



## Review Article

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# Potential Use of Medicinal Plant Gokhru: A Review

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## ABSTRACT

Currently, herbal medicines have attained great preferences over chemical drug based medicines due to more economic, lesser side effects on health and easy availability. Gokhru is an important medicinal plant which is being used in preparation of formulations in pharmaceutical companies. Gokhru is of two types *i.e.* Chhota gokhru (*Tribulus terrestris*) and Bada Gokhru (*Pedalium murex L.*). This review was conducted to study about these two important medicinal plants and their uses in curing various diseases. Further studies can be conducted on these two medicinal plant species by identifying their potential to develop into a new drug or to be used as a medicinal plant in curing various diseases. This review article mainly deals with botanical description, geographical distribution, ecology, environmental conditions required for growth, cultivation, utilization as a source of medicine and future prospect of *Tribulus terrestris* and *Pedalium murex L.*

**Keywords:** Pedalium Murex, Medicinal Plant, Tribulus Terrestris, Infertility.

## INTRODUCTION

Medicinal plants parts and isolated phytochemicals have been used in healthcare since time immemorial which are resources for new drugs. It has been estimated that 25 per cent of the drugs prescribed worldwide are derived from plants. India has about 25,000 species, rich in medicinal plant floras, of which 150 species are commercially used for preparation of formulation of medicines [1]. More than 80% of the world's population exclusively depends on plants for their health and healing [2]. Due to increase in stress, increase in pollution, change in diet system, it has been observed that case of impotency in men are increasing rapidly which is one of the main reason of increasing divorce cases now a days. The side effect of medicines has been observed on human health that's why use of medicinal plants in ayurvedic medicines is increasing. Gokhru is a useful medicinal plant which is being used as constituent of food supplements in many countries. Gokhru is an important medicinal plant which is of two types-Chhota gokhru (*Tribulus terrestris*) and Bada Gokhru (*Pedalium murex L.*). The various plant parts act as cardiac and have circulatory stimulants, anti-tumor, anti-pyretic, anti-epileptic, anti-inflammatory, anti-ulcer, anti-spasmodic, diuretic, antihypertensive, cholesterol lowering, anti-oxidant, anti-diabetic, hepatoprotective, anti-microbial activities, anti-hyperlipidemic, anti-nephrolithiatic, nephroprotective and aphrodisiac properties all of which are used to cure various diseases. Gokhru (*Pedalium murex L.*) is not only used in herbal medicines for treatments of diseases but also used by the athletes for enhancing their stamina and performance. All parts of both the plants are used in preparation of medicines. Many researchers have studied a number of biological active components from leaves, roots and fruit extracts of these two plants. The total annual trade estimated for *Tribulus terrestris* and *Pedalium murex* respectively is 2000-5000 and 100-200 MT [3].

### Chhota Gokhru (*Tribulus terrestris*)

Chhota Gokhru (*Tribulus terrestris*) is also known as gokshura, bhakhdi, puncture vine, goat-head. It is an annual shrub distributed in Mediterranean, subtropical and warm climatic regions such as India, China, Southern USA, Mexico, Spain, and Bulgaria [4,5]. Chhota Gokhru (*T. terrestris*) is generally known as noxious weed because of its small woody spiny fruits. The greyish brown fruit powder of *Tribulus terrestris* contains flavonoids, glycosides, alkaloids, steroids and saponin derivatives such as tigogenin, hecogenin, ruscogenin, diosgenin, chlorogenin and sarsapogenin [6,7]. Due to diuretic, analgesic, anti-diabetic, anti-uro lithic, aphrodisiac, anthelmintic and anti-microbial properties, it is used in traditional medicines [8,9].

Distribution: Chhota Gokhru (*Tribulus terrestris*) plant is distributed throughout India, ascending to 3300 m in Himalaya. The plants are common in hot, sandy and dry parts of the country such as Deccan, Gujarat, Andhra Pradesh, South Haryana and Rajasthan.

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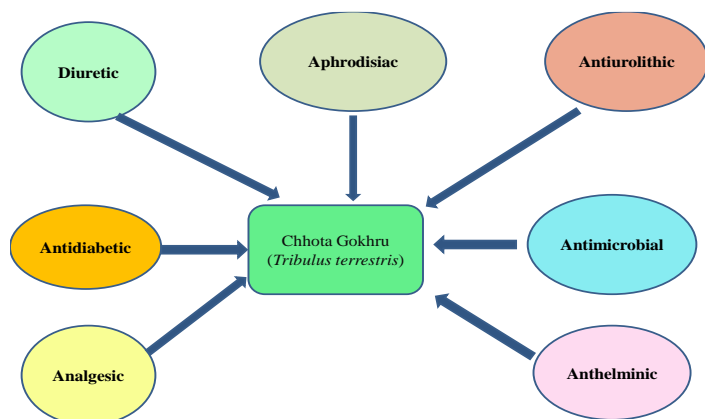
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**Botanical Description:** The plant belongs to family Zygophyllaceae, is an annual herbs having weak stem, creeping, branched and up to 95 cm in length. Leaves are compound, sub-opposite, paripinnate and stipulate, similar to chickpea leaves. The leaves are oblong to linear-oblong, sub-equal, pubescent on both surfaces and mucronate type. Leaflets are oblong in 5-10 pairs with short petiole. The roots are 7-18cm long and 0.3-0.8 cm in diameter, fibrous, cylindrical, sturdy, woody, fracture fibrous (numerous small rootlets) and yellow to light brown in colour having presence of small nodules with aromatic odour.



**Figure 1:** Plant of Chota Gokhru (*Tribulus terrestris*) with its parts (flowers and fruits)

The flowers are axillary solitary, hypogynous, pentamerous, bisexual, sub-sessile, actinomorphic, pale yellow to yellow in colour, 8-12mm in diameters which appear during July-August. Sepals are five in polysepalous condition and five petals in polypetalous condition. Stamens are ten (5+5) arranged in two whorls and inserted at the base of a disc. Gynoecium is pentacarpellary, pentalocular with single ovule. Style is simple, very short, stigma lobed and ten lobed disc is present below the ovary. The peduncles of flowers are shorter than that of leaves. Flowering occurs in autumn. Fruit is schizocarp, 5- spinous cocci and 5-angled with a pair of unequal spines. The peculiar feature of fruit is that they made up of 5-12 woody mericarps having 2 long and 2 short spines. The tips of spines almost gather in pairs, forming pentagonal frame work around the fruit. The fruits have faintly aromatic smell and slightly pungent in taste. Each coccus contains many seeds with transverse partition between them. The crops can be raised through direct sowing of seeds during February-March. Approximately 1.0-2.0kg seeds are required for planting one hectare area. Seeds can be collected during October- November. Seed takes about 30 days to germinate.



**Figure 2:** Medicinal properties of Chota Gokhru (*Tribulus terrestris*)

**Diuretic properties:** *Tribulus terrestris* possess diuretic property due to enormous quantity of nitrates and essential oil available in its fruits and seeds. Effect of herbal extract of *T. terrestris* was analyzed on the urine output and electrolytes in rabbits and remarkable enhancement was observed in urine quantity over a period. Furthermore, it was also found that it significantly reduced the sodium level and serum potassium level throughout the study period [10]. Diuretic potential of *Tribulus terrestris* was assessed in albino rats which due to presence of high concentration potassium salts [11].

**Analgesic activity:** An *analgesic* is a remedy that relieves from pain. Analgesic properties were observed in methanolic extract of *Tribulus terrestris* when 100 mg/kg was given to male mice using tail flick test and formalin [12].

**Anti-diabetic activity:** Various studies have shown that *Tribulus terrestris* fruit extracts had a hypoglycemic effect on animals. *Tribulus terrestris* fruit extract was found beneficial in reducing blood sugar to its normal level in hyperglycemic animals [13]. *Tribulus terrestris* plant parts are also helpful in lower downing blood sugar to its normal level and useful in treatment of different diabetes forms [14].

**Anti-urolithic Properties:** The fruits of *Tribulus terrestris* are being used in medicines for the treatment of kidney stones and various urinary diseases. Calcium oxalate which is of two types: calcium oxalate monohydrate stones and calcium oxalate dihydrate is a major type of crystal found in kidney stones. The bioactive fraction (*n*-butanol) of aqueous extract of *T. terrestris* fruits contains quercetin, diosgenin and tannic acid contents which results in protective capacity rather than a curative property against urolithiasis [15].

**Aphrodisiac activity:** *Tribulus terrestris* contains saponins which has stimulating effect on spermatogenesis by enhancement in the quantity of “Luteinizing Hormone” secreted by Pituitary gland. This hormone stimulates secretion of male hormone “Testosterone” resulting in remarkable augmentation of sperm [16]. Wonderful improvement was observed in erection, duration of coitus and ejaculation and post coital satisfaction during the study conducted on 52 male patients of sexual dysfunction with a composite drug containing fruits of *Tribulus terrestris* along with seeds of cowhage (*Mucuna pruriens*), stem of Liquorice (*Glycyrrhiza glabra*), roots of ashwagandha (*Withania somnifera*), stem of guduchi/giloy (*Tinospora cordifolia*) and nutmeg fruit (*Meristica fragrans*) for four months [17]. In another study conducted on sixty seven women with hypoactive sexual desire disorder to whom *Tribulus terrestris* extract (7.5 mg/day) was provided for 4 weeks and found that it was effective and safe to improve sexual desire in women [18].

**Anti-microbial Properties:** Methanolic extract of fruits of *Tribulus terrestris* was observed to be most active against gram-positive and gram-negative bacteria, while moderate activity was found in its petroleum ether extract and chloroform extract [19,20]. Saponin content extracted from *Tribulus terrestris* exhibited anti fungal properties by damaging cell membrane, killing and by enervating the virulence of fungi *Candida albicans* [21].

**Anthelmintic activity:** Helminthic infections are the most common gastrointestinal infection in human beings which may cause abdominal pain, diarrhoea, nausea, vomiting, gas/bloating, fatigue and weight loss

resulting in anemia and intestinal blockages. *Tribulus terrestris* has *anthelmintic activity* that expel parasitic worms (helminths) and other internal parasites from the body. Anthelmintic property was observed in beta sitosterol d-glucosid and tribulosin extract of *Tribulus terrestris* plant [22]. Hydroalcoholic extract of *Tribulus terrestris* seed exhibited anthelmintic activity on adult Indian earth worm *Phertima posthuma* [23].

**Body muscles and sports stamina:** Many herbal medicinal products manufacturers are claiming that muscles can be attained by using *Tribulus terrestris* for 5-28 days but *Tribulus terrestris* did not produce large gains in strength or lean muscle mass. Moreover, it did not alter the urinary testosterone/epitestosterone ratio and would not place an athlete at risk of testing positive based on the World Anti-Doping Agency's urinary testosterone/epitestosterone ratio limit *i.e.* 4:1 [24].

### Bada Gokhru (*Pedalium murex L.*)

*Pedalium murex L.* belongs to family *Pedaliaceae* is perhaps one of the most useful traditional medicinal plant in India. It is known by different names such as Large Caltrops, Bada Gokhru, Gokshura, Gokantaka, Kshourak, Khaar-e-Khasak Kalan, Brihata gokshur Khaar-e-Khasak Khurd etc [25]. This plant is widely distributed in East Africa, Indonesia and India and within India, it occurs commonly in waste places in the Deccan Peninsula, particularly near the coast, river belts and other sandy areas. It is also found in Delhi, Southern Haryana, Rajasthan and Punjab.

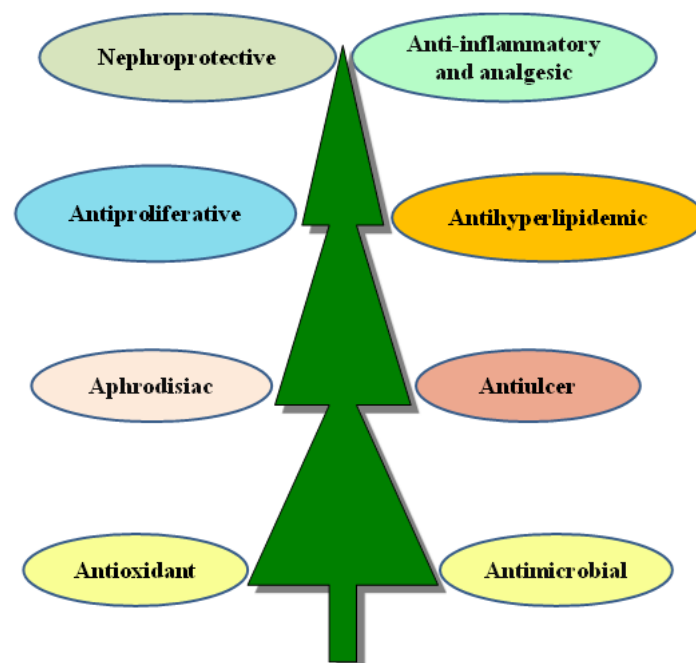


**Figure 3:** Plant of Bada Gokhru (*Pedalium murex L.*) with its parts (flowers, fruits and seeds)

**Plants morphology:** *Pedalium murex L.* having chromosome number  $n=8$ , is a succulent, glandular, annual creeper with 2 to 3 feet length having branches spread all over. Leaves are simple, opposite, ovate, glabrous, alternate, fleshy, estipulate, petiolate and irregular in shape in pairs of 5 to 8 having leaf length and width varies from 4.0-6.5cm, and 4.0-5.0cm respectively. Flowers secrete minute quantity of nectar which can be collected at the base of corolla tube [26]. Yellow coloured flowers are solitary, hermaphrodite (bisexual) and zygomorphic having 2.5-3.0 cm length and 1.0-1.5 cm width with short pedicel arise from leaf axis. Flowers have five sepals, with gamopetalous corolla, tetradynamous stamens, bicarpellary pistil in syncarpous condition with 4 ovules arranged on axile placentation. The pollen grains are light yellow, sticky, hexacolpate with 66.4um in size. Fruit set rate is about 95% in open pollination. The fruits of *Pedalium murex L.* are

indehiscent, pale yellowish brown in colour, hard pyramidal with 4 sharp spines (Figure 3). The plant is entomophilous (pollinated by bee and butterfly). Dark brown seed powder is rich in flavonoids, sapogenin and many alkaloids such as pedalithin, diosmetin, dinatin, pedalin dinatin-7-glucuronide [27-29]. Germination starts with onset of monsoon during June-July, grows well at 25-30°C temperature and flowering & fruiting occurs during October to November.

### Medicinal Properties



**Figure 4:** Medicinal properties of Bada Gokhru (*Pedalium murex L.*)

**Nephroprotective activity:** Nephrotoxicity is a most common kidney disorder which takes place due to toxic effects of chemicals or medicines in body. Nephrotoxicity protective activity was observed in dried fruits of *Pedalium murex* when analyzed by Cisplatin induced screening method that was due to presence of flavanoids, flavones, alkaloids, triterpenoids and carbohydrates [30]. *Pedalium murex* was found very effective in urinary problems when ethanolic and aqueous extracts of *Pedalium murex* fruits (300 and 600 mg/kg, p.o. body weight) was evaluated against CdCl<sub>2</sub> induced (3 mg/kg/s.c.) renal toxicity in rats, and result revealed that ethanolic and aqueous extract of *Pedalium murex* fruits (300 and 600 mg/kg, p.o. body weight) with Cadmium chloride remarkably hindered the renal injury in dose dependent manner [31].

**Anti-proliferative activity:** *Pedalium murex* inhibits cell growth and prevents the cancer due to presence of flavoids and vitamin C having *antiproliferative* properties. Anticancer activity of flowers of *Pedalium murex* was confirmed against liver cancer at various concentrations by methylthiazolyldiphenyl- tetrazolium bromide assay [32]. Fruits of *Pedalium murex* are known for antiproliferative properties and higher concentration (1000 µg/ml) of methanolic fruit extract decreased cell viability percentage by significant growth inhibition in A549 lung cancer cell line [33,34].

**Aphrodisiac, Sexual dysfunction:** Nowadays sexual disorders such as erectile dysfunctions, pre-mature ejaculation, loss of sexual desire,

seminal emission during night, low sperm count and less sperm viability are very common in males. In this situation we need a drug without any side effect. The fruits powder (5 gram) is boiled in milk, and taken twice a day in case of impotence, seminal weakness, premature ejaculation, nightfall, spermatorrhoea (involuntary discharge of semen). The powder of fruits of *Pedaliium murex* is mixed with leaf juice of *Cleome viscosa* L. (Asian spider flower) and two spoons are used for seven days to enhance fertility, sexual desire and other female reproductive disorders. Petroleum ether extract of *P. murex* was used to enhance aphrodisiac activities and to cure ethanol induced germ cell damage and infertility in male rat models and found that it can be used as an aphrodisiac drug [35]. *Pedaliium murex* can be used as traditionally excellent cure for impotency in men [36]. In Southern part of Haryana and Rajasthan, gokhru seeds powder is used to prepare Laddoos (a kind of sweet) and consumed with milk to cure the sexual disorder.

**Anti-oxidant:** Presently anti-oxidants have gained considerable attention due to their potentiality as free radical scavengers, by donating hydrogen to most reactive radicals, thereby preventing further radical formation [37]. An antioxidant is a compound which inhibits or delays the oxidation of substance even if the compound is available in a significantly lower amount than the oxidized substance. Natural antioxidants available in fruits, vegetables, medicinal plants and cereals are utilized not only for curing the diseases caused by oxidative damage, but also for improving the shelf life of food products. Methanol extract of *Pedaliium murex* exhibited liver protective properties and contains peroxidative and antioxidant activities when evaluated by hepatotoxic model in rats at 70mg/kg, p.o. body weight for 90days by using carbon tetrachloride [38]. Ethyl acetate fraction of *Pedaliium murex* fruits was found to have high levels of phenolic ingredients with radical scavenging activity indicating their significance to human health. Various alcoholic extract fractions of *Pedaliium murex* plants possess prominent contents of phenolic ingredients [39]. Efficacy of free radical scavenger was observed in *Pedaliium murex* plants [40].

**Anti-hyperlipidemic activity:** The problem of hyperlipidemia is increasing throughout the world. There is a close connection between the hyperlipidemia and cardiovascular diseases [41]. *Decrease in cholesterol level of rats was recorded* when ethanolic extract of *Pedaliium murex* fruits fed at doses of 200 and 400mg/kg/p.o. confirming the anti-hyperlipidemic potential [42].

**Anti-inflammatory:** Inflammation is the defense response of body which results in symptoms like redness, heat, swelling fever and pain. Indigenous medicinal plants can be source new formulations of anti-inflammatory and analgesic drugs. The potential of ethanolic extract of *Pedaliium murex* fruits was analyzed with doses of 200 mg/kg and 400 mg/kg, p.o. for anti-inflammatory, analgesic, and antipyretic and found that it possesses anti-inflammatory and analgesic effects in *Wistar* albino rats [43].

**Antiulcer activity:** The changes in food habits and way of living have given rise to problem of ulcers in humankind worldwide. Aqueous alcoholic extract of *Pedaliium murex* L. leaves could be regarded as a favorable antiulcerogen which could be attributed to its content of flavonoids and mucilage in rats [44].

**Anti-microbial activity:** Ethanolic extract of *Pedaliium murex* L. plants was tested against bacteria and fungi through disc diffusion assay where amoxicillin was used as standard. It was observed that ethanolic extract have adequate antimicrobial activity against selected test bacteria and fungi [45]. Ethanol extract 100 µg/ml from flower of *Pedaliium murex* L. plant showed 67.47 % free radical scavenging activity and had antibacterial activity against pathogens [46].

**Other uses:** *Pedaliium murex* seeds are grinded with the root of safed musli (*Chlorophytum tuberosu*) and given to women distress with leucorrhoea disease [47]. Leucorrhoea is thick whitish or yellowish liquid discharge from vagina of women of reproductive age. *Pedaliium murex* is an excellent traditional source to cure woman suffering from leucorrhoea [48]. The infusion of leaves and stem is taken for ten days which is used to cure Gonorrhoea/painful urination. For making the infusion, 4-8 fresh leaves of the plant are stirred in one cup water. Always use freshly prepared infusion. Laddoos made from the seeds of *Pedaliium murex* are used to give the patients distressing with joint pain and lumbago. These Laddoos are also used to maintain good health [49]. Whole plant of *Pedaliium murex* is used to manufacture several medicines to cure diseases such as cold and cough. It is one of the main components of Ayurvedic formulations such as Gokhurwath, Gokhuradiguggul, Deshnularishta and Gokhuradiawalaha [50].

## CONCLUSION

On the basis of multifaceted potential of *Tribulus terrestris* and *Pedaliium murex* it is concluded that these two species are underutilized and currently used for the health maintenance only by Ayurveda, Unani, and traditional practitioner. The plants have industrial value as fruits of these plants are dealing as raw material in Indian herbal mandies which is used by herbal medicines producers in preparations of medicinal formulations. Nowadays, people are more conscious about their health and more emphasizes is being given on plants products due to lesser side effects on health and reduced cost, hence these plants may have high demand in near future as a raw material for pharmaceutical companies. As the plants are grown in sandy marginal lands, so it will generate additional source of income for the rural population. Besides medicinal references, researchers should emphasis on breeding programmes, plant tissue culture and nanotechnology aspects of these crops. For commercial cultivation and full potential utilization of these two species for human welfare, further studies for the development of suitable agrotechnology/package and practices is required. Gokhru is mainly propagated through seed, hence there is a need to develop seed as well as field standards for quality seed production, and export of seeds for international trade. The present review is a bunch of information assembled from different published research papers which will be helpful in developing new formulations and increasing the production of these crops in future.

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### Conflict of Interest

None declared.

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