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PHARMACOGNOSTIC AND PRELIMINARY PHYTOCHEMICAL STUDIES ON THE FLOWERS OF KVIDARA: BAUHINIA PURPUREA L.

T. R. Shantha*1, M. Prathapa Reddy2, V. Rama Rao3, Vandana bharthi4, R. Kishore Kumar5 and G. Venkateswarlu6

ABSTRACT

The present communication attempts to evaluate the macroscopy, microscopy, physico-chemical, preliminary phytochemical and TLC fingerprint studies of different extracts of the flowers of ‘Kvidāra’ (Bauhinia purpurea Linn.). Microscopically flowers showed the presence of unicellular to multicellular elongated warty trichomes in pedicel and calyx portion, abundant rosette and clustered calcium oxalate crystals in all most all parts of the flower. Abundant spheroidal to tricolporate pollen grains, crescent shaped vascular bundles at the centre of the petal region with xylem and phloem. Ground tissue of petal shows prominent colouring matter and starch grains. Preliminary phytochemical screening of the extracts showed the presence of carbohydrates, flavonoids, terpenoids, proteins, saponins, steroids and tannins. These parameters will be useful in the identification and standardization of the flower drug of Kvidara and also to identify other species of Bauhinia.

Key words: Bauhinia purpurea, Flower, Kvidara, Phytochemical, Pharmacognosy.

Introduction:

‘Kovidara’ is a Sanskritized Ayurvedic name of a medicinal tree botanically equated to Bauhinia purpurea Linn. (=Bauhinia triandra Roxb.) belongs to the family Caesalpiniaceae. It is a medium-sized, evergreen ornamental tree, found throughout India, ascending up to an altitude of 1,300 meters in the sub- Himalayan tract, sparingly throughout India and China, often cultivated and also planted among avenues for shade and ornamental purpose1. Reports of Macroscopical features suggest that the flower pedicel is 2.5-3.8 cm long, with rosy purple large flowers, in few flowered terminal, brown tomentose panicles; pedicels are 5-13 mm. long, stout, tomentose, tubes that are 7.5-10 mm. long. The limb is twice as long as the tube, usually splitting into 2 reflexed segments, i.e., one is emarginate and the others are tri-toothed. Petals are 3.8-5 cm. long, oblanceolate, long-clawed, spreading and veined. Among the stamens, 3 are usually fertile and the others (4) are reduced to anther-less filaments. Ovary is downy and long-stalked. Style is long and the stigma is large and oblique2.

The flowers, roots and bark of the Bauhinia purpurea Linn tree have been used in Ayurvedic medicinal formulations since times immemorial and has been mentioned in Ayurvedic classical texts. It also forms a part of folk and traditional community health practices in certain parts of Karnataka and India. Ayurvedic preparations also

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prescribe its use as one of the ingredient for intrinsic hemorrhage, snake poisoning etc. The flowers of the tree have got medicinal uses both in Ayurveda and in traditional systems. Hence, there is a necessity to develop standardized identification parameters to aid quality control and to avoid adulteration with special focus on flowers. Although botanical identification studies have been reported earlier, phytochemical fingerprinting has not been carried out till now. Hence this study is an attempt to develop and report comprehensive authentication parameters including macroscopical, microscopical, physico-chemical, preliminary and phytochemical profile of the flowers of *Bauhinia purpurea* Linn.

**Regional language Names :**

Sanskrit. : Rakta pushpa Kovidarara  
Bengali : Devakanchan, rakta kanchan  
Eng. : Butterfly tree.  
Hindi : Knairwal  
Kan. : Basavanapada, kempumandara, mandara,  
Mal. : Chuvanna-mandaram, mandaram.  
Tam. : Mandari  
Tel. : Kanchanam, chovanna-mandaru.

**Ayurvedic description of properties :**

The flowers of *B.purpurea* are used in Ayurvedic system of medicine. In terms of rasa panchaksha theory of Ayurveda, the properties of kovidara are as follows:  
*Rasa* (taste): Kasaya (astringent);  
*Guna* (quality): Ruksa (Creates dryness) & laghu (light for digestion);  
*Veerya* (Potency): Sheeta (Conserves energy during digestion & metabolism);  
*Vipaka* (Digestive effect): Katu (pungent);  
*Karma* (action): Grahi (constipative);  
*Doshagnata* (effect on doshas): Pittahara (mitigates pitta);  
*Vyadhiharatva* (indications): Arshas (hemorrhoids), kasa (cough), Rakta pradara (menorrhagia), Ruksa (creates dryness), grahi/Kostabaddhata (constipation).

**Medicinal properties :**

Flowers have been reported to possess medicinal properties. They are laxative, astringent, and beneficial in hemorrhagic diseases, leucorrhoea and cough. Dried buds are anthelmintic, useful in piles and dysentery associated with blood. Flowers and flower buds are useful in treating cancer. Flowers possess significant cardiotonic activity. The infusion of the fresh flowers and the decoction of the bark are anti-dysenteric. Flower buds and flowers, fried in purified butter, are administered to patients suffering from dysentery. The stem bark/root and flowers mixed with rice water are used as a maturant for boils and abscesses. Flowers poultice applied for promoting suppuration. Preclinical and clinical studies authenticating these claims.
as well as others supported by basic science parameters can establish the use of this medicinal tree as a candidate for many intractable disorders.

**Traditional community health practices:**

Roots and Flowers are used for stomach disorders by ‘Santal’ tribal community of Jharkhand. Flower buds and tender leaves boiled, grinded and cooked along with gram flour as a vegetable or fried as ‘pakoras’ (a deep fried preparation), and eaten as food. Flowers are also used with curd for preparing ‘raita’ (a curd based preparation), petals edible. A decoction prepared with flower buds is useful in relieving constipation.

**Phytochemical constituents:**

*B. purpurea* flowers have been reported to contain Astragalin (Kaempferol-3-glucoside), Iso-quercetin, Quercetin; Pelargonidin 3-glucoside, 3-triglucoside; Butein galactoside. A flower sample from Egypt, on steam distillation yielded 0.45% of a yellow coloured essential oil of refractive index, 1.483, specific gravity, 0.922 and chemical constituents like monoterpenes, α-terpinene, mycene, citronyl acetate, linalool, limonene, eugenol and caryophyllene.

Pharmacognosy and Physicochemical studies of the flowers have not been reported till date.

**Materials and Methods:**

Flowers were collected in the vicinity of Bangalore, authenticated by Dr. V. Rama Rao, R.O. (Bot.), NADRI-Bangalore. Herbarium specimen of the plant (coll. no.12355) was deposited at NADRI, for further reference.

Preparation: The flowers were dried under shade, pulverized by mechanical grinder, passed through 40 mesh sieves and stored in a closed vessel, to carry out microscopical, Physico-chemical, preliminary phytochemical analysis.

The macroscopical characters of the flowers were noted. For powder microscopy study, the powder was stained with phloroglucinol and concentrated HCl to study the lignified cells, trichomes, fibres, xylem vessels, etc. The powder was also stained with N/50 iodine solution to detect the presence of starch. A small portion of powder was mounted in water to identify calcium oxalate crystals. Microscopy of different parts of the flowers was carried out by the methods prescribed by Trease and Evans. Camera lucida drawings were drawn with the help of mirror type camera lucida.

Water and hydro-alcoholic (50:50) extractive values were determined according to the standard Ayurvedic Pharmacopoeial methods by using water bath. For this purpose the powder (100g) was extracted 3 times (each 300 ml) with water and water-alcohol each for 16 hours. The dried extractives were obtained after evaporation of solvent under reduced pressure by rotary evaporator. Preliminary Phytochemical analysis carried out according to standard procedures and recorded in table-1. Physico-chemical parameters such as ash values, alcohol soluble and water soluble extractive
values and loss on drying and pH, total dissolved solids for extracts of flowers were determined as per the standard Ayurvedic Pharmacopoeial methods and recorded in Table-2.

**Table-1:** Preliminary Phytochemical tests for flower extracts of *B. purpurea* L.

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Natural product test</th>
<th>Presence (+), Absence (-)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Alkaloids</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>Carbohydrates</td>
<td>+</td>
</tr>
<tr>
<td>3</td>
<td>Flavonoids</td>
<td>+</td>
</tr>
<tr>
<td>4</td>
<td>Terpenoids</td>
<td>+</td>
</tr>
<tr>
<td>5</td>
<td>Proteins</td>
<td>+</td>
</tr>
<tr>
<td>6</td>
<td>Resins</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>Saponins</td>
<td>+</td>
</tr>
<tr>
<td>8</td>
<td>Steroids</td>
<td>+</td>
</tr>
<tr>
<td>9</td>
<td>Tannins</td>
<td>+</td>
</tr>
<tr>
<td>10</td>
<td>Starch</td>
<td>+</td>
</tr>
</tbody>
</table>

**Table-2:** Physicochemical parameters

<table>
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<tr>
<th>S.No.</th>
<th>Name of the parameter</th>
<th>Values (%) w/w</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Description</td>
<td>Grey coloured powder</td>
</tr>
<tr>
<td>2</td>
<td>Foreign matter</td>
<td>≤ 1.0 %</td>
</tr>
<tr>
<td>3</td>
<td>pH (10% w/v aq. solution)</td>
<td>4.45</td>
</tr>
<tr>
<td>4</td>
<td>Loss on drying at 105°C</td>
<td>11.02 %</td>
</tr>
<tr>
<td>5</td>
<td>Total ash</td>
<td>6.16 %</td>
</tr>
<tr>
<td>6</td>
<td>Acid-insoluble ash</td>
<td>0.083 %</td>
</tr>
<tr>
<td>7</td>
<td>Water-soluble extractive</td>
<td>28.82 %</td>
</tr>
<tr>
<td>8</td>
<td>Alcohol-soluble extractive</td>
<td>11.10 %</td>
</tr>
</tbody>
</table>

**Results:**

**Macroscopic features (Fig. 1)**

Flowers large, rosy purple/bright pink in few flowered terminal brown tomentose panicles. Flowers bisexual, pedicellate, varies in colour, from almost white to a rich purple. They are conspicuous, pink, and fragrant, with five petals. Dried flowers are dark majenta in colour, shriveled, pedicellate, when fresh bright pink, characteristic odour and slightly sweet to taste. Pedicels 5-13mm. long stout, tomentose, bracts and bracteoles small, tomentose, tube 7.5-10cm. long, limb twice as long as the tube, usually
splitting in to two reflexed segments, one emarginate and the other, three- toothed. Inflorescence is raceme with bracts, buds are 5-ridged, calyx is tubular, splitting at maturity into two segments, tomentose, segments oblong. Petals are five and are oblong, lanceolate, clawed, prominently nerved and showy. Each petal is 3.8 to 5 cm. long, 1.6 cm in width, oblanceolate, long clawed, spreading viewed (Fig.1b). There are 3-4 stamens, fertile shorter than corolla, filaments are stout at base, staminodes are unequal, there are three to four fertile and six to seven sterile stamens per flower (Fig.1c). When fully open, the large, fragrant, five petalled flowers are 8.9 to 10.2 cm across. Ovary is downy, long stalked, the style is long and stigma is large and oblique (Fig.1d).

Fig. 1 : Macroscopic features of Bauhinia purpurea Linn. Flower

Microscopic features of Pedicel (Fig. 2)

The diagrammatic transverse section (TS) of pedicel is circular in outline with thin cuticle. It shows abundant unicellular trichomes a 2-3 layered collenchymatous and 5-8 layered slightly loosely arranged parenchymatous cortex embedded with abundant rosette and clustered calcium oxalate crystals. Stelar tissue encircling the central broad pith is embedded with abundant rosette and clustered calcium oxalate crystals. Groups of pear shaped vascular bundles are present with xylem and peripheral phloem with single layered endodermis. Pith is broad, with closely arranged thin walled parenchymatous cells embedded with abundant rosette and clustered calcium oxalate crystals.
**Transverse Section of Sepal (Fig. 3: a, c)**

TS of sepal is plano convex with undulated margin of both upper and lower epidermis covered with thick cuticle, cells of both upper and lower epidermis are covered with striated cuticle and abundant uni to multicellular trichomes and are devoid of stomata, cells of ground tissue shows thin walled slightly closely arranged parenchymatous cells embedded with abundant clustered and rosette type of crystals. Vascular bundles are arranged in groups alternating with ridges and furrows, with well developed xylem and phloem.
Transverse Section of Petal (Fig. 3: b, d)

TS of the petal shows undulated margin for both upper and lower epidermis, covered with thick cuticle. Cells of ground tissue are thin walled, closely arranged with abundant simple rounded starch grains and colouring matter. Vascular bundles are crescent shaped and centrally located with well developed xylem and phloem.

Transverse Section of Anther (Fig. 4a)

Diagrammatic TS of anther is slightly crescent shaped in outline with a broad connective bearing 4 Pollen chambers 2 each on either laterals. The wall of the anther is composed of a layer of epidermis covered by thin cuticle. Underneath the epidermis lies a layer of column shaped cells of endothecium near the pollen chamber which on complete maturity disintegrates for the dispersal of pollen grains. Spores are enclosed in the cavity surrounded by sporogenous tissue which in turn is surrounded by tapetum. The connective tissue shows closely packed parenchyma, and vascular bundles are scattered in 3-4 groups with xylem and phloem cells.
Fig. 4 : Microscopic features of *B. purpurea* flower-androecium and carpel

**Transverse Section of Carpel (Fig. 4b)**

Diagrammatic TS of carpel is circular in outline and shows outer epidermis bearing numerous simple unicellular warty trichomes, centrally placed locules encircled by compressed cell containing ovules on axile placentation, the remaining parenchymatous tissue being embedded with abundant of rosette and clustered calcium oxalate crystals with vascular bundles.

**Powder microscopy (Fig. 5 & 6)**

Powder is dark purplish with a mild sweet taste, the following features are seen: Fragments of abundant uni to multicellular warty trichomes, debris of helical to spiral xylem vessels, collenchymatous cells with rosette crystals, epidermal cells of calyx with uniseriate trichomes, parenchymatous cells of pedicel in surface view, fragments of endothecium tissue of androecium, epidermal cells embedded with rosette crystals, epidermal cells in surface view, parenchymatous cells of sepal with colouring matter and starch grains, groups of annular thickenings of xylem vessel, epidermal cells with annular thickenings of xylem, abundant spherical to tricolporate pollen grains, abundant rosette and clustered calcium oxalate crystals in epidermal cells in surface view, epidermal cells of petal covered with undulated cuticle.
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Fig. 5: Power characteristic of *B. purpurea* flower

- b: Deberi's of helica to spiral xylem
- c: Collenchymatous cells with rosette type of crystals
- d: Epidermal cells of calyx with uniseriate trichomes
- e: Parenchymatous cells of pedicel in surface view
- f: Fragments of endothecium tissue of androecium
- g: Epidermal cells embedded with rosette type of crystals
- a: Epidermal cells in surface view
- b: Groups of annular thickenings of xylem vessel
Thin layer chromatography:

Thin layer chromatography was carried out on a precoated silica gel 60, plate by using the solvent system: *n*-Butanol : water : Glacial Acetic acid (3:1:1). Test solution prepared by taking 2.0 g of the flower powder in 25 ml of methanol. Test solution applied on a TLC plate as a band and developed the plate to a distance of 8 cm from the line of application. Dried the plate in air and examined at 254 nm and sprayed with 0.1% Ninhydrin in Acetone reagent. The plate was heated at 110°C for about 5 minutes. After elution, the chromatogram shows different Rf values after derivatisation with 0.1% Ninhydrin in Acetone are showed in table-3.
Pharmacognostic and Preliminary Phytochemical Studies......

Table-3: Thin layer Chromatography (TLC) studies of Bauhinia purpurea L. flower

<table>
<thead>
<tr>
<th>Methanol Extract</th>
<th>Hydro-Alcoholic extract</th>
<th>Water extract</th>
</tr>
</thead>
<tbody>
<tr>
<td>After derivatization</td>
<td>After derivatization</td>
<td>After derivatization</td>
</tr>
<tr>
<td>$R_f$ : 0.22, 0.28, 0.37</td>
<td>$R_f$ : 0.08, 0.18, 0.22, 0.25, 0.30, 0.35, 0.41, 0.48.</td>
<td>$R_f$ : 0.16, 0.21, 0.27, 0.33, 0.40, 0.48, 0.77</td>
</tr>
</tbody>
</table>

Discussion:

The findings of our studies in terms of macroscopy are consistent with those reported in the studies reported by Kirtikar and Basu. Among the main objectives of this study was to report for the first time in addition to the macroscopic features the findings of microscopical, physico-chemical, preliminary and phytochemical studies. This is principally because these flowers have been mentioned to possess medicinal properties and are used as an ingredient in the preparation of many Ayurvedic therapeutic formulations. They are not sold in the crude markets of Bangalore and therefore identification and sample collection was made in its original habitat of Bangalore. The study therefore reports for the first time comprehensive identification, physicochemical and phytochemical profile of the flower.

The flower sample tested positive for Saponins, Steroids, Tannins, Carbohydrates, Flavonoids, Terpenoids, starch and Proteins which is consistent with the reported phytochemical constituent studies as reported above. Further HPTLC studies might throw more light on the constituent fingerprint.

Conclusion:

1. This study therefore brings out comprehensive identity profile of the flowers of medicinal tree ‘Kovidara’ including macroscopical, microscopical, physico-chemical, preliminary phytochemical.
2. In terms of Pharmacognosy, the following features are striking to the flowers of ‘Kovidara’ and can serve as principal parameters for authentication in fresh as well as dry form (including powder form).

a. Presence of abundant unicellular to multicellular, elongated trichomes in pedicel and calyx portion of the flower, which are broad at the base and pointed at the apex.

b. Presence of abundant rosette and clustered calcium oxalate crystals in all most all parts.

c. Presence of abundant spheroidal to tricolporate pollen grains.

d. Presence of crescent shaped vascular bundles, which are centrally located with well developed xylem and phloem in the petal region.

e. Parenchymatous tissue being embedded with plenty of rosette and clustered calcium oxalate crystals with pear shaped vascular bundles in carpel region.

f. Debris of helical to spherical xylem vessels, ground tissue of petal shows prominent colouring matter and starch grains.

These Pharmacognostical studies and physico-chemical data evolved from the present investigation may be utilized for the standardization of the drug in order to check and ensure the quality of the drug in quality control laboratories and also for laying down Pharmacopoeial standards for the flowers of ‘Kovidara’ (Bauhinia purpurea L.).

Acknowledgement:

Authors are thankful to the Director General, CCRAS, New Delhi, for providing necessary facilities and encouragement to carry out the work successfully.

References:


बर्तमान अध्ययन कोविदा (Bauhinia purpurea L.) के फूलों पर माइक्रोकोपी, माइक्रोकोपी, भौतिक रसायन, विभिन्न निष्कर्षों के प्रारंभिक पादप रसायन और टीएलसी फिगरप्रिंट अध्ययन का मूल्यांकन करने के लिए प्रयास करता है। माइक्रोकोपीकली पुष्पों के अध्ययन के आधार डंडल और पुष्पकोष के हिस्से में कोशिकीय और बहुकोशिकीय लम्बी मसेवाला ट्राइकोम्स की उपस्थिति देखी गई। पुष्प की सभी भागों में प्रचुर मात्रा में रोजेट और क्लस्टर कैल्कियम ऑक्साइडट्रिस्टाल में देखी गई। पोलिनेस्स ट्रा कोलोपरिएट गोलाकार प्रचुर मात्रा में, बर्तमान के आकार संरक्षित बंदलों को पती क्षेत्र के केंद्र में जाइल और प्लाइम के साथ उपस्थिति देखी गई। पती की जमीन उत्तक में प्रमुख रंग और स्टार्च देखी गई। प्रारंभिक पादप रसायन स्कीनिंग में कार्बोहाइड्रेट, प्लेबोनेक्स,टर्पिनोयड्स, प्रोटीन, सपोनिन्स, स्टेरॉयड और टैनिन की उपस्थिति देखी गई। इन पुष्प मानकों में औषधी की पहचान और मानकीकरण में उपयोगी हो सकता है और भी बहुनिया की अन्य प्रजातियों की पहचान करने के लिए उपयोगी हो सकता है।