Pharmacognostic Study and Development of Quality Control Parameters for Different Parts of *Lavatera Cashmeriana*

Neelofar Majid (✉ neelofarmajid@gmail.com)

University of Kashmir

Weekar Y. Raja

University of Kashmir

Saduf Nissar

University of Kashmir

Irshad A. Nawchoo

University of Kashmir

Zulfikar Ali Bhat

University of Kashmir

Kausar Rashid

University of Kashmir

Research Article

Keywords: *Lavatera cashmeriana*, Extractive yield, Fluorescence, Macroscopy, Microscopy, Pharmacognostical, Physicochemical

Posted Date: January 27th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-151365/v1>

License: © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

**Pharmacognostic study and development of quality control parameters for different parts
of *Lavatera cashmeriana***

**Neelofar Majid^{1*}, Weekar Younus Raja², Saduf Nissar¹, Irshad A. Nawchoo¹, Zulfikar Ali
Bhat², Kausar Rashid¹**

**¹Plant Reproductive Biology, Genetic Diversity and Phytochemistry Research Laboratory,
Department of Botany, University of Kashmir, Srinagar, 190006, J&K, India.**

**²Department of Pharmaceutucal Sciences, University of Kashmir, Srinagar, 190006, J&K,
India.**

***email:neelofarmajid @gmail.com**

Phone number: 07780811508

Short title: Comparative pharmacognostic characterization of *Lavatera cashmeriana*

Abstract

Lavatera cashmeriana Camb. is an endemic and important medicinal plant species of Kashmir Himalaya. It is widely used locally and is sold as crude drug in Kashmir markets due to its various medicinal properties. However, despite its traditional usage there is limited information pertaining to pharmacognostic characterization of *L. cashmeriana*. So, the present study was carried out to investigate the pharmacognostical and physicochemical profile of different parts of *L. cashmeriana*. The measures taken for pharmacognostical characterization were organoleptic study, macroscopy, anatomy, powder microscopy, foreign matter analysis, ash values, loss on drying, swelling index, foaming index, pH values, fluorescence analysis and extractive yield. Organoleptic and macroscopic studies revealed that *L. cashmeriana* is a perennial herb with very thick branched tap root system; orbicular, palmate, slightly cordate at base, upper surface of leaves with dense simple, fascicled or stellate hairs, lower surface densely stellate hairy, lobes ovate or obtuse, stipule linear lanceolate; axillary, solitary or in terminal sub-racemes inflorescence; fruit discoid mericarps and seeds glabrous, dark brown. Anatomical studies and powder microscopy revealed some important diagnostic features in the plant species. The pharmacognostic profile studies generated helpful data to set up standards for the plant. The present study for the first time endows with an inclusive pharmacognostic profiling of *L. cashmeriana*, thereby, acting as a platform for accurate identification, authentication and development of quality control parameters of the species. Data obtained may be used as a standard for future studies.

Keywords: *Lavatera cashmeriana*, Extractive yield, Fluorescence, Macroscopy, Microscopy, Pharmacognostical, Physicochemical.

1. INTRODUCTION

Plants have dole out human beings as a natural resource for curing diseases and therapies since earliest times. The medicinal herbs have gained interest because of its extensive use and less side effects. An enormous amount of evidences have been collected to show vast potential of medicinal plants used in various traditional systems (Prabhavathi *et al.*, 2016). Therefore, there is a need to appraise phytoconstituents obtained from traditional medicines, based on a range of phytochemical screening, pharmacological and analytical methods (Patil *et al.*, 2010). Furthermore, there is need to standardize the plants and its parts to be utilized as a medicine. The process of standardization can be acquired by step wise i.e. pharmacognostic and phytochemical studies. Proper identification and quality declaration of beginning material is a noteworthy march to assure reproducible eminence of herbal medicine which will facilitate us to establish its safety and effectiveness (Prasanth *et al.*, 2016). The pharmacognostical study not only offers the authentication but also quality, purity and standard of the plant drug. Various methods are used to establish pharmacognostical standards which include microscopy and macroscopy, physicochemical parameters, extractive values, fluorescence analysis and heavy metal analysis. These parameters in turn can help to ensure the quality of the drug.

Lavatera cashmeriana Camb. (Kashmir mallow or wild hollyhock) a member of family Malvaceae, is a perennial herb which inhabits forest clearings, shrubberies, wet meadows, and sunny rocky slopes. It is a medicinal plant broadly used in conventional folk remedy such as, abdominal disorders and renal colic (Kaul, 2010), flowers for common cold and mumps (Malik *et al.*, 2011) and seeds as antiseptic etc. (Dar *et al.*, 2002). Four protease inhibitors viz LC-pi I, II, III and IV were purified from seeds of *Lavatera cashmeriana* which inhibited trypsin, chymotrypsin and elastase *in vitro* (Rakashanda *et al.*, 2013). *L. cashmeriana* extract also showed antibacterial activity (Rakashanda *et al.*, 2012). The decoction of flowers of *L. cashmeriana* mixed with leaves of *Salix alba* is given to cure the skin irritation in pregnant women (Ganie *et al.*, 2013).

Inspite of its tremendous medicinal importance a lesser amount of information is available on the standardization parameters of *L. cashmeriana*. Therefore, the present work is an attempt to provide comprehensive report on the quality control and standardization parameters of *L. cashmeriana*. In this connection, different parts (leaves, stem, root, flowers and seeds) of the plant were examined. The methods used to establish pharmacognostical standards include microscopy and macroscopy, physicochemical parameters, extractive values and fluorescence analysis.

These parameters in turn can help to ensure the quality of the drug and be useful for the compilation of a suitable monograph for its proper identification.

2. MATERIAL AND METHODOLOGY

2.1 Preparation for pharmacognostic studies

Healthy and disease free plants of *L. cashmeriana* were collected from Aharbal area of Jammu and Kashmir. The collected specimens were identified and deposited in Kashmir University Herbarium (KASH) under voucher number 2038-KASH. The plant collections were made quite judiciously throughout the course of the present study. The plant materials were fragmented into different parts (root, stem, leaves, flowers and seeds) and dried under shade at room temperature for 15-20 days. After shade drying, the plant materials were pulverized to coarse powder using grinder and stored under proper conditions for future use. The pharmacognostic studies were carried out on different parts (root, stem, leaves, flowers and seeds) separately.

2.2 Organoleptic evaluation

It refers to the evaluation of plant material by color, odour, taste, shape, texture etc. Different dried parts of *L. cashmeriana* were considered for macroscopical evaluation (Anonymous, 1998).

2.3 Macroscopic evaluation

Fresh and healthy plants of *L. cashmeriana* were assessed for their external characteristics.

2.4 Microscopic evaluation

2.4.1 Anatomy

Transverse sections of fresh materials of different parts of *L. cashmeriana* were cut with the help of sharp blades. Peels were obtained from fresh leaves by forceps. Different sections/peels were stained with safranin and observed under microscope and photographed.

2.4.2 Powder microscopy

For the analysis of plant powder, pinch of fine powder is taken in a test tube and boiled in chloral hydrate solution for few minutes. A few drops of powder were smeared on a slide mounted with phloroglucinol followed by few

drops of concentrated HCl (Anonymous, 1998). The prepared slides were then observed under a microscope and photographed.

2.5 Physico-chemical parameters

Various physico-chemical parameters (foreign matter, moisture content, ash value, fat content, pH, swelling index, foaming index, fluorescent analysis, extractive value) were analyzed (Mukherjee, 2002; Anonymous, 1996; Anonymous, 1987; Chase and Pratt, 1949; Kokoski *et al.*, 1958).

3. RESULTS

3.1 Macroscopic and organoleptic description

The macroscopic and organoleptic characteristics of various parts of *L. cashmeriana* are presented in the table 1, 2 and Fig.1.

Table 1: Macroscopical attributes of *Lavatera cashmeriana*

Habit	perennial, stellate tomentose herb
Root	tap root system, very thick, branched
Stem	erect, hollow, aerial, branched, solid, glabrous, 1-2m in height
Leaves	orbicular, palmate, slightly cordate at base, upper surface of leaves with dense simple, fascicled or stellate hairs, lower surface densely stellate hairy, lobes ovate or obtuse, stipule linear lanceolate
Inflorescence	axillary, solitary or in terminal sub-racemes
Epicalyx	epicalyx lobes 3, broadly ovate- orbicular, mucronate, entire
Calyx	campanulate, 5 lobed, lobes ovate-lanceolate, apex acuminate
Corolla	pinkish purple, 5 lobed, heart shaped, obovate, basally densely stellate hairy
Androecium	staminal tube 1cm long, hairy at base, filaments very short, anthers reniform
Gynoecium	ovary many loculed, each locule with single ovule; style filiform, branched, enlarged at the base; stigmas decurrent
Flowering	June–August
Fruit	discoid, mericarps 20-25, reniform, glabrous

Seed	glabrous, dark brown
-------------	----------------------

Table 2: Organoleptic features of different parts of *Lavatera cashmeriana*

Organoleptic characteristics	Plant parts				
	Leaves	Stem	Root	Flower	Seed
Color	Green	Light Green	Dark Brown	Purplish pink	Grayish black
Odor	Characteristic	Characteristic	Characteristic	Characteristic	Characteristic
Taste	Slightly sweet	Sweet	Bitter	Sweet	Bitter
Texture	Soft	Rough	Hard	Soft	Rough

Fig. 1: Morphological attributes of *L. cashmeriana*: (a) Habit (perennial herb); (b) Flower with caudate petals; (c) Stamens and stigma; (d) Multilocular ovary; (e) Seeds (dark brown)

3.2 Anatomy

The anatomical studies of different parts of *L. cashmeriana* revealed presence of various diagnostic features as depicted in Fig. 2(a-e).

Fig. 2: Anatomical features of *L. cashmeriana* leaf: a) A patch of stomata (10x); b) Anomocytic stomata with wavy epidermal cells (100x); c) Stellate trichomes (40x). **Anatomy of *L. cashmeriana* stem:** d) Transverse section of stem (10x): 1. Trichomes 2. Epidermis 3. Parenchymatous cortex 4. Sclerenchymatous patches 5. Secondary phloem 6. Secondary xylem 7. Pith. **Anatomy of *L. cashmeriana* root:** e) Transverse section of root (10x): 1. Cork 2. Phelloderm 3. Mucilage cavity 4. Pericycle fibers 5. Phloem 6 Xylem .

3.3 Powder microscopy

The result of powder microscopy of different parts of *L. cashmeriana* revealed many important features which are illustrated in the Fig.3 (a-m).

Fig.3: Powder microscopy of *L. cashmeriana* leaves: a) A patch of stomata (10x); b) Stellate trichomes (40x). **Powder microscopy of *L. cashmeriana* stem:** c) 1. Group of fibers (40x) 2. Crystal sheath of calcium oxalate (40x); d) Stellate trichomes (40x); e) Inner epidermis(40x); f) Xylem fibers (40x). **Powder microscopy of *L. cashmeriana* root:** g) Lignified Reticulate vessels (40x); h) Lignified cork cells (40x). **Powder microscopy of *L. cashmeriana* flower:** i) Spinous pollen grains and stellate trichomes (40x). **Powder microscopy of *L. cashmeriana* seed:** j) Parenchyma cells (40x); k) Elongated sclereids (40x); l) Prismatic calcium oxalate crystals (40x); m) Stellate trichomes (40x).

3.4 Physicochemical parameters

The results attained from various physicochemical parameters including ash value, foreign matter, moisture content, swelling index, foaming index, pH in different parts of *L. cashmeriana* are presented in Table (3). The detailed results of cold extraction, hot extraction and successive extraction values are presented in the Table (4). The fluorescence characteristics of powdered leaves, stem, root, flower and seed of *L. cashmeriana* was observed in visible, short and long UV light. The observations are presented in Tables (5-9) showing the variation in color.

Table 3: Physicochemical analysis of various parts of *Lavatera cashmeriana*

Parts/physicochemical parameters (%)	Leaves	Stem	Root	Flower	Seed
Total ash	15.03	4.73	5.80	8.99	6.34
Acid insoluble ash	9.66	0.55	1.34	0.84	1.03
Water soluble ash	10.90	1.74	4.79	5.10	4.87
Foreign matter	0	0.8	0.5	1.02	0
Loss on drying	7.71	10.04	9.34	9.42	5.35
Swelling index	140	150	200	100	140
Foaming index	< 100	< 100	< 100	< 100	< 100
1% Ph	5.90	6.60	7.07	6.73	6.54
10% pH	5.23	6.35	6.59	6.24	6.37
Total Fat content	7.08	1.48	8.3	5.08	11.75

Table 4: Extractive values (%) of various parts of *Lavatera cashmeriana*

Plant parts	Solvents	Cold	Hot	Successive
Leaf	Hexane	4.2	7.08	3.54
	Chloroform	4.25	7.73	2.235
	Ethyl acetate	3.07	9.11	1.555
	Methanol	7	13.47	9.165
	Aqueous	22.73	33.36	16.25
	Hydroalcohol	17.99	63.917	-
Stem	Hexane	0.45	1.48	0.74
	Chloroform	0.96	1.62	0.795
	Ethyl acetate	0.64	1.49	0.62

	Methanol	3.97	17.82	11.05
	Aqueous	10.53	8.02	3.25
	Hydroalcohol	10.903	11.277	-
Root	Hexane	4.27	8.3	4.15
	Chloroform	5.44	7.13	1.98
	Ethyl acetate	9.25	5.99	1.115
	Methanol	12.42	16.06	9.66
	Aqueous	13.38	7.44	6.525
	Hydroalcohol	11.303	19.464	-
Flower	Hexane	1.71	5.08	2.54
	Chloroform	3.18	3.5	0.705
	Ethyl acetate	2.96	5.07	1.065
	Methanol	6.44	18.24	14.11
	Aqueous	22.42	28.43	11.42
	Hydroalcohol	9.491	23.912	-
Seed	Hexane	6.39	11.75	5.875
	Chloroform	8.69	11.05	1.675
	Ethyl acetate	6.81	8.9	0.64
	Methanol	3.89	9	3.75
	Aqueous	5.34	8.29	3.46
	Hydroalcohol	9.522	4.64	-

Table 5: Fluorescence analysis of *Lavatera cashmeriana* leaf

S.No.	Reagents	Visible light	UV 254nm	UV 366nm
1	Powder Drug	Light green	Brown	Light green
2	Powder Drug + Distilled Water	Dark green	Brown	Moderate green
3	Powder Drug + 10% aq. Sodium Hydroxide	Brownish green	Blackish brown	Bluish green*
4	Powder Drug + Ammonia	Dark green	Blackish green	Moderate green
5	Powder Drug + conc. Sulphuric Acid	Reddish black	Brownish green	Grayish green
6	Powder Drug + Sulphuric Acid + Water	Greenish black	Brown	Light brown
7	Powder Drug + conc. Hydro Chloric Acid	Blackish green	Blackish brown	Blackish gray
8	Powder Drug + Chloric Acid + Water	Olive green	Brown	Blackish gray
9	Powder Drug + conc. Nitric Acid	Moderate orange	Moderate orange	Bluish gray
10	Powder Drug + Nitric Acid + Water	Light orange	Light orange	Blackish gray
11	Powder Drug + Iodine	Olive green	Moderate brown	Bluish gray
12	Powder Drug + 5% Ferric Chloride	Greenish black	Light brown	Grayish black

13	Powder Drug + Picric acid	Yellowish green	Light brown	Greenish gray
14	Powder Drug + Picric acid + Water	Yellowish green	Light brown	Blackish gray
15	Powder Drug + Glacial Acetic Acid	Brownish black	Dark brown	Purplish gray*
16	Powder Drug + Petroleum Ether	Green	Olive green	Orange*
17	Powder Drug + Chloroform	Blackish green	Brown	Pinkish orange*
18	Powder Drug + Ethyl Acetate	Dark green	Brown	Dark pink*
19	Powder Drug + Methanol	Bottle green	Light brown	Dark orange
20	Powder Drug + 5% Potassium dichromate	Brown	Blackish brown	Grayish black
21	Powder Drug + Alcoholic Potassium Hydroxide	Dark green	Blackish brown	Light orange*

* Diagnostic color

Table 6: Fluorescence analysis of *Lavatera cashmeriana* stem

S.No.	Reagents	Visible light	UV 254nm	UV 366nm
1	Powder Drug	Cream	Light gray	Dark cream
2	Powder Drug + Distilled Water	Dark cream	Light brown	Greenish brown
3	Powder Drug + 10% aq. Sodium Hydroxide	Moderate yellow	Moderate brown	Greenish gray
4	Powder Drug + Ammonia	Light yellow	Grayish brown	Greenish gray
5	Powder Drug + conc. Sulphuric Acid	Reddish black	Blackish brown	Black
6	Powder Drug + Sulphuric Acid + Water	Blackish green	Moderate brown	Light green*
7	Powder Drug + conc. Hydro Chloric Acid	Brown	Moderate brown	Bluish gray*
8	Powder Drug + Chloric Acid + Water	Moderate yellow	Blackish brown	Olive green
9	Powder Drug + conc. Nitric Acid	Moderate orange	Moderate orange	Blackish gray
10	Powder Drug + Nitric Acid + Water	Light orange	Light orange	Grayish green*
11	Powder Drug + Iodine	Light brown	Blackish brown	Black
12	Powder Drug + 5% Ferric Chloride	Brown	Moderate brown	Grayish black
13	Powder Drug + Picric acid	Yellow	Blackish brown	Greenish black
14	Powder Drug + Picric acid + Water	Yellow	Blackish brown	Greenish black
15	Powder Drug + Glacial Acetic Acid	Light cream	Light brown	Greenish gray
16	Powder Drug + Petroleum Ether	Light cream	Light brown	Greenish gray
17	Powder Drug + Chloroform	Moderate brown	Blackish brown	Greenish gray

18	Powder Drug + Ethyl Acetate	Light cream	Blackish brown	Greenish gray
19	Powder Drug + Methanol	Light yellow	Moderate brown	Light green*
20	Powder Drug + 5% Potassium dichromate	Dark yellow	Blackish brown	Jet black
21	Powder Drug + Alcoholic Potassium Hydroxide	Light yellow	Brown	Light green*

* Diagnostic color

Table 7: Fluorescence analysis of *Lavatera cashmeriana* root

S.No.	Reagents	Visible light	UV 254nm	UV 366nm
1	Powder Drug	Light gray	Blackish brown	Light cream
2	Powder Drug + Distilled Water	Light brown	Light brown	Greenish gray
3	Powder Drug + 10% aq. Sodium Hydroxide	Moderate brown	Blackish brown	Light green
4	Powder Drug + Ammonia	Light brown	Blackish brown	Light green
5	Powder Drug + conc. Sulphuric Acid	Reddish black	Blackish brown	Grayish black
6	Powder Drug + Sulphuric Acid + Water	Brownish black	Chocolate brown	Olive green
7	Powder Drug + conc. Hydro Chloric Acid	Dark brown	Light orange	Greenish gray
8	Powder Drug + Chloric Acid + Water	Light brown	Blackish brown	Greenish gray
9	Powder Drug + conc. Nitric Acid	Brown	Moderate orange	Blackish gray
10	Powder Drug + Nitric Acid + Water	Brown	Light orange	Grayish black
11	Powder Drug + Iodine	Black	Blackish brown	Blackish gray
12	Powder Drug + 5% Ferric Chloride	Gray	Blackish brown	Blackish gray
13	Powder Drug + Picric acid	Yellow	Reddish brown	Black
14	Powder Drug + Picric acid + Water	Yellow	Light brown	Blackish gray
15	Powder Drug + Glacial Acetic Acid	Brown	Brown	Light gray
16	Powder Drug + Petroleum Ether	Light brown	Reddish brown	Greenish gray
17	Powder Drug + Chloroform	Blackish brown	Grayish brown	Greenish gray
18	Powder Drug + Ethyl Acetate	Light gray	Grayish black	Greenish gray
19	Powder Drug + Methanol	Light gray	Brown	Bluish gray*
20	Powder Drug + 5% Potassium dichromate	Orange yellow	Moderate orange	Grayish black
21	Powder Drug + Alcoholic Potassium Hydroxide	Moderate brown	Blackish brown	Light green*

* Diagnostic color

Table 8: Fluorescence analysis of *Lavatera cashmeriana* flower

S.No.	Reagents	Visible light	UV 254nm	UV 366nm
1	Powder Drug	Purplish gray	Reddish brown	Gray
2	Powder Drug + Distilled Water	Light brown	Blackish brown	Greenish gray
3	Powder Drug + 10% aq. Sodium Hydroxide	Yellowish brown	Brown	Greenish gray
4	Powder Drug + Ammonia	Brownish yellow	Brown	Light gray
5	Powder Drug + conc. Sulphuric Acid	Reddish black	Blackish brown	Greenish brown
6	Powder Drug + Sulphuric Acid + Water	Reddish brown	Light orange	Olive green
7	Powder Drug + conc. Hydro Chloric Acid	Reddish brown	Brown	Greenish brown
8	Powder Drug + Chloric Acid + Water	Pinkish brown	Moderate orange	Greenish gray
9	Powder Drug + conc. Nitric Acid	Orange brown	Moderate orange	Blackish gray
10	Powder Drug + Nitric Acid + Water	Brown	Light orange	Greenish black
11	Powder Drug + Iodine	Brown	Blackish brown	Grayish green
12	Powder Drug + 5% Ferric Chloride	Brownish black	Light orange	Grayish black
13	Powder Drug + Picric acid	Yellow	Brown	Greenish gray
14	Powder Drug + Picric acid + Water	Yellow	Light brown	Greenish gray
15	Powder Drug + Glacial Acetic Acid	Pinkish brown	Pinkish orange	Greenish gray
16	Powder Drug + Petroleum Ether	Gray	Brown	Light gray
17	Powder Drug + Chloroform	Brownish green	Brown	Greenish brown*
18	Powder Drug + Ethyl Acetate	Grayish green	Brown	Pink*
19	Powder Drug + Methanol	Light green	Brown	Brownish pink
20	Powder Drug + 5% Potassium dichromate	Yellowish brown	Light brown	Black
21	Powder Drug + Alcoholic Potassium Hydroxide	Brownish green	Blackish brown	Brownish yellow*

* Diagnostic color

Table 9: Fluorescence analysis of *Lavatera cashmeriana* seed

S.No.	Reagents	Visible light	UV 254nm	UV 366nm
1.	Powder Drug	Grayish black	Brownish black	Grayish black
2.	Powder Drug + Distilled Water	Black	Moderate brown	Grayish black
3.	Powder Drug + 10% aq. Sodium Hydroxide	Brownish black	Brown	Grayish black
4.	Powder Drug + Ammonia	Black	Brown	Gray
5.	Powder Drug + conc. Sulphuric Acid	Reddish black	Blackish brown	Black
6.	Powder Drug + Sulphuric Acid + Water	Brownish black	Brown	Gray
7.	Powder Drug + conc. Hydro Chloric Acid	Black	Moderate brown	Blackish gray
8.	Powder Drug + Chloric Acid + Water	Brownish black	Brown	Blackish gray
9.	Powder Drug + conc. Nitric Acid	Light brown	Light orange	Gray
10.	Powder Drug + Nitric Acid + Water	Dark brown	Moderate orange	Dark gray
11.	Powder Drug + Iodine	Black	Brown	Light gray
12.	Powder Drug + 5% Ferric Chloride	Brownish black	Brown	Black
13.	Powder Drug + Picric acid	Greenish black	Brown	Grayish black
14.	Powder Drug + Picric acid + Water	Greenish black	Brown	Grayish black
15.	Powder Drug + Glacial Acetic Acid	Black	Brown	Light gray
16.	Powder Drug + Petroleum Ether	Black	Dark Brown	Blackish gray
17.	Powder Drug + Chloroform	Brownish black	Brown	Light black
18.	Powder Drug + Ethyl Acetate	Black	Dark Brown	Grayish Black
19.	Powder Drug + Methanol	Black	Dark Brown	Light brown
20.	Powder Drug + 5% Potassium dichromate	Yellowish black	Light orange	Black
21.	Powder Drug + Alcoholic Potassium Hydroxide	Brownish black	Blackish brown	Light green*

* Diagnostic color

4. DISCUSSION

Authentication of the herbal drug is the critical part to make sure reproducible quality of herbal plant. The pharmacognostical study not only offers the authentication but also quality, clarity and standard of the plant drug.

The pharmacognostical factors are chief dependable and cheap criteria for corroboration of the crude drugs. World Health Organization (WHO) holds up, recommends and encourages traditional/herbal remedies in national health care programmes as these drugs are by far obtainable at low cost, safe and people have reliance in them (Pandey and Tripathi, 2014).

Organoleptic assessment can be made by means of sense organs, which offer the simplest as well as quickest means to ascertain the distinctiveness and clarity to make sure quality of a particular drug (Chanda, 2014). According to WHO, the macroscopical and microscopical description of a medicinal plant is the first step towards ascertaining the identity and the degree of purity of such material (Pandey and Tripathi, 2014). The microscopic study encompasses powder microscopy as well as anatomical studies of different parts of the plants under study. The physicochemical parameters are also important for the standardization and quality control of herbal drugs. Estimation of extractive values determines the amount of the active constituents in a given amount of plant material when extracted with a particular solvent. The extractions of any crude drug with a particular solvent yield a solution containing different phytoconstituents. It also hints whether the crude drug is exhausted or not (Chanda, 2014; Tatiya *et al.*, 2012). Fluorescence analysis is a vital pharmacognostic factor. Some components illustrate fluorescence in the visible range in daylight. In many natural products the ultra violet light produces fluorescence which does not visibly fluoresce in daylight. If substance themselves are not fluorescent, they may often be changed into fluorescent derivatives or decomposition products by applying different reagents. In this way crude drugs are often assessed qualitatively and it is an essential parameter for pharmacognostic estimation of crude drugs (Chanda, 2014; Zhao *et al.*, 2011).

5. CONCLUSION

The study may present a base for further accomplishments towards generating understanding about medicinal plants of Kashmir Himalaya. The pharmacognostic studies are the first step towards ascertaining the identity and the degree of purity of herbal materials. The pharmacognostic analysis is not reported previously in this plant species which makes this first report providing complete pharmacognostic profile of *L. cashmeriana* and hence will be useful for correct identification and authentication of the species for future studies.

CONFLICT OF INTEREST

No conflict

ACKNOWLEDGEMENT

The authors are greatly thankful to the Department of Botany and Department of Pharmaceutical Sciences for providing necessary research facilities.

Authors' contributions: NM and SN carried the experimental work and result analysis; WYR and KR helped in the compilation of data; IAN and ZAB helped in the supervision of the work. All authors have read and approved the final manuscript.

REFERENCES

Anonymous (1987) Standardization of single Unani Medicine, part-I, II. Central Council for Research in Unani Medicine (CCRUM), New Delhi-India.

Anonymous (1996) Indian Pharmacopeia. Government of India 2, Ministry of Health and Family Welfare, New Delhi.

Anonymous (1998) Quality control methods for medicinal plant materials. World Health Organization, Geneva.

Chanda S (2014) Importance of pharmacognostic study of medicinal plants: an overview. J Pharmacogn Phytochem 2 (5):69-73.

Chase CR, Pratt R (1949) Fluorescence of powdered vegetable drugs with particular reference to development of a system of identification, J Am Pharm Assoc 38(6) 324-331.

Dar GH, Bhagat RC, Khan MA (2002) Biodiversity of Kashmir Himalaya Valley book house, Srinagar Kashmir, J&K.

Ganie AH, Tali BA, Rather AM (2013) An ethanobotanical study in Budgam district of Kashmir valley: An attempt to explore and document traditional knowledge of the area. International Research Journal of Pharmacy 4(1) 201-204.

Kaul MK (2010) High altitude botanicals in integrative medicine-Case studies from Northwest Himalaya. IJTK 9 18-25.

Kokoski CJ, Kokoski RJ, Slama FJ (1958) Fluorescence of powdered vegetable drugs under ultraviolet radiation, J Am Pharm Assoc (Scientific ed.) 47(10) 715-717.

- Malik AH, Khuroo AA, Dar GH, Khan ZS (2011) Ethnomedicinal uses of some plants in Kashmir Himalaya. Indian Journal of Traditional Knowledge 10(2) 362-366.
- Mukherjee PK. (2002) Quality control of herbal drugs. Business horizons, New Delhi.
- Pandey A, Tripathi A (2014) Concept of standardization, extraction and pre phytochemical screening strategies for herbal drug. Journal of Pharmacognosy and Phytochemistry 2 (5) 115-119.
- Patil VV, Patil RV (2010) *Ficus bengalensis* Linn- an overview. Int J Pharm Bio Sci 1(2) 1-11.
- Prabhavathi RM, Prasad MP, Jayaramu M (2016) Studies on Qualitative and Quantitative Phytochemical Analysis of *Cissus quadrangularis*. Advances in Applied Science Research 7(4) 11-17.
- Prasanth DSNBK, Rao AS, Prasad YR (2016) Pharmacognostic Standardization of *Aralia racemosa* L. Stem. Indian Journal of Pharmaceutical Sciences 79(2) 220-226.
- Rakashanda S, Ishaq M, Masood A, Amin S (2012) Antibacterial activity of a trypsin- chymotrypsin-elastaseinhibitor isolated from *Lavatera cashmeriana* Camb. seeds. The Journal of Animal & Plant Sciences 22(4) 983-986.
- Rakashanda S, Khurshid AQ, Majeed R, Rafiq S, Mohammad ID, Masood A, Hamid A, Amin S (2013) Trypsin inhibitors from *Lavatera cashmeriana* Camb. seeds: isolation, characterization and in-vitro cytotoxicity activity. International Journal of Pharmaceutical Science Invention 2(5) 55-65.
- Tatiya A, Surana S, Bhavsar S, Patil D, Patil Y (2012) Pharmacognostic and preliminary phytochemical investigation of *Eulophia herbacea* Lindl. Tubers (Orchidaceae). Asian Pac J Trop Disease 2(1) S50-55.
- Zhao Z, Liang Z, Guo P (2011) Macroscopic identification of Chinese medicinal materials: Traditional experiences and modern understanding. J Ethnopharmacol 131 556-561.

Figures

Figure 1

Morphological attributes of *L. cashmeriana*: (a) Habit (perennial herb); (b) Flower with caudate petals; (c) Stamens and stigma; (d) Multilocular ovary; (e) Seeds (dark brown)

Figure 2

Anatomical features of *L. cashmeriana* leaf: a) A patch of stomata (10x); b) Anomocytic stomata with wavy epidermal cells (100x); c) Stellate trichomes (40x). Anatomy of *L. cashmeriana* stem: d) Transverse section of stem (10x): 1. Trichomes 2. Epidermis 3. Parenchymatous cortex 4. Sclerenchymatous patches 5. Secondary phloem 6. Secondary xylem 7. Pith. Anatomy of *L. cashmeriana* root: e) Transverse section of root (10x): 1. Cork 2. Phelloderm 3. Mucilage cavity 4. Pericycle fibers 5. Phloem 6 Xylem .

Figure 3

Powder microscopy of *L. cashmeriana* leaves: a) A patch of stomata (10x); b) Stellate trichomes (40x). Powder microscopy of *L. cashmeriana* stem: c) 1. Group of fibers (40x) 2. Crystal sheath of calcium oxalate (40x); d) Stellate trichomes (40x); e) Inner epidermis(40x); f) Xylem fibers (40x). Powder microscopy of *L. cashmeriana* root: g) Lignified Reticulate vessels (40x); h) Lignified cork cells (40x). Powder microscopy of *L. cashmeriana* flower: i) Spinous pollen grains and stellate trichomes (40x). Powder microscopy of *L. cashmeriana* seed: j) Parenchyma cells (40x); k) Elongated sclereids (40x); l) Prismatic calcium oxalate crystals (40x); m) Stellate trichomes (40x).