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Pharmacognostic evaluation and physico-chemical analysis of *Lantana camara* (Linn.) flowers

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ABSTRACT

Pharmacognostic standardization plays a crucial role in identification of a particular plant and also helps to authenticate the plant under study and prevent it from adulteration and substitution. The plant *Lantana camara* Linn. (Family: Lamiaceae) is native to the tropical regions of the America, Africa and Asia. It is found in Kumaun and Garhwal resign of Uttarakhand, India. It is locally known as shrub Verbenas and Ghaneri. The plant has been used for various ailments in traditional systems of medicines. In the current investigation, pharmacognostic standardization and physico-chemical analysis of *Lantana camara* flowers has been attempted. All the parameters including, extractive values, ash values, loss on drying and determination of foreign organic matter were determined following the World Health Organization guidelines. Macroscopic characters like shape, size, color, odor, and surface characteristics along with inflorescence characteristics of flower of *Lantana camara* were noted. Powder microscopy showed useful diagnostic features like fibres, xylem vessels, pitted xylem vessels, glandular trichomes, covering trichomes, calcium oxalate crystals etc. The transverse section of peddicles of flower showed epidermis, covering trichomes, vascular cylinder, central medulla etc. Furthermore, various physico-chemical parameters were also estimated as per WHO guidelines. The data generated from the current study would be employed as supplement information in respect of identification parameters in the way of acceptability and quality control of this plant.

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Introduction

Quality control deals with the study of purity, safety, potency and efficacy. Thereby, standardization and quality control of herbal medicines and raw material are always required. Quality standard of any herbal drug is related to its uniformity in quality which is numerical quantities by which the quality of commodities may be assessed. The information upon which standards may be based is obtained by a study of the genuine drug, the method used for adulteration and means adopted for the detection of adulterants. There are various several aspects are to be considered as pharmacognostical standards. The popularity of the herbal drugs is increasing worldwide generally and particularly in the developed countries but one of the obstacles in its acceptability is lack of standard quality control profile. World health organization (WHO) emphasizes physico-chemical and phytochemical evaluation of crude drug materials for developing standardized quality control profile of herbal medicine (1, 2). The plant *Lantana camara* Linn. (Family: Lamiaceae), commonly known as shrub Verbenas is native to the tropical regions of the America, Africa and Asia. It is found in Kumaun and Garhwal resign of Uttarakhand, India. Traditionally, the plant has been used as diaphoretic, carminative, tonic and antispasmodic. It is useful in the treatment of tetanus, malaria, epilepsy, and gastropathy. Powdered leaves are used for cuts, wounds, ulcers and swelling. Fruits are useful in tumors and rheumatism (3). Flowers are used to cure epilepsy, skin inflammation, rheumatism and used to stimulate vomiting for food poisoning (4). *L. camara* possesses various bioactive agents having therapeutic potential like alkaloids, carbohydrates, tannins, flavanoids, terpenoids, glycosides and phenols (5-7). The pharmacognostic studies have not been evaluated on flowers of this plant so far. Therefore, it is considered worthwhile to study pharmacognostic parameters of *L. camara* flowers.

Materials and methods

Plant material

The flowers of the plant *L. camara* were collected from the region of Balawala, Dehradun, Uttarakhand, India. The plant was identified and authenticated by Scientist-D/HOO Kumar Ambrish, Department of Botany, Botanical Survey of India, Northern Region Centre, 192, Uttrakhand, Dehradun, India vide reference no. 118094. The voucher specimen is maintained in Botanical Survey of India laboratory for the further reference.

Macroscopic characters

Macroscopic evaluation was done by identifying the color, odor, taste, shape, surface characteristics, texture and fracture characteristics (8). In the present study,

flowers of the plant were studied for color, odor, taste, shape, surface characteristics, etc.

Microscopic characters

Transverse section (TS) of the plant part (flower pedicel)

Transverse section is obtained by cutting along the radial plane of a cylindrical portion of the flower pedicel and perpendicular to the long axis. This section when prepared and observed under the microscopy reveals the radial arrangement of tissues and shows concentric layers (9).

Preparation of slides

Firstly, selected the clean glass slide and placed the fine powder of the drug on the glass slide and tapped the slide such that uniform powder is distributed on the surface of the slide. Observed the glass slide by using different reagents for the internal study of the powdered drugs with the help of microscope (9,10).

Physico-chemical parameters

Determination of ash values

Determination of total ash value

Weighed and ignited crucible in an oven up to constant weight occurred. Added 3 g powdered drug into it and put covered lid on it and put into muffle furnace at 500-600°C for 6 hrs. Cooled in a desiccator. Weighed the obtained ash and calculated the total ash with reference to the air dried sample of the drug.

Determination of acid-insoluble ash value

Weighed and ignited crucible in an oven up to constant weight occurred. Added 3 g powdered drug into it and put covered lid on it and put into muffle furnace at 500-600°C for 6 hrs. Cooled in a desiccator. Weighed the obtained ash and calculated the total ash with reference to the air dried sample of the drug. Used 25 ml of dilute hydrochloric acid and washed the ash in the beaker and put the mixture on the water bath up to boiling the mixture. Filtered the mixture and washed the residue with hot water 2 times. Put the filter paper and placed into crucible and further placed into muffle furnace at 500-600°C for 6 hrs. Cooled in a desiccator. Weighed the obtained residue and calculated the acid-insoluble ash with reference to the air dried sample of the drug**.**

Determination of water soluble ash value

Weighed and ignited crucible in an oven up to constant weight occurred. Added 3 g powdered drug into it and put covered lid on it and put into muffle furnace at 500-600 °C for 6 hrs. Cooled in a desiccator. Weighed the obtained ash and calculated the total ash with reference to the air dried sample of the drug. Used 25 ml of water and washed the ash in the beaker and put the mixture on the water bath upto boiling the mixture. Filtered the mixture and washed the residue with hot water 2 times. Put the filter paper and placed into crucible and further placed into muffle furnace at 500-600°C for 6 hrs. Cooled in a desiccator. Weighed the obtained residue and calculated the water soluble ash with reference to the air dried sample of the drug**(**11,12).

Determination of extractive values

Determination of alcohol soluble extractive values

Weighed 10 g of powdered drug and put into 250 ml conical flask. Filled 90% alcohol up to 100 ml marked. Kept the conical flask on magnetic stirrer for 6 hr. Filtered the mixture and collected 25 ml filtrate into porcelain dish. Evaporated up to dryness on ware bath and complete drying in an oven at 100°C. Cooled in a desiccators. Calculated the percentage w/w of extractive value with reference to the air dried drug.

Determination of water soluble extractive value

Weighed 10 g of powdered drug and put into 250 ml conical flask. Filled water up to 100 ml mark and cork the flask. Kept a side the conical flask for 24 hr with shaking frequently. Filtered the mixture and collected 25 ml filtrate into porcelain dish. Evaporated up to dryness on ware bath and complete drying in an oven at 100°C. Cooled in desiccators. Calculated the percentage w/w of extractive value with reference to the air dried drug.

Determination of foreign organic matter

100 g of drug was weighed and spreaded the sample on a white tile without overlapping. Inspected the sample with naked eye or by lens (10 x or above). Separated the foreign organic matter. After completed separation, weighed the foreign organic matter and calculated the percentage w/w present in the sample.

Determination of Loss on drying

Weighed 2 g powdered drug and kept into a porcelain dish. Dry in the oven at 100°C or 105°C. Cooled in a desiccators and watch. The loss in weight is usually recorded as moisture (11,13).

Results

Macroscopic characters of L. camara flowers

L. camara was evaluated for macroscopic characteristics. Macroscopic characters like shape, size, color, odor, and surface characteristics along with inflorescence characteristics of flower of *Lantana camara* were studied. Observed macroscopic characters are shown in table 1.

Inflorescence characteristics of L. camara flowers

Flower found irregular, bracteates, zygomorphic, hermaphrodite, cyclic, bisexual, pentamerous and hypogynous. Inflorescence observed Umbellate cyme type. Corolla found with 4 petals, reddish-orange in colour, gamopetalus, tubular and cylindrical in shaped. Androecium with 4 stamens found in the throat of corolla, didynamous, epipetalus, polyandrous, and tricarpellary superior ovary observed. Inflorescence characteristics of *L. camara* flower are presented in table 2.

Table 1 Macroscopic characters of *L.camara* flowers

S.No.	Characters	Observations
1	Color	Reddish orange
2	Odor	Strong aromatic
3	Taste	Characteristic
4	Head	Small rounded heads
5	Occurrence	Dense in flat-topped clusters
6	Corolla	Narrow tube with four short spreading lobes
7	Diameter	2-2.5 cm
8	Shape	Small tublar shaped flowers
9	Petals	Four petals and are arranged in clusters

Table 2 Inflorescence characteristics of *L. camara* flower

S.No.	Floral characteristics	Observations
1	Inflorescence type	Umbellate cyme
2	Flower	Irregular, bracteates, zygomorphic, hermaphrodite, cyclic, bisexual, pentamerous, hypogynous
3	Calyx	5 sepals, green in colour, polysepalus, valvate, persistant, sometimes bell shaped
4	Corolla	4 petals, reddish-orange in colour, gamopetalus, tubular and cylindrical in shaped
5	Androecium	4 stamens found in the throat of corolla, didynamous, epipetalus, polyandrous
6	Gynoecium	3 carpels (tricarpellary), style, stigma, superior ovary

Floral formula

Br % ♂ K $_{(5)}$ C$_{(2+2)}$ ‾ A$_{2+2}$ $\underline{G}_{(3)}$

Floral diagram

Floral diagram is represented in figure 1.

Microscopy of *L. camara* flowers

Powder microscopy

Powder microscopy studies observed various diagnostic characters like fibres, xylem vessels, pitted xylem vessels, glandular trichomes, covering trichomes, calcium oxalate crystals etc. Observed powdered microscopic characters are shown in figure 2.

Transverse section of peddicle of L. camara flowers

The transverse section (TS) of peddicle showed the characters like epidermis, covering trichomes, vascular cylinder and central medulla. Results of TS studies are shown in figure 3.

Physico-chemical Parameters of L. camara flowers

Physico-chemical parameters are helpful in setting standards for a crude drug as these parameters are mostly constant for a plant. Various physic-chemical parameters were evaluated as per WHO guidelines. These parameters are important for the detection of drug adulteration or improper handling of raw materials (1). Foreign organic matter helps to determine the adulteration present in the crude drug. The foreign organic matter was calculated as 1.3% w/w. The ash value such as total ash, acid-insoluble and water soluble ash value were calculated as 4.65 %, 1.05% and 1.34% respectively as shown in table 3. Alcohol soluble, water soluble, petroleum ether and chloroform extractive value by cold maceration were calculated as 2.12 %, 3.3 %, 0.34%, 1.05% and by using hot maceration were calculated as 3.14%, 4.10%, 1.89%, 2.10% respectively as shown in table 4. Determine the moisture content present in the crude drug. The loss on drying was calculated as 8.9% w/w.

Table 3 Ash values of *L. camara* flowers

S.No.	Ash value	Yield (%w/w)
1	Total ash value	4.65 ± 0.090
2	Acid-insoluble ash value	1.05 ± 0.015
3	Water soluble ash value	2.34 ± 0.017

Table 4 Extractive values of *L. camara* flowers

S.No.	Extractive value	Methods	
		Cold maceration	Hot maceration
		Yield (%w/w)	Yield (%w/w)
1	Alcohol soluble	2.12 ± 0.0438	3.14 ± 0.0201
2	Water soluble	3.3 ± 0.0447	4.10 ± 0.0156
3	Petroleum ether	0.34 ± 0.1520	1.89 ± 0.0347
4	Chloroform	1.05 ± 0.0093	2.10 ± 0.0067

Discussion

World health organization (WHO) emphasizes physico-chemical and phytochemical evaluation of crude drug materials for developing standardized quality control profile of herbal medicine (8, 12). In the present study, pharmacognostic evaluation and physico-chemical analysis were determined following WHO standardization guidelines. Macroscopic studies help to determine the identity and degree of purity of herbal materials. The flowers of *L. camara* are found reddish-orange in color having strong aromatic odor and characteristics in taste. There are small rounded heads of flowers which occurs dense in flat-topped clusters. The flowers are small tublar in shaped and varies 2-2.5 cm in diameter. Corolla are narrow tube with four short spreading lobes. Four petals and are arranged in clusters. The inflorescence characteristics of *L. camara* are identified. The results of inflorescence characteristics of *L. camara* are shown in table 2 and figure 1.

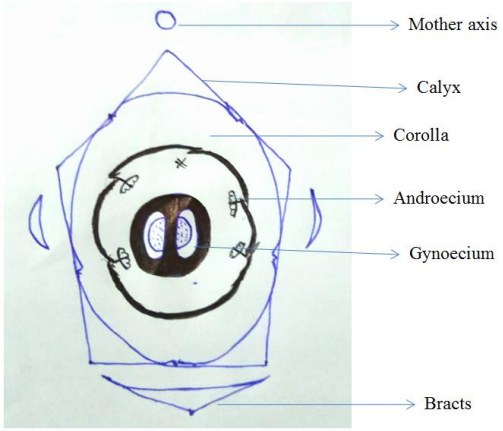


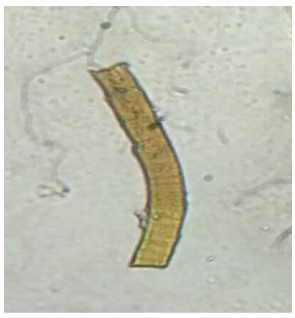
Figure 1 Floral diagram of *L. camara* flower

Microscopic examinations are helpful for the identification of broken or powdered materials (8, 9). In this study, powder microscopy shows the various characters like fibres, xylem vessels, pitted xylem vessels, glandular trichomes, covering trichomes, calcium oxalate crystals etc (figure 2). The transverse section of peddicles shows the various characters like epidermis, covering trichomes, vascular cylinder, and central medulla. The TS of peddicles are shown in figure 3.

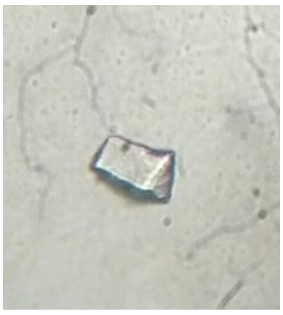
The pharmacognostic investigations of some physical parameters are helpful in setting standards for a crude drug as these parameters are mostly constant for a plant. Various physico-chemical parameters were evaluated for the leaves as mentioned in WHO guidelines (8). These parameters are important for the detection of drug adulteration or improper handling of raw materials. The ash value gives an idea of inorganic composition and other impurities in plant drug. The moisture content of crude drug is directly related to its stability when there are chances of microbial growth. The shelf life of the drug also increases with lowering the moisture contents (14). The ash value such as total ash, acid-insoluble and water soluble ash value were calculated as 4.65 %, 1.05 % and 1.34 % respectively as shown in table 3. The extractive

Covering trichome with basal cells 10X

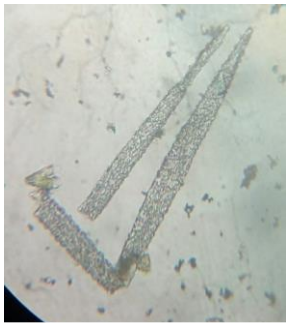
Covering trichomes (uniseriate bicellular conical trichome) 10X



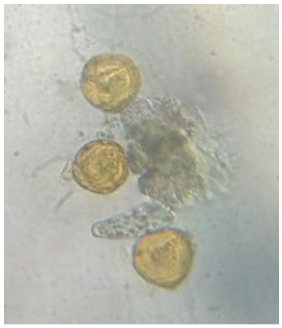
Vessel 10X



Calcium oxalate crystal 10X



Pitted vessel with prismatic



Pollen grains 10X

Fibre 10 X

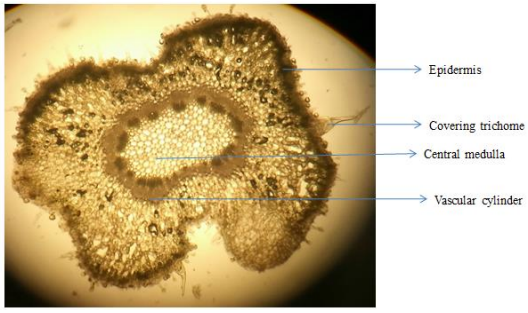
Figure 2 Powder microscopy of *L. camara* flowers

value gives an idea about the nature of the chemical constituents present in a crude drug. The extractive values were determined in different solvent using cold and hot maceration method. Alcohol soluble, water soluble, petroleum ether and chloroform extractive value by cold maceration were calculated as 2.12 %, 3.3 %, 0.34 %, 1.05 % and by using hot maceration were calculated as 3.14 %, 4.10 %, 1.89 %, 2.10 % respectively as shown in table 4. This helps to determine

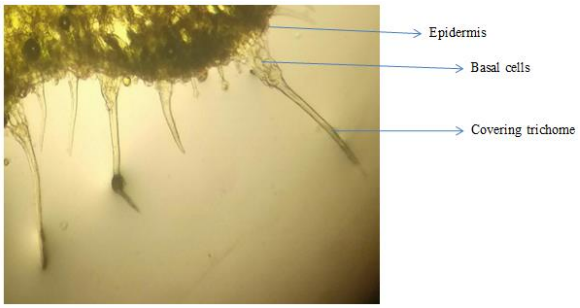
the presence of the moisture content in the crude drug.The loss on drying was calculated as 8.9 % w/w. This helps to determine the presence of the adulteration in the crude drug. The foreign organic matter was calculated as 1.3 % w/w.

Conclusion

The various pharmacognostic parameters studied are useful to identify and authenticate the important medicinal plant *Lantana camara*. WHO emphasized to conduct such studies which ultimately are helpful in the preparation of herbal monographs and pharmacopeia



Transverse section of peddicle of *L. camara* flowers 4X



Covering trichomes on surface of peddicle 10X

Figure 3 Transverse section of peddicle of *L. camara* flowers

standards. Therefore, the findings of the present investigation on *Lantana camara* flowers could be employed as supplement information in respect of identification parameters in the way of acceptability and quality control of this plant.

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Conflicts of interest

Authors declare no conflicts of interest.

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