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Review Article

VACHA (ACORUS CALAMUS LINN.): A VALUABLE MEDICINAL PLANT

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ABSTRACT

Last few decades have again shown a notable resurgence of interest in medicinal plants. The reason behind is the increasing awareness about the limitations of the synthetic chemotherapeutic agents. Now herbal medicines and natural products are in big demand all over the world. One of the important medicinal plant used in Ayurveda traditional medicine to treat different ailments and maintain health condition is *Vacha* (*Acorus calamus* Linn.). It is a herbaceous perennial belonging to family Araceae. *Vacha* is one of the most renowned herbs of the ancient Vedic seer as a rejuvenative for the brain and nervous system. *Vacha* stimulates the power of self expression and intelligence. Rhizome of *Acorus calamus* Linn. contain calamediol, essential oil, tanning substances and vitamin - C. These constituents are valuable in a vast range of diseases. *Vacha* has a special potency as a nervine tonic. It is a very vigorous brain tonic, because it shows results in a very short time. It increases the overall memory of the person and strengthens the nervous system. *Vacha* is prescribed to people who have amnesia. Improving the memory is a quest on which human beings have embarked centuries ago. In almost all civilizations, there have been attempts to discover the best herbs for brain enhancement with minimum side-effects. Perhaps, Ayurveda wins the race in this. All the herbs Ayurveda uses for its brain tonics have minimum side-effects and are quite safe for the human beings. Western science is now warming up to these herbs and is looking upon them as effective supplements for the human brain. It works well in digestive ailments like flatulence, loss of appetite, distaste, abdominal dull pain and worms. *Vacha* relieves the phlegm, eases cough and asthma. It is also useful to reduce fever. It is also highly useful for the treatment of epilepsy and other mental ailments.

KEYWORDS: *Vacha*, *Acorus calamus* Linn., Sweet flag, Brain tonic, *Rasayana*, Cough.

INTRODUCTION

Vacha (*Acorus calamus* Linn.) rhizomes synonymously called sweet flag, sweet roots are also known by the common names *Golomi*, *Uragandha*, *Vekhanda* and *Bach*. *Vacha* has a special place in Ayurveda as it is a main *Medhya* drug, which has the property of improving the memory power and intellect. Poor memory, lower retention and slow recall are common problems in today's stressful and competitive world. Age, stress, emotions are conditions that may lead to memory loss, amnesia, anxiety, high blood pressure, dementia and to more ominous threat like schizophrenia and Alzheimer's diseases.^[1] *Vacha*, *Acorus calamus* Linn, is an uncommon but widespread, semi-aquatic plant of aquatic habitats in temperate to sub temperate regions.^[2] It is an aromatic herb,

indigenous to Central Asia and eastern Europe. It has been used since time immemorial by the inhabitants of these continents. *Acorus calamus* is one of the most renowned herbs used for mental diseases and diseases of the nervous system. In Sanskrit, *Vacha* literally means speaking.^[3] It is full of various pharmacological constituents like cineol, copaene, cyperenone, cyperol, cyperolone, kobusone, mustakone, sugenol, b-sitosterol etc.^[4] *Vacha* is helpful to treat epilepsy, mental ailments, chronic diarrhea, dysentery, bronchial catarrh, intermittent and tumors. It also has the insecticidal, antifungal, antibacterial, tranquilizing, antidiarrhoeal, antidyslipidemic, neuroprotective, antioxidant, anticholinesterase, spasmolytic, vascular modulator.^[5] It is useful in

preparation of some important formulations like *Vachadi churna*, *Vachadi ghrita*, *Vachavaleha* etc.

VERNACULAR NAMES

Vacha is commonly known as “*Shadgrantha*, *Golomi*, *Ugragranthi*, *Sataparvika*, *Jatila*” in Sanskrit, “*Bach*” in Hindi and Bengali, “Sweet flag” in English, “*Agri-turki*” in Persian, “*Godavaj*” in Gujarat, “*Vaj*” in Bombay, “*Vekhand*” in Marathi, “*Vasa*” in Telugu, “*Vashambu*” in Tamil, “*Vayambu*” in Malayalam, “*Baje*” in Kannada, “*Ekhanda*” in Konkan, “*Vacha*, *Bacch*” in Unani, “*Bojho*” in Nepali and “*Shobu*” in Japanese.^{[6],[7]}

The plant *Acorus calamus* Linn. is known as *Vacha* and *Swaralu* because it is a potent drug used for improving voice. *Vacha* is a semi-aquatic herb having reddish brown (*Aruna*), hairy (*Golomi*, *Lomashi*, *Jatila*) and intense smelling (*Ugragandha*) rhizome which has many nodes (*Sadagrantha*, *Sataparvika*). *Vacha* is highly beneficial in reducing body weight (*Karshani*), arousing consciousness (*Bodhniya*, *Smarniya*), relieving colic (*Shulaghni*) and destroying organisms (*Bhutanashani*, *Rakshoghni*). *Vacha* is regarded generally as auspicious (*Mangalya*)^{[8],[9]}

CLASSICAL REFERENCE

Acharya Charaka has categorized *Vacha* in *Lekhaniya*^[10], *Arshoghna*^[11], *Triptighna*^[12], *Asthapnopaga*^[13], *Shirovirechana*^[14], *Sanjnasthapana*^[15], *Sitaprashamana Mahakashaya*^[16]. *Charaka* enumerated *Haimvati* (*Shweta Vacha*) under *Mulini Varga*^[17].

In *Sushruta samhita*, *Vacha* has been found in *Pippalyadi*^[18], *Mustadi*^[19] and *Vachadi gana*^[20].

Acharya Vagbhatta has included the plant *Vacha* in *Mustadi*^[21], *Vachadi*^[22], *Vatsakadi*^[23], *Haridradi*^[24], *Chardana*^[25] and *Niruhana varga*^[26].

VARIETIES OF VACHA

Bhavamishra quoted 5 different varieties of *Vacha* in his *Nighantu* as *Vacha*^[27] (*Acorus calamus* Linn.), *Parasika vacha*^[28] (*Iris germanica* Linn.), *Mahabhari Vacha*^[29] (*Alpinia galangal* Willd.), *Sthulagranthi*^[30] (*Zingiber zerumbet* Rosc.ex. Smith) and *Dvipantra vacha*^[31] (*Smilax china* Linn.).

Thakur Bulwant Singhji reported that *Paris polyphylla* Sm, a white rhizome is sold in Dehradun as *Safed Vacha*. He identified it as the “*Dudha vacha*” and it is the Nepali variety.^[32]

BOTANICAL DESCRIPTION

Vacha (*Acorus calamus* Linn.) is a tall, perennial wetland monocot, 1-4 feet tall of the *Araceae* or *Acoraceae* family. It is an aromatic marsh herb with creeping root stock. The seemingly numerous plants seen above ground in a population probably arise from a single plant connected by an extensive underground rhizome.^[33]

RHIZOME: The root system consists of shallow, branching rhizomes that are stout and knobby. Tufts of basal leaves occur at intervals along these rhizomes while coarse fibrous roots develop below. The plant multiplies by its rhizomes. Rhizome is long indefinite branched, smooth, pinkish or pale green. Internally the rhizome is whitish pink in color and pleasantly aromatic, smelling of citrus, although it has a bitter taste.

LEAVES: The basal leaves are erect and sword shaped, resembling Iris leaves. They are flattened and smooth along the margins. The leaves are few and distichously alternate whose size is between 0.7 and 1.7 cm wide with average of 1 cm. The sympodial leaf of *Acorus calamus* is shorter than that of the vegetative leaves. The leaf has a single prominent midvein and then on both sides slightly raised secondary veins and many, fine tertiary veins. The margin is curly edged or undulate. Botanists distinguish between the *Acorus* species by the number of prominent leaf veins as *Acorus calamus* Linn. has only one.^[34]

FLOWERS: Plants are very rarely flower or set fruit, but when they do, the flowers are 3 to 8 cm long cylindrical in shape, greenish brown and covered in a multitude of rounded spikes. The inflorescence consists of a leaf-like spathe and a spike-like spadix, produced from the middle of the spathe, that is densely covered with yellow and green flowers. The spadix, at the time of expansion, can reach a length between 4.9 and 8.9 cm. Flowers blossom in early to late summer depending on the latitude.

FRUITS: The fruits are found to be small and berry like with few seeds.^[35]

DISTRIBUTION

Acorus calamus is a native of both North America and Eurasia. However some authorities regard it as an introduced species that was originally native to India, Central Asia and Eastern Europe.^[36] It is cultivated throughout India in the marshy tracts of Kashmir, Shirmaur (Himachal Pradesh), Manipur, and in Nagahills and in the Koratagere taluka of Karnataka state

in peninsular India. The second fortnight of June is the best time for planting. It is a hard plant found to grow in tropical and subtropical climates.^[37]

CHEMICAL CONSTITUENTS

The dried rhizome of *Acorus calamus* contain the yellow aromatic volatile oils having asarone as a main constituent which contains the small quantity of sesquiterpenes and its alcohols; the rhizome also contains the choline, flavone, acoradin, galangin, acolamone, isocolamone and aerial parts of plant contains lutcolin-6,8 c-diglucoiside.^[38]

The major chemical constituents of the essential oils of sweet flag are phenylpropanes, monoterpenes, and thermolabile sesquiterpenoids. The pale yellow to pale brown volatile calamus oil has an odor described as "woody-spicy with increasingly sweet after notes and great tenacity" that resembles "dried milk or sweet leather, slightly creamy-nutty," and has been compared to the fragrance of a milk-truck or shoe-repair shop (Arctander 1960). This characteristic aroma is derived from the chemical compound (Z,Z)-4, 7-decadienal.^[2]

The chemical constituents are of 67 hydrocarbons, 35 carbonyl compounds, 56 alcohols, eight phenols, two furans and four oxido compounds also detected, in an alcohol extract of *A. calamus* var. *calamus*, 243 volatile components, 45 of which were new records from sweet flag. Methyleugenol, cis-methylisoeugenol, β -asarone, geranylacetate, β -farnesene, shyobunone, epishyobunone and isoshyobunone are the most abundant chemical compounds which are present in 20% of the essential oil. The other chemical components include α and γ -asarone, calamenene, asaronaldehyde, acorenone, calamenone, n-heptanic acid, calanendiol, numerous sesquiterpenes, and other compounds in the plant.

This oil and asarone has a relaxing effect on smooth muscle tissue. Tannins, starches, mucin, soft gums and resins are also present in this plant. Lectins present in plant have mitogenic action on mononuclear cells of human cells (macrophages of murine spleen). Lectins have inhibitory effect on the growth of some neoplastic cell lines from mice. Saponins showed effects against hyperlipdemia in rats. Especially α and β - asarone are highly active in antioxidant, antilipidemic, antimicrobial, anticancer, immunosuppressive, antidiabetes activities.^{[39],[40]}

PHARMACOLOGICAL ACTIVITY

- ❖ Methanolic extract of *Acorus calamus* showed analgesic effect on the rat in a study done through the Writhing response and rat caudal immersion method while the anticonvulsant effect was studied through the Pentylene-tetrazol-induced seizures method. The studies showed that *Acorus calamus* roots have significant anti-inflammatory and anticonvulsant activity.^[41]
- ❖ The anti spasmodic and antidiarrhoeal activity of *Acorus calamus* was studied. In the study, jejunum was isolated from the rabbit and further effect of crude extract was evaluated. It was found that plant extract causes the spontaneous inhibition of high K(+)induced contractions which resulted in spasmolytic activity which is mediated through the calcium channel blockade.^[42]
- ❖ Peroxidase activity of leaves extract of *Acorus calamus* was evaluated. The leaf extract protein of *Acorus calamus* was purified through the chromatography and peak giving fractions were tested for the anti fungal activity by gel filtration using Superose 12 10/300 GL column. Through leaves of the plant peroxidase enzyme activity was observed in the lumen of the xylem and vessels.^[43]
- ❖ Study of *Acorus calamus* was done for inducing neurotoxicity against acrylamide for increasing the activity of corpus striatum while dopamine receptors decreased. These neurobehavioral changes are occurring by ACR (acrylamide) for the treatment of diseases with the *Acorus calamus* rhizome.^[44]
- ❖ Effect of *Acorus calamus* on acetaminophen induced toxicity in rats for antihepatotoxic and anti oxidant activities was studied. It was seen that the effect of ethanol extracted *Acorus calamus* confer the hepatoprotective and anti oxidant activities by biochemical and pathological observations against acetaminophen induced liver injury in rats.^[45]
- ❖ Anticancer activity of *Acorus calamus* rhizomes was evaluated. In this study, hydro alcoholic extract of *Terminalia chebula*, rhizome of *Acorus calamus* and root of *Glycyrrhiza glabra* was prepared and further their antiproliferative activity on anti cancer cell was studied. Results predict the fact that all of these plant materials have significant antiproliferative activity.^[46]

- ❖ Anti cellular and immunosuppressive potential of ethanolic extract of *Acorus calamus* was evaluated. The ethanolic extract of *Acorus calamus* rhizome showed anti proliferative and immunosuppressive properties. This extract causes the tumor necrosis which inhibits the proliferation of mitogen, antigen stimulated peripheral blood mononuclear cells in humans, nitric oxide and interleukins-2.^[47]
- ❖ The methanol and acetone extract of *Acorus calamus* leaves was evaluated for their CNS activity in mice. They showed the spontaneous locomotors activity for immobility by time using through forced timed swim test, diazepam induced sleeping time and motor impairment assessment using Rota rod for CNS depression/analytic activity of ACME and ACAE in mice.^[48]
- ❖ In vitro and in vivo releasing alpha glycosidase inhibitory activity of ethyl acetate fraction of *Acorus calamus* was studied. The effects of serum glucose were detected in the fasted and amylum challenged normal mice. They used *Acorus calamus* extract for in vivo studies and found suppression in blood glucose level after the 2g/kg glucose loading in the normal mice. *Acorus calamus* extract had the hypoglycemic effects and glycosidase inhibition and improves the postprandial hyperglycemia and CVS complications.^[49]
- ❖ The reversal neurotoxicity of *Acorus calamus* in mice was studied which is induced with the phenytoin and Phenobarbital. The administration of *Acorus calamus* at ED50 dose of phenytoin markedly potentiated the anti convulsant activity of phenytoin. The main reason is that the combination of *Acorus calamus* with phenytoin does not show any significant effect on the PTZ (pentylentetrazole) induced convulsions. From these studies they concluded that administration of *Acorus calamus* with phenytoin and Phenobarbita showed the synergistic effect. Hence it is confirmed that the combined administration of *Acorus calamus* with phenytoin and phenobarbital showed the better effect in epileptic treatment.^[50]
- ❖ The effect of acetone extract of *Acorus calamus* in albino rat for their anti inflammatory activity was studied. Anti inflammatory activity was evaluated using paw edema model induced by formaldehyde injection in the male rat. The inflammatory effect was completely diminished and the normal status of paw was achieved when 25-75% acetone extract was tested against inflammation in male rat within 30 minutes.^[51]
- ❖ One study showed that *Acorus calamus* possesses the ability for preventing the development of FeCl induced epileptogenesis by modulating antioxidant enzyme; exhibit the potentiality of herb to be developed as an effective anti epileptic drug. Through the various methods which is used for inducing the experimental epileptic models induces the recurrent seizures and epileptic discharge similar to humans post traumatic epilepsy through generation of free radicals into sensorimotor.^[52]
- ❖ The effect of *Acorus calamus* on bronchial dilation which is mediated through multiple pathways was studied. Crude extract of *Acorus calamus* in the guinea pig tracheal segments was more effective in the carbachol response with the blockage of calcium channels. In the crude extract of *Acorus calamus* the calcium channel blockers and phosphodiesterase in the hexane fraction has a novel combination which shows anti cholinergic and anti depressant effect that provides the pharmacological basis for various uses of *Acorus calamus* in airways disorders.^[53]
- ❖ The anti microbial and antifungal activity of *Acorus calamus* rhizome and leaf was evaluated. In this study, petroleum ether, chloroform, hexane and ethyl acetate extract of rhizomes and leaves were used and it was found that ethyl acetate extract was highly effective in anti fungal and anti yeast activity. The alpha and beta asarone is mainly responsible for the antimicrobial activities further it was established that beta asarone has high anti microbial activity as compared to the alpha asarone.^[54]
- ❖ In vitro and in vivo sensitizing activity of ethyl acetate fraction of *Acorus calamus* was evaluated. The consumption of glucose is mediated through the insulin which was detected in the rat skeletal muscle cells. It has been concluded from the whole study that the insulin sensitizing *Acorus calamus* extract has the potential to be used in the treatment of diabetes and cardio vascular complications without weight gain.^[55]
- ❖ In a study, methanolic and aqueous extract of *Acorus calamus* plant were used and further cytotoxic effect was studied. From

whole study it was concluded that it might act against the cytotoxicity in time and concentration dependent manner.^[56]

- ❖ The preliminary and physicochemical studies on the rhizome of *Acorus calamus* were done. It is perennial, semi aquatic, smelly plant found in temperate and sub temperate zone and mainly used as anti spasmodic, carminative and anthelmintic. They mainly focused on the crude drug (*Acorus calamus*) which is useful in the identification and control to adulteration of the raw drug. So they concluded that heavy metals and pesticide residue estimation and microbial contamination are essential for raw drugs and its formulation.^{[57], [58]}
- ❖ In a study, the derivatives against fish pathogen *Aeromonas hydrophila* from *Acorus calamus* residue were derived for showing the antibacterial activity of the plant. Eighteen compounds were isolated from the *Acorus calamus* which was then microtiter to find out their inhibitory concentration. The antimicrobial potency of the substances was ranked through bioautographic assays. Then the derivatives which are derived through the isolation of plant has been predicted from the GC-MS, UV, ¹HNMR, ¹³CNMR, and IR spectroscopy related to beta asarone. The extracts of *Acorus calamus* have been found to possess an anti bacterial activity. Alphaasarone in *Acorus calamus* has stronger antibacterial property. However beta asarone concentration varies markedly among the oil from *A. calamus* varieties.^{[59], [60]}
- ❖ The potential of *Acorus calamus* was also studied in biotechnology and pharmaceutical field. It was found that *Acorus calamus* is widely used in Unani, Ayurveda and Local Health Care Systems. It is used in the treatment of different ailments and as insecticides, anti bacterial, anti fungal, anti oxidant etc. It belongs to the monocotyledons group which is used in the medicinal plants during the Ancient and Vedic periods. Beta asarone present in the herb is less carcinogenic which makes it highly valuable in biotechnology and pharmaceutical industries. *Acorus calamus* based markers play an important role of the selection of desired germplasm.^[61]
- ❖ The anti microbial activity of *Acorus calamus* rhizomes was studied with the phylogenetic placement of an endophyte fungus *Fusarium oxysporum*. The fungus was effective against the gram positive and gram negative micro organisms. An endophytic fungus was isolated from the *Acorus calamus* rhizomes which was identified as *Fusarium oxysporium*. In this study phylogenetic tree was generated with the use of maximum parsimony method for the relation establishment with *F. oxysporum* in the different forms. Plant is mainly prescribed as the drug for anti cancer and anti microbial agents. This plant act as reservoir for some microbes known as endophytes, which are important bioactive metabolites for therapeutic use.^{[62], [63], [64]}
- ❖ The effect of *Acorus calamus* leaves extract was studied on dopaminergic system in mice for neuromodulatory effect. The effects of methanol extract and acetone extract of the plant leaves against the apomorphine (APM) induced stereotypy and haloperidol induced catalepsy was found. The ACME and ACAE (*Acorus calamus* methanol extract and *Acorus calamus* acetone extract) administration potentiated the haloperidol induced catalepsy in mice. It was also found that the ACME and ACAE treatment at various levels against the APM induced catalepsy in mice significantly reversed the stereotypy.^[65]
- ❖ In a study, Pakistanian *Acorus calamus* was used and further its importance and implementation as a biopesticide was studied. It was proved that the essential oil of the *Acorus calamus* is safe as compared to the other commercial pesticides. This oil can be safely used in the agriculture as well as in health sector. The essential oil of *Acorus calamus* has been tested on the cuts and wounds and found that it was more effective as compared to the other oils.^[66]
- ❖ The leaf and rhizome part of *Acorus Calamus* is found to possess the antibacterial activity. The methanolic extract of *Acorus Calamus* showed the inhibitory action against the bacterial strains of *Salmonella typhi*, *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Staphylococcus aureus*.^[67]
- ❖ The efficacy of the *Acorus calamus* extract in lowering serum cholesterol and triglycerides effects has been proved on the serum lipids of rats which already fed with an atherogenic diet. The alcoholic extract of *Acorus calamus* contains saponins which plays a role in hyperlipidemia. Saponins are also found to

prevent the cholesterol absorption and interferes with its entero hepatic circulation and also increase its fecal excretion.^[68]

- ❖ The ethanolic extract of *Acorus* rhizome is used as the antiulcer agent as they were found to inhibit the gastric secretion and also shows the protection against the gastro duodenal mucosa injuries that were caused by the pyloric ligation in rat.^[69]

Ayurvedic Properties and Pharmacological Effect

- According to Ayurveda Literature, *Vacha* is *Katu* (pungent), *Tikta* (bitter) in *Rasa* (taste); *Laghu* (light), *Tikshna* (sharp) in *Guna* (properties); *Ushna* (hot) in *Virya* (potency) and *Katu* in *Vipaka* (metabolism). *Vacha* has a special potency (*Prabhava*) as a nervine tonic (*Medhya*). Due to these properties, it pacifies *Vata* and *Kapha*. Pharmacological effects of *Vacha* are *Vamaka*, *Agnivardaka*, *Aadhmanahara*, *Shulaghna*, *Malvishodhak*, *Mutravishodhaka*, *Apsamarahara*, *Unmadahara*, *Bhutaghna*, *Krimighna*, *Samjanasthapana*, *Medya*, *Lekhana*, *Vrishya*, *Sugandhi*.^[70]
- *Vacha* is fragrant, emetic, digestant, an appetizer, deflatulent and anti-epileptic in properties.^[71]

MEDICINAL USES

Part medicinally used is rhizome.

- In piles, the fumigation with *Vacha* with is helpful.
- Old *ghee* processed with *Vacha*, *Brahmi* juice, *Kushtha* and *Shankhapushpi* alleviates insanity, inauspiciousness, epilepsy and insinful conditions.^[72]
- *Vacha* mixed with honey or *Lashuna* with oil or *Satavari* with milk or juice of *Brahmi* is highly beneficial to cure epilepsy.^[73]
- Water boiled with *Vacha* and *Prativisha* or *Musta* and *Parpata* or *Haridra* and *Shunthi* should be given to the patient suffering from diarrhoea.^[74]
- *Vacha* medicated *Taila* should be applied and *Vacha* fermented with warm pounded lump of *Vacha* and *Shatapushpa* should be used for curing Hemorrhoids.^[75]
- *Vacha* along with *Devadaru*, *Musta*, *Shunthi*, *Ativisha* and *Haritaki* fermented in *Varuni* (a type of wine) or seeds of *Jyotishmati* percolated in warm water is also beneficial for hemorrhoids.^[76]
- *Vacha*, *Vayastha*, *Golomi* and *Jatila* should be worn on the body of children seized by *Naigmesha graha*.^[77]

- In *Suryavartta* and *Hemicrania*, pressed snuff of *Vacha* and *Pippali* or *Madhuka* and honey is useful.^[78]
- According to *Sushruta samhita*, *Vacha* cooked a hundred times with one *drone* (10.24 kg) of *Ghee* when given to a person, that person obtains a life of five hundred years and acts as a good *Rasayana*, it also cures cervical lymphadenitis, goitre, filariasis and disorders of voice.^[79]
- Application of paste of *Vacha* and *Devadaru* or *Gunja* is highly beneficial for alopecia.^[80]
- Emesis induced with *Vacha* powder and honey or *Madanphala* with *Madhuka* cures ophthalmia neonatorum.^[81]
- Use of *Vacha* with milk or *ghee* or oil for one month makes the person invincible for pathogenic agents and endowed the person with sharp intellect and sweet voice.^[82]
- *Vacha*, *Hingu*, *Yashti*, *Tagara*, *Shirisha*, *Lashuna* and *Kushtha* are pounded with goat's urine and used as snuff and collyrium in epilepsy and hysteria.^[83]
- If a person takes *Vacha* powder with honey keeping on diet of milk and rice, then chronic and severe epilepsy of that person also gets cure.^[84]
- The paste of *Vacha* and *Sarshapa* is applied on inflammatory swelling of testis (Orchitis).^[85]
- Milk added with water and *Vacha* should be taken in order to alleviate *Udavarartta* due to retention of urine.^[86]
- *Vachadi churna* made with *Vacha*, *Haritaki*, *Hingu*, *Vid lavana*, *Kuth*, *Chitrak*, *Ajwayana* and taken with honey or lukewarm water helps to cure colic.^[87]
- *Vacha* mixed with honey and jaggery should be given to the patients suffering from gastritis.^[88]
- The wound in the pinna of ear heals up by applying *Vacha* powder after the ointment of *Kapitha* mixed with oil.^[89]
- 10 gm of *Vacha* powder should be taken with honey and *ghee* for three days to cure *Apsamara* (hysteria) and milk is used in the diet.^[90]
- *Vacha* is a brain tonic which promotes higher mental functions. It is an ideal herb for mediators, students, musicians and all who need deep focus and attention in their work. *Vacha* penetrates deep into the brain tissues and scrapes toxins from the subtle channels in the mind and opens the nadis of the higher chakras. *Vacha*'s heating qualities stimulate the brain and increase alertness and focus. It

significantly aids information absorption and memory recall as it promotes cerebral circulation. It acts as a curative for memory loss, and any attention deficit disorders.^[91]

- *Vacha* is a subtle purificatory herb that has an affinity for the throat chakra and removes obstructions to clear expression. It clears the throat of mucus and opens the lungs promoting fuller respiration. Used in cases of speech impediments, stuttering, cough and cold, sinus congestion, nasal polyps.^[91]
- *Vacha* acts as a remedy for mental stagnation of all degrees. It awakens latent cerebral functions which when inactive can cause depression, grief, mental handicap, and post-stroke symptoms.^[91]
- *Vacha* is used both internally as well as externally. In Rheumatism, Rheumatic fever and inflamed joints, the paste is applied externally which alleviates the pain and swelling.^[92]
- The juice of *Vacha* instilled into ear mitigates the earache and tinnitus. The *Nasya* of *Vacha* is salutary in headache, heaviness of head due to *Kapha*, unconsciousness, epilepsy and hysteria.^[92]
- The decoction of *Vacha* with Camphor is effectively used for cleansing the wounds and ulcers as it possesses the antibiotic properties.^[92]
- The dry powder massage (*Udvaartana*) of *Vacha* is beneficial in Obesity to reduce the subcutaneous fatty accumulations.^[92]
- Internally, *Vacha* is valuable in vast range of diseases. It works well in digestive ailments like flatulence, loss of appetite, distaste, abdominal dull pain and worms. In higher dosage, it induces vomiting. The fresh lemon juice and fennel is an antidote for emetic effects of *Vacha*. The powder of *Vacha* given with lukewarm salt water induces vomiting and relieves the phlegm, eases cough and asthma. *Vacha* is also useful to reduce fevers.^[92]
- *Vacha siddha ghrita* is an excellent nervine tonic for children which improves memory, reception as well as the speech. In slow learning children, *Vacha* powder in small amount is recommended with honey for long duration with great benefit.^[92]
- *Vacha* is mild diuretic and hence, is beneficial in dysuria and urinary stones, as an adjunct. As it stimulates the uterine contractions, the combination of *Vacha*, *Kumkuma* and *Pippali* is used to augment the labour pains.^[92]
- Root of *Vacha* with *Bhang* and *Ajowain* in equal parts are used as a fumigation to get relieve in painful piles.^[93]
- In Unani, it is mentioned that *Vacha* is hot 3 degree, dry 2 degree, cleans brain, aphrodisiac, provides strength to sight, expels reeh, expels balgam, works as antipoisonous, cures paralysis, drops and nervous complaints, cold and cough. *Vacha* is given as antiperiodic in tertian fevers. In Asthma, *Vacha* is found useful when given in small doses of 10 grains and repeated every two or three hours till relief is obtained.
- *Vacha* is eaten freely during the prevalence of an epidemic as it is supposed to be an antidote for several poisons including snake bite. In Croton poisoning, its powder mixed with water is given to counteract the poisonous effect. The root of *Vacha* burnt to cinder, mixed with coconut oil or castor oil and smeared over the abdomen relieves flatulent colic. *Vacha* is used as a diuretic in calculous affections and as an anthelmintic to expel worms in children. Root of *Acorus calamus* with equal quantity of *Asafoetida*, *Atis*, *Pippali*, *Marich*, *Shunthi*, *Haritaki* and *Sonchal lavana* are taken and this compound powder is highly beneficial in dyspepsia and as a stimulant in low fever, epilepsy and insanity. It is given in dosage of 20 to 60 grains.^[94]
- Actins present in *Vacha* have been found beneficial in menstrual disturbance. ^[95]
- *Vacha* is also much valued by Manipuris, especially in the treatment of cough or sore throats. For this purpose, a small piece is chewed for a few minutes. *Vacha* is commonly used to allay distressing cough. A small piece of the dried root stock kept in the mouth acts better than many cough lozenges. It produces warm sensation in the mouth and a beneficial flow of saliva. In Ceylon, the rootstock is used in bowel complaints. The root is supposed by the Chinese to affect the heart and the lungs and to be beneficial for cancer. In general, it is taken as a restorative for the body and spirits. In Constantinople, the root of *Vacha* is eaten as a preventive against pestilence. The rhizome of *Vacha* can also be used in the form of a tincture or an infusion (Moodeen Sheriff). In *Udarshula*; *Vacha*, *Sauvarchala*, *Hingu*, *Ativisha*, *Haritaki* and *Indrayava* is given.^[96]

- Diseases of mouth can be simply cured by keeping a nodular piece of *Vacha* in mouth for day and night. In condition of *Amajirna*, emesis should be done with decoction of *Vacha* added with salt. In rat poisoning, *Vacha* taken with rice water in the morning for three or seven days while keeping on wholesome diet counteracts the poison. In Heart diseases caused by *Kapha*, patient should be vomited with decoction of *Vacha* and *Nimba*.^[97]

IMPORTANT FORMULATIONS

Vachadi churna, Vachadi ghritta, Vachavleha, Vachadi taila, Vachalashunadi taila, Saraswata churna, Saraswatarishta, Manasmitra vataka, Chandraprabha vati, Khadiradi vati, Hinguvachadi churna, Lakshmivilasa rasa, Medhya rasayana.^{[4],[33]}

SUBSTITUTES AND ADULTERANTS

Roots of *Alpinia galanga* Wild and *Aconitum* species, known as *Sugandha vacha* and *Akot vacha* respectively are sometimes erroneously supplied in place of *Vacha*. The commercial material especially that procured from North eastern regions is adulterated with the rhizomes of *Costus speciosus* which are odourless and brownish in colour.^[33]

RESEARCH STUDIES

- Alpha and beta asarones exhibited spasmolytic action on isolated Guinea pig trachea and ileum.^[98]
- Cis-asarone showed anti fungal activity against *Helmintho-sporium oryzae*.^[99]
- *Acorus calamus* shows neuroprotective effect against stroke and chemically induced neurodegeneration in rats. Specifically, it has protective effect against acrylamide induced neurotoxicity.^[44]
- Both roots and leaves of *Acorus calamus* have shown antioxidant, antimicrobial and insecticidal activities.^[54]
- *Acorus calamus* may prove to be an effective control measure against cattle tick, *Rhipicephalus* (*Boophilus*) *microplus*.^[43]
- A recent study showed that beta-asarone isolated from *Acorus calamus* oil inhibits adipogenesis in 3T3-L1 cells and thus reduces lipid accumulation in fat cells.^[100]

CONCLUSION

In the present era, herbs are being rediscovered, as people around the world seek a healthier and more natural life style and *Vacha* is one of the important herbal drug. *Acorus calamus* is a medicinal plant used for the treatment of various diseases and possess the property of improving the memory power and

enhancing the intellect. *Vacha* is used in vitiated conditions of *Vata* and *Kapha*, various GIT troubles like dyspepsia, flatulence, stomatopathy, helminthiasis; amenorrhoea, dysmenorrhoea, nephropathy, calculi, stragury, hoarseness of voice etc. Essential oils of *Vacha* has anti-spasmodic and carminative effect and also used for treatment of Epilepsy, mental ailments, chronic diarrhea, dysentery, bronchial catarrh and tumours. The rhizome part of *Acorus calamus* is also used to treat several diseases like asthma and as a sedative. Native tribes used to treat cough by making a decoction of the plant as a carminative and also for cholice. *Vacha* is also used in remittent fevers and ague by the native doctors, and is held in high esteem as an insectifuge, especially for fleas. The rhizome of *Vacha* can also be used in the form of a tincture or infusion. Regular intake of *Vacha* with *Ghritta* or *Taila* or milk serves the purpose of *Rasayana* and boosts the immunity. So this plant *Acorus calamus* helps in treating different ailments involving various systems and enhances the immunity and improves hoarseness of voice. So further studies must be carried out to explore some other benefits of *Vacha*.

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