Jenifer Panneer and Balakrishnan CP. / *International Journal of Phytopharmacology*. 6(3), 2015, 143-151.

e- ISSN 0975 – 9328
Print ISSN 2229 – 7472

International Journal of Phytopharmacology

Journal homepage: www.onlineijp.com

IJP

MORPHO-ANATOMICAL AND PHYTOCHEMICAL STUDIES OF *COMMENLINA BENGHALENSIS* L. OF *COMMENLIACEAE*

Jenifer Panneer and C.P. Balakrishnan*

Project Fellow, Department of Botany, Aditanar College of Arts and Science, Virapandianpatnam, Tiruchendur - 628 216, Tamil Nadu, India.
*Assistant Professor & Head, Department of Botany, Aditanar College of Arts and Science, Virapandianpatnam, Tiruchendur - 628 216, Tamil Nadu, India.

ABSTRACT

The bioactive substances or chemical constituents naturally occur in the organ of medicinal plants and they have therapeutic importance. On this basic information, the perennial monocotyledon herb *Commenlina benghalensis* L. of *Commenliaceae* was examined by morpho-anatomical and phytochemical studies (Qualitative and Quantitative) were made. The most important bioactive compounds such as alkaloids, catechin, flavonoids, phenols, tannins, steroids, glycosides etc were presents in the entire dried sample. Quantification of physicochemical, biochemical and photosynthetic pigments were notably presents in the dried shoot and root of *C. benghalensis*.

Key words: *Commenlina benghalensis*, Morpho - anatomy, Phytochemicals and Quantification.

INTRODUCTION

Medicinal plants are the major sources of medicines in Ayurvedha, Siddha, and Folk medicine systems. In India about 95% of all modern drugs are derived from medicinal plants and very likely most of these medicines are used by people to cure many ailments. The medicinal plants are rich in secondary metabolites and essential oil which are of therapeutic importance. The presence study deals with morpho-anatomical characters, phytochemical studies such as physicochemical and biochemical estimation of medicinal plant of *C. benghalensis*. L. It is a benghal day flower and also known as tropical spiderwort, is an herbaceous perennial and a troublesome weed, native to Africa and tropical Asia. They belong to this family *Commenliaceae* and genus *Commenlina*. Whole part of the plant is medicinally useful. Plant is bitter, emollient, demulcent, refrigerant, laxative and beneficial in leprosy treatment. The plant is used medicinally but as a laxative to cure inflammations of the skin as well as leprosy (Qaiser *et al.*, 1975). The people of Nepal eat the young leaves as a vegetable, use a paste from the plant to treat burns and the fluid from the roots is used to treat indigestion (Manandhar *et al.*, 2002).

Corresponding Author

C.P. Balakrishnan
Email: sharubala08@gmail.com

MATERIALS AND METHODS

Collection of plant materials

Commenlina benghalensis L. was collected from near costal area of Tiruchendur Taluk in Tuticorin district, Tamil Nadu. India. Herbarium specimen was prepared and identified based on the keys given by (Oladipo *et al*., 2014). The collected plant was authenticated and voucher specimen (Voucher No. ACBH34) was lodged in the Botany Research Laboratory, Aditanar College of Arts and Science, Virapandianpatnam, Tiruchendur, Tamil Nadu, India.

Morpho-anatomical observations

Macroscopic studies

The fresh plant was used for the study of macroscopic characters such as habit, stem type, leaf type, phyllotaxy, leaf shape, leaf blade, leaf apex, leaf surface,

leaf base, leaf margin, leaf venation, stem colour, root colour and flower colour, flower shape, length of plant, length of leaf, width of leaf, length of flower, width of flower, width of stem etc, as described by (Brain and Turner, 1975; Wallis 1985).

Microscopic study

Anatomical study was carried out by taking free hand section of fresh leaves, stem and root of *C. benghalensis* L. Toludine blue O, Eosin blue and Crystal violet was used to stain the sections. Photomicrographs were taken by using compound binocular microscope (Olympus CH20i) with built in analogue camera and the help of Adobe Photoshop version 11.0. of Computer.

Preparation of plant materials

The whole plant was cleaned thoroughly in order to free it from dust, soils and other unwanted materials that may adhere to it. The plant was shade dried and then ground to fine powder using mortar and pestle and then stored in an appropriate container until required for further analysis.

Physicochemical analysis

Physicochemical parameters such as total ash value, acid insoluble ash value, water soluble ash value and moisture content were determined as per method described Anonymous, 1996.

Phytochemical screening

Two gm of powdered sample was taken and extracted by cooling percolation method using different solvents (Benzene, Petroleum ether, Chloroform, Acetone, Methanol and Water) at room temperature. Then the extract was collected and subjected for phytochemical analysis and identification of various phytochemical constituents as per standard procedures (Harborne, 1973; Brinda *et al.,* 1981 and Lala, 1993)

Quantitative estimation

For biochemical analysis such as estimation of carbohydrate, protein, amino acid, total free phenols, tannins, organic carbon, chlorophyll *a, b*, total chlorophyll and carotenoids were carried out using standard methods. The total carbohydrate was estimated by anthrone method of Sheifter *et al.,* (1950). Protein was estimated by Lowry's method (Lowry *et al.,* 1951). Amino acid was estimated by ninhydrin method as suggested by Rosen, (1957). Other biochemical's like estimations of total free phenols by Folin-Ciocalteu's method by Sadasivam and Manickam (1992), tannin was vanillin-HCl method by Burns (1971)**,** Vitamin A by (Eitenmiller and Landenm, 1998), Organic carbon by (Walkley and Black, 1943), and photosynthetic pigments by Arnon (1949) as modified by Harborne (1973) methods are followed.

RESULTS AND DISCUSSION

Morphological character

Morphological observations of *C. benghalensis* L. was presented in table 1. *C. benghalensis* L (Benghal dayflower) is a perennial herb 20-25 cm long, stem are round and hairy. Width of stem was 0.3-0.4 cm, stems often root at the nodes and purple-blue aerial flowers are funnel-shaped about 2 cm long 1.2 cm width. Roots are white and brown and fibrous. Underground stolons can produce subterranean flowers are cleistogamous reported by (Ferrell *et al*., 2004). Stipules are absent. Leaves evenly distributed (alternately) on the stem, simple, 5cm length and 3-3.5 cm width, sub-sessile, leaf blade curved, leaf surface hairy and leaf sheath are present, leaves and above ground stems have short hairs (pubescent) and longer red hairs on the leaf sheath and petiole margins, margin is entire, apex acute and parallel-veined.

Microscopic characters

Stem

Transverse section of *C. benghalensis* stem is circular in outline with trichomes emerging all over the surface. For microscopic observation, it consists of epidermis, hypodermis, ground tissue and vascular bundles. The epidermis is a single outer layer rectangular in shape with thick cuticle covering and the presence of hairs or trichomes are emerged from the epidermal cells. Next to epidermis constitute the hypodermis. It was 3 to 5 layers of thick walled cells collenchymatous followed by few layers of chlorenchymatous cells are present. The cells of the ground tissue are smaller in size, compactly arranged polygonal in shape. The vascular bundles are scattered in ground tissue, closed, collateral, enclosed by sclerenchymatous sheath was present. Starch grains, scelerides, and raphides (crystals) are present in the cortical cells. Spiral thickening of xylem vessels also present. These observations were confirmed early by (Tomlinson, 1969; Kausch and Horner, 1982, Madhavan *et al.,* 2010). (fig 1)

Root

Single outermost layer rhizodermis is thick walled cells and unicellular root hairs are present. Next to the rhizodermis followed by hypodermis one or two layers of thick walled parenchymatous cells were present followed by thin walled parenchymatous cells are present. Stone cells and intercellular space are present in the hypodermis. Broad parenchymatous ground tissues are smaller in size, compactly arranged polygonal shaped cells. The vascular bundles are scattered in ground tissue, closed, collateral and enclosed by sclerenchymatous sheath was present. Crystals were found in phloem parenchymatous cells and spirals of vessels and sieve plates also observed in xylem elements. (fig 2).

Leaves

Transverse section of *C. benghalensis* leaves consists of an upper epidermis and lower epidermis. The epidermal cells are polygonal in shape. Amphistomatic types of stomata were present and abaxial side of the epidermis is more frequently. The presence of simple bicellular hooked non glandular trichomes on both surface of leaves. The epidermal morphology of *C. benghalensis* was also reported by Oladipo and Ayo-Ayinde (2014). The ground tissue system of leaf is known as mesophyll tissue. The presences of mesophyll tissue have lot of air spaces. The vascular bundles are collateral and closed. Kidney shaped, hexacytic type stomata were present. This observation was agreed in earlier work of Chandurkar (1971). Xylem vessels and trachids are also present in the vascular bundle. Stone cells of astrosclereids and osteosclereids were present in the mesophyll tissue. Crystals and starch grains are present in the mesophyll tissue. (fig 3).

Physicochemical analysis

The dried root and shoot of *C. benghalensis* L plant powder was carried out to the physicochemical analysis. In this study moisture content, total ash value, acid insoluble ash value, and water soluble ash value were determined is presented in Table - 2. The moisture content of shoot (13.047±0.904%) and root (14.307±0.142%) were recorded. Total ash, acid insoluble and water soluble ash value of the shoot via 16.33±0.163%, 1.267±0.147%, 11.250±1.97% and root via 17.987±0.131%, 7.533±0.178%, and 10.170±0.111% were respectively noted. The amount of composition of ash remaining after combustion of plant material varies considerably according to the part of the plant, age, treatment etc. the constituents of the ash also vary with time and from organ to organ. Ash usally represents the inorganic part of the plant (Vermani Archa *et al.,* 2010). Ash value is useful in determination authencity and purity of sample and also these values are of important qualitative standards. When the plant is consumed higher value of acid insoluble ash indicates the higher digestability (Lethika Nair *et al.,* 2012). The amount of inorganic matter present in the sample and the acid insoluble ash almost with in 1.5% which expresses low siliceous matter present in the sample (Kumar S *et al.*, 2014).

Phytochemical screening

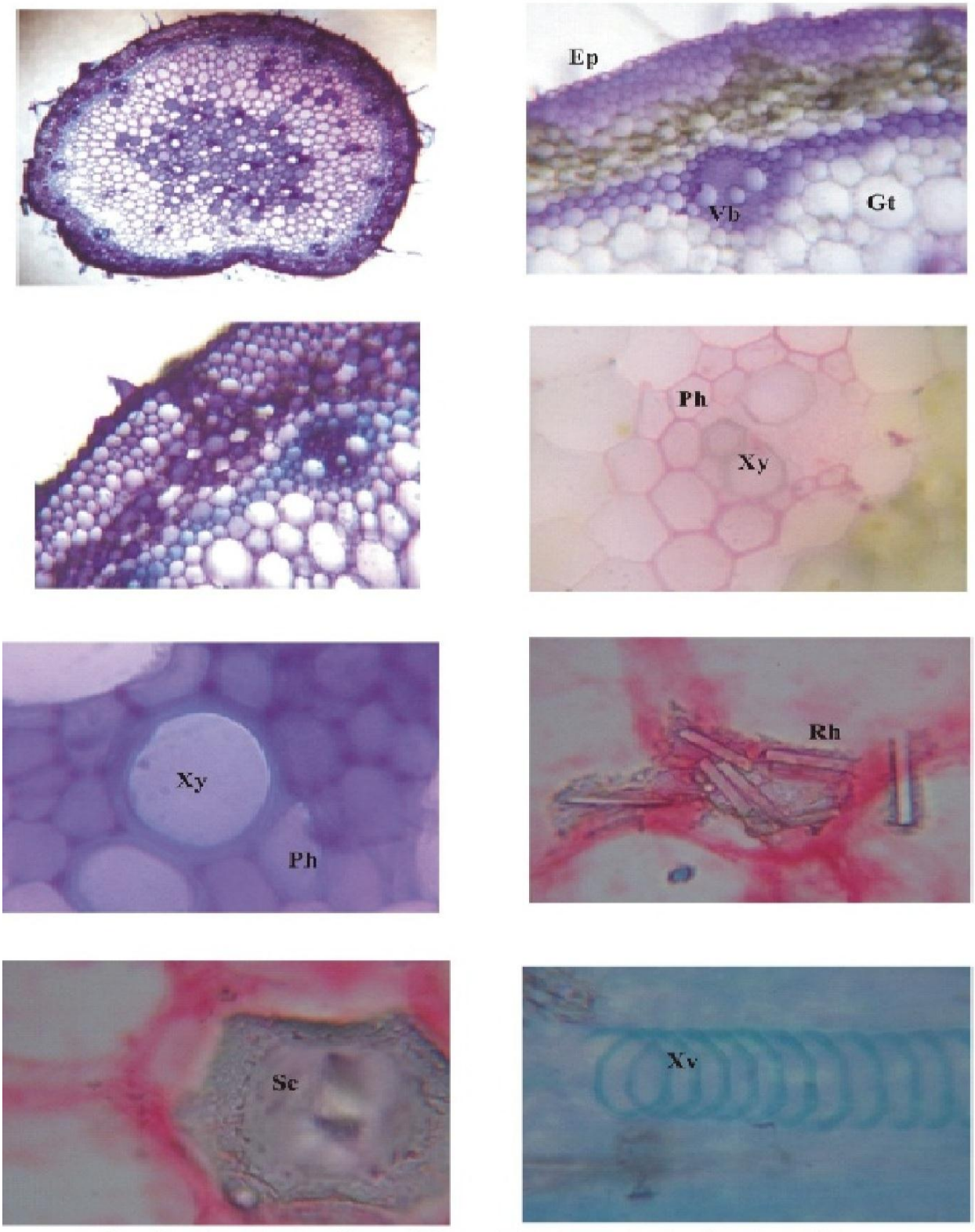
The phytochemical screening of *Commenlina benghalensis* L. was presented in Table-3. The bioactive compound like alkaloids, catechin, flavonoids, phenols, quinons, saponins, tannins, sugar, glycosides, protein and amino acids were presents. The compound like anthraquinones, coumarin, and xanthoprotein are absent. The traditional uses of this plant *C. benghalensis* reacted against infection by wounds or burns (Mohammad A A Khan *et al., 2011*) and also this medicinal plant has antibacterial activity. Phytochemical screening is one of the techniques to identify new sources of therapeutically and industrially important compounds present in the plant extract. The chemical constituents of plants are desirable the synthesis of new bioactive compounds for treating the specific disease such phytochemical screening in various plants is reported by many workers. The plant is also suggested to have diuretic properties (Jayvir *et al.,* 2002). The presence of tannin shows that the plant is astringent as documented and suggests that it might have antiviral and antibacterial activity and can aid in wound healing and burns (Haslem, 1989; Ibrahim *et al.,* 2010). The saponins and glycoside are also very important classes of secondary metabolites as some are cardio-active and used in treatment of heart conditions (Oloyode, 2005). The plant body of *C. benghalensis* L is used in the treatment of leprosy and leucoderma (Mukerjee, 2006).

Biochemical Analysis

Biochemical constituents such as carbohydrate, protein, amino acid, vitamin A and organic carbon of dried shoots and roots *C. benghalensis* L. were presented in Table 4. The primary metabolites of carbohydrate (0.582±0.009mg/g and 0.005±0.0004 mg/g), protein (15.62±0.134 and 1.08±0.025 mg/g), and amino acid (1.191±0.013 and 0.269±0.010 mg/g) were presented in the shoot and root system respectively. The presence of higher protein level in the plant towards their possible increase in food value and that a protein base bioactive compound could also be isolated in future (Thomsan *et al.,* 1991). The vitamin A content of shoot (17.48±0.205) and root (13.6±0.277mg/g), organic carbon content shoot (22.6±0.145) and root (15.2±0.119%) were presented. The secondary metabolites like total free phenols (44.8±0.438 mg/g) and (12.8±0.118mg/g), tannins in (10.7±0.26 and 1.3±0.159mg/g) were presented in the dried shoot and root of *C. benghalensis* L. respectively. Medicinal plants have provided a good source of a wide variety of compounds, such as phenolic compound vitamins and some other secondary metabolites with are rich in valuable bioactivities such as anti-inflammatory agent, antibacterial, antifungal and antiviral activities (Lai, 2014, Tapseell, 2006 and Soni *et al.,* 2013).

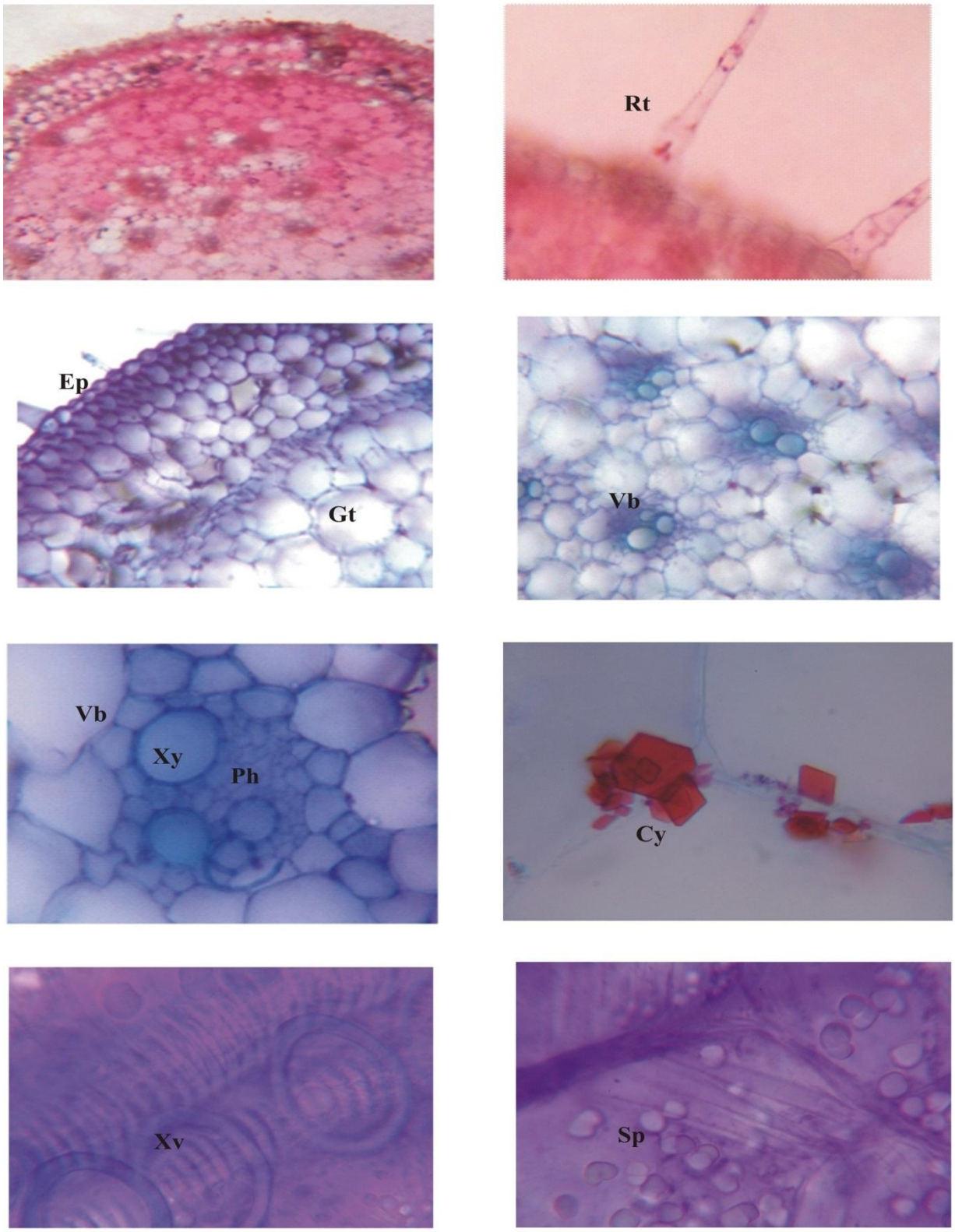
The photosynthetic pigments like chlorophyll *a*, chlorophyll *b*, total chlorophyll and carotenoids content of fresh shoot and root were estimated and presented in Table 5. The pigment chlorophyll *a*, chlorophyll *b*, total chlorophyll and carotenoids content of fresh shoot; 0.397±0.015, 0.157±0.018, 0.543±0.008, 104.86±1.98 mg/g, and root; 0.007±0.0007, 0.012±0.0014, 0.022±0.0014 and 7.833±0.540 mg/g were respectively. The considerable amount of photosynthetic pigments to enhance the metabolic activity of *C. benghalensis* and also the carotenoids are functioned as provitamin A activity.

Fig 1. Photomicroscopy of *C. benghalensis* stem



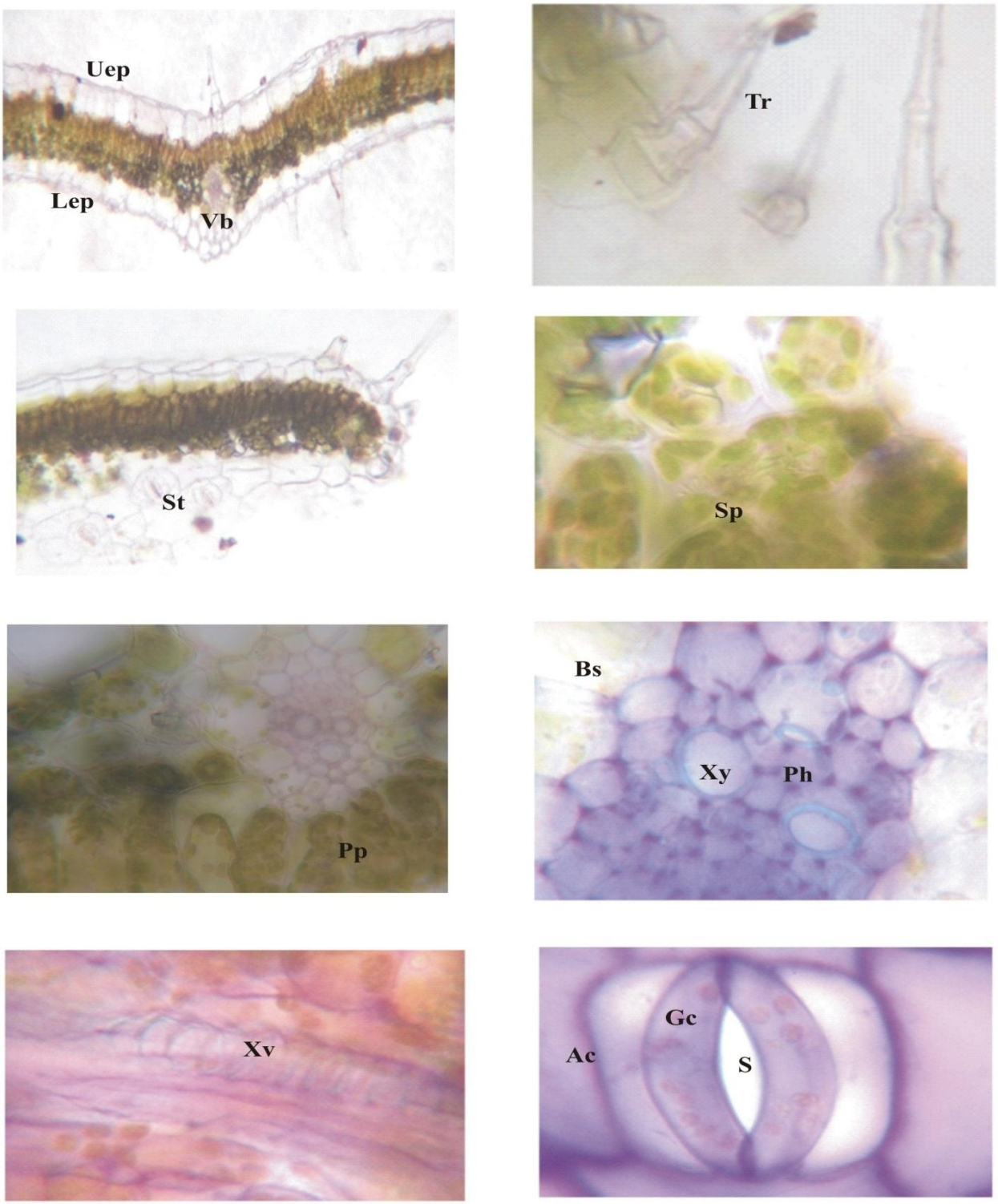
Ep= Epidermis; Gt = Ground tissues; Vb = Vascular bundle; Xy = Xylem
Ph = Phloem; Xv = Xylem vessels; Rh = Raphides; Sc = Sclereides

Fig 2. Photomicroscopy of *C. benghalensis* root



Rt = Root hairs; Ep =Epidermis; Gt = Ground tissues; Vb = Vascular bundles;
Xy = Xylem; Ph = phloem; Xv = Xylem vessels; Sp = Sieve plate; Cy = Crystals

Fig 3. Photomicroscopy of *C. benghalensis* leaves



Uep = Upper epidermis; Lep = Lower epidermis; Vb = Vascular bundles; St = Stomata; Sp = Spongy parenchyma; Pp; Palisade parenchyma Xy = Xylem; Ph = Phloem; Xv = Xylem vessels; Gc = Guard cells Ac = Accessary cells; S = Stoma
Xy = Xylem; Ph = phloem; Xv = Xylem vessels; Sp = Sieve plate; Cy = Crystals

Table 1. Morphological observations of *Commenlina benghalensis.* L

Sl. no.	Morphological observation	*C. benghalensis.* L.
1.	Habit	Herb
2.	Stem type	Round with nodes and hairy
3.	Leaf type	Simple
4.	Phyllotaxy	Alternate
5.	Leaf shape	Ovate
6.	Leaf blade	Curved
7.	Leaf apex	Acute
8.	Leaf surface	Hairy (white and brown coloured hairs)
9.	Leaf base	Sheathing
10.	Leaf margin	Entire
11.	Leaf venation	Parallel
12.	Stem colour	Green
13.	Root colour	White and Brown
14.	Root flower	subterranean flowers (Cleistogamous)
15.	Flower colour	Purple blue
16.	Flower shape	Funnel shape
17.	Length of plant	20-25 cm
18.	Length of leaf	5 cm
19.	Width of leaf	3-3.5 cm
20.	Length of flower	2 cm
21.	Width of flower	1.3 cm
22.	Width of stem	0.3-0.4cm

Table 2. Physicochemical analysis of *Commenlina benghalensis* L. dried shoot and root system (n=3; means ± SE)

Parameter	Shoot	Root
Moisture content % (w/w)	13.047±0.904	14.307±0.142
Total ash % (w/w)	16.327±0.163	17.987±0.131
Acid insoluble ash % (w/w)	1.267±0.147	7.533±0.178
Water soluble ash % (w/w)	11.250±0.197	10.170±0.111

Table 3. Preliminary phytochemical screening of *C. benghalensis* L. of Commenliaceae

Phytoconstituents	Solvents					
	Benzene	Petroleum Ether	Chloroform	Acetone	Methanol	Water
Alkaloids I. Mayer's test	-	-	-	+	+	-
II.Wagner's test	-	-	-	-	+	-
Anthraquinones (Borntrager's test)	-	-	-	-	-	-
Catechin	-	-	-	+	+	+
Coumarin	-	-	-	-	-	-
Flavonoids	+	-	+	+	+	+
Phenols	-	+	+	+	+	+
Quinones	-	-	-	+	+	+
Saponin (Foam test)	+	+	+	+	-	-
Steroids	-	-	-	-	+	-
Tannins	+	-	+	+	+	+
Sugar I. Benedict's test	-	-	+	+	+	+
II. Fehling's test	-	-	+	+	+	+
Glycosides I. Anthrone test	+	+	-	-	-	-
II. Borntrager's test	-	-	-	-	-	-
Amino acids Ninhydrin test	-	-	-	+	+	+
Xanthoprotein	-	-	-	-	-	-
Protein	+	-	+	+	+	+

('+' present, '-' absent)

Table 4. Biochemical composition of *C. benghalensis* dried shoots and roots (n=3; means ± SE)

Parameter	Shoot	Root
Carbohydrate mg/g	0.582±0.009	0.005±0.00038
Protein mg/g	15.62±0.134	1.08±0.025
Amino Acid mg/g	1.191±0.013	0.269±0.010
Vitamins A Mg/100g	17.48±0.205	13.6±0.277
Total free Phenols (mg/g)	44.8±0.438	12.8±0.118
Tannins (mg/g)	10.7±0.262	1.3±0.159
Organic Carbon %	22.6±0.145	15.2±0.119

Table 5. Photosynthetic pigments of *C. benghalensis* fresh shoot and roots (n=3; means ± SE)

Parameter	Shoot	Root
Chlorophyll a (mg g^{-1})	0.397±0.015	0.007±0.0007
Chlorophyll b (mg g^{-1})	0.157±0.018	0.012±0.0014
Total Chlorophyll (mg g^{-1})	0.543±0.008	0.022±0.0014
Carotinoids (mg g^{-1})	104.866±1.982	7.833±0.540

CONCLUSION

The present study could be used to standardize the bioactive substance of *C. benghalensis* L. in future.

REFERENCES

Anonymous, Indian Phamacopoeia, Edn 4, Government of India, Ministry of Health and Family Welfare, Controller of Publication, New Delhi, 1996, 53-A54

Arnon DJ. Copper enzymes in isolated chloroplast phenol oxidase in *Beta vulgaris. Plant Physiol*, 24, 1949, 1-15.

Brain KR, Turner TD. The practical evaluation of phytopharmaceuticals. Bristol: Wright Scientechnica, 1975, 4-9.

Brinda P, Sasikala P, Purushothaman KK. Pharmacognostic studies on Merugan Kizhangu. *Bullet in Medical Ethanobotanical Research*, 3, 1981, 84-96.

Burns RR. Methods for estimation of tannin in grain, Sorghum. *Agron. J*. 63, 1971, 511–512.

Chandurkar PJ. PLANT ANATOMY. Fourth edition, Oxford & IBH Publishing Co, Newdelhi, 1971.

Eitenmiller RR. and Landen Jr, W.O. Vitamin analysis for the health and food sciences. CRC Press, Boca Raton, Florida, USA. 1998, 122-123.

Ferrell JA, GE. MacDonald. Tropical Spiderwort (*Commelina benghalensis* L.), Identification and Control. SS-AGR-223. University of Florida, Gainesville, FL, 2004.

Harborne JB. Phytochemical methods. Chapman & Hall, New York, 1973, 288.

Haslem E. *Plant polyphenols: Vegetable tannins revisited – chemistry and pharmacology of natural products*. Cambridge University Press, Cambridge, 1989, 169.

Ibrahim, Jemilat, Ajaegbu, Vivian Chioma, Egharevba and Henry Omoregie. Pharmacognostic and Phytochemical Analysis of Commenlina benghalensis L. *Ethanobotanical leaflets*, 14, 2010, 610-615.

Jayvir A, Minoo P, Gauri B and Ripal K. *Nature Heals: A glossary of selected indigenous medicinal plant of India*. 2nd Ed, SRIST Innovations, Ahmedabad, India, 2002, 22.

Kausch AP and Horner HT. A comparison of calcium oxalate crystals isolated from callus cultures and their explant sources. *Scanning Electron Microscopy*, 1982, 199-211.

Kumar Santhosh, Niranjan Sutar, Anurag Kumar, Ranju Sutar and Sonu Sonkar. Pharmacognotical characterization on the leaves of *Euphorbia hirta* (Family: Euphobiaceae). *Ind, Res J Pharm & Sci*, 1(2), 2014, 10-16.

Lai PK. Antimicrobial and chemo preventive properties of herbs and spices. *Curr. Med. Chem*, 2004, 1451-60.

Lala PK. Lab manuals of Pharmacognosy. CSI Publishers and Distributers, Calcutta, 1993, 226.

Lethika Nair D, Sar Santhose K, Arora Arun and Mahapatra Deepak. A comparative study on proximate analysis conducted on medicinal plant of Chhattisgarh, CG, India. *Res J. Chem Sci*, 2 (9), 2012, 18-21.

Lowry OH, Rosebrough NJ, Farr AL, Randall RJ. Protein measurement with the folin phenol reagent. *J. Biol. Chem*, 193, 1951, 265–275.

Madhavan V, Gajendra Singh Tomar, S N Yoganarasimhan and M R Gurudeva. Pharmacognostical studies on *flickingeria nodosa* (Dalz) Seidenf. Stem and pseudobulbs – A botanical source of the Ayurvedic drug Jivanti. *Indian J Nat prod Resource*, 1(1), 2010, 22-28.

Manandhar, N and Sanjay P. *Plants and people of Nepal*. Timber press. Nepal, 2002.

Mir Amin M, Sawhney SS and Jassal MMS. Qualitative and quantitative analysis of Phytochemicals of *Taraxacum officinale*. *Wudpecker J Pharmacy and Pharmocology*, 2(1), 2013, 001-005.

Mohammad AA Khan, Mohammad T Islam, Md. Ashikur Rahman and Qamrul Ahsan. Antibacterial activity of different fractions of *Commelina benghalensis* L. *Der Pharmacia Sinica*, 2 (2), 2011, 320-326

Mukerjee SK. *College Botany.* Academy Press, London and New York, 2006, 45-57.

Oladipo OT and Ayo-Ayinde MA. Foliar Epidermal Morphology of the Genera *Aneilema* and *Commenlina* (Commenlinaceae). *Ife J science*, 16 (2), 2014, 219-225.

Oloyode O.I. Chemical profile of unripe pulp of *Carica papaya*. *Pakistan Journal of Nutrition*, 4(6), 2005, 379-381.

Qaiser M, Jafri SMH, In: Flora of Pakistan S.I. Ali, M. Qaiser (Ed.). *Commelina benghalensis* (Botanical Garden Press, Missouri,) 10, 1975.

Rosen H. A modified ninhydrin colorimetric analysis for amino acids. *Arch Biochem Biophys*, 67(1), 1957, 10–15.

Sadasivam S. and A. Manickam. Biochemical methods for agricultural sciences. Wiley Eastern Ltd., Madras. 1992, 240.

Sheifter S. Bayton S, Novic B. and Muntwyler E. The estimation of glycogen with the anthrone reagent. *Arch. Biochem. Biophys*, 25, 1950, 190–200.

Soni Anjali and sheetal sosa. Phytochemical analysis and free Radical Scavenging potential of herbal and medicinal plant Extracts. *J Pharmacognocy and Phytochemistry*, 2(4), 2013, 22-29.

Tapsell LC. Health benefits of herbs and spices the past the present, the future. *Mad. J. Aust*. 1, 2006.

Thomsen S, Handen HS and Nyman V. Ribosome inhibiting proteins from in vitro cultures of phytolacea dodecandra. *Planta. Med*. 57, 1991, 232-236.

Tomlinson PB. Anatomy of the monocotyledons. III. Commelinales- Zingiberales. Oxford: Oxford University Press, 1969.

Vermani Archa, Navneet, Prabhat and Avnish chauhan. Physicochemical analysis of ash of some medicinal plants growing in Uttarakhand, India. *Nature and science*, 8(6), 2010, 88-91.

Walkley AJ and Black IA. An estimation of the method for determining soil organic matter and proposed modification of the chromic acid titration method. *Soil. Sci*, 37, 1943, 29-38.

Wallis TE. Test book of Pharmacognosy, CBS Publishers, Delhi, India. 1985, 572-575.