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An Overview of Vetiveria zizanioides's Pharmacogonostical Aspects (Khas-Khas)

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ABSTRACT: Vetiver, also known as Khus grass, is a perennial grass that originated in India. Its volatile oil is used to make aroma compounds including vetriverol, vetriverone, and vetriveryl acetate. The plant's vast finely constructed fibrous roots are beneficial for both soil and water conservation, and the plant itself is drought resilient. The global output of vetiver oil is roughly 300 tonnes per year, with India contributing just about 20-25 tonnes. Patent for *Vetiver zizanioides* is granted to Canada, USA and India. Haiti, India, Java, and Reunion are the world's top producers. Rajasthan, Uttar Pradesh, Karnataka, Tamil Nadu, Kerala, and Andhra Pradesh are the states where it is grown, with an annual yield of roughly 20 tonnes of oil. This review emphasis on the pharmacognostical study of vetiver including its cutivation, collection, chemical constituents, medicinal uses and some reported work on this plant. Furthermore, patent filled for vetiver are also been discussed.

Key words: khas-khas, poaceae, selinene, *Vetiver zizanioides*, vetiverol

1. Introduction

Herbal supplements are very on demand today. The more one hears about it, the more in demand it is. More than 500 plant species have been used in traditional medicine and about 800 have been cited as having medicinal properties in written historical accounts. India is a hub for a large number of different medicinally important plants used in traditional medicine.

The area of herbal medicine has gained extremely popularity over the last few decades. It has found popularity in both developed and developing nations because of its natural source and lesser side effects as compared with other drugs. Out of the species of Vetiveria, are Vetiveria zizanioides.

It is sometimes called khas-khas in India, khas, or khus grass, being a strong-smelling perennial grass in the Poaceae family.

This tufted grass grows to a certain height of 1200 meters above sea level on the plains of India. Apart from being an aromatherapy and fragrance usage, vetiver grass is also used to obtain essential oils [2].

Such a grass has immense ecological amplitude as it occurs in numerous ecological conditions of the biogeographic provinces of India. It is, therefore, hardly surprising that this grass has been widely used by virtually all cultures.

a) Binomial nomenclature

Vetiveria zizanioides Linn. (family Poaceae)

b) Local name

Sanskrit: Usirah, Usira, Vira,
Hindi: Khas, Khus;
Gujarati: Valo;
Bengali: Khas-khas;
Malayalam: Ramacham;
Tamil: Illamichamber;
Telugu: Vattiveru;
Punjabi: Panni;
Marathi: Vala;
Urdu: Khas

c) Taxonomic hierarchy

Flora Subkingdom - Tracheobionta
Superintendence – Spermatophyta
Division - Magnoli ophyta
Category – Liliopsida
Subcategory – Commelinidae
Succession – Cyperales
Lineage – Poaceae
Brand - Vetiveria Bory
Variety - *Vetiveria zizanioides* (L.)[4].

2. Bioactive components of *Vetiveria zizanioides* (khas-khas)

Benzenecarboxylic acid, vetiverol, Furfuryl alcohol , alpha and beta-vetivone, Vetiverene, and vetivenyl vetivenate are the primary chemical components. Terpinen-4-ol, 5-epiprezizane, Khusimene, a-muurolene, Khusimol, Calacorene, ß-humulene, a-longipinene, selinene, d-selinene, dcadinene, valencene.

3. Biodiversity hotspots

In Malaysia, Sri Lanka, Bangladesh, India, and Pakistan, veterinarians are present.
The main producing regions are tropical Southeast Asia, Northern Africa, Australasia, Haiti, Indonesia, Central America, Mainland China, and Latin America.
Some of the countries where the plant is grown are Indonesia, Philippines, Japan, Angola, Belgian Congo, Dominican Republic, Argentina, British Guiana, Jamaica, Mauritius, and Honduras.
The crop is estimated to be grown throughout the world in a total of about 250 tons per annum.
It is seen growing as a wild crop in India in the provinces of Punjab, Uttar Pradesh, and Assam. It is also grown as a crop in the provinces of Rajasthan, Uttar Pradesh, Kerala, Karnataka, Madhya Pradesh, and Andhra Pradesh. India produces 20 to 25 thousand tonnes of oil annually. The highest oil is from the Uttar Pradesh province, mostly from the wild source. The Vetiver oil, produced from North India, is graded to be the best.

4. Species concept

a) *Chrysopogon zizanioides* L

Both Chrysopogon lawsonii and Chrysopogon zizanioides are natives of the Indian subcontinent. Chrysopogon zizanioides has numerous forms. Especially cultivated varieties from Southern India have enormous, dignified root systems. Chrysopogon zizanioides through phytoremediation and bioengineering

b) *Chrysopogon nemoralis*

This is an indigenous species of vetiver widely spread in highlands of Thailand, Laos, Vietnam, Cambodia, and Myanmar. It is a common material used for thatching in Thailand. C. zizanioides distinguishes itself from C. nemoralis only in that the latter has stouter, stiffer stems with much greater size.

c) *Chrysopogon nigritana*

Such a plant can only be used in Southern and West Africa because it belongs to those regions [6]. Only the regions provide suitable application since it produces fertile seeds.

5. Therapeutic approaches

Botanical segment	Ethnic group	Disorders
Root infusion	Santhals	As a cooling remedy for high fever, inflammation, and Reproductive tract infections.
Root paste	Lodhas	Headache, fever, diarrhoea, and chronic dysentery are all symptoms of chronic dysentery.
Root powder, Leaf mash, stem extract.	Uraon Adivasis and Dravidian Tribes	Acidity can caused through symptoms such as skin infections, thermal injuries, Seizure disorder, venomous stings, musculoskeletal inflammation, mouth ulcers, and twisted joints.
Root extract.	Tribes of south.	Anthelmintic

The different parts of the vetiver plant are used.

6. Vetiver zizanioides's Attributes.

Vetiver zizanioides characterises as.
Rasa (taste) sharp taste – tikta (bitter), madhura (sweet)
Guna (qualities) – rooksha (dryness), laghu (lightness)
Vipaka-katu – Katu (pungent) – Sharp (after digestion), spicy
Veerya – (cold potency) – chilling property.

7. Utilized part and Recommended amount

a) Usher root, vetiver oil, and vetiver seeds were utilized.
b) Dosage: 3-6g of powder, 50-100ml of decoction, and 25-50ml of infusion (hima/phanta).

8. Therapeutic uses [7]

a) Root: Infusion used as a blood purifier, stimulant, stomachic, antispasmodic, emmenagogue, astringent, febrifuge, and diaphoretic. used to treat strangury, spermatorrhea, vomiting, flatulence, fevers, and colic.
b) Root oil: Used to treat gas, colic, and persistent vomiting.

9. Biological response to vetivera zizanioides

a) Antioxidant Activity: Free radicals cause lipid peroxidation and DNA damage, which may lead to many diseases. It has been discovered that some plant extracts have antioxidant agents that can scavenge free radicals in vivo. For thousands of years, human beings have been using the sparsely tufted grass Vetiveria zizanioides as an aromatherapy plant to alleviate tension, anxiety, insomnia, and stress. The roots of V. zizanioides were extracted using ethanol followed by an assessment of several in vitro antioxidant activities, including total antioxidant capacity, total phenolics, total flavonoid composition, deoxyribose degradation assay, and superoxide anion radical scavenging activity [8].

b) Fungal defense mechanism

Vetiveria zizanioides ethanol and aqueous extracts' antifungal efficacy. The ethanol and aqueous extracts of Vetiveria zizanioides were prepared. Standard cultures of Asperigulls nigar, Asperigulls clavatus, and Candida albicanus were used for the study. By the agar well plate technique, antifungal tests were performed. In the form of control measures, the antibiotics griseofulvin and nystatin were utilized [9].

c) Bacterial suppression mechanism: Antibacterial activity is measured by zone of inhibition in millimeters. Two gramme positive organisms, B. subtilis, and S. aureus, and two gramme negative, P. aeurogenosa, and E. coli were included in the study. All the flavonoids, alkaloids, terpenoids, saponins, tannins, and phenols isolated by extraction from Vetiveria zizanioides ethanolic extract either separately or as a combination exhibit antibacterial activities. EEVZ was found to be a strong inhibitor of gramme

negative bacteria compared to gramme positive bacteria. Flavonoids were also found to be good antibacterial agents; it gets attached to soluble and extracellular proteins as well as the bacterial cell wall; more lipophilic flavonoids can lyse microbial membranes. The root of Vetiveria zizanioides has tannins, thus tannin becomes the bioactive compound behind the in vitro antibacterial activity of the experiment. It has been proven that the tannin in the plant extract has antibacterial activity [10].

d) Mosquito avoidance mechanism: The nanoemulsions of hairy basil oil, vetiver oil, and citronella oil prepared have been explored through in vitro and in vivo experiments with a mean particle size from 150-220 nm. Improved release rate occurs with high-pressure homogenization since larger emulsion droplets at 195-220 nm moved towards smaller droplets upon the completion of the homogenization process at 150-160 nm. Small particle sizes in nanoemulsions formed thinner films, hence remaining more intact; this would improve the evaporation of essential oils and extend the period before they lost their repellency against mosquitoes. In laboratory testing of oviposition deterrents, Vetiveria zizanioides root extract significantly decreased oviposition egg numbers by gravid Anapheles stephens at all concentrations [11].

e) Hyperglycemia control mechanism: With the comparison with diabetic control group and treatment of Vetiveria zizanioides root extract with normal fasting rats, it appears to have significant antidiabetic effect at the 2nd and 4th hour following the injection, the results being highly comparable to the orthodox glibenclamide. Ethanolic extract of roots of Vetiveria zizanioides exhibited maximum antihyperglycemic activity among all extracts in both normal and allaxon-induced diabetic rats [12].

10. Agricultural production phase

a) Cloning and rooting phase

Vegetables are propagated by either seeds or slips but slips are preferred. While seed propagation is relied on for variety development in vegetatively propagated farming concurrences, there is limited diversity. Self-sown seeds supply much seeding and spontaneous regeneration in North Indian varieties.

The yield potential per acre is 400–650 kg of seeds. Recently collected spikelets have promise and require a three-month after-ripening time. Germination is promoted if the caryopsis is removed from the husk.

Gibberlic acid or potassium nitrate can be applied to the seeds in order to cause them to break dormancy. In south Indian varieties, most of the spikelets are not fertilized and the few seeds germinate very thin and have a short dormant phase. Slip forming is done with the presence of the rhizome part of the desired banana variety, and 15-20 cm of the aerial portion from aggregates of harvests earlier is used for planting in these non-bearers. Store your handmade slips in the shade and with humidity. Before transplanting, slips should have their dry leaves removed for the purpose of preventing the spreading of pests and diseases.

b) Optimal planting time

For instance, in south India, the best time for planting vetiver is during February and April, when there is almost no variation in the daily temperatures, and the monsoon breaks a month earlier than its time. Usually, the monsoon falls between June and August.

c) Tilling the soil

With annual weeds, which regenerate every year, the land is ploughed to a depth of 20 to 25 cm by way of couple of deep ploughings and all the weeds removed. A fair amount of compost or farm patch manure, along with other fertilizers, are put in the soil and thoroughly mixed together. Pits are cut across the contour in sloppy lands.

d) Sowing seeds for plantation

The mother clumps could be pulled to small pieces which create plenty of slips. The shoot part, around 15-20 centimeters , remains intact once the rhizome of the clump is separated from the slips. The slips are to be made free of fibrous roots and leaves prior to planting. Plant the slips at the right time.

This is planted immediately after the beginning of the monsoon season in June or July. Slips from healthy and disease-free clumps are planted vertically at 6030 cm / 60 45 cm / 60 60 cm spacing, depending on climate, variety, soil quality, and irrigation capacity. Plant density is between 27800 to 110000/hectare. It should be planted preferably during the months of March or April if irrigation facility is available, because it requires more frequent irrigation. If it is planted late, the formation of coarse roots, which ultimately produce lowquality oil, ensues [14].

Planting schedule and agronomic methods information about vetiver grass [15]Planting schedule and agronomic methods information about vetiver grass [15]

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The following is the time frame for vetiver growth:

S. No.	Months	Work	Work details
1.	(May – June)	Preparation of Land	Perennial weeds removal and deep ploughings
2.	(May – June)	Addition of fertilizer and Manure	Mixing the basal dose of compost and fertilizers
3.	(June – July)	Plantation and Irrigation	Plant healthy and disease freeclumps with rhizome, Irrigation
4.	(July – August)	Fertilizer application	Add nitrogen 25 kg/ha
5.	(July –August)	Intercultural operations	2-3 weeding and Trimming
6.	(March – April)	Fertilizer application	Add nitrogen 25 kg/ha
7.	(October - November)	Intercultural operations	Trimming of aerial portion
8.	(December -February)	Harvesting	At eighteen months after planting, either manually or mechanically dig the clumps and their roots.

12. Marketing research of vetivera zizanioides

The following are some of the commercially available formulations.

S.no.	Formulation	Manufacturing company	References
1.	Khas khas soap	Mountain ayurveda, anuspaa heritage products pvt. Ltd., khadi natural.	[16,17]
2.	Khus powder	Himalaya, pooja traders	[18,19]
3.	Poppy seeds	Shreeji bio seeds, Verdant seeds chemical pvt. Lmt., akash seeds corporation.	[20]
4.	Khus syrup	Guruji products pvt. Ltd, mala's	[21, 22]
5.	Vetiver oil	Kanta enterprices private limited, konark herbal and health care	[23]

13. Patent [24, 25]

The following is a list of vetiver patents that have been filled:

S. No.	Tittle	Inventors and team	Country/patent no./grant date	Summary
1.	Use Of The Root Extract Of ***Vetiveria zizanioides.*** In the treatment of fluoroquinolone-resistant and multidrug-resistant bacterial infections.	Sps Khanuja, Suchi Srivastav, Trs Kumar, Mm Gupta, Ak Tripathi, Monika Singh, Jr Bahl, Rk Lal, Mp Darokar, Ak Shasany, Sushil Kumar	Canada/2480284/30.6.2013 USA/6676974/13.1.2004 India/218190/31.3.2008	The present invention is for a Hexane Bioactive Fraction from the roots of an aromatic grass species called Vetiveria zizanioides, commonly available in India, to prevent the growth of drug-resistant bacterial infections in humans and animals. It also includes a pharmaceutical composition comprising the bioactive extract and additives for preventing the growth of drug-resistant bacterial infections in humans and animals, and a process for isolating said bioactive extract.

S.no.	Title	Plant name	Inventor	Application no.	Patent no.	Patent date
1.	Autotetraploid *Vetiveria zizaniodes* plant useful for carbon sequestration and soil conservation named 'CIMAP-KH 40'	*Vetiver zizaniodes*	Umesh Chandra lavania, Santosh kumar ral, Seshu lavania, Surochita basu, Basant kumar dubey, Ram ujagir	13/506,598	USPP26,474 P3	Mar.8,2016

14. Research objectives for the future directions

It is the future of khus grass for the world because it has no undesirable side effects. While it is reassuring to see aroma therapists invest in khus and that pharmaceutical companies infuse its aroma into their syrups, it is surprising that the current usage of khus or its derivatives in Tibb-i-Unani is not considerable and merits further observation [26].

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