



## ETHNOBOTANICAL AND PHARMACEUTICAL USES OF *VETIVERIA ZIZANIOIDES* (LINN) NASH: A MEDICINAL PLANT OF RAJASTHAN

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### ABSTRACT

Wetlands provide a unique habitat for several medicinal plants. Attempt has been made to document some of the little known medicinal properties of wetland plants used by local community of India. *Vetiveria zizanioides* (L.) Nash synonymously known as *Chrysopogon zizanioides* (L) Roberty (Family: Poaceae/Gramineae) is widely cultivated in the tropical regions of the world. The plant has a unique characteristic of being xerophyte (tolerates prolonged drought) but it survive under long seasonal flooding; it tolerates extreme temperature and grows over a wide range of soil pH. A perennial aromatic grass grows up to 2 meter in height. Vetiver has been known in India from the ancient times. It is known as Khas-Khas and is widely used as cooling agent, tonic and blood purifier. It is used to treat many skin disorders and is known to have calming effect on the nervous system. Other medicinal uses of Khas Khas include ringworm, indigestion and loss of appetite. It has been considered a high-class perfume. Though the aquatic situations of India are rich repositories of various plant species, not much work has been undertaken to enumerate the medicinal uses of them.

**Key words:** Khas Khas, perfume, ringworm, xerophytes, wetland plant, traditional medicine, aquatic angiosperms, biodiversity, wetlands of India.

### 1. INTRODUCTION

Although Rajasthan is considered desert state but it has rich aquatic flora and biodiversity. Out of an estimated 1500 species of plants in the state nearly one fifth are aquatics (Pareek, 1996, Razvy, 2011). Reports published exclusively on the aquatic plants of the state are not many (Pareek and Sharma, 1988). Some of the reports include Ajit Sagar bandh (Nair and Kanodia , 1959) ; Bharatpur (Sarup, 1961), Ghana bird sanctuary (Saxena , 1975) ; Alwar (Vyas 1962) ; Kota (Gupta, 1966) , 1966); Bundi district (Maheshwari and Singh, 1974) and Jaipur district (Sharma and Kumar, 2011, 2012) Pareek (1994a, 1994b) carried out detailed investigations on several aquatic species from Rajasthan and also studied their medicinal properties. Shreevastava and Kumar (2007) characterized wetlands of Rajasthan as potential

source for cultivation of medicinal plants. Though the aquatic situations of India are rich repositories of various plant species, not much work has been undertaken to enumerate the medicinal uses of them. Maya et al. (2003) analyzed the economic importance of river vegetation of Kerala and gave the uses of 35 species including the bank species apart from the aquatic/wetland species. Panda and Misra (2011) provided information about ethno medicinal uses of 48 wetland plant species of South Orissa and discussed their conservation. Swapna et al (2011) made a review on the medicinal and edible aspects of aquatic and wetland plants of India. In this review they includes 70 species. Traditional Indian Medicine had their roots in one way or another in folk remedies and household remedies. Useful compilations of medicinal plants

of India were published by Kumar (2000). Kumar and Sopory, (2008) reviewed the studies on traditional Indian Ayurvedic Medicines and some potential plants for bioenergy, medicine from India.

Sharma et al., (2003) characterized medicinal plants for skin and hair care. Quite a number of workers have published their work on the ethnomedicine of the tribals of Rajasthan. Sharma and Kumar, (2005, 2006, 2007), studied traditional medicinal practices of Rajasthan. Besides this plant based veterinary medicine from traditional knowledge of India has been recorded in Bulletin of Botanical Survey of India (Sharma, Dadhich and Kumar, 2005). Ethnobotanical survey of medicinal plants from Baran District. (Meena and Kumar, 2012)

## 2. MATERIALS AND METHODS

The sample of selected plants were collected from different parts of Rajasthan from water bodies and marshy areas. To acquire detailed knowledge on the utilization of plant resources, old and experienced persons, village heads, and farmers were also contacted, besides making personal observation on spot; the species are identified with the help of relevant literatures and deposited in Herbarium, University of Rajasthan, Jaipur. For the study of medicinal property of wetland plants frequent trips were made in wetland areas, lakes, ponds, puddles, ditches, canal, swamps etc. During the survey, plants occurring in different water saturated areas were collected, photographed and identified. Their nature of growth, habit, habitat and medicinal property were noted from local rural and tribal people of different area.

## 3. RESULTS AND DISCUSSION

*Vetiveria zizanioides* (Linn) Nash belongs to Family Gramineae / Poaceae.

Common name Khas Khas grass (Africa), Vetiver (Europe), Akar Wangi - fragrant root - name used in Java, Khus Khus – aromatic root - name used in India.

### SANSKRIT SYNONYMS

Useera, Seyya, Veerana, Veera, Ranapriya, Samagandhika, Sugandhimoola.

English: Vetiver, Khas –khas grass

Hindi: Khas

Malayalam: Ramacham

*Vetiveria zizanioides* L. Nash synonymously known as *Chrysopogon zizanioides* L. Roberty (Family: Poaceae/Graminae) is widely cultivated in the tropical regions of the world.

### 3.1 Habit and habitat

It is a miraculous grass native to India first developed for soil and water conservation by the World Bank during mid 1980s. The plant has a unique characteristic of being xerophyte (tolerates prolonged drought) but it survive under long seasonal flooding; it tolerates extreme temperature and grows over a wide range of soil pH. A perennial aromatic grass grows up to 2 meter in height. The plant has small stout rhizomatous stolens which gives rise to spongy, fibrous, dense root system. Roots have aromatic properties and grow 20-30 cm deep in medium textured marginal soils under cultivation. The leaves are linear, narrow, erect, grassy, and glabrous with scabrid margins. Inflorescence is a panicle upto 15 to 45 cm long, bearing numerous racemes in a whorl on a central axis. Spikelets grey in a panicle of numerous racemes. One floret in spike is bisexual and sessile, fruits oblong grains. The other floret is pedicelled and staminate. The lower spikelet are reduced to lamina. There is considerable diversity in pattern of growth, orientation and thickness of roots as well as occurrence of secondary roots. Java vetiver is non flowering type has a broader leaves (1.1mm) medium thick stems, bushy growth bearing with high pollen sterility the plants give out more branching roots with higher oil contents and oil is dextro-rotatory in nature. Khas (Vetiver) grass is tall, stout and perennial herb with oblong penicle over 30 cm long which has whorled branches bearing spikeletes 5-6 mm long, with a few tubercle-based short bristles. The species under cultivation do not flower. Vetiver roots are stout and contain oil which provide its fragrance (Fig 1).



**Figure 1**  
*Vetiver roots*

### 3.1.2. Distribution

This tufted grass grows throughout the plains of India ascending up to an elevation of 1200 m. Having wide ecological amplitude, this grass grows in a wide variety of ecological habitats covering all bio-geographic provinces of India. Khas grass grows wild in many states, namely Haryana, Uttar Pradesh, Rajasthan, Gujarat, Bihar, Orissa and Madhya Pradesh and throughout South India. It is systematically cultivated in the North Indian states of Rajasthan, Uttar Pradesh and Punjab and in the South Indian states of Kerala, Tamil Nadu, Karnataka and Andhra Pradesh. The bulk of the roots used for cooling purposes and for the extraction of the oil are obtained from the wild.

### 3.1.1 Cultivation

The grass grows luxuriantly in areas with an annual rainfall of 800 -2000 mm and temperature ranging from 22 to 40° C. Marshy riverbeds with sandy loam are best suited for this grass. It is commercially cultivated as large population of Khas (Vetiver) grass in wet and damp environments over marshy places and riverbanks. However the yield from the cultivated crops, however, meets only a very small percentage of the requirements of the country.

## 3.2. AYURVEDIC PROPERTIES

Rasa : Tikta, Madhura

Guna : Lakhu, Rooksha

Virya : Seeta

Vipaka : Katu

Vetiver has been known in India from the ancient times. It is known as Khas-Khas and is widely used

as cooling agent, tonic and blood purifier. It is used to treat many skin disorders and is known to have calming effect on the nervous system. It is regarded as a stimulant, refrigerant and antibacterial and when applied externally, it removes excess heat from the body and gives a cooling effect. Being a major constituent of 'Rasayana' in Ayurveda, different parts of the vetiver plant have traditionally been used by the Indian tribes for treating various ailments, diseases and disorders including boils, burns, epilepsy, fever, scorpion sting, snakebite, sores in the mouth, headache, toothache, weakness, lumbago, sprain, rheumatism, urinary tract infection, malarial fever, acidity relief and as an anti-helmintic. It has also been used in traditional medicine of Asia and Africa, particularly ancient Tamil literature mentions the use of vetiver for medical purposes. Other medicinal uses of Khas Khas include ringworm, indigestion and loss of appetite. It has been considered a high-class perfume. Copper plate inscriptions listing the perfume as one of the articles used by royalty have been discovered in Ayurvedic literature is called as "Suganti-mulaka" i.e. sweet smelling and "Sita Mulaka" (having cool roots). All over India the roots are made to scented mats, fans, ornamental baskets and many other small articles. Also burnt as fumigator.

### 3.2.1. Phytoremediation

Research on various aspects of vetiver make it an excellent plant describing many characteristics including phytoremediation, water purification,

leachate and effluent disposal, utilizing wastewater, removing nitrogen and phosphorus etc.

### 3.2.2. *Vetiver oil*

Vetiver oil is one of the most valuable and important raw materials in perfumery, extensive applications in the soap and cosmetic industries, for pharmaceutical companies and as antimicrobial and anti-fungal agent (Singh et al. 1978; Dikshit and Husain 1984). These properties may open new possibilities to the utilization of vetiver extracts in the pharmaceutical industry. Vetiver oil is being used in Ayurvedic system of medicine in India (Lavania, 2003). Vetiver oil is prescribed to relief rheumatism, lumbago, headache, sprain (Anon., 1976), and vetiver drink is prescribed for fever, inflammation and irritability of stomach. Pure vetiver (Khus) root oil known in trade as "Ruh – Khus" and its use in scents since ancient time. It is the major source of the well known vetiver oil with world-wide demand of 250 metric tonnes annually. The 'Sunshine' cultivar of vetiver (*Vetiveria zizanioides* (L.) Nash, =*Chrysopogon zizanioides* (L.) Robert) show fungicidal and bactericidal properties. Some biological activities are also attributed to the vetiver root extracts such as antifungal (Sridhar et al., 2003) antioxidant (Kim et al., 2005) and antiinflammatory (Jagtap et al., 2004). The vetiver oil can also be used for nursing care residents with dementia-related behaviours, in order to increase mental alertness and cognitive function (Bowles et al., 2002). World market the demand for vetiver oil is increasing day by day due to its unique odour, for which it is used in both flavour and fragrance industries. Moreover, this oil cannot be substituted with reconstituted oil and cannot be made through synthetically. Vetiver perfumes give pleasing aroma and has slow evaporation rate. Its major constituents in oil extract are Vetivone, Zinanal and Epizizizanal. Zinanal and Epizizizanal also have insect repellent activity.

It is widely used in perfumes and cosmetics and for scenting soaps. Popularly known as 'KHUS', it is the major source of the well-known oil of vetiver, which is used in medicine, cosmetics and in perfumery making agarbattis, soaps, soft drinks, pan masala. It blends well with the oils of sandalwood patchouli and rose. The oil is reported to be used as carminative in flatulence colic and obstinate vomiting. Major constituents of the essential oil of Khas Khas are vetiselineol and khusimol which render the herb its pharmacological properties.

Vetiver oil has potent antibacterial, drug-resistant modifying, hydroxyl radical scavenging, anticancer, antihepatotoxic and antioxidant activity in intact and spent root of vetiver. The essential oil of vetiver has extensive applications in toiletries and cosmetics, possesses sedative property and has traditionally been used in aromatherapy for relieving stress, anxiety, nervous tension and insomnia. The plant roots are steam distilled to obtain Vetiver oil. The oil is finest oriental perfume with persistent fragrance. The blended perfume oil of vetiver acts as an excellent fixative for volatile compounds. It is known for its cooling properties. Vetiver oil is the basis of the Indian perfume 'Majmua' and is the major ingredient in some 36% of all western perfumes (e.g. Caleche, Chanel No. 5, Dioressence, Parure, Opium) and 20% of all men's fragrances.

### 3.3. *Traditional medicinal properties*

Khas grass plays an important role in the socio-economic life of rural India. In Madhya Pradesh and Maharashtra, the plant is used as anthelmintic for children. The plant is used as a tonic for weakness; the Lodhas of West Bengal use the root paste for headache, rheumatism and sprain, and a stem decoction for urinary tract infection; the Mandla and Bastar tribes of Madhya Pradesh use the leaf juice as anthelmintic; the tribes of the Varanasi district inhale the root vapour for malarial fever. The root ash is given to patients for acidity by the Oraon tribe. Likewise, there are very many different applications of the plant for different ailments among different ethnic tribes (Jain 1991; Singh & Maheshwari 1983). Root is also important in traditional medicine as a carminative, stimulant and diaphoretic. The decoction of leaves is recommended as a diaphoretic. A decoction When applied locally applied in rheumatism lumbago and sprain, it is a good ambrocatoxin and affords relief in. In Madhya Pradesh the plant is used as an anthelmintic for children. Formulations containing oil and/or extracts of vetiver have been reported to treat inflammatory bowel disease, urinary tract infection, and in making insect repellents. It is one of the most promising aromatic plants known to possess antimicrobial, antioxidant and germicidal properties. However, the plant has not been studied exclusively for other pharmacological activities and there is a lack of scientific evidence to prove these effects.

### 3.4.1. Desert coolers

Its roots are used for desert coolers in summer in North India. In India, since ancient times, the roots have been used for making screens, mats, hand fans, and baskets. The screens are hung like curtains in the houses and when sprinkled with water, impart a fragrant coolness to the air; they are in great demand during the summer. In Kerala, the roots are woven along with bamboo splits and made into flat mattresses for use as under-beds to give a cooling effect. The roots have found increased use in electric room-coolers.

### 3.4.2. Soft drinks and perfumery products

It is also used in perfumery, cosmetics and soaps and for flavoring sherbets (Indian cool drinks). Roots are also used for preparing Sherbet or soft drink during summer, especially in North India. Both vetiverols and acetates have softer odours and fixative qualities, and are used as blender with high-class perfumery products. They blend well with ionone, linalool, cinnamic alcohol, oakmoss, vanilla, sandalwood, patchouli and rose bases, and are frequently used in western type of fragrances having chypre, fougere, rose, violet and amber aldehyde base, and oriental fragrances and floral compounds. In addition to its direct perfumery applications, vetiver oil in its diluted form is extensively used in after-shave lotions, air freshners and bathing purposes, as well as flavoring syrups, ice cream, cosmetic and food preservation. Khus essence is used in cool drinks, and for reducing pungency of chewing tobacco preparations, providing sweet note to other masticatories and incense sticks.

### 3.5 Chemical constituents

The chemical constituents present in the plant are Vetiverol, Vetivone, Khusimone, Khusimol, Vetivene, Khsitone, Terpenes, Benzoic acid, Tripene-4-ol,  $\beta$ -Humulene, Epizizianal, vetivenyl vetivenate, iso khusimol,  $\beta$ -vetivone, vetivazulene. In the roots, the main component was valencene (30.36%), while in the shoots and leaves, they were 9-octadecenamide (33.50%), 2,6,10,15,19,23-hexamethyl-2,6,10,14,18,22-tetracosahexaene (27.46%), and 1,2-benzendicarboxylic acid, diisooctyl ester (18.29%). The results showed that there were many terpenoids in the volatils. In shoot volatiles, there existed 3 monoterpenes, 2 sesquiterpenes and 1 triterpene. Most of the volatiles in roots were sesquiterpenes.

### 4. Medicinal properties

It is also used for boils, burns, epilepsy, fever, scorpion sting, snakebite, and sores in the mouth. Root extract is used for headache and toothache. Vetiver oil is regarded as stimulant, diaphoretic and refrigerant. Local application of leaf paste for rheumatism, lumbago and sprain gives good relief. The dried roots are also used to perfume the linen clothes. The rachis is used in the manufacture of moodas, sirkies, etc.

### 5. Commercial Applications

The commercial applications of the grass mainly pertain to the extraction of vetiver oil through distillation of the roots. Over 150 compounds have been isolated and characterized from vetiver oil so far. A major portion of oil consists of sesquiterpene alcohol (Thakur et al. 1989).

### 6. Additional uses

Besides these medicinal properties of the plant, the dried culms of the plant are used as brooms and to thatch roofs. Pulp of the plant is used to prepare straw boards and paper. In India, the roots have been used for making screens, mats, hand fans, and baskets. The young leaves are browsed by cattle and sheep. Dried culms are used for making brooms and thatching of huts. Apart from the medicinal uses, the culms along with the panicles form a good broom for sweeping. The culms and leaves are also extensively used by the tribes and villagers for thatching their huts, mud walls, etc. Some tribes (in Kerala) use the mats of the roots and leaves as bed for a cooling effect.

### 7. Recommendations

Several villagers and rural folk collect the roots of the grass in large quantities from Lucknow, Delhi, Kanpur, etc. Three to four months of livelihood of several rural families is sustained extensively by the sale of roots of this grass, which thus plays a significant role in the socio-economic lives of village and rural folk. In view of its tremendous use and also in view of its declining wild populations, the authors strongly recommend the large-scale systematic cultivation of this grass in the plains of North India. Counting both the grass and the root system, vetiver can produce up to 100 tons/hectare of biomass (dry weight) within 8 months. If the grass is only harvested as a biomass fuel, and the perennial vetiver grass is left in the ground and allowed to grow back, year after year lasting for ever with only minimum care and some fertilizer (TVN, 2008).

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