

Pharmacognostical Study of *Ixora coccinea* Flower

Bindu Gopalkrishnan*, Roy Chiranjeev

ABSTRACT

Introduction: The medicinal values of *Ixora coccinea* Linn. (Raktaka) has been recorded since ancient times. It belongs to family Rubiaceae. The roots and leaves are used in treating various ailments. The flower too has therapeutic potentials. Although the flowers are used as medicine by traditional healers it is not known too many. The current study is carried out to provide scientific details in the identification and the authenticity of *I. coccinea* Linn. floral parts with the help of pharmacognostical standards. **Methods:** Pharmacognosy of *Ixora coccinea* flower parts was carried out by macroscopy, microscopy, histochemistry, powder study, proximate analysis and preliminary phytochemical studies. **Results:** The macroscopic detail of the flower is calyx persistent; corolla scarlet orange with long corolla tube; the stamen alternipetalous and gynoecium bicarpellary with basal placentation. The transverse section of flower passing through corolla, corolla tube, calyx and ovary showed the presence of unicellular trichomes, cells of anthocyanin pigments, oil globules, calcium oxalate crystals and paracytic stomata. Powder microscopy showed the presence of oil globules, calcium oxalate crystals, anthocyanin pigments, starch grains, unicellular trichomes, stomata, vessels etc. Physicochemical studies revealed total ash (3.1%), acid insoluble ash (0.2%), water soluble ash (1.25%), alcohol soluble extractive value (11.25%) and water soluble extractive value (12%) respectively. Histochemistry and Preliminary phytochemical screening goes concurrent with the presence of alkaloids, glycosides, tannins, flavonoids, terpenoids, etc. **Conclusion:** The observations confirmed that in *Ixora coccinea* each floral whorl has its diagnostic characters. These will help in identification, authenticity and to put forth the pharmacopoeial standards of the said plant.

Key words: Pharmacognosy, *Ixora coccinea*, Rubiaceae, Raktaka, Flower, Pharmacopeia,

Bindu Gopalkrishnan*,
Roy Chiranjeev

Department of Botany, Mithibai College, Vile Parle (West), Mumbai -56, Maharashtra, INDIA.

Correspondence:

Dr. Bindu Gopalkrishnan

Department of Botany, Mithibai College, Vile Parle (West), Mumbai -56, Maharashtra, INDIA.

Email: bindu_phd@rediffmail.com

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INTRODUCTION

Herbal medicines had glorious past and promising future throughout the world. Hence it is necessary to identify and characterize the crude drugs well before the use. This can be easily and reliably done by the Pharmacognostic study. Pharmacognosy is the simultaneous application of various scientific disciplines with the object of acquiring knowledge of drugs from every point of view. *Ixora coccinea* Linn. is a shrub commonly known as Raktaka/ Rukmini/ Tetti etc. It belongs to family Rubiaceae.¹ It is much branched shrubs, branch lets somewhat compressed. Leaves are sessile, subcordate and amplexicaul at base, elliptic or oblong, obtuse, apiculate. Flowers numerous in dense, corymbiform, sessile or pedunculated cymes.² *Ixora coccinea* is native to India. The root, stem, leaves and flowers are used to treat various ailments in Indian traditional system of medicine. The use of flower in medicine is less known although it is mentioned in Ayurveda. The flowers of raktaka are used in dysentery, dysmenorrhoea, leucorrhoea, haemoptysis, catarrhal bronchitis, ophthalmopathy, sores, hypertension, anaemia and ulcers.³⁻⁴ It is also used as a remedy

for skin diseases, colic flatulence, wounds, indigestion and as antiseptic.⁵ The chemical composition of *Ixora coccinea* flower were intensively investigated in previous studies. The anthocyanins were extracted and studied in detail by HPTLC.⁶ *Ixora* flower has been confirmed as a natural pH indicator in all acid base titrations.⁷ The new triterpenoid, Ixoroid was isolated from the *Ixora* flower with spectral evidence.⁸ The pharmacological activities of flower was reported to have antioxidant, antitumor, wound healing, hepatoprotective and as chemoprotective.⁹⁻¹¹ However, the information regarding identification of the flower parts are not been carried out. As this flower has huge therapeutic potentials it needs to be explored and brought into world of herbal medicine hence, the current study was done. A detailed investigation on macroscopic, microscopic characters, histochemistry, physicochemical parameters, powder study, fluorescence analysis and preliminary phytochemical screening of the flower parts were done. These will help in identification and standardization of said drug.

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MATERIAL AND METHODS

Collection of plant material

Authentic flower sample were collected from wilderness areas of Gorai and Dapoli, Maharashtra, India. The flower was collected in the month of January early morning. The sample was authenticated for its botanical identity from the Botany department, Mithibai College, Vile Parle (W), Mumbai, India. After collection some of the flowers were preserved in Formalin: Acetic acid: Alcohol solution. Remaining flowers were dried after removing stamens, style and made into powder. It was sieved through British Standard Sieve, meshes number 85 and stored in air tight bottles.

Pharmacognostic Studies

Pharmacognosy of the entire flower was carried out using standard methodology.

(a) Macroscopy

The entire flowers were studied for its morphological characters using appropriate techniques.¹²

(b) Microscopy

Transverse hand cut sections of corolla, corolla tube and calyx with ovary were taken and made permanent with suitable stains.¹³ Quantification and photomicrographs were taken of the permanent preparations. The cell contents were measured using stage and ocular micrometer.¹⁴

(c) Histochemistry

The histochemical studies for the cell content were done by staining the hand cut sections of corolla, corolla tube, and calyx passing through ovary with different reagents.¹⁵

(d) Powder study

The dried powder of flower was treated with chloral hydrate solution followed by staining in 1% safranin for 5-10 mins and mounted in 50% glycerine.¹⁶

(e) Proximate analysis

The physicochemical parameters like ash values (total ash, water soluble ash and acid insoluble ash) and extractive values (water and alcohol extractive values) were established using powdered drug.¹⁷

(f) Fluorescence analysis

The fluorescence response of powdered drugs exposed to Ultra violet (U.V.) radiations was studied.¹⁸⁻¹⁹

(g) Preliminary phytochemical screening

A known quantity of dried powder was extracted with water and alcohol. These extracts were tested for different constituents.¹⁰⁻²²

RESULTS

Macroscopy

The fresh flower of *Ixora coccinea* is sessile, actinomorphic, bisexual, hypogynous and tetramerous. The calyx is with 4 sepals, short, triangular, persistent, gamosepalous measuring 0.3 - 0.35 - 0.4 cm in length. Corolla has four petals, oblong to ovate, gamopetalous, 0.5 - 0.7 cm in width; corolla tube is long scarlet orange colour, 3 - 3.2 - 3.5 cm in length. Androecium consists of 4 stamens, alternipetalous, extrose, anthers basifixed. The gynoecium is bicarpellary, syncarpous, bilocular ovary with basal placentation, bifid stigma. (Figure 1-2)

Organoleptic study of fresh flower: Colour – Scarlet orange, odour – characteristic, Taste – characteristic.

Microscopy

T.S of flower passing through corolla tube

Outer epidermis of corolla tube is single layered, compactly arranged, tangentially elongated cells measuring 90 - 105µm in length. It is covered



Figure 1: *Ixora coccinea* plant.

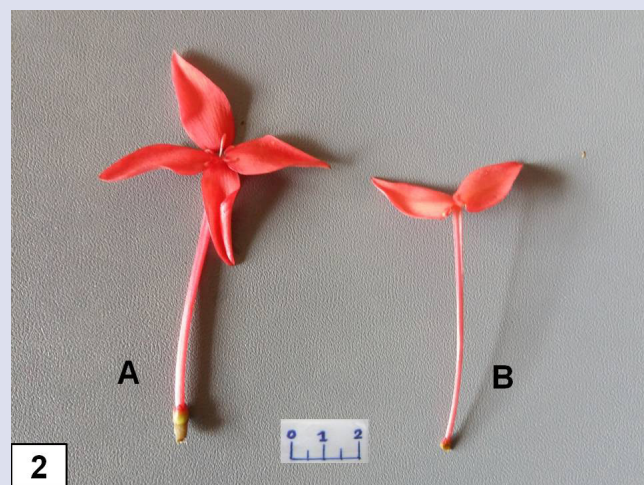


Figure 2: Flower of *Ixora coccinea* (A - Entire flower; B - L.S. of flower).

with thick waxy cuticle and interrupted by unicellular trichomes. The cells below the lower epidermis are larger and filled with anthocyanin pigments. Mesophyll region consists of 8-9 layers of polygonal parenchymatous cells measuring 45 - 60 - 75µm in diameter. This region is embedded with vascular bundles consisting xylem on the inner side and phloem on the outer side. The cells are filled with abundant oil globules, starch grains and few anthocyanin filled cells. Inner epidermis is similar to that of outer epidermis. The epidermis is interrupted with stomata and very few smaller trichomes. (Figure 3)

T.S of flower passing through corolla

Outer epidermis of corolla is single layered tangentially arranged 89 - 108 µm in length. It is covered with thick cuticle and few unicellular trichomes. The cell below the outer epidermis is larger and is filled with

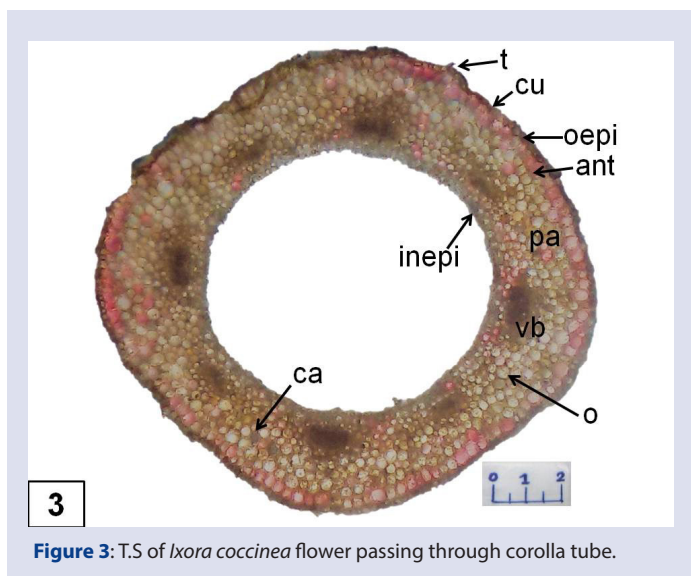


Figure 3: T.S. of *Ixora coccinea* flower passing through corolla tube.

anthocyanin pigments. Mesophyll region consists of 8-9 layers of closely packed parenchymatous cells 75 - 90 - 120 μm in diameter, with vascular bundles embedded at intervals. The parenchymatous cells are filled with oil globules and starch grains. Inner epidermis is similar to outer epidermis; it also shows a layer of anthocyanin filled cells above the inner epidermis. Trichomes are very few in number. (Figure 4)

T.S. of flower passing through calyx and ovary

T.S. of Calyx: The outer epidermis of calyx is single layered, compactly arranged, tangentially elongated cells 30 - 45 - 70 μm in length and covered with cuticle. It is interrupted with numerous unicellular trichomes

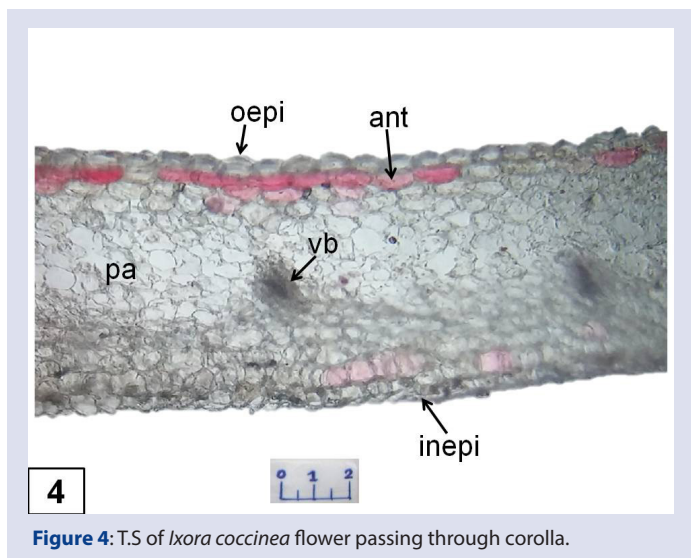


Figure 4: T.S. of *Ixora coccinea* flower passing through corolla.

and stomata. The outer epidermis of calyx is followed by a single layer of anthocyanin filled cells. Mesophyll region consists of 9 -10 layers of polygonal parenchymatous cells 105 - 120 - 135 μm in diameter. The mesophyll region is interrupted with vascular bundles. The cells are filled with oil globules, starch grains and calcium oxalate crystals. The inner epidermis of calyx is single layered with the absence of trichome and stomata.

T.S. of Ovary: The calyx surrounds the ovary. The ovary is bicarpellary. Both the ovaries are surrounded by an intact epidermis which is single layered and covered with cuticle. The central region of ovary is made up of parenchymatous cells closely arranged. The two ovaries are connected by a connective tube made of parenchymatous cells. (Figure 5)

Powder study

The *Ixora coccinea* flower powder

The dried flower powder is scarlet orange in colour. The flower powder on treatment with chloral hydrate solution followed by staining in

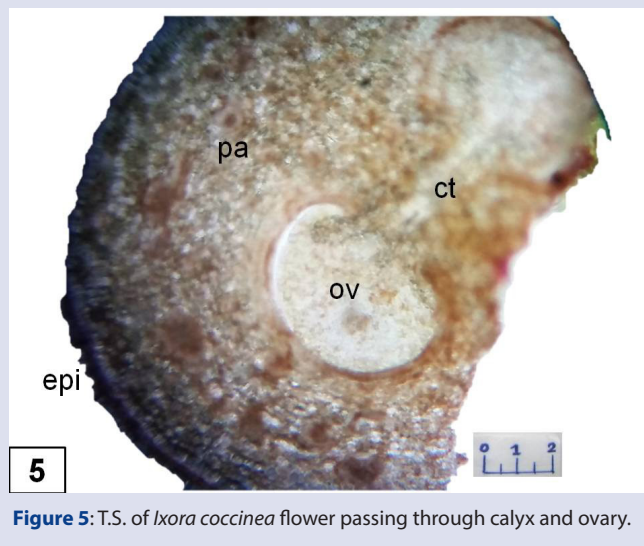


Figure 5: T.S. of *Ixora coccinea* flower passing through calyx and ovary.

1% Safranin for 5-10 mins and mounted in 50% glycerine exhibited fragments of parenchymatous cells, anthocyanin filled cells, paracytic stomata, annular vessels, starch grains, calcium oxalate crystals and oil globules. (Figure 6)

Histochemical Analysis

The histochemical analysis using various reagents showed the presence of primary and secondary metabolites like starch, lipids, proteins, tannins, saponins, glycosides and oil globules respectively.



Figure 6: Powder study of *Ixora coccinea* flower.

Physicochemical evaluation

The physicochemical constants of flower revealed total ash content 3.1%, water soluble ash content 1.25% and acid insoluble ash content 0.2%. Thus, the acid insoluble ash value states the presence of least amount of silica in flower powder. The extractive value of water is 12% and ethanol 11.25% the above extractive values determine that more chemical constituents are soluble in the water.

Fluorescence analysis

The fluorescence analysis of *Ixora coccinea* flower powder with different chemicals exhibited various colours in the UV light. The results are depicted in Table 1.

Phytochemical screening

The preliminary qualitative phytochemical screening of alcohol and water extract of *Ixora coccinea* dry flower revealed the presence of terpenoids, flavonoids, anthraquinone glycoside, cardiac glycoside and tannins. The saponin was reported only in water extract. Table 2.

DISCUSSION AND CONCLUSION

Pharmacognosy is the first step in deciding the status of a plant organ as a crude medicine before including it in herbal pharmacopoeia. It is important to establish pharmacognostic parameters for the detection of adulterant or substitute. The current research work focuses on, the pharmacognostic investigations of *Ixora coccinea* L. flower. The said flower is used by traditional and local people without standardization and has obtained good results. Macroscopic observations of fresh flower such as persistent calyx, scarlet orange corolla with corolla tube, the stamens alternipetalous and gynoecium bicarpellary with basal placentation are useful for gross identification of the flower. Anatomical features like unicellular trichomes, parenchymatous cells filled with anthocyanin pigments, starch grains, calcium oxalate crystals and oil globules are of significance in recognition of floral parts. The corolla tube differs from the corolla in presence of anthocyanin filled cells below outer epidermis and above inner epidermis as well as in the mesophyll region. The calyx shows the presence of paracytic stomata on the outer epidermis and also the presence of calcium oxalate crystals. The paracytic stomata are restricted to inner epidermis of corolla and corolla tube. These microscopic characters can be used as a parameters in standardization of *Ixora* flower. Authentication of powdered drug can be reliably done on the basis of diagnostic characters of paracytic stomata, oil globules, starch grains, anthocyanin filled cells, calcium oxalate crystals and annular vessels. Fluorescence analysis will be useful in identification of *Ixora coccinea* flower in powder form. All physicochemical parameters like ash and extractive values are also of help in detection of adulterants. The qualitative phytochemical and histochemical screening revealed the presence of diverse types of phytochemicals namely, alkaloids, tannins, terpenoids, flavonoids, saponins, essential oil etc. They give clue about therapeutic potential of the drug. In brief, all these findings are highly essential for the drug manufacturers in thorough assessment of quality drug and its efficacy.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

Table 1: Fluorescence analysis

Test	i	ii	iii	iv	v	vi	vii	viii	ix
Visible light	Dark brown	Brown	Brown	Orange	Reddish brown	Yellow	Brown	Orange	Orange
Short wavelength	Dark green	Light green	Light green	Purple	Brown	Yellow	Light green	Purple	Dark green
Long wavelength	Dark green	Dark green	Dark green	Purple	Brown	Yellowish brown	Dark green	Purple	Dark green

Table 2: Preliminary phytochemical screening

Test for phytoconstituents	Water extract	Ethanol extract
Test for Starch	+	-
Test for Terpenoids	+	+
Test for Proteins	+	+
Test for Amino acid	+	+
Test for Mucilage	+	+
Test for Alkaloids	+	+
Test for Anthraquinone glycoside	+	+
Test for Cardiac glycoside	+	+
Test for Saponin	+	-
Test for Tannins	+	+
Test for Steroids	-	-
Test for Flavonoids	+	+

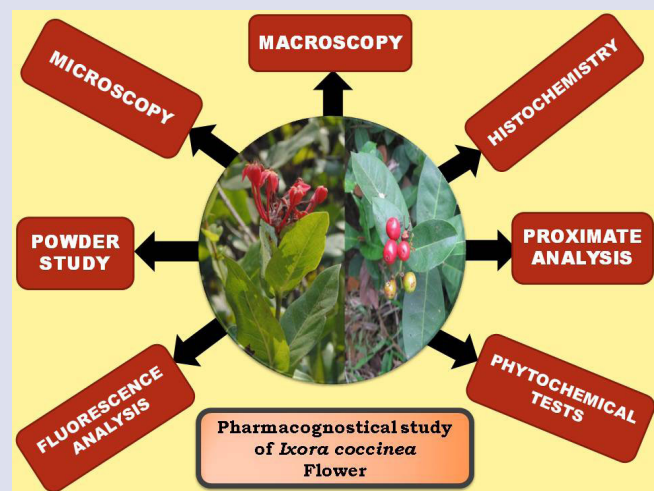
ABBREVIATIONS

T.S: Transverse section; **min:** Minutes; **cm:** Centimetre; **µm:** micrometre.; **t:** Trichome; **cu:** Cuticle; **ant:** Anthocyanin; **pa:** Parenchyma cell; **vb:** Vascular bundle; **inepi:** Inner epidermis; **oepi:** Outer epidermis; **ca:** Calcium oxalate crystal; **o:** Oil globule; **epi:** Epidermis; **ov:** Ovary; **ct:** Connecting tube; **s:** Starch grain; **v:** Vessel.

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PICTORIAL ABSTRACT



SUMMARY

- Ixora coccinea* Linn. is commonly known as Raktaka (Family: Rubiaceae). The flowers of Raktaka are used in curing various ailments such as dysentery, leucorrhoea, etc by the folklore. Until now, no scientific investigation had been carried out for the standardization of flower of *Ixora coccinea* Linn. Hence it was felt necessary to put forth the pharmacopoeial evidences of flower so that it can be a part of herbal world. The various parameters studied are macroscopy, microscopy, powder study, histochemical analysis, physicochemical evaluation and phytochemical tests. These parameters will be useful in authentication of *Ixora coccinea* flower.

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