Research Article

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A COMPARATIVE PHARMACOGNOSTICAL STUDY OF RHIZOMES OF MUSTAKA AND NAGARMUSTAKA

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ABSTRACT

Mustaka was held in high esteem by the ancient sages of India. This super bulb has been used throughout the ages for the treatment of numerous illness. It is an aquatic or semi-aquatic herb and found throughout India. Like Mustaka, Nagarmustaka is a perennial herb which grows in aquatic and sub-aquatic region especially on banks of streams and rivers. Rhizome is the useful part of both the plants. Both the drugs have high therapeutic value in day to day medical conditions like obesity, hyperlipidemia, acute & chronic fevers, diarrhoea, skin diseases, cough, digestive disorders, intestinal worms etc. But there is some confusion about their identity because both were considered as synonyms as well as varieties in ayurvedic texts and in most of the markets also, the raw drug sellers are selling a single drug under the name of Motha and Nagarmotha both. The present study was aimed to systematically classify Mustaka (*Cyperus rotundus* Linn.) and Nagarmustaka (*Cyperus procerus* Rottb.) through their Pharmacognostical evaluation by macroscopy, microscopy and powder analysis for their correct identification. Mustaka (*Cyperus rotundus* Linn.) and Nagarmustaka (*Cyperus procerus* Rottb.) were collected from their natural habitat and botanically identified from BSI. Oraganoleptic study, transverse sections and powder microscopy of the rhizomes of both the species were carried out. Organoleptically, Rhizomes of Mustaka (*Cyperus rotundus* Linn.) are ovoid, blunt and spindle in shape while the rhizomes of Nagarmustaka (*Cyperus procerus* Rottb.) are elongated and cylindrical in shape. Microscopically, in the T.S of rhizomes, vascular bundles was more closely present in Nagarmustaka (*Cyperus procerus* Rottb.) than the Mustaka (*Cyperus. rotundus* Linn.) and bundle sheath was present around the vascular bundles of Nagarmustaka (*Cyperus procerus* Rottb.) while it was absent in Mustaka (*Cyperus. rotundus* Linn.). Cell nuclei was found in the powder microscopy of Nagarmustaka (*Cyperus procerus* Rottb.) only. This study will provides identifying features of Mustaka (*Cyperus. rotundus* Linn.) and Nagarmustaka (*Cyperus procerus* Rottb.) for their correct identification. From this study it can be concluded that these are two different species from Cyperus.

Keywords: Mustaka, Nagarmustaka, *Cyperus rotundus* Linn., *Cyperus procerus* Rottb., microscopy

INTRODUCTION

Mustaka and Nagarmustaka are important drugs of Ayurveda. The therapeutic utility of Mustaka and Nagarmustaka are wide ranging as these two drugs are used in the different classical formulations for the treatment of different diseases. Mustaka (*Cyperus rotundus* Linn.) is an erect and perennial glabrous herb with woody subterranean stoloniferous rhizome which is clothed with fibrous remains of leaf sheaths. Stems are nodose at base, 3-gonous and 10-60 cm high[1]. The rhizome of Mustaka i.e. *Cyperus rotundus* Linn. are cooling, intellect promoting, nervine tonic, diuretic, antiperiodic and used to treat diarrhoea, dysentery, leprosy, bronchitis, amenorrhea and blood disorders[2].

In ayurveda, Mustaka is considered to be best among Deepana, Pachan and Sangrahik drugs. It is used as an ingredient of many important formulations like Chyavanprash, Shadangpaniya, Trayamanadya ghrita, Mahatiktaka ghrita, Navayasa loha, Anu taila, Phala ghrita, Yograj guggulu, Navak guggulu, Pushyanaga churna, Balchaturbhadrika churna, Sudarshana Churna, Brihat Manjisthadi Kwatha, Chandraprabha vati, Gokshuradi guggulu, Kumarayasva, Dashmularista, Lakshadi taila, Gangadhara churna, Bilva taila, Narikela khanda, Maha yograja guggulu, Triphala guggulu, Vangeshvara rasa, Haridra khanda, Ashokarista etc. and use of different formulations of Mustaka have been mentioned in various diseases like Jvara (fever), Atisara (Diarrhoea), Medo roga (Hyperlipidemia), Grahani roga, Arsha (Piles), Pandu roga (Anaemia), Raktapitta (Hemoptysis), Kasa (Cough), Yakshma roga , Chardi (Vomitting), Arochaka (Anorexia), Kubja, pangu, Ardhangvata (Hemiplegia) and other Vata vyadhi, Vatarakta (Gout), Amavata (Rheumatoid arthritis), Shula (pain) etc. It plays an important place among medicinal herbs in India since ancient times[3-16].

Like Mustaka, Nagarmustaka is a perennial herb which grows in aquatic and sub-aquatic region. It is also very useful in treatment of various disorders like Jvara (Fever), Aruchi (Anorexia), Atisara (Diarrhorea), Trishna (Thirst), Jantu roga (Worms) etc. Nagarmustaka (*Cyperus procerus* Rottb.) is a herb grows 40-120 cm. tall, branches are long and with three edges. It is a larger plant than Mustaka *(Cyperus rotundus* Linn.) and rhizomes are also larger[17].

Brihatrayi, has only mentioned about the Mustaka and there is no description of Nagarmustaka. Description of Nagarmustaka is mainly found in different Nighantus. Nighantus created so much confusion regarding the identity of Mustaka and Nagarmustaka. Some considered the both as a synonyms and some described both as a varieties.

- **Dhanwantari Nighantu, Bhavprakash Nighantu, Raj Nighantu and Shaligram Nighantu** considered Mustaka and Nagarmustaka as a varieties[18-21].
- **Sodhala and Madanpal Nighantu** considered the both as a synonyms[22-23].
- But **Priya Nighantu** had only mentioned about the Mustaka and there is no description about Nagarmustaka in this Nighantu[24].

Mustaka is commonly known as Motha and Nagarmustaka is also known as Nagarmotha.

In the market of crude drugs also, mostly rhizomes of Nagarmustaka (*Cyperus procerus* Rottb.) are being sold under the name of Motha and Nagarmotha while Mustaka is found abundantly throughout India. So, there is need to find out the pharmacognostical study of both the drugs for their correct identification.

MATERIAL AND METHODS

Plant Materials

The plants material which were taken for study are -
Mustaka
Nagarmustaka
Cyperus rotundus Linn. is taken as a source of Mustaka and *Cyperus proceruss* Rottb. is taken as a source of Nagarmustaka.

Collection of genuine sample from the field

- The genuine samples were collected after identifying the source of plant as per standard description.
- The genuine sample of Mustaka i.e. rhizomes of *Cyperus rotundus* Linn. were collected from Rishikul Campus, Uttarakhand ayurved university, Haridwar District, State-Uttarakhand
- The genuine sample of Nagarmustaka i.e. rhizomes of *Cyperus procerus* Rottb. were collected from Muni ki reti, State-Uttarkahand.
- From these sources as mentioned above, samples were collected, Herbarium were made and authenticated at Botanical Survey of India (BSI), Dehradun. (Figure 1)

Table 1: List of Plants with Herbarium account number

S.no	Plant Name	Place Of Collection	Herbarium Account No.
1.	*Cyperus rotundus* Linn.	Rishikul Campus, Haridwar, Uttarakahand	116043
2.	*Cyperus procerus* Rottb.	Muni ki reti, Uttarakahnad	116039

Macroscopic/Organoleptic Study

The fresh rhizome of Mustaka (*Cyperus rotundus* Linn.) and Nagarmustaka (*Cyperus procerus* Rottb.) were dried and studied organoleptically, with naked eye & magnifying lens, with the help of Pharmacognostical procedure i.e. Appearance, size, shape, colour, odour, taste, fracture and findings were recorded and comparative study was done.

Microscopic Study

Microscopic sections were cut by Microtome sectioning. Numerous temporary and permanent mounts of the microscopical sections of the specimen were made and examined microscopically. Histochemical reactions were applied with staining reagents on transverse sections and on rhizome powder by reported methods. Powder characteristics Preliminary examination and behaviour of the powder with different chemical reagents was carried out and microscopical examination was carried out as per reported methods[25].

RESULTS

Organoleptic Study

Table 2: Comparative Organoleptic Study of Mustaka)*Cyperus rotundus* Linn (.and Nagarmustaka) *Cyperus procerus* Rottb(.Rhizome

S.No	Rhizomes	Genuine Sample of Mustaka (*Cyperus rotundus* Linn.)	Genuine Sample Of Nagarmustaka (*Cyperus procerus* Rottb.)
1.	Shape	Ovoid, bluntly conical and spindle shape	Elongated and cylindrical
2.	Size	1-2.5 cm in length and 0.5-1cm. in thickness.	5-20cm in length and 0.5- 1.5 cm. in thickness.
3.	Colour	brownish black externally and starchy white internally.	Brownish black externally and creamish internally
4.	Surface	Rough with striations and covered with flexuous hairs.	Rough and covered with flexuous hairs.
5.	Odour	Pleasant	Pleasant
6.	Taste	Bitter, pungent & astringent in taste	Bitter, pungent & astringent in taste
7.	Fracture	Not easily breakable due to smaller size, Short exposing white interior with light brown dots	Fracture is somewhat flexible and fibrous exposing with creamish interior.

Transverse Section

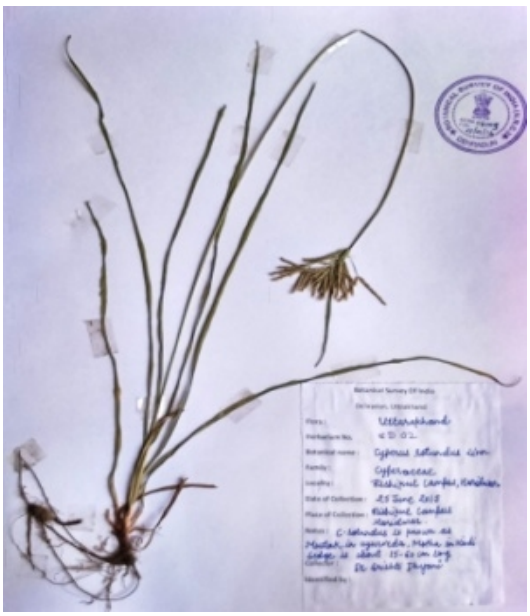
Table 3: Comparative Study of Transverse Section of Mustaka)*Cyperus rotundus*Linn (.and Nagarmustaka) *Cyperus procerus* Rottb (. Rhizome

S.NO	Parameters	T.S of Genuine Sample of Mustaka (*Cyperus rotundus* Linn.)	T.S of Genuine Sample of Nagarmustaka (*Cyperus procerus* Rottb.)
1.	**Epidermis**	Single layer of epidermis.	Single layer of epidermis.
2.	**Cortex**	Cortex, wide and composed of uniformly round, thin walled, parenchymatous cells.	Cortex, wide and composed of uniformly round, thin walled, parenchymatous cells.
3.	**Endodermis**	Single layered	Single layered
4.	**Vascular bundles** **a)Bundle sheath** **b)Oil globules**	Small, rounded vascular bundles present inner to the pericycle. **Less in numbers** absent More	The ground tissue inner to the pericycle contains a large number of small rounded vascular bundles. **More in numbers and closely set vascular bundles.** Present Less
5.	**Starch**	Cells of pith and cortex region contain starch.	Cells of pith and cortex region contain starch.

Powder Microscopy

Table 4: Comparative Powder Microscopy of Genuine Sample of Mustaka (*Cyperus rotundus* Linn.) and Nagrmustaka (*Cyperus procerus* Rottb.) Rhizome

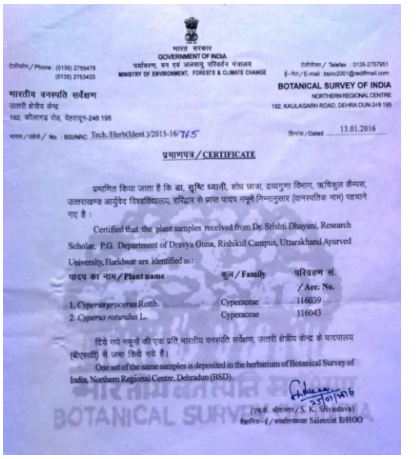
S.NO	Features	Genuine Sample of Mustaka (*Cyperus rotundus* Linn.)	Genuine Sample of Nagarmustaka (*Cyperus procerus* Rottb.)
1.	**Tannins**	+	+
2.	**cellulose**	+	+
3.	**Mucilage**	+	+
4.	**Cutin**	+	+
5.	**Cell nuclei**	_	+



Specimen of Mustaka (*Cyperus rotundus* Linn.)

Specimen of Nagarmustaka (*Cyperus procerus* Rottb.)

Figure 1: Herbarium Specimen



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192, KAULAGARH ROAD, DEHRA DUN-248 195

भाग्य / संदर्भ / No. : BSI/NRC Tech./Herb(Ident.)/2015-16/715

दिनांक / Dated 13.01.2016

प्रमाणपत्र / CERTIFICATE

प्रमाणित किया जाता है कि डा. सृष्टि ध्यानी, शोध छात्रा, द्रव्यगुण विभाग, ऋषिकुल कैम्पस, उत्तराखण्ड आयुर्वेद विश्वविद्यालय, हरिद्वार से प्राप्त पादप नमूने निम्नानुसार (वानस्पतिक नाम) पहचाने गए है :

Certified that the plant samples received from Dr. Srishti Dhayani, Research Scholar, P.G. Department of Dravya Guna, Rishikul Campus, Uttarakhand Ayurved University, Haridwar are identified as:

पादप का नाम / Plant name	कुल / Family	परिग्रहण सं. / Acc. No.
1. *Cyperus procerus* Rottb.	Cyperaceae	116039
2. *Cyperus rotundus* L.	Cyperaceae	116043

दिये गये नमूनों की एक प्रति भारतीय वनस्पति सर्वेक्षण, उत्तरी क्षेत्रीय केन्द्र के पादपालय (बीएसआई) में जमा किये गये हैं।

One set of the same samples is deposited in the herbarium of Botanical Survey of India, Northern Regional Centre, Dehradun (BSD).

(एस. श्रीवास्तव) / S. K. Srivastava
वरिष्ठ वैज्ञानिक / Senior Scientist In-HOO

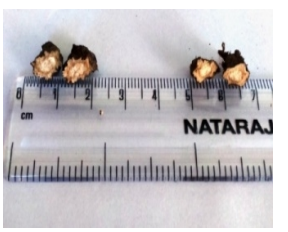
BOTANICAL SURVEY OF INDIA

Figure 2: Herbarium Authentication Certificate

Mustaka (*Cyperus rotundus* Linn.)

Nagarmustaka (*Cyperus procerus* Rottb.)

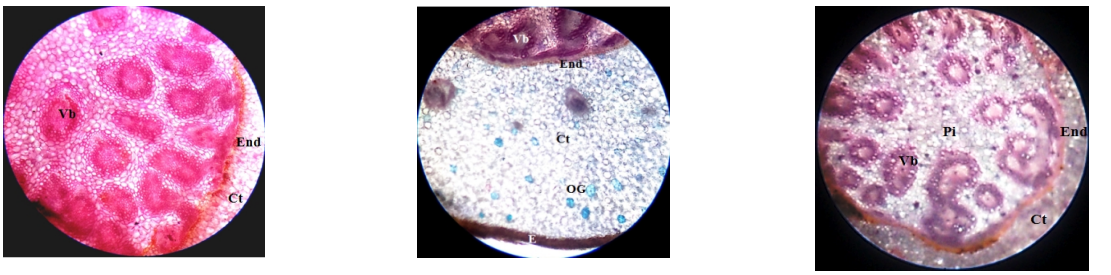
Figure 3: Rhizome



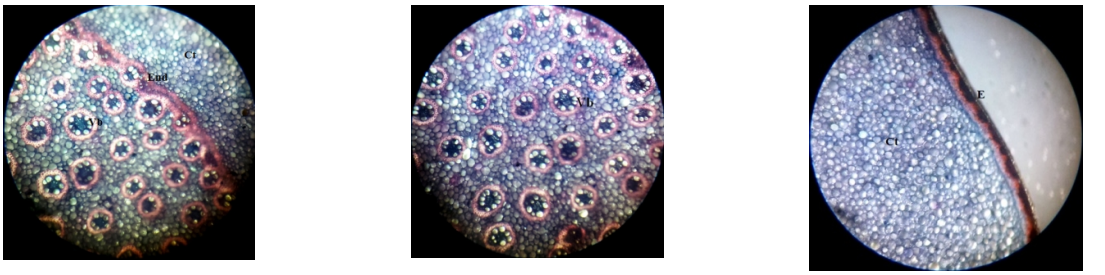
Short fracture exposing with starchy white interior
***Mustaka* (*Cyperus rotundus* Linn.) Rhizome**

Fibrous and Flexible
***Nagarmustaka* (*Cyperus procerus* Rottb.) Rhizome**

Figure 4: Organoleptic Study



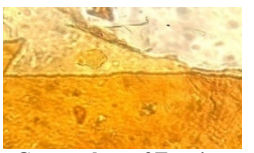
T.S of Mustaka Rhizome (*Cyperus rotundus* Linn.)



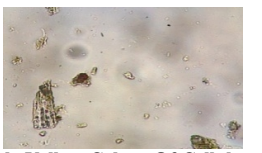
T.S of Nagarmustaka Rhizome (*Cyperus procerus* Rottb.)

E : Epidermis, End : Endodermis, Ct : Cortex, Vb : Vascular bundles, OG :Oil globules, Pi : Pith

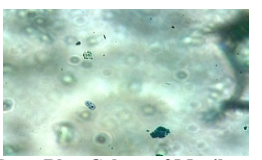
Figure 5: Transverse Section



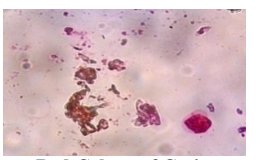
Green colour of Tannins
(Stain: Dil. Ferric Chloride Solution)



Pale Yellow Colour Of Cellulose
(Stain: Iodine Solution)



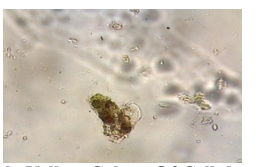
Deep Blue Colour of Mucilage
(Stain : Methylene Blue)



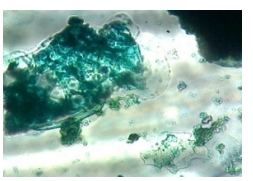
Red Colour of Cutin
(Stain : Sudan III)

Rhizome of *Mustaka* (*Cyperus rotundus* Linn.)

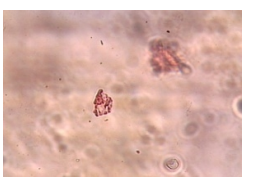
Green colour of Tannins
(Stain: Dil. Ferric Chloride Solution)



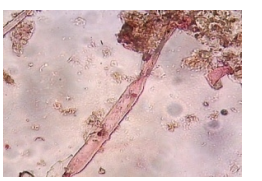
Pale Yellow Colour Of Cellulose
(Stain: Iodine Solution)



Deep Blue Colour of Mucilage
(Stain : Methylene Blue)



Red Colour of Cutin
(Stain : Sudan III)



Red Colour of Cell Nuclei
(Stain : Safranin)

Rhizome of *Nagarmustaka* (*Cyperus procerus* Rottb.)

Figure 6: Powder Microscopy

DISCUSSION

Organoleptic study of Mustaka (*Cyperus rotundus* Linn.) and Nagarmustaka (*Cyperus procerus* Rottb.) were reported in Table 2.

Rhizomes of Mustaka (*Cyperus rotundus* Linn.) are ovoid, blunt and spindle in shape, vary in size and nearly about 1-2.5 cm in length and 0.5- 1 cm. in thickness while the rhizomes of Nagarmustaka (*Cyperus procerus* Rottb.) are elongated and cylindrical in shape and larger than the Mustaka which is about 5-20 cm in length and 0.5 – 1.5 cm. in thickness. Mustaka (*Cyperus rotundus* Linn.) rhizomes are not easily breakable due to smaller size and hardened nature and the fracture is short exposing white interior with light brown dots while the fracture is fibrous and flexible exposing with creamish interior in Nagarmustaka (*Cyperus procerus* Rottb.). (Figure 4)

Microscopic study of Mustaka (*Cyperus rotundus* Linn.) and Nagarmustaka Rhizome (*Cyperus procerus* Rottb.) were reported in Table 3.

T.S of Mustaka (*Cyperus rotundus* Linn.) and Nagarmustaka (*Cyperus procerus* Rottb.) rhizome were almost same. But the difference was present in vascular bundles of both. The vascular bundles were more in number and more closely present in the Nagarmustaka than the Mustaka.

In the transverse section, bundle sheath was absent in the vascular bundle of Mustaka (*Cyperus rotundus* Linn.) rhizome while it was present in the vascular bundle of Nagarmustaka (*Cyperus procerus* Rottb.) rhizome.

Oil globules were present more in Mustaka (*Cyperus rotundus* Linn.) rhizome than the Nagarmustaka (*Cyperus procerus* Rottb.) rhizome. **(**Figure 5)

Powder microscopy were reported in Table 4.

Microscopic examination of powder shows presence of Tannin, Cellulose, Mucilage, Cutin in the genuine sample of Mustaka and Nagarmustaka both. The difference was cell nuclei is absent in genuine sample of Mustaka (*Cyperus rotundus* Linn.) while present in genuine sample of Nagarmustaka (*Cyperus procerus* Rottb.). (Figure 6)

CONCLUSION

The Comparative Pharmacognostical study of *Mustaka* (*Cyperus rotundus* Linn.) and *Nagarmustaka* (*Cyperus procerus* Rottb.) helps in the identification of these species. After the detailed study, it can be concluded that *Mustaka* and *Nagarmustaka* are two different species of Cyperus. In this present study standardization parameters such as macroscopy, microscopy and powder analysis were carried out which could helpul in authentication of *Mustaka* (*Cyperus rotundus* Linn.) & *Nagarmustaka* (*Cyperus procerus* Rottb.) and will serve as a reference for correct identification and distinguishing both the drugs.

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