Pharmacognostical studies of *Cleome viscosa* Linn.

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*Cleome viscosa* Linn. (Family: Capparaceae) is an annual, sticky herb and commonly known as wild or dog mustard. It has various ethnomedicinal values as various traditional communities find diverse medicinal properties. This work aimed to study the macro- and microscopical, physicochemical, phytochemical and fluorescence analysis of different parts of the *C. viscosa*. Macro- and microscopical studies showed the presence of palmately compound leaf with 3-5 leaflets, obovate to lanceolate, glandular and simple covering trichomes and anomocytic arrangement of stomata. Sclerenchmatous caped vascular bundle in petiole, arc shaped pericyclic fibres in stem and distinct uni to biseriate medullary rays of root are some of the diagnostic features noted from anatomical study of the plant. Powder microscopy revealed the presence of fibres, spiral and pitted vessels, trichomes and calcium oxalate crystal. Total ash of leaf was about two times higher than root and about four times higher than seed. The fluorescent analysis under day light and UV light by treatment with different chemical reagents showed different colour. Phytochemical evaluation revealed the presence of triterpenoids, saponins, tannins, flavonoids and steroids.

**Keywords:** *Cleome viscosa*, Dog mustard, Microscopy, Pharmacognosy, Physicochemical.

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**Introduction**

Ethnomedically, the whole plant and its parts (leaves, seeds and root) are widely used by local people for the treatment of various disease conditions without standardization. The standardization of a crude drug is an integral part of establishing its correct identity. Before any crude drug can be included in an herbal pharmacopoeia, pharmacognostic parameters and standards must be established. Microscopic method is one of the simplest and cheapest methods to start with for establishing the correct identity of the source materials.

*Cleome viscosa* Linn. (Family: Capparaceae) is a weed distributed throughout the tropics of the world and the plains of India. The plant is an annual, sticky herb with a strong penetrating odour, yellow flowers and long slender pods containing seeds. It is known as *Hurhur* (Hindi), *Hurhuria* (Bengali), *Nayikkadugu* (Tamil) in Indian traditional medicine.

**Uses in traditional medicine and other reported activities**

In Ayurvedic system of medicine, the plant is used in fever, inflammations, liver diseases, bronchitis and diarrhoea. The rural people use the fresh juice of the crushed seed for infantile convulsions and in mental disorders. The juice of the plant diluted with water is given internally in small quantities in fever and the leaves are useful in healing the wounds and ulcer.

*C. viscosa* is highly effective in a wide spectrum of diseases and reported to possess anti diarrhoeal, analgesic, psycho-pharmacological, antimicrobial properties including *in vitro Helicobacter pylori* and wound healing activity. However, available literature revealed that no detailed pharmacognostic studies have been carried out on plant; hence the present investigation was undertaken. The object of present study is to evaluate various pharmacognostical parameters such as macroscopy, microscopy, physicochemical parameters, fluorescence analysis and phytochemical studies of the plant.

**Previously isolated constituents**

A wide variety of chemical constituents have been isolated from various parts of *C. viscosa*. A novel
umbeliferone derivative, designated as cleosandrin, series of coumarino-lignans (cleomiscosins) from the seeds and a new glycoside eriodictyol-5-rhamnoside have been isolated from the whole plant\textsuperscript{13}.

**Materials and Methods**

**Plant material**

Whole plant of \textit{C. viscosa} was collected from the rural area around Kanpur, India. The whole plant material was identified, authenticated taxonomically by Dr. Tariq Husain, Taxonomist of National Botanical Research Institute (NBRI), Lucknow, India and a voucher specimen (No. UIOP/M-121) was deposited at the herbarium section of departmental museum for future reference.

**Pharmacognostic evaluation**

Fresh whole plant of \textit{C. viscosa} (Plate 1) was taken for morphological and histological studies. Coarse powder (60 #) was used to study microscopical characters, physicochemical parameters and phytochemical investigation. For the microscopical studies, transverse sections of leaves, petiole, stem and root were prepared and stained as per standard procedure\textsuperscript{14,15}. The powder microscopy was performed according to the method of Khandelwal\textsuperscript{16}.

**Physicochemical and phytochemical analysis**

Physicochemical values such as percentage of ash values and extractive values were determined according to the well established official method and procedure\textsuperscript{17,18}. Preliminary phytochemical screening was carried out using the standard procedure described by Khandelwal\textsuperscript{16}.

**Fluorescence analysis**

Powdered leaf, root and seed material were treated with various chemical reagents and exposed to visible, ultraviolet light (Short UV) to study their fluorescence behavior\textsuperscript{19}.

**HPTLC fingerprint profile**

For proper and meaningful utilization it is important to have quality standards of material and for this quality standardization HPTLC finger print profile of methanolic extract of \textit{C. viscosa} (10 µl of 1 mg/ml) was developed. The HPTLC analysis was carried out on precoated silica gel G 60 F\textsubscript{254} TLC plate (Merck) with the help of Camag Linomat IV applicator. The plate was eluted with toluene: ethyl acetate: glacial acetic acid (5:5:0.3) as mobile phase. After development, the plate was dried and densitometrically scanned on a TLC scanner III at 366 nm using Wincat software (CAMAG, Switzerland) and peak area was recorded.

**Results and Discussion**

**Macroscopic characters**

Macroscopically, the fresh leaf of \textit{C. viscosa} was green in colour, alternate, palmately compound with 3-5 leaflets, 2-6 cm long, 1-3 cm wide, leaf stalk 10-40 mm in length with hairs, obovate to lanceolate in shape with entire margin, obtuse to acute apex, rounded to acute base. Flowers bisexual, yellow in colour; fruit cylindrical, erect capsule, many seeded; seeds reddish brown in colour, sub-orbicular with narrow cleft covered with strong cross ribs and faint concentric ribs; stem angular, sticky with hairs, unbranched to sparsely branched; root long, tap with some secondary roots. Plant has characteristic smell, bitter taste and is sticky in nature.

**Microscopical characteristics**

**Leaf**

T.S. of leaf (Plate 2) passing through midrib region show slight depression on upper side and broad cushion on lower side. Single layered, thick walled upper and lower epidermis covered with thick cuticle, multicellular glandular and simple covering trichomes (Plate 3a). Meristele consists of collateral vascular bundle; ground tissue collenchymatous. T.S. passing through lamina region show 2 to 3 layer of chlorophyllous palisade cells followed by spongy...
mesophyll. Lateral vascular bundle also observed, embedded with spongy mesophyll and anomocytic type of stomata (Plate 3b) present in both the surfaces of leaf.

**Petiole**

T.S. of petiole (Plate 4) is pear shaped with deep depression at upper side; single layered epidermal cell covered with thick cuticle; ground tissue collenchymatous embedded with six vascular bundle. Vascular bundle is collateral and capped with sclerenchymatous bundle sheath. Trichomes present on the surfaces of epidermis; stalk is multicellular with small globular head.

**Stem**

T. S. of stem (Plate 5) almost circular with wavy outline and four larger processes. Single layered and thick walled epidermis covered with thick cuticle; multicellular trichomes present on the surfaces; hypodermis collenchymatous followed by 2 to 3 layer of collenchyma; cortex parenchymatous; pericycle present in form of group of sclerenchyma and pericyclic fibres are in arc shape below each notch. Phloem well developed in form of ring and consist of sieve tubes, companion cells and phloem parenchyma; cambium not distinct. Xylem is present in form of continuous ring and consists of vessels, tracheids, fibres and xylem parenchyma; vessels are in radial rows. Medullary rays are distinct; centre portion occupied by collenchymatous pith.

**Root**

T. S. of root (Plate 6) almost circular in outline; the outer most layers is thick walled, remnant of cork cells which become crushed at places and cortex

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**Plate 2** — T.S. of Cleome viscosa leaf

**Plate 3** — T.S. of leaf showing; a-covering trichome, b-anomocytic stomata
consist of thin walled mostly oval shaped parenchymatous cells; phloem is well developed and consist of sieve tubes, companion cells and phloem parenchyma. Major portion of the root is occupied by secondary xylem which consists of vessels, tracheids, fibres and xylem parenchyma; uni to biseriate medullary rays are also distinct.

**Powder microscopic characters**

The powdered leaf and stem material was greenish in colour; showing fibres (Plate 7a), pitted vessels (Plate 7b), spiral reticulate vessels (Plate 7c), fragments of spongy mesophyll (Plate 7d), palisade cells, glandular trichome (Plate 7e), epidermal cells with vessels and calcium oxalate prism (Plate 7f). The powdered root was straw in colour; showing fragments of cork cells with phelloderm (Plate 8a), parenchyma (Plate 8b), medullary rays crossing the parenchyma (Plate 8c), and reticulate thickened vessels (Plate 8d).

**Preliminary phytochemical screening**

Preliminary phytochemical screening mainly revealed the presence of triterpenoids, saponins, tannins, flavonoids and steroids.

**Physicochemical parameter**

Ash values of drug give an idea of earthy matter or the inorganic composition and other impurities present along with drug. Extractive values are primarily useful for the determination of exhausted and adulterated drugs. Foreign matter, loss on drying, extractive value and ash analysis of powdered leaf, root and seed of *C. viscosa* were carried out and comparative results are shown in Figure 1. Fluorescence analysis of powdered drug was also observed and the results are shown in Table 1. As there is no detailed pharmacognostic study on record of this drug which is of great value, present study was taken up with a view to lay down the microscopic standards, which could be used in deciding the genuineness of the drug source. The drug was found to contain simple and multicellular glandular trichomes and trichomes are epidermal outgrowths of considerable value for taxonomic purposes. The presence of 5 to 6 collateral vascular bundle caped with sclerenchymatous bundle sheath in petiole and arc shaped pericyclic fibre in stem and distinct uni- to biseriate medullary rays of root are some of the diagnostic features noted from anatomical study of the plant. Ash values and extractive values
Plate 7 — Powder characteristic of *Cleome viscosa* leaf: a-Fibres, b-Pitted vessels, c-Spiral reticulate vessels, d-Spongy mesophyll, e-Glandular trichome, f-Calcium oxalate prism

Plate 8 — Powder characteristics of *Cleome viscosa* root: a-Cork cell with phelloderm, b-Parenchyma, c-Medullary rays crossing the parenchyma, d-Reticulate thickened vessels
can be used as reliable aid for detecting adulteration. These studies help in identification and authentication of the plant materials. Percentage extractive and ash analysis were carried out and results showed that total ash of leaf was about two times higher than root and about four times higher than seed. Alcohol soluble extractive value of seed was two times higher than water soluble extractive value and water soluble extractive value of leaf and root was more than two times higher than alcohol soluble extractive value. Extractive values are useful to evaluate the chemical constituents present in the crude drug. The fluorescent analysis under day light and UV light by treatment with different chemical reagents showed different colour. This analysis suggests that, leaves, root and seed extract of *C. viscosa* probably contain active agent(s) and this provides the basis for their folkloric use as a cure for some human ailments.

**HPTLC studies**

The preliminary HPTLC studies revealed that the solvent system toluene: ethyl acetate: glacial acetic acid (5:5:0.3) was ideal for the methanolic extract of *C. viscosa* and gave well resolved peaks. The band in the sample were obtained at *R*<sub>f</sub> 0.26, 0.38, 0.44, 0.49, 0.72 and 0.79 which can be used as identifying marker (Plate 9).
Conclusions
The present work was undertaken with an aim of pharmacognostic investigation of *C. viscosa* providing useful information, which could be useful to detect the authenticity of this medicinally useful plant. Pharmacognostic evaluation can be useful to substantiate and authenticate the drug.

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References

Plate 9 — HPTLC profile and densitometric scanning of methanolic extract of *Cleome viscosa*. Solvent system: toluene: ethyl acetate: glacial acetic acid (5:5:0.3), Detection: Under UV light λ 366 nm

