluation and validation of folk drug.

Key words: Pharmacognostic analysis, phytochemical screening, antimicrobial activity, micromorphology and anatomy, *Ipomoea cairica,* ethnomedicinally important plant

***Corresponding Author: Sudhendu Mandal,** Department of Botany, Visva-Bharati, Santiniketan-731235.

1. Introduction

The role of pharmacognostic and anatomical data for traditional knowledge of folklore medicine is highly important since the earlier past. Use of micromorphology and anatomy is now a recognized tool in the field of pharmacognosy as well as plant systematics. Therefore in this investigation, an attempt has been made to evaluate this ethnomedicinal plant pharmacognostically, including its morpho-anatomy and antimicrobial activity. The leaves and stem of the investigated taxa have been considered here in this investigation because leaves and stems are commonly used by the tribal and common people for curing the diseases. Use of micromorphology and anatomy is now a recognised tool in the field of plant systematics [1, 2]. Importance of epidermal characters in general and those of trichomes in particular and comparative wood anatomy are widely recognised in taxonomic consideration of angiosperms [3, 4, 5, 6, 7, 8]. Ontogeny and structure of stomata are now also considered as an important taxonomic character for many of the angiospermic taxa [8, 9, 10, 11, 12, 13]. The members of different genera and families of angiosperm have been studied anatomically by various workers with special emphasis on leaf epidermal micromorphology [14, 15].Only to some extent, the ontogeny, structure of stomata and phytochemical studies of different members of Convolvulaceae have been studied by different workers. Chemical analysis and biological assays are very important aspects in pharmacognostic evaluation of medicinal plants [16, 17]. Along with various pharmacognostical evaluation of medicinal plants now there is an urgent need to study the antibacterial properties of medicinal herbs, which will be helpful in the treatment of several diseases caused by bacteria. With this scientific documentation, we now know why certain herbs are effective against specific conditions.

2. Plant Material

Ipomoea cairica (L.) Sweet (Family: Convolvulaceae)

Common name: 'Railway creeper', Morning glory.

Botanical Characteristics: Perennial twiner with tuberous root-stock. Leaves palmately 5 to 7-partite; segments elliptic - obovate or lanceolate, narrowed at both ends, retuse, mucronate at apex, glabrous. Flowers in 1 to 3-flowered cymes. Calyx-segments unequal, ovate, mucronulate, tuberculate on the back of outer ones. Corolla 6 -7 cm long, white or purple. Capsules 2 -celled, 4 -valved. Seeds pubescent

Flowering and fruiting time: Throughout the year.

Distribution: A native of Tropical Asia and Africa, now widely grown in tropical countries including India.

Habit and habitat: Perennial twiner with tuberous root- stock. Terrestrial, common among bushes, hedges of gardens, waste places and outskirts of forests. Also cultivated occasionally in the gardens, parks, railway platforms.

Parts used: Whole plant.

Medicinal uses: Antioxidant, antiviral, highly potent against malaria.

Chemical constituents: lignans, arctigenin, matairesinol and trachelogenin, indole alkaloids.

3. Methods

Field Survey

Intensive field work was conducted covering all the seasons so as to collect detail information on plant species found useful in ethnomedicine as well as for the other local uses of the plants occurring in Birbhum district in West Bengal. During etnobotanical surveys, all tribal localities, adjoining forest areas and the plains of the districts were visited. Routine methods of botanical collections and techniques of herbarium preparations were followed as suggested by [18]. Observations were made of the plant species with respect to their location, habit, habitat and other field characters.

Epidermal Micromorphology

For the study of foliar epidermis, leaf samples were cleared following the Bokhari's method [19]. The cleared leaf samples were then mounted on the slide with a drop of 10% glycerine and 1% aqueous safranin solution and observed under the compound light microscope.

Wood Maceration

For wood elements study, the stem pieces of the plant were macerated following the standard method [20]; washed several times, teased with needles, stained in safranin, mounted on the slides with 10% glycerine and observed under microscope. The drawings of the stem xylem element characters were made with the camera lucida and measurements were taken with standardized ocular micrometer in each cases.

Histochemical Colour Reaction Tests

Histochemical study was carried out by cutting the section of fresh materials following the standard methods [21, 22, 23]. It is generally used for on spot determination of localized phytochemicals present in the cells.

Antimicrobial Activity

Screening of antimicrobial activity was carried out by agar diffusion method. Nutrient agar medium was prepared by suspending nutrient agar (Merk) 20g/L in distilled water. The pH value of the media was adjusted to 7.0, autoclaved, and allowed to cool up to 45^0C. 50 µl of extract was poured in 6mm wells punched in test culture seeded assay plates. 24 h old bacteria cultures in nutrient broth were used to seed the assay plates containing NAM. Assay plates seeded with bacterial cultures were incubated at 37° C, for 24 hours. After incubation antimicrobial activity was determined by measuring the zone of inhibition

Eight common human pathogenic bacterial strains (*Bacillus subtilis* ATCC 11778, *Enterococcus faecalis* ATCC 19433 , *Escherichia coli* NCTC 10418, *Klebsiella aerogenes* W70, *Micrococcus luteus* NCTC2665, *Pseudomonas aeruginosa* NCTC10662, *Salmonella typhi* ATCC 19430 and *Streptococcus faecalis* MTCC 439) were selected for this purpose. The minimum inhibitory concentration (MIC Assay) method was applied.

4. Results

Macromorphology

i) Leaf: Herbaceous, palmately 5 to 7-partite, segments elliptic-obovate or lanceolate, narrowed at both ends, retuse, mucronate at apex, glabrous.

ii) Stem: Perennial twiner with tuberous root- stock, branched, older ones somewhat woody, greenish young part, whitish-brown older part.

Micromorphology

General description and measurement of the epidermal cells, stomata and trichomes of the investigated plant have been represented in Tables 1, 2 and 3.

1. Epidermis:

Epidermal cells are irregular in shape and the outlines are strictly wavy on both the surfaces. Cell size is 28.60 µm x 71.42 and 37.51 µm x 55.71 µm on the upper and lower surfaces respectively. Cell frequency of the upper and lower surfaces is 1211.45 /mm^2 and 1497.80 /mm^2 respectively. Palisade ratio is 6 (Table-1; Figure 1- A, B, C, D, E).

2. Stomatal Complex:

Leaves are amphistomatic i.e. stomata are present on both surfaces of the leaf. On both surfaces paracytic stomata are predominant with few anisocytic and anomocytic type. Size of the stomata on the upper and lower surfaces is 28.60 µm x 21.42 µm and 28.60 µm x 53.60 µm respectively. Stomatal frequency of the upper surface is 33. 04 /mm^2 and 198.23 /mm^2 on the lower surface. Stomatal index is 11 (Table-2; Figure 1 A, B, C, D, E).

3. Trichomes:

Trichomes show an assortment of both nonglandular, multicellular and glandular, multicellular, sessile types. These two types are recorded on both surfaces. Size and frequency of the nonglandular, multicellular trichomes of the upper surface are 142.84 µm x 42.85 µm and 16.60 /mm^2 respectively. On the lower surface their size and frequency are 124.98 µm x 44.04 µm and 22.03 /mm^2. Diameter of the multicellular glands is 42.85 µm on the upper surface and 28.60 µm on the lower surface. Frequency is 11.01 /mm^2 and 16.60 /mm^2 on the upper and lower surfaces respectively. Trichome index is 0.1 (Table-3; Figure 1- F, G, H, I, J).

Wood Elements

General description and measurement of the type and size, pittations, perforation plates of vessel elements, side wall thickening of tracheids, fibre size and nature, etc. of the investigated plant have been represented in Table 4.

Vessel elements are moderately long with simple and transverse or obliquely placed perforation plates. Pits are simple and tails are frequently present with some vessel elements. Size of the vessel element is 450.60 µm x 66.06 µm; frequency is 29.35 /mm^2 (Figure 2- A, B, C, D).

Tracheids are long with spiral sidewall thickening. Diameter of the tracheids is 16.07 µm; frequency is 22.02 /mm^2 (Figure 2- E).

Fibres are typically libriform type and are extremely long. Ends are mainly blunt, but pointed endings are also recorded. Pits are present but lesser in number. Size of the fibre is 660.01 µm x 10.71 µm; frequency is 44.05 / mm^2 (Figure 2- F, G, H, I).

Stem Anatomy

The transverse section through the internodes of stem shows the following anatomical features (Figure 3- a, b).

Epidermis: Epidermis consists of single layered cells of compact arrangement and covered with cuticle.

Cortex: The cortex is massive and consists of three distinct zones. The first zone is

hypodermis of few cells thick, lying just below the epidermal layer. Two to three layers of parenchyma cells are present beneath the hypodermal layer is called the middle cortex. A continuous, compactly arranged barrel shaped cells forms the starch sheath layer which is the last zone of cortex. Crystals and latex are present in some cells of the middle cortex.

Vascular bundles: Vascular bundles form a continuous cylinder of xylem and phloem. They are collateral, conjoint and open type with outer phloem, middle xylem and inner phloem patches. Intraxylary phloem patches are lying on the margin of the pith and are discontinuous.

Pith: Pith is massive with large parenchymatous cells. Middle portion of the pith is with many hollow cavities. Some crystal and latex containing cells are present in the pith region.

Organoleptic Features of the Crude Drug

Colour: Dark green**;**
Odour: Characteristic**;**
Taste: Soft slimy feeling**;**
Texture: Herbaceous, glabrous (in fresh form).

Microchemical Evaluation of the Powdered Drug

Through the phytochemical tests of the methanolic extract of leaf and stem, the important phytochemical groups have been detected in both the cases which actually confirm the medicinal properties of this plant. In the leaf extract, the detected phytochemical groups are alkaloids, flavonoids, steroids and triterpenoids, reducing sugars, tannins, gums and saponins, etc. In the stem extract flavonoids, steroids and triterpenoids, reducing sugars, tannins and saponins are present (Table 5, Figure IV).

Histochemical Study

Histochemical study has been carried out to detect various phytochemicals localized in different tissue zones of the stem. Different histochemical localizations have been identified in the stem which contain some specific phytochemical groups (lignins, celluloses, suberins, proteins and alkaloids) (Table 6).

Physical Evaluation

[I] Physical Constant

i) Ash Value:

a) Total ash - 35.88%
b) Water soluble ash- 18.78%
c) Acid insoluble ash- 05.90%
ii) Moisture Content - 89.25 % (in fresh form).

[II] Fluorescence Analysis

Here in this study it is observed that drug powder treated with different chemical reagents gives characteristic colourations when seen under UV light and it is compared with the colourations observed under ordinary light. In some cases there are marked differences in colour (Table 7).

Antibacterial Activity

Methanolic foliar extract of *Ipomoea cairica* exhibited inhibitory action against *Bacillus subtilis, Enterococcus faecalis, Escherichia coli, Klebsiella aerogenes, Micrococcus luteus, Salmonella typhi* and *Streptococcus faecalis*. Ethyl acetate soluble foliar extract was able to inhibit all the selected bacteria.

The highest inhibition zone was found against *Salmonella typhi* and *Klebsiella aerogenes* (inhibition zone, 15 mm) in the methanolic extract. Ethyl acetate extract showed the maximum inhibition on

Pseudomonas aeruginosa (inhibition zone, 19 mm).

Methanolic and ethyl acetate soluble foliar extracts were found inhibitory to the selected bacteria in the following order:

Methanolic extract:

Salmonella typhi and *Klebsiella aerogenes* (inhibition zone, 15 mm) > *Escherichia coli*, *Streptococcus faecalis* and *Micrococcus luteus* (inhibition zone, 14 mm) > *Bacillus subtilis* (inhibition zone, 13.5 mm) > *Enterococcus faecalis* (inhibition zone, 12 mm) (Figure VI).

Water extract:

Only *Salmonella typhi* (inhibition zone, 10 mm) was inhibited by the water soluble foliar extract (Figure VI).

Ethyl acetate extract:

Pseudomonas aeruginosa (inhibition zone, 19 mm) > *Salmonella typhi* (inhibition zone, 16 mm). > *Escherichia coli* (inhibition zone, 15 mm) > *Bacillus subtilis* (inhibition zone, 14 mm) > *Klebsiella aerogenes* (inhibition zone, 12mm) > *Enterococcus faecalis, Micrococcus luteus* and *Streptococcus faecalis* (inhibition zone, 10 mm) (Figure VI).

Table 1. Foliar Epidermal Cell Characters of the Investigated Plant

Plant	Leaf Surface	Cell Shape	Cell Length (µm)	Cell Width (µm)	Cell Frequency /mm2	Cell Wall Outline	Palisade Ratio
Ipomoea cairica	Upper	Irregular	28.60	71.42	1211.45	Wavy	06.20
	Lower	Irregular	37.51	55.71	1497.80	Wavy	

Table 2. Stomatal Features of the Investigated Plant

Plant	Leaf Surface	Stomatal Type	Stomatal Length (µm)	Stomatal Width (µm)	Stomatal Index (%)	Stomatal Frequency /mm2
Ipomoea cairica	Upper	Mainly paracytic; few anisocytic and anomocytic	28.60	21.42	11.40	33.04
	Lower	Mainly paracytic; few anisocytic and anomocytic	28.60	53.60		198.23

Table 3. Trichome Features of the Investigated Plant

Plant	Leaf Surface	Types	Trichome Length (µm)	Trichome Width (µm)	Trichome Frequency /mm2	Trichome Index %
Ipomoea cairica	Upper	Nonglandula, multicellular, uniseriate	142.84	42.85	16.60	01.21
		Glandular, multicellular, sessile	--	42.85	11.01	
	Lower	Nonglandula, multicellular, uniseriate	124.98	44.04	22.03	
		Glandular, multicellular, sessile	--	28.60	16.60	

Table 4. Wood Elements Characters of the Investigated Plant

Plant	Structure	Type	Measurement
Ipomoea cairica	**Vessel Elements**	Types of perforation plate	Simple
		Arrangement of perforation plate	Transverse or oblique
		Pit	Simple
		Tail	Sometime present
		Length (µm)	450.60
		Breadth (µm)	66.06
		Frequency /mm2	29.35
	Tracheids	Wall thickening	Spiral
		Diameter (µm)	16.07
		Frequency /mm2	22.02
	Fibres	Ends	Blunt; sometimes pointed
		Pittation	Present
		Septation	Absent
		Length (µm)	660.01
		Diameter (µm)	10.71
		Frequency /mm2	44.05

***** Data presented in the tables are averages of 20 observations

Table 5. Microchemical Tests of Leaf and Stem Extracts of the Plant

Tests/ Reagents	Tests For	Nature of Changes	Degree of Changes	
			Leaf	Stem
Dragendroff's reagent	Alkaloids	Orange brown ppt	++	–
Wagner's reagent	Alkaloids	Orange brown ppt	+	–
Shinoda's tests	Flavonoids	Magenta colour	+	+
10% NaOH	Flavonoids	Magenta colour	++	++
Salkowski test	Steroids and triterpenoids	Reddish-blue and green florescence	+	+
Benedict's reagent	Reducing sugars	Brick red ppt	+	–
Fehling's reagent	Reducing sugars	Brick red ppt	+	+ (Faint)
Molish's test	Gums	Red-violet ring	+	–
10% aqueous potassium dichromate solution	Tannins	Yellowish-brown ppt	+	+++
10% aqueous lead acetate solution	Tannins	Yellow ppt	+++	+++
5% aqueous ferric chloride solution	Tannins	Greenish-black colour	+++	+++
1% lead acetate	Saponins	White ppt	++	+
Borntrager's test	Anthraquinones	–	–	–

- = Absent; **+** = Present

Table 6. Histochemical Colour Reactions of the Investigated Plant

Tests/ Reagents	Test for	Nature of changes	Degree of changes	Histological location
Phloroglucinol-HCl	Lignin	Reddish- brown to rose-red	+++	Xylem, hypodermis and sclerenchyma patches
Chlor-zinc iodide solution	Lignin and	Violet and greyish black	+++	Xylem, hypodermis and

	cellulose			sclerenchyma
Sudan III	Suberin	Brownish to rose-red	+	Hypodermis and xylem
Heating with strong H2SO4	Suberin	Yellow	+	Hypodermis and xylem
Lugol's solution	Protein	Yellowish brown	++	Parenchyma cells of cortex and pith
Millon's reagent	Protein	Yellow to brown	++	Phloem region, parenchyma cells of cortex and pith
Dragendroff's reagent	Alkaloids	Yellow to brown	+++	Xylem and hypodermis
Wagner's reagent	Alkaloids	Deep brown	+++	Xylem, some cells of cortex and outer phloem region
Kedde reagent	Glycoside	–	–	–

- = Absent; **+** = Present

Table 7. UV Fluorescence Nature of the Investigated Plant

Materials and treatment	**In fluorescence light**	**In ordinary light**
Powder as such	Greenish	Dark green
Treated with dilute nitric acid	Orange	Moderate orange yellow
Treated with sodium hydroxide in water	Dark magenta	Brown
Treated with hydrochloric acid	Pale greenish yellow	Yellowish green
Treated with dilute sulphuric acid	Very pale blue	Strong pink
Treated with antimony trichloride	Vivid violet	Light brown

5. Discussion

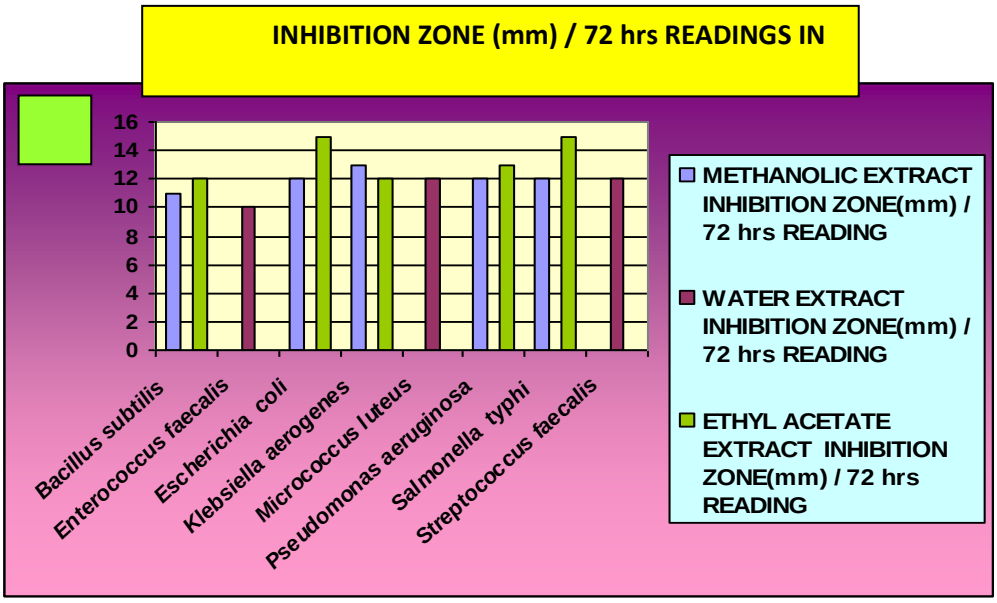
A large number of plants for their curative properties have traditionally being used since long past in different traditional systems of medicine worldwide. Although documentation of this wisdom in written or other form is being made rapidly in different parts of the world including India. The ethnobotanical knowledge of plants is responsible for recognition of most of the medicines and foods used in our modern society. We have ignored the diversity of wild medicinal and food plants which were existed in the past and have over exploited some important current species in various ways that causes a great threat to those important plant species [24]. Approximately 2,400 – 3,000 plants species of India are reported to have medicinal properties generally used in

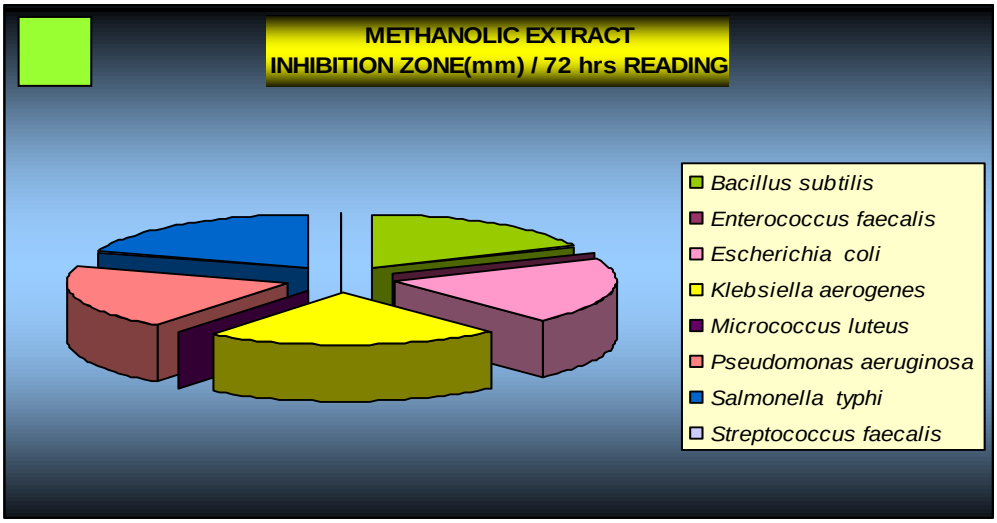
different Indian systems of medicine and they are constantly being screened for their biological activities [25].

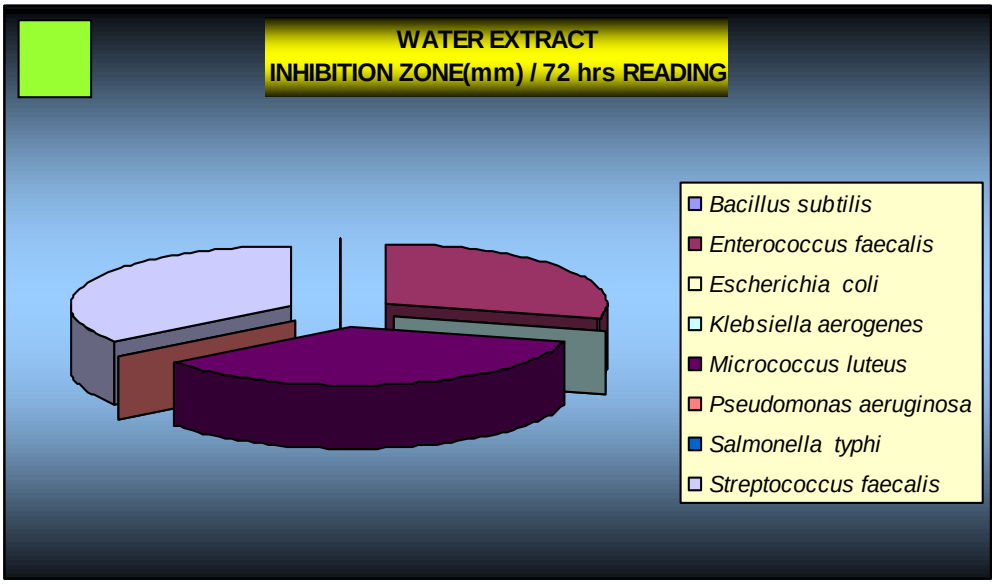
This is a fascinating area of research which has proved quite rewarding, the scientific examination of plants used for medicinal, narcotic and other purpose by the natives. Therefore in this investigation, an attempt had been made to evaluate such ethnomedicinally important plant pharmacognostically including morpho-anatomy and their pharmacognosy, anatomy and antimicrobial activity which are lying still unexplored. The leaves and stems of the investigated taxa (*Ipomoea cairica*) had been considered here in this investigation because leaves along with the stems are commonly used by the tribal people and common folk for curing the diseases. Pharmacognostic evaluation of leaf drugs are not so very expensive though this drug is of tremendous biomedical value.

Table 8. Zone of Inhibition (mm) for *Ipomoea Cairica* Leaf Extracts against Some Gram-Positive and Gram-Negative Bacteria

SELECTED BACTEIA	INHIBITION ZONE (mm)								
	METHANOLIC EXTRACT			WATER EXTRACT			ETHYL ACETATE EXTRACT		
	24 Hrs	48 Hrs	72 Hrs	24 Hrs	48 Hrs	72 Hrs	24 Hrs	48 Hrs	72 Hrs
Bacillus subtilis ATCC 11778	15.5	14	13.5±.02	-	-	-	11	13	14±.03
Enterococcus faecalis ATCC 19433	-	12	12±.02	-	-	-	10	10	10±.02
Escherichia coli NCTC 10418	13.16	14	14±.03	-	-	-	11	15	15±.02
Klebsiella aerogenes W70	12	12	15±.03	-	-	-	10	12	12±.04
Micrococcus luteus NCTC2665	28	19	14±.04	-	-	-	10	10	10±.02
Pseudomonas aeruginosa NCTC10662	-	-	-	-	-	-	18	18	19±.02
Salmonella typhi ATCC 19430	19	14	15±.04	10	10	10±.02	12	16	16±.03
Streptococcus faecalis MTCC 439	15.3	14	14±0.03	-	-	-	-	10	10±.02


INHIBITION ZONE (mm) / 72 hrs READINGS IN
16
14
12
10
8
6
4
2
0
Bacillus subtilis
Enterococcus faecalis
Escherichia coli
Klebsiella aerogenes
Micrococcus luteus
Pseudomonas aeruginosa
Salmonella typhi
Streptococcus faecalis
METHANOLIC EXTRACT INHIBITION ZONE(mm) / 72 hrs READING
WATER EXTRACT INHIBITION ZONE(mm) / 72 hrs READING
ETHYL ACETATE EXTRACT INHIBITION ZONE(mm) / 72 hrs READING


METHANOLIC EXTRACT
INHIBITION ZONE(mm) / 72 hrs READING
Bacillus subtilis
Enterococcus faecalis
Escherichia coli
Klebsiella aerogenes
Micrococcus luteus
Pseudomonas aeruginosa
Salmonella typhi
Streptococcus faecalis


WATER EXTRACT
INHIBITION ZONE(mm) / 72 hrs READING
Bacillus subtilis
Enterococcus faecalis
Escherichia coli
Klebsiella aerogenes
Micrococcus luteus
Pseudomonas aeruginosa
Salmonella typhi
Streptococcus faecalis

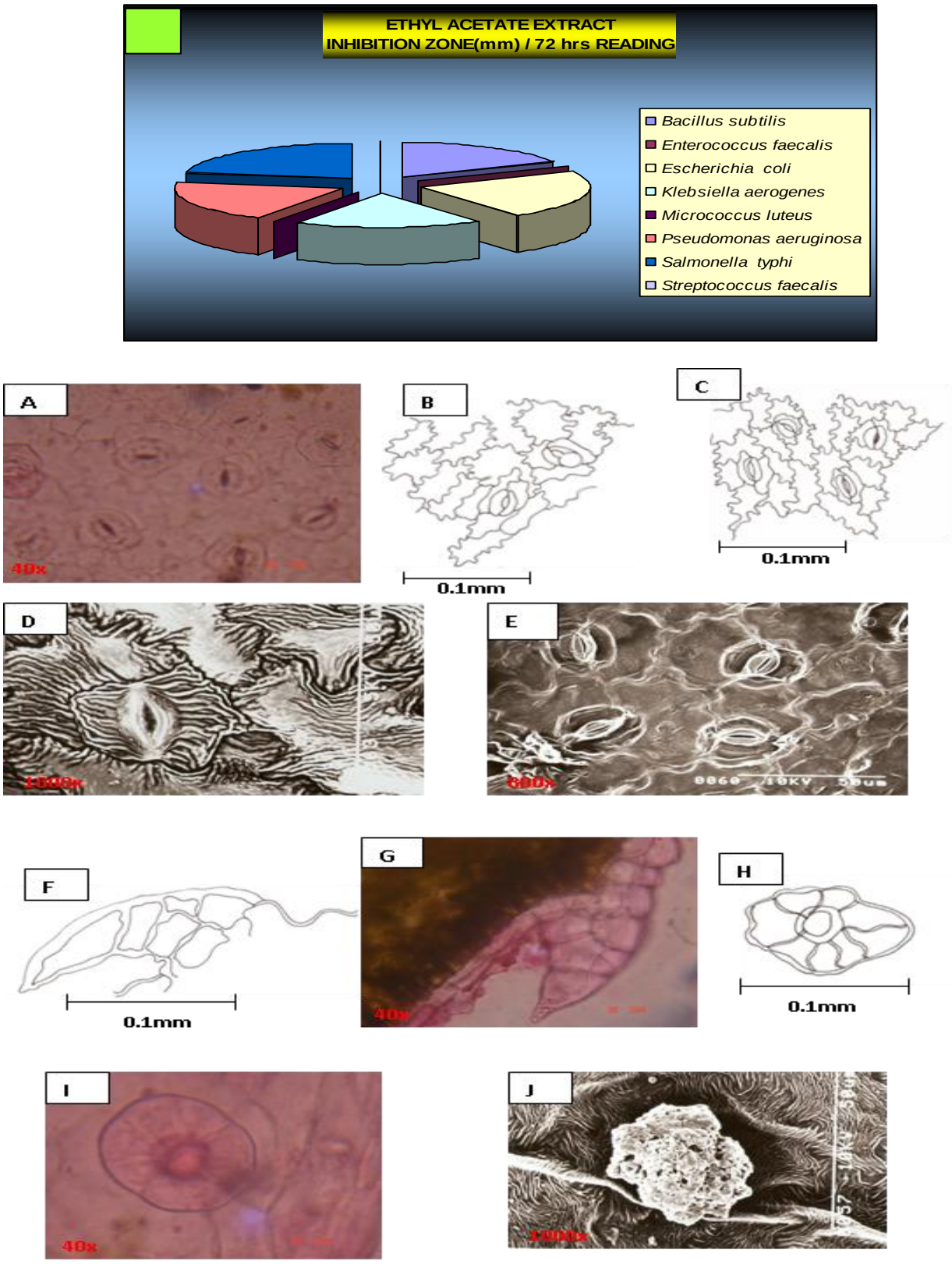


Figure 1: Epidermal Micromorphology: A, B, C, E- Paracytic and Anisocytic Stomata; D- Single Stoma; F, G- Nonglandular, Multicellular Trichomes; H, I, J- Multicellular Sessile Glands.

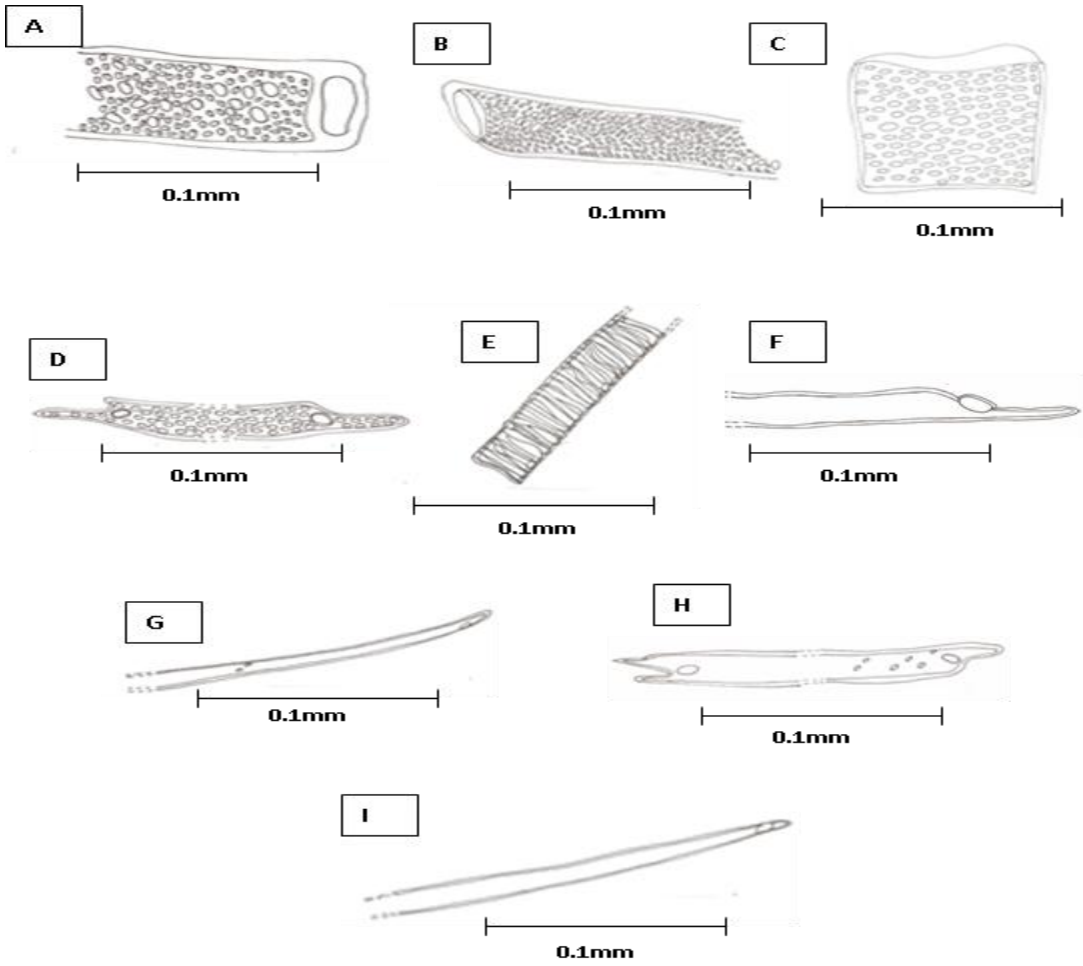


Figure 2: Wood Elements: A, B- Portion of Vessel Elements; C, D- Vessel Elements; E- A Portion of Tracheid; F, G, I- Portion of Fibres; H- Fibre.

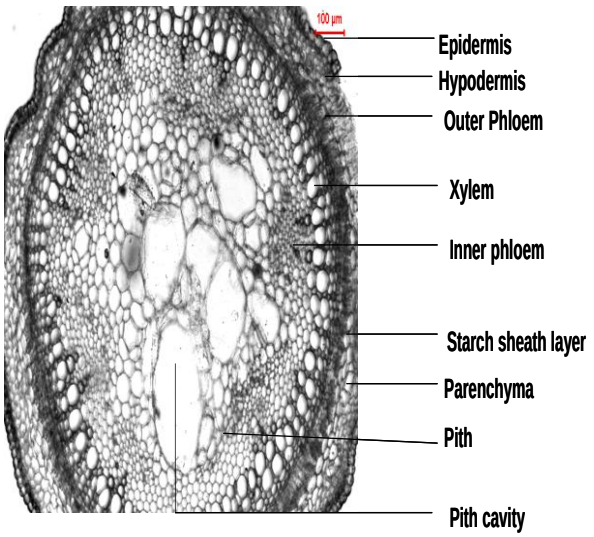


Figure 3. a- T. S. of STEM (Snap taken by Leica Axioscope, No. - QG2-32)

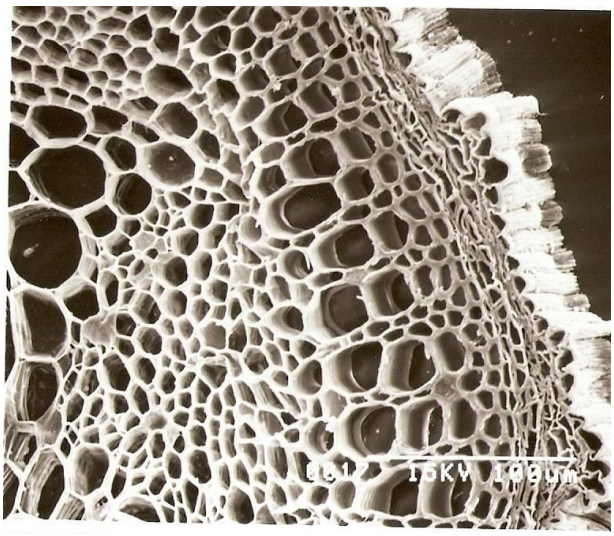
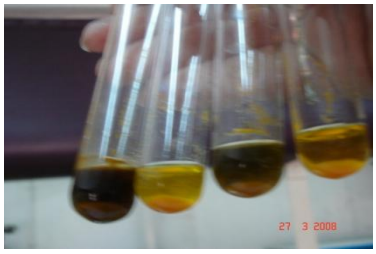


Figure 3. b- T.S. of STEM (Snap taken by SEM: Hitachi-S530, Japan)

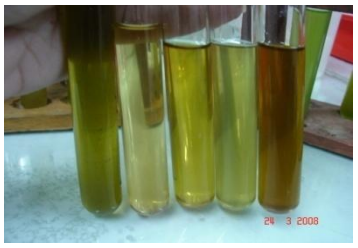
Streroids and triterpenoids (reddish-blue and green florescence)

Reducing sugars (brick- red ppt)

Reducing sugars (brick- red ppt)

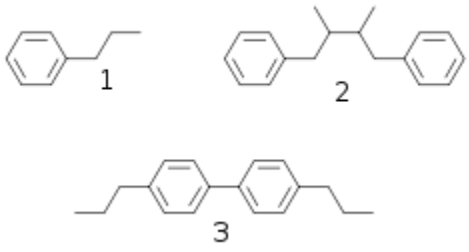


Alkaloids (reddish-brown ppt)

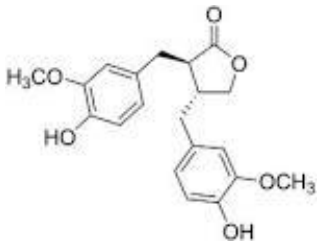


Flavonoids (yellow colour)

Figure 4. Microchemical test

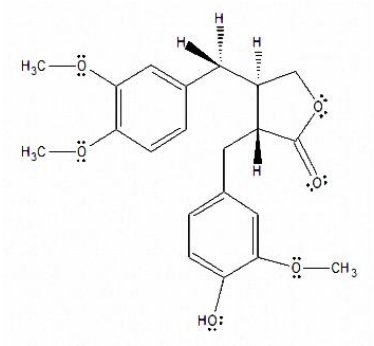


Lignans

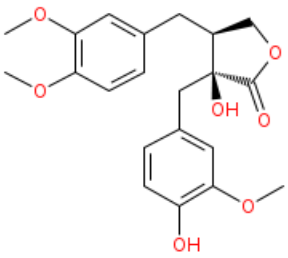


Matairesinol

Pharmacognosy implies a particular knowledge of methods of identification and evaluation of crude drugs obtained from plants which include macromorphology, anatomy, phytochemical and pharmacological studies. The major problem of the commercial supply of crude drugs is identification of genuine drug. Crude drugs may easily be adulterated or substituted by or confused for other ones because neither it has any trade name printed on it nor it carries any identifying structure for the easy identification of it by the plant taxonomists, rather drug samples supplied are shrunked, rolled, twisted, deformed and discoloured. So, pharmacognostic evaluation of crude drugs with macromorphology, micromorphology, organoleptic tests, ash value, histochemical colour reactions and UV fluorescence study will help in identifying genuine drugs and thus in checking adulteration, because the tests are very specific for a particular drug.



Arctigenn



Trachelogenin

Figure 5. Active principles

Here in this study all crude drugs in fresh as well as dried form obtained from respective investigated ethnomedicinal plant had been easily identified by some pharmacognostic characters like epidermal cells size, trichome types and index, stomatal type and index, palisade ratio, crystals, sclereids, size of fibres and vessel elements, ash value, UV fluorescence feature, etc. Palisade ratio is 6. Leaves are amphistomatic. Stomatal index is 11. Trichomes show an assortment of both nonglandular, multicellular and glandular, multicellular, sessile types. *Ipomoea cairica* having the wavy epidermal cell on both the surfaces (upper surface, 28.60µm x 74.42µm; lower surface, 37.51µm x 55.71µm). Though stem anatomy of the investigated plants is found to be very common to each plant, although it is specific in case of number of layers of some tissues present in cortex, vascular zone and pith and by using these features investigated plants can be distinguished along with other anatomical features like vessel elements, fibres, tracheids of xylem. Vessel elements are very much variable in size found in angiosperms and it is used as identifying character in identification of plants [26]. In this study, vessel elements are found in various sizes; perforation plates are simple, oblique or transversely placed. Fibres are typical libriform type with pointed or blunt tips. Presence or absence of fibre-tracheids has considered as a distinct feature here in this study for identification of investigated plants. Diameter of tracheid is found variable in many cases. Considering all those xylem elements features it has been found that they are very important one in identification of each plant of this study and also be helpful in authentication of crude drugs obtained from those plants.

Through the phytochemical tests of the methanolic extract of leaf and stem, the important phytochemical groups have been detected in both the cases which actually confirm the medicinal properties of this plant. In the leaf extract, the detected phytochemical groups are alkaloids, flavonoids, steroids and triterpenoids, reducing sugars, tannins, gums and saponins, etc. In the stem extract flavonoids, steroids and triterpenoids, reducing sugars, tannins and saponins are present Different histochemical localizations have been identified in the stem which contain some specific phytochemical groups (lignins, celluloses, suberins, proteins and alkaloids).

Inhibition Zone
***Salmonella Typhi* Atcc 19430 (Methanolic Extract)**

Inhibition Zone
***Pseudomonas Aeruginosa* Nctc10662 (Ethyl Acetate)**

In case of crude drug identification ash value plays a very important role which includes % of total ash, water soluble ash and acid insoluble ash [27]. Here in this investigation ash value for each plant is very distinct and different from one another. It gives a marker character for identification of crude drugs obtained from those investigated taxa. Ash value and moisture content of the leaf are 35.88 % and 89.25 %respectively. Now the traditional medicinal plants are being screened on various lines of bioassay for their antimicrobial activity [28, 29, 30].

Here in this investigation, the leaf extracts of different solvents (methanol, water and ethyl acetate) of the plant have been tested for antimicrobial activity against eight Gm (+ve) and Gm (-ve) bacteria i.e., *Bacillus subtilis, Enterococcus faecalis, Escherichia coli, Klebsiella aerogenes, Micrococcus luteus, Pseudomonas aeruginosa, Salmonella typhi* and *Streptococcus faecalis.* The highest inhibition zone was found against *Salmonella typhi* ATCC 19430 and *Klebsiella aerogenes* W70 (inhibition zone, 15 mm) in the methanolic extract. Ethyl acetate extract showed the maximum inhibition on *Pseudomonas aeruginosa* NCTC10662 (inhibition zone, 19 mm).
Similarly fluorescence characters of the crude drugs are considered very important marker in making distinction among the drugs. Here some distinct features have been identified which are very much distinctive in identifying the respective drugs.
Thus, it may conclude that the present study will add some specific criteria for authentification of all those respective crude drugs and will be helpful for the quality control and to increase the economic potentiality of these drugs.

Acknowledgements
We are very grateful to the Head of the Botany Department, Visva-Bharati for providing the necessary laboratory facilities and also very thankful to the University Grant Commission, Govt. of India for financial assistance.

References
1. Rahaman, C.H., Choudhury, S. and Mandal, S. Studies on foliar Epidermal micromorphology and stem xylem elements of Dipteracanthus prostratus and Hygrophila schulli - two medicinl plants of Acanthaceae. J. Botan. Soc. Beng. 2008 62 (1): 33-42.

2. Choudhury, S., Rahaman, C.H. and Mandal, S. Studies on foliar epidermal micromorphology and preliminary phytochemical screening of three medicinally important taxa of the family Vitaceae. Sci. & Cult. 2009, 75 (7-8): 294-300.
3. Cutler, D.F., Systematic anatomy and embryology, recent development, In Current concepts in Plant Taxonomy, pp. 1984, 107- 131. Eds. VH Heywood & D.M. Moore (Academic Press: London, UK).
4. Ogundipe, O.T. & Olatunji, O.A., The leaf anatomy of the species of Cochlospermum Kunth. (Cochlospermaceae) in West Africa, Feddes Repertorium. 1991, 102: 183-187.
5. Parveen, N.S.; Murthy, K.S.R & Pullaiah, T. Leaf epidermal characters in Crotalaria sp. (Papilionoideae) from Eastern Ghats, Phytomorphology. 2000, 50: 205-212.
6. Mukherjee, K.K., Roy, M. Saha, P.K., Ganguly, S.N. Surface morphology of tea (Camellia sinensis L.) leaves, Phytomorphology. 2000, 50: 125-131.
7. Banerjee, A., Rahaman, C.H., Kar, R.K. and Mandal, S., Micromorphology of foliar epidermis of some tropical tree legumes. Pytomorphology, 2002, 52(2 & 3): 223-230.
8. Paliwal, G.S. Structure and ontogeny of stomata in some Acanthaceae Phytomorphology. 1966, 16: 533-539.
9. Inamder, J.A. Epidermal Structure and ontogeny of Caryophyllaceous stomata in some Acanthaceae Bot. Gaz. 1970, 131: 261-268.
10. Carpenter, S.B. & Smith, N.D. Stomatal distribution and size in Southern Appalachian hardwoods, Can. J. Bot. 1975 53: 1153 – 1156.
11. Kothari, M.J. & Shah, G.L. Epidermal structure and ontogeny of stomata in the Papilionaceae Bot. Gaz. 1975, 136 : 372-379.
12. Ahmed, K.J. Stomatal features of Acanthaceae. In Structure, Function and Ecology of Stomata, 1979, pp. 43-60 .Ed. DN Sen (Bishen Singh Mahendra Pal Singh; Deheradun, India).
13. Rajagopal, T. Distributional patterns and taxonomic importance of foliar stomata. Indian J. Bot. 1979, 2: 63-69.
14. Metcalfe, C.R. & Chalk, L. Anatomy of Dicotyledons, 1950, Vol. 2 (Clarendon Press : Oxford, UK).
15. Hagarup, O. The Morphology and systematics of the leaves of Ericales Phytomorphology. 1953, 3: 459 – 464.
16. Trease, G.E. & Evans, W.C. Pharmacognosy. English Language Book Society Bailliere Tindall, 1983.
17. Harborne J.B., Christine A. Williams. Phytochemistry. 2000, 55:481-504.
18. Jain, S.K. and and Rao, R.R., A Hand book of Field and Herbarium Methods. Today and Tomorrow's Printer and Publishers, New Delhi. 1977.
19. Bokhari, M.H. Morphology and Taxonomic significance of foliar sclereids in Limonium. Notes Royal Bot. Gard. 1970, 30: 43-53.
20. Johansen, D.A. Plant Microtechnique, Mc Graw-Hill, New York 1940.
21. Bush, I.E. and Taylor, D.A., Paper chromatographic examination of the cardiac aglycones of Stropanthus seeds. Biochem. Jour. 1952, 52: 643.
22. Cromwell, B.T., Paech, K. and Tracey, M.V. Modern methods of plant analysis. 1955 Vol 4. Springer-Verlag, Heidelberg.
23. Youngken, H. W. Pharmaceutical Botany. 7th edn. The Blakiston Co. Toronto 1951.
24. Youngken, H. W. Natural Drugs – Morphology and Taxonomic Consideration. Biotech Books, Delhi, 2003.
25. Gylulai, F (Ed.). Preservaion and Use of Agrobiodiversity. A lecture dedicated to A. Janossy (1908 – 1975), the founder of the Hungarian Agrobotanical Institute and Genebank. Agr. Mus., Inst, Agrobot., Budapest, Tápiószele, 2000.
26. Bhakuni, D.S. Biologically active compounds from some Indian plants. In: Chatterjee, S.K. (ed.) Proc. 5th Int. Soc. Hort. Sci. Med. Arot. Sp. Plts., Darjeeling, 1985, pp 1-4.
27. Pharmacopoeia of India (Indian Pharmacopoeia) The Controller of Publications, New Delhi, 1996, 4th edition, Vol. 1.. pp A 100-A124.

28. Dhenukar, S.A. and Garkal, Development of herbal products as a therapeutic agent. Chem weekly 1995, 6: 114-118.
29. Dülger, B., Kirmizi, S., Arslan, H. and Güleryüz, G. Antimicrobial activity of three endemic Verbascum species. Pharm. Biol. 2002, 40 (8): pp. 587-589.
30. Prakash. W.J., Hepsibha. S, Joseph, J. and Balasingh, G.S. Regini. Antibacterial activity of selected macro-algae from the river Thambraparani, Tamilnadu. Ind. J. Bot. Res. 2008, 4 (3&4): 405-409.