GOKHARU (TRIBULUS TERRESTRIS): AN ABBREVIATED REVIEW

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ABSTRACT

Gokharu; a commonly available weed which possess substantial therapeutic value in the field of traditional systems of medicine, viz. *Ayurveda*, Chinese, *Siddha*, and *Unani*. It is well known medicinal plants in the folk medicine of many countries for a number of diseases i.e. diuretic, aphrodisiac, antiurolithic, immunomodulatory, antihypertensive, antihyperlipidemic, antidiabetic, hepatoprotective, anticancer, anthelmintic, antibacterial, analgesic, anti-inflammatory, antihyperlipidemic, and cardioprotective activity.

Keywords : *Gokharu, Tribulus terrestris*

INTRODUCTION

Gokharu (Tribulus terrestris) is an annual plant commonly known as puncture vine, goat head, devil's thorn [1, 2]. Tribulus genus belongs to family zygophyllaceae that roughly contains 25 different plant species which grow as hairy herbs in tropical and warm areas [3, 4]. *Gokharu (Tribulus terrestris)* is a well-recognized and vastly distributed plant of the genus Tribulus. It exists in the Mediterranean, subtropical and desert areas [5]. *Gokharu (Tribulus terrestris)* have been used to treat different diseases due to its bioactive components i.e. saponins, alkaloids, tannins, vitamin, glutamic acid and aspartic acid [6]. The Chinese use *Gokharu (Tribulus terrestris)* for over 400 years. Masai in Southern Africa use its thorns of to pierce earlobes of children [7]. The Eastern European Olympic athletes claimed that *Gokhru* contributed to their success in the mid of nineties. The research of Chemical and Pharmaceutical Institute in Sofia, Bulgaria, brought this plant

into the limelight in 1982. In India, it is used as anticonvulsant, anti-inflammatory, aphrodisiac, cardio tonic, diuretic and litholytic and treated for gleet, gonorrheal rheumatism with cystitis, gout and impotency and its ash is good for external application in rheumatic-arthritis [8-10].

Table No. 1 Taxonomy classification [5, 11-14]

Classification	**Pedalium murex (*Gokharu* -big)**	**Tribulus terrestris (*Gokharu* - small)**
Kingdom	Plantae	Plantae
Subkingdom	Tracheobionta	Tracheobionta
Division	Magnoliophyta	Magnoliophyta
Class	Magnoliopsida	Magnoliopsida
Subclass	Asteridae	Rosidae
Order	Lamiales	Sapindales
Family	Pedaliaceae	Zygophyllaceae
Genus	Pedalium	Tribulus
Species	Murex	terrestris

VERNACULAR NAME [5, 15, 16]

Sanskrit *Gokharuka, Trikata, Svadamshtra, Traikantaka*

Hindi *Gokharu, Chotagokhru*

Assamese *Gokharu, Gukhurkata*

Tamil *Nerunji*

Bengali *Gokhri, Gokharu*

Marathi *Sarate, Gokaru, Lahangokhru, Sarala*

Oriya *Gukhura, Gokhyura*

Urdu *Khorkashak, Khar-e-Khasak Khurd, Gokharu*

Gujarati *Bethagokhru, Nahanagokhru, Mithagokhru*

Telugu	*Palleru kayalu, Chinnipalleru*
Tamil	*Nerinjil, Nerunjeekai*
Kannada	*Sannaneggilu, Neggilamullu, Neggilu*
Kashmiri	*Michirkand, Pakhda*
Malayalam	*Neringil, Nerinnil*
Punjabi	*Bhakhra, Gokhru, Kurkundai*
English	*Caltrops fruit*
Arabic	*Qutıiba*
Burma	*Charatte*
Chinese	*Chili, Tsilitse*
Sind	*Land caltrops*
South Africa	*Devils thorn*
Spanish	*Abrojos*

Table No. 2 Synonyms of *Gokharu* [17-19]

Sr. No	Synonyms	C.S	Su.S	A.S	D.N	M.N	R.N	K.N	BP.N	Ma.N	A.R	A.K
1	Bahukantaka	-	-	-	-	-	✓	-	-	-	-	-
2	Bhakshakha	-	-	-	✓	✓	-	-	-	-	-	-
3	Bhakshyaka	-	-	-	✓	-	-	✓	-	-	-	-
4	Bhaksyakanta	-	-	-	-	-	✓	-	-	-	-	-
5	Bhukshura	-	-	-	-	-	-	✓	-	-	-	-
6	Chanadruma	-	-	-	-	-	✓	-	-	-	-	-
7	Gokantaka	-	-	-	✓	✓	-	-	✓	✓	-	✓
8	*Gokharu*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
9	*Gokharu*ka	-	-	-	✓	-	✓	-	-	-	-	✓
10	Ikshugandha	-	-	-	-	-	✓	-	✓	✓	-	✓
11	Kantaka	-	-	-	-	-	✓	-	-	-	-	-
12	Kanti	-	-	-	-	-	✓	-	-	-	-	-
13	Kantakashura	-	-	-	-	-	-	-	-	-		-
14	Kantakatrika	-	-	-	✓	-	-	-	-	-	-	-
15	Kantaphala	-	-	-	-	✓	-	✓	-	-	✓	-
16	Kshudrakshura	-	-	-	-	-	✓	-	-	-	-	-

17	Kshura	-	-	-	-	✓	✓	✓	✓	-	-	-
18	Kshuraka	-	-	-	-	✓	✓	-	-	-	-	-
19	Kshuranga	-	-	-	-	-	✓	-	-	-	-	-
20	Mahanga	-	-	-	-	-	✓	-	-	-	-	-
21	Palankasha	-	-	-	-	-	✓	-	✓	✓	-	✓
22	Shadanga	-	-	-	✓	✓	-	✓	-	-	-	-
23	Sthalashrunghata	-	-	-	-	✓	✓	✓	-	✓	✓	-
24	Swadamstra	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
25	Swadu kantaka	-	-	-	✓	✓	✓	✓	✓	✓	-	✓
26	Trika	-	-	-	✓	-	-	-	-	-	-	-
27	Trikantaka	-	✓	-	-	✓	✓	✓	✓	✓	✓	-
28	Vanashrunghata ka	-	-	-	-	-	✓	-	✓	-	-	✓
29	Vyaladamstraka	-	-	-	-	✓	✓	✓	-	-	✓	-

Table No. 3 Classification of *Gokharu* or *Gokharu* gana

Sr. no.	Text name	Gana (group)	Therapeutic uses
1	Charak samhita [17]	Anuvasanopaga, mutravirechaniya, shothahara, krimighana	Sothahara, mutrakrichahara, anilhara karmas
2	Sushruta samhita [18]	Vidharigandhadi gana, veeratarva gana, madhur varga, laghu panch mool gana, kantaka panch mool	Mutrakrichrahara, ashmari
3	Astanga sangraha [19]	Krimighan, laghu panchmoola, mutra virechaniya, sothahara, veeratarvadi, vidaryadi	Sothahara, mutrakrichrahara, anilhara karmas, krimighan
4	Bhavprakash Nighantu [20]	Guduchyadi varga	Asmari, hridya roga, mutral, svasa, kasa, arsha
5	Shodhala Nighantu [21]	Guduchyadi varga	Mutrakrichrahara, ashmari, rasayana
6	Shaligrama Nighantu [22]	Guduchyadi varga	Mutrakricha,ashmari, prameha, svasa, kasa, vataroga
7	Dhanvantari Nighantu [23]	Guduchyadi varga	Mutrakricha, hridya roga, prameha, shoola, tridosha shamak, dipak, vrushya, brimhana

8	Madanpal Nighantu [24]	Abhayadi varga	Mutrakricha, hridya roga, prameha, svasa, kasa, vata roga
9	Aadarsh Nighantu [25]	Laghu *Gokharu*di varga	Vrishya, mutrakricha, asmari, hridya roga, prameha, svas, pradar, rasayana
10	Mahaushdha Nighantu [26]	Bilwadi varga	Vrishya, mutrakricha, asmari, hridya roga
11	Kaiyadeva Nighantu [27]	Oshadadi varga	Mutrakricha, asmari, hridya roga, prameha, svas, kasa, bastidosha, vrishya, balya
12	Raj nighantu/ nighantu raj or abhidhana cudamani [28]	Shatahvadi varga	Vrisya, mutrakricha, asmari, prameha, rasayana
13	Hridayadipaka Nighantu [29]	Doshaghana varga	Tridosha shamak
14	Priya Nighantu [30]	Haritakyadi varga	Tridosha shamak
15	Madava dravyaguna [31]	Vividoushadi varga	Tridosha shamak
16	Amara Kosha [32]	Vanoushadi varga	Tridosha shamak

Table No. 4 *Rasa panchak* (properties and action mentioned in various nighantus)

Text name	Synonyms	Rasa	Guna	Veerya	Vipaka	Prabhav
Bhavprakash Nighantu [20]	Bhakstaka, gokantak, iksugandhika, ksuraka, palamkasa, svdramastra, svadukantaka, trikantaka, vanasrngata	Madhur	-	Sheeta	-	Vata shamak
Dhanvantari Nighantu [23]	Gokantak, swadukantak, *Gokharu*, *Gokharu*k vakshak, vakshatak, kantakari	-	-	-	-	Tridosha shamak

Madanpal Nighantu [24]	Gokantak, kantaphala, swadukantak, yaladanstra, *Gokharu*, saranga trikantak, trik, khurak, bhaksyantaka, vyaadamstraka, svadamstra, sthulasrngata	Madhur	-	Sheeta	-	Vata shamak
Adarash Nighantu [25]	Swadanstak, *Gokharu*, *Gokharuk*, saranga, swadamstra, vanasrngata	Madhur, tikta	-	Sheeta	Madhur	Vata shamak
Kaiyadeva Nighantu [27]	Gokantak, kantaphala, bhakstaka, swadukantak, swadanstak, byaladanstra, goksharu, *Gokharu*, kshur, sarang, trikantak, trik, shalasringat	Madhur	-	Sheeta	-	Kapha vata shamak
Raj nighantu or nighantu raj or abhidhana cudamani [28]	Bhadrakantaka, duscakrama, vyaldantra, mahanga, gokhuraka, antah, bahukantaka, gokantaka, palankasa, bhaksataka, sthalsrangataka, iksu gandha, trikantaka, sadanga, ksura, kantaphala, ksudra-ksura, canadrumqa,	Madhur	-	Sheeta	-	-

	van srngataka, kantah					
Dravyaguna vigyana [33]	*Gokharu*, trikantaka, *Gokharuk*	Madhur	Guru, snigdha	Sheeta	Madhur	Tridosha shamak
The Ayurvedic pharmacopoeia of India [34]	Mutrakricha, hridya roga, kasa, arsa, svasa, asmari, prameha	Madhur	Guru, Snigdha	Sheeta	Madhur	-

ETYMOLOGY OF *GOKHARU*

Literally the word '*Gokharu'* means the spines of the fruit that injures grazing cow or cattle [25].

SUBSTITUTES AND ADULTERANTS:

Pedalium murux which is considered as source for *Bruhat Gokharu* is substituted for *Laghu Gokharu* - *Tribulus terrestris*. Pharmaceutical industries use fruits instead of roots for the preparation of various formulations. The fruits of *Acanthospermom hispidum* DC resemble of Tribulus and frequently used in adulteration [35, 36].

DESCRIPTION:

a) Macroscopic:

Leaves: leaves are opposite, pinnate, one of each pair and smaller than the other, 3-6 pairs of leaflets, stipules are lanceolate, more or less hairs on the upper surface, base is round oblique, petiole is very short [34].

Flowers: flowers are axillary of leaf opposed, solitary, 1.2-2cm long pedicle, slender, hairy flowers, petals are 1cm long, oblong or obovate, style is short and stout [34].

Fruit: globose, consisting of 5 hairy or glabrous, woody cocci, each cocci has 2 pairs of hard spines (very sharp), 1 pair if spines is longer than the other, several seeds are present in the each coccus with transverse partitions [34].

Root: root is 7-18 cm long and 0.3-0.7 cm in diameter, root is slender and cylindrical, fibrous and frequently branched, number of rootlets are present over it. Root is woody

and color of the root is yellow to light brown, surface is rough due to presence of small nodules. Fracture is fibrous and aromatic odour. Taste is sweetish and astringent [34].

b) Microscopic:

Root: transverse section shows layers of epidermis (4-5 layers) followed by parenchymatous cortex (thin walled), endodermis is distinct, in mature root 4-6 layers of cork cells are present, there is only single layer of cork cambium which is followed by thin walled parenchymatous cells (6-4 layers) and varying numbers of fibres are present, fibres are found in groups which resembles phloem, there are two zones of secondary phloem, in outer zones numerous phloem fibres are present and also some sieve tubes are present which is slightly collapsed, inner zone consists of parenchymatous, no fibre is there but shows some sieve tubes and companion cells, phloem rays are distinct, in outer region few cells get converted into fibres, 3-5 layers of cambium, vessels, tracheids, parenchyma and fibres transverse with medullary rays, vessels are scattered, xylem parenchyma is rectangular or slightly elongated, medullary rays are also present. Few prismatic crystals are also present in the xylem ray cells [34].

Fruit: small epidermal cells in each coccus rectangular, trichomes are unicellular, mesocarp (6-10 layers) of large parenchymatous cells, calcium oxalate crystals (rosette) are present, in mesocarp small cells are present which is consist of calcium oxalate crystals (prismatic crystals) [34].

CHEMICAL CONSTITUENTS:

Protodioscin, terrestrosins, glycosides, diosgenin, hecogenin, ruscogenin, quercetin, saponins, alkaloids, Flavonoids, lignn amides etc [5, 34, 37, 38].

IDENTITY, PURITY AND STRENGTH

Root [39]

Foreign matter	NMT 2%
Total ash	NMT 13%
Acid insoluble ash	NMT 3%
Alcohol soluble extractive	NMT 4%
Water soluble extractive	NMT 10%

Fruit [34]

Foreign matter	NMT 1%
Total ash	NMT 15%
Acid insoluble ash	NMT 2%
Alcohol soluble extractive	NMT 6%
Water soluble extractive	NMT 10%

PHARMACOLOGICAL ACTIVITIES:

1) **Aphrodiasiac activity:**

It is used as a traditional medicine for the management of male and female infertility and reported for its aphrodisiac properties [40-43].

2) **Antioxidant activity:**

It shows antioxidant activity in a concentration-dependent manner by 2,2-di-(4-tert-octylphenol)-1-picrylhydrazyl (DPPH), H_2O_2, and superoxide scavenging activity, as well as the FRAP (Ferric reducing antioxidant power) assay [44]. Diosgenin from the callus of T. terrestris was found to have great antioxidant activity [45, 46].

3) **Anti-inflammatory activity:**

The terrestinones A1/A2 (1a/1b) and N-trans-ρ-caffeoyl tyramine isolated from ethanolic extract of *Gokharu* is capable to produce anti-inflammatory activities by inhibiting the productions of nitric oxide [47].

4) **Antiurolithic activity:**

It is used for the management of various disorders related to urinary system including urolithiasis [48-50].

5) **Immunolodulatory activity:**

Saponins which is isolated from the fruits of *Gokharu* increase the phagocytosis which indicates the stimulation of non specific immune response.

6) **Antidiabetic activity:**

It shows inhibitory activity against α-glucosidase and postprandial increase in blood glucose which lead in the improvement in insulin dependent diabetes symptoms [51-53].

7) **Protective activity in neuronal cells:**

The experimental studies shown that due to anti-inflammatory and antioxidant effects it able to produce protective effect against neuron injury [38, 54, 55]. The apoptosis of retinal ganglion cells acts as precursor for glaucoma. *Gokharu* able to block the optic nerve injury and enhance the survival of the optic nerve to protect the optic nerve [38].

8) **Cardiac disorders:**

It can play a role in dilating coronary artery and improving coronary circulation. It was recommended for treatment of angina pectoris, antihypertensive effect and dietary intake can able to lower down of serum lipid [56, 57].

9) **Hepatoprotective activity:**

The hepatoprotective activity may be due to the antioxidant activity, the influence on metabolism regulation and the repression of apoptosis of liver cells, which effectively reduces the level of Caspase-3 in liver tissue [58].

10) **Anti-cancerous activity**:

It has cytotoxic activity. The anti-tumours activity of the drug is well reported with its anti-cancerous effect [59-61].

11) **Antimicrobial activity**:

Antimicrobial activities depend upon origin of the plant and the part of the plant used. As *Yemeni* plant did not show antibacterial activity whereas the methanolic/ethanolic extracts of different parts i.e. fruits, roots and stems with leaves of *Iranian, Indian or Turkish* able to inhibit the growth of microorganisms [37, 62, 63].

12) **Antihelminthic activity**:

Tribulosin and sitosterol glycosides present in 50% methanolic extracts of tribulus terrestris reported to possess antihelminthic properties [64].

DOSE:

- Moola (root)/ phala (fruit) *churna*: 3-6 gm/day [39]
- Moola (root)/ phala (fruit) *kwath*: 50-100 ml/day or 20-30 gm drug for *kwath* preparation [34]

CONCLUSION

Gokharua (Tribulus terrestris) is a valued herb in the *Ayurvedic* system of medicine. Used to treat various types of disorders. Its various parts contain a variety of chemical constituents which are medicinally important, such as flavonoids, flavonol glycosides, steroidal saponins, and alkaloids. Tribulus is a plant that produces fruit that is covered with spines. Tribal people use the fruit, leaf, and root as a medicine. It is classified under *mishrak varga* as '*Dashmoola'* in *Ayurveda*.

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