

Pharmacological Properties and Ayurvedic Value of Indian Buch Plant (*Acorus calamus*): A Short Review

Rupali Singh, Pramod Kumar Sharma and Rishabha Malviya

Department of Pharmaceutical Technology, Meerut Institute of Engineering and Technology,
Bypass Road- Baghpat Crossing, Meerut-250005, Uttar Pradesh, India

Abstract: *Acorus calamus* is a useful medicinal plant which gave benefit in different fields of medicines. This review deals with the different pharmacological activity of plant with different extract or solvents. This herb stimulates the power of intelligence and self expression in humans. This herb is generally used from the Ancient and Vedic periods due to its wonderful power of rejuvenation of brain, nervous system and normalizing the appetite. *Acorus calamus* is widely used in the pharmaceutical as well as on biotechnological scale because it has great potency and defense system. *Acorus calamus* has many wide varieties which were used in different studies possesses anti-inflammatory, anti-spasmodic, anti-protective and anti-hepatotoxic activities. Article also deals with various marketed product of *Acorus calamus*.

Key words: *Acorus calamus* • Sweet flag • Tumors • α asarone • Galangin • Anti inflammatory

INTRODUCTION

Acorus calamus or sweet flag or buch plant has been known for its beneficial and medicinal value in the Asia since long time. From the ancient it is harvested on the commercial scale and mostly cultivated in the Asian region. It is a most valuable plant in the medical sciences almost throughout the India. In Ayurvedic science the use of sweet flag is effective against wide varieties of illnesses. The word 'acorus' is originated from the Greek word 'acoron' used by the Dioscorids which in turn derived from the 'coreon' word means 'pupil' because it is used in the treatment of eyes diseases and its inflammation. This plant showed anti-spasmodic, carminative and anthelmintic properties. The rhizomes of this plant is widely used in the number of ailments like epilepsy, mental ailments, chronic diarrhea, dysentery, bronchial catarrh, intermittent fevers and glandular, abdominal tumors, kidney and liver troubles, rheumatism, sinusitis and eczema. Other virtues of this plant include its mature leaves, act as an insect repellent when cut up and stored in dry foods. In ancient times the buch plant is mainly known as vaca literally means speaking. In the Vedic periods it is used as a rejuvenative agent for the brain and nervous systems. This stimulates the power of self expression and intelligence. Maharishi Charka has

simply categorized it as lekhaniya- reducing herb, especially, kapha and meda etc, trptighna (anti-saturative), asthapanopaga (an adjunct to decoction enemas), sita prasamana (relieves cold sensation on the skin), samjna sthapana (restores consciousness), vaya sthapana (promotes longevity), arsoghna (anti-hemorrhoidal) and siro virecana (cleansing nasal therapy). This plant clears the main channels of toxins and obstructions of the nervous systems and sharpens the memory due to its divine and nervine nature [1]. It is a highly valued herb because it acts as a rejuvenator for the brain and nervous systems. In small doses it reduces the acidity in stomach and used in the treatment of anorexia nervosa while large doses causes nausea and vomiting. The *Acorus Calamus* has wonderful power of stimulating and normalizing the appetite. It is externally used to treat the skin eruptions, rheumatic pains, neuralgia, cancer dyspepsia and epilepsy. Its infusion causes an abortion and alleviates the toothache. The root was chewed to encounter the problem of toothache and help to stop smoking. In many parts of India it is used to encounter the acidity, heartburn and dyspepsia [2]. The massage through the dry powder is benefitted in the obesity and further reduces the subcutaneous fatty accumulations. Due to its antibiotic activity It is also used for wounds and ulcers cleansing. In different systems the *Acorus calamus* is used in

different ways like in 1) Agni Purana this plant is used in the treatment of epilepsy and in rheumatic arthritis 2) in Siddha system the fresh root is used in the treatment of bronchial asthma 3) in Unani system it is used in the treatment of flatulent colic, carminative, emetic, stimulant and as a bitter tonic 4) in Santal system it is used for the treatment of the cold and cough, dry cough, haemoptysis, indigestion 5) in Birhor system it is used for the medical benefit in the alopecia, root as a massage, teething problem in the children, malaria and cancer. The Indigenous Technical Know How are adopted by the people from the Ancient time are used for accumulating the information evolved through experience over years and years [3].

Description of Buch Plant [4]

Kingdom	: <i>Plantae</i>
Subkingdom	: Tracheobionta (Vascular plant)
Superdivision	: Spermatophyta (Seed plants)
Division	: Magnoliophyta (Flowering plants)
Class	: Liliopsida (Monocotyledons)
Subclass	: Arecidae
Order	: Arales
Family	: Acoraceae
Genus	: <i>Acorus</i> L.
Syn	: <i>Acorus griffithii</i> Schott. <i>A. belangeii</i> Schott, <i>A. casia</i> Bertol
English Name	: The sweet flag.
Indian Name	: Bach
Sanskrit Name	: Vacha
Trade Name	: Boch
Botanical Name	: <i>Acorus calamus</i>

Common Name of Buch Plant: Calamus root, sweet flag, rat root, sweet sedge, flag root, sweet calomel, sweet cane, sweet rush, beewort, muskrat root, pine root, racha, vaca.

Description: Sweet flag or buch plant is a grass-like, rhizome forming, perennial that can grow to 2 meters high, resembling an iris. This plant found in the wet areas like ponds, lakes and ditches. It consists of long creeping roots which spread out just below the surface of the soil. It is mostly common with the cat tail. The leaves are thick, erect and are very similar in appearance to the iris but edges are crimped. The flower is very rarely grown in this plant if grown than it is 3-8cm long, cylindrical in shape, greenish brown in color and covered with the multitudes of rounded spikes. The fruits are small and berry-like containing few seeds. Flowers are grown from early to late summer depending on the latitude. The flowers are small, sessile and densely packed and 5-10 cm of spadix on all

sides. The leaves are free, alternate, green and wavy. 1-3 seeded having thin testa which is cylindrical in shape and green in color. Flowering and Fruiting occurs in July-August; fruiting very rare.

This plant is mostly grown in the Northern latitude countries around the World. Mainly grown in the North America and Northern and Eastern Asia and naturalized in Southern Asia and Europe since ancient periods. The cultivated plants are sterile triploids and originated from the hybrids between diploid and tetraploids forms. The roots are grown widely by the natives of Americans along to be harvested as needed. *Acorus calamus* Linn. (Araceae) is a native of Central Asia and Eastern Europe and also has widespread use in the traditional system of medicine for gastrointestinal disorders such as colonic pain and diarrhoea. *Acorus calamus* L. sweet flag, is a well-known medicinal plant that grows worldwide along swamps, rivers and lakes. In India it grows in marshy places up to 1800 meters height; mainly cultivated in the Kashmir, Manipur and Nagaland [5].

Parameters for the Cultivation: This plant is hardy and easily grown in the medicinal/ visionary gardens. The plant growth is started from the division of roots at least from 5-6 cm piece of root most preferably clean, aromatic and free of any type of microbial infection. These plants grow anywhere as long where an adequate amount of water is present and full sunshine.

Weeding: This crop is weeded once every month for the 4 to 5 months when the plants blocks the rows in a thick over.

Yield: The average yield of rhizome is 40 qt/ha. However, yield could be increased with better agronomic practices. Irrigation: It is a water intensive crop similar to irrigated paddy but duration of sweet flag is 10 to 11 months. So this crop is more suitable where water is not scarce. At the initial stages of the crop, the field is raised to 10 cm till 20 days [6].

Active Constituent: The dried rhizome of *Acorus calamus* contain the yellow aromatic volatile oils having β 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 lutcolumin-6,8-c-diglucoside; chemical constituents vary in ecotypes and polyploides. β asarone is a genotoxic substance causing genetic mutation and tumors. Phenylpropanoid promotes defense mechanism in herbivores and ultra violet rays

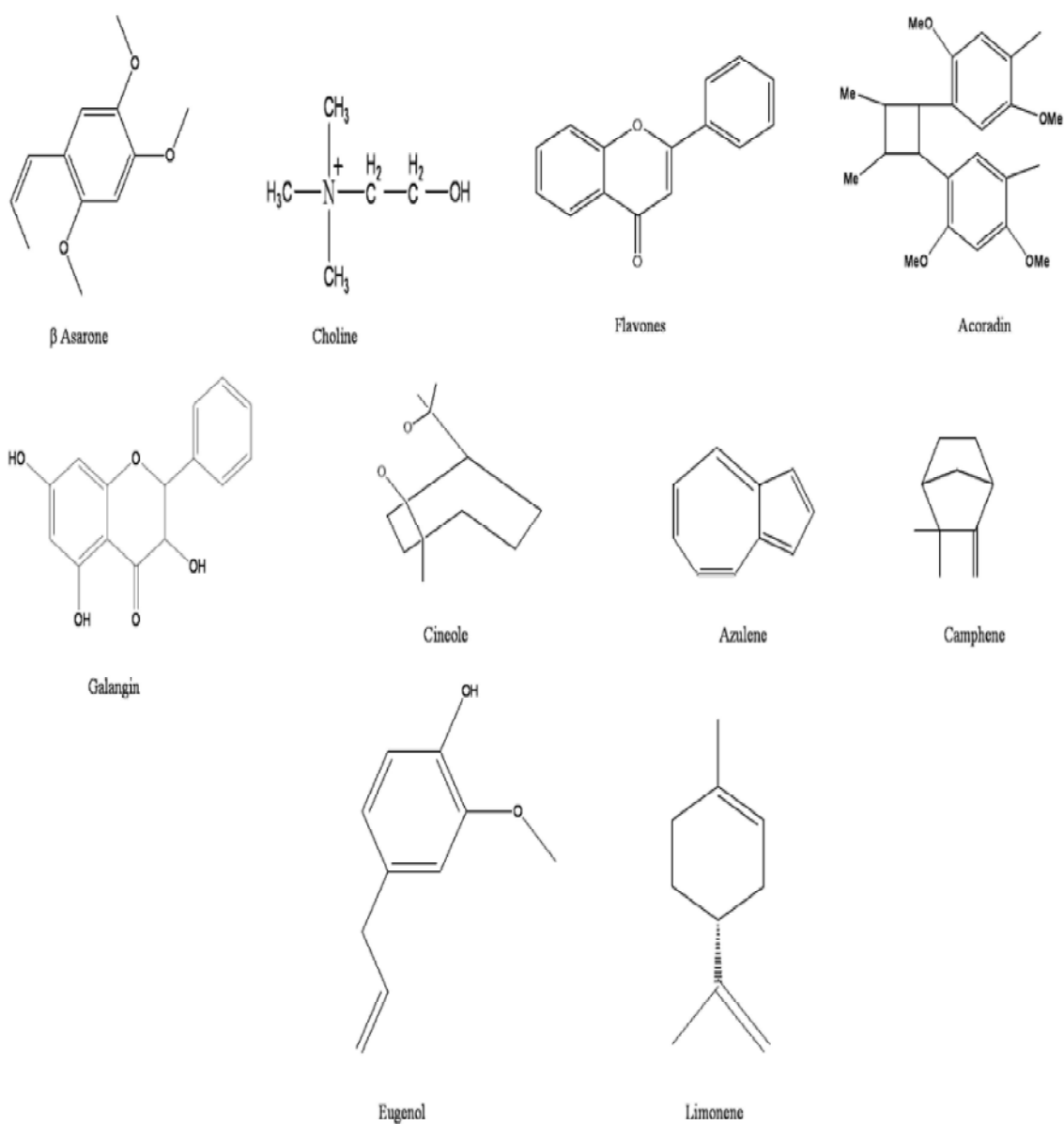


Fig. 1: Structures of various chemical constituents of *Acorus calamus*

protection. It is also active in inducing the liver tumors. Other constituents are α pinene, cineole, limonene, α terpineol, azulene, eugenol, camphene, δ cadinene, ethanol, galangin, magnesium, zinc, tannin, terpenes, menthol and camphor (Figure 1). The Asian varieties contain the varying amounts of β asarone which causes the more sedate feeling after ingestion while European varieties yielded sesquiterpenoids which is psychoactive agent and having good medicinal properties [7].

Medicinal Uses: Sweet flag used in Asia since last 2000 years for a number of beneficial and medicinal effects. It

has been found that Chinese used this herb for the treatment of constipation [8]. In Ayurvedic system the *Acorus calamus* has been used as a magical root which cures asthma, fevers, bronchitis and all over it is a sedative. The paste of the *Acorus calamus* is applied externally on the inflamed joints, rheumatism and in rheumatic fever alleviates the pain and swelling. The administration through nasal route is salutary in headache, heaviness, epilepsy and hysteria. In piles the fumigation is done through the buch is effective and helpful. The inhalation of the buch powder alleviates the headache due to the migraine whereas the juice instilled

into ears that mitigates the earache and tinnitus. The decoction of this plant with camphor is more effective in the cleansing of wounds and ulcers, as it possesses antibiotic properties. The Indians of Alberta use calamus in reducing the fever, prevention of toothache, headache, hangover, for oral hygiene and disinfect the teeth. The Dakotas use the calamus in the treatment of diabetes whereas other native's tribes used in the treatment of cough, carminative and as an infusion. When Indians use the root of calamus they miraculously cured the long diseases within a month. The Sioux natives use the whole plant in making aromatic garlands; root used in the making of tea for bowel pains, or rubbed, chewing the roots for a general cureness. The root of *Acorus calamus* was used as psychoactive, "witches flying ointments" when mixed with solanaceous herb during the middle ages. In the Biblical times in Exodus it is mentioned as one of the most important ingredients known as "holy anointing oil". The unpeeled, dried rhizome of *Acorus calamus* was listed in the United State Pharmacopoeia and National Formulary till 1916 for the medicinal use on the humans. It is also used by the Canadian Trappers working in the Hudson Bay Company used as a stimulant, chewing the small piece of the rhizome whenever tired. Walt Whitman writes the poetry about his beloved herb as "Leaves of Grass". Modern Use: It is mainly used in the mental ailments, dysentery, nerve tonic and stomachic, in bronchitis, dysentery, remittent fevers and emetic, in glandular and abdominal tumors and in snake bites[9]. *Acorus calamus* Linn. controls the tick in animals through its repellent action[10].

Adulterants: The drug is adulterated with siliceous earth, ground marsh mallow root and cereal flowers.

Pharmacological Activity of *Acorus Calamus*: The following studies have been carried out to evaluate its medicinal properties:

Jayaraman et al. [11]: Extracted the methanolic extract of *Acorus calamus* and further studied analgesic effect on the rat through the Writhing response and rat caudal immersion method while the anticonvulsant effect was studied through the Pentylenetetrazol-induced seizures method. The studies showed that *Acorus calamus* roots have significant anti-inflammatory and anticonvulsant activity. It has been observed that when methanol extract of *Acorus calamus* was administered orally at the doses of the 100 and 200 mg/kg showed the protective effect against the pain models in mice and this extract also increased the latency period in the seizures. Through

these studies it has been concluded that the extracts which is obtained from the extract of the *Acorus calamus* root seems to shows the analgesic as well as an anticonvulsant effects which may be potentiated by the activity of GABA.

Palani et al. [12]: Studied the therapeutic efficacy of *Acorus calamus* on acetaminophen induced male albino rats for nephrotoxicity and oxidative stress. *Acorus calamus* is a traditional plant mainly used for the treatment of insomnia, melancholia, epilepsy, hysteria and neurosis. The extract of the plant is used for the various activities like immunosuppressive, antidiarrhoeal, antiproliferative, antidiabetic and hypolipidemic activities. They studied the nephroprotective and antioxidant activities of ethanolic extract of *Acorus calamus* on acetaminophen induced toxicity in male albino rats. The acetaminophen increased the level of hemoglobin, total leukocyte count, packed cell volume, DLC, mean corpuscular volume, granulocytes, raised body weight, uric acid and platelet concentration. *Acorus calamus* increased the activity of the renal superoxide dismutase, glutathione peroxidase, catalase and decreased the level of monodialdehyde content of acetaminophen. They also find that the *Acorus calamus* inhibited the hematological effect of acetaminophen. The histopathological changes showed the protective nature of the ethanolic extract of *Acorus calamus* against acetaminophen induced necrotic tissues and renal damage in rats.

Vengadesh et al. [13]: Studied the effect of *Acorus calamus* leaves extract on dopaminergic system in mice for neuromodulatory effect. They investigated the effects of methanol extract and acetone extract of the plant leaves against the apomorphine (APM) induced stereotypy and haloperidol induced catalepsy. 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.

Palani et al. [14]: Studied the efficacy of *Acorus calamus* on acetaminophen induced toxicity in rats for antihepatotoxic and anti oxidant activities. They studied the effect of ethanol extracted *Acorus calamus* and further confer the hepatoprotective and anti oxidant activities by biochemical and pathological observations against acetaminophen induced liver injury in rats.

Lad et al. [15]: Studied the effect of acetone extract of *Acorus calamus* in albino rat for their anti inflammatory activity. 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.

Gilani et al. [16]: Studied the anti spasmodic and anti diarrhoeal activity of *Acorus calamus*. 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 resulting spasmolytic activity which is mediated through the calcium channel blockade.

Devi et al. [17]: Studied the anti microbial and antifungal activity of *Acorus calamus* rhizome and leaf. In this study they used petroleum ether, chloroform, hexane and ethyl acetate extract of rhizomes and leaves and found that ethyl acetate extract was highly effective in anti fungal and anti yeast activity. The α and β asarone is mainly responsible for the antimicrobial activities further it was established that β asarone has high anti microbial activity as compared to the α asarone.

Wu et al. [18]: Studied the *in vitro* and *in vivo* insulin sensitizing activity of ethyl acetate fraction of *Acorus calamus*. 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.

Lee et al. [19]: Evaluated the anti diabetic effect of *Acorus calamus* which inhibits the adipogenesis and stimulates the lipolysis in 3T3-L1 adipocytes. They determined the molecular mechanism under the anti diabetic activity of asarone. Treatment of diabetes through differentiation of 3T3-L1 preadipocytes through suppression and expression of transcription factors, enhancer binding protein-alpha and peroxisome proliferator which activates the adipogenesis. It was predicted that asarone reduced the intracellular triglyceride levels in a dose dependent manner and can be used in the treatment of the phosphorylation of hormone sensitive lipase.

Rajkumar et al. [20]: Used methanolic and aqueous extract of *Acorus calamus* plant and further studied cytotoxic effect. From whole study they concluded that it might be act against the cytotoxicity in time and concentration dependent manner .

Si et al. [21]: Found the *in vitro* and *in vivo* insulin releasing α glucosidase inhibitory activity of ethyl acetate fraction of *Acorus calamus*. The effects of serum glucose were detected in the fasted and amyllum 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 α glucosidase inhibition and improves the postprandial hyperglycemia and CVS complications .

Tariq et al. [22]: Used Pakistanian *Acorus calamus* and further studied its importance and implementation as a biopesticide. They 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 .

Singh et al. [23]: Showed the antifungal activity using methanolic extract of *Acorus calamus*. It involves the number of inducible defence mechanism against many diseases or pathogens. Majority of them are induced but after recognition they become constitutive and non specific. Results easily established antifungal potential of methanolic extract of *Acorus calamus*.

Ghosh [24]: Evaluated peroxidase activity of leaves extract of *Acorus calamus*. 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.

Barik et al. [25]: Studied the antimicrobial activity of the *Acorus calamus* rhizomes 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 are identified as *Fusarium oxysporium* [26]. 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. Plants are mainly prescribed as the drugs for anti cancer and anti microbial agents. This plant is act as reservoir for some microbes known as endophytes, which are important bioactive metabolites for therapeutic use [27].

Pandy et al. [28]: Evaluated the methanol and acetone extract of *Acorus calamus* leaves 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 rotarod for CNS depression/ analyptic activity of ACME and ACAE in mice.

Pradhan et al. [29]: Showed that *Acorus calamus* possesses the ability for preventing the development of FeCl₃ induced epileptogenesis by modulating antioxidant enzyme; exhibit the potentiality of AC 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.

Gaidhani et al. [30]: Evaluated anticancer activity of *Acorus calamus* rhizomes. They prepared hydro alcoholic extract of *Terminalia chebula*, rhizome of *Acorus calamus* and root of *Glycyrrhiza glabra* and further studied their antiproliferative activity on anti cancer cell. Results predict the fact that all of these plant materials have significant antiproliferative activity.

In one study Chaitali et al. [31]: Prepared ethanolic extract of fourteen Indian Medicinal plants like *Acorus calamus*, *Asparagus racemosus*, *Aegle marmelos*, *Cassia fistula*, *Gymnema sylvestre*, *Holarrhena antidysentrica*, *Minmusops elengi*, *Ocimum sanctum*, *Piper longum*, *Sapindus trifoliatius*, *Terminalia arjuna*, *Termenalia bellerica*, *Terminalia chebula* and *Withania somnifera* roots were and further evaluated for their cytotoxic, anti tumor and pesticidal efficacy using brine shrimp Lethality assay. Results showed that *Acorus calamus* extract have significant anti tumor activity.

Shukla et al. [32]: Studied the effect of *Acorus calamus* 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.

Yende et al. [33]: Showed the reversal neurotoxicity of *Acorus calamus* in mice 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 (pentelynetrazole) induced convulsions. From these studies they concluded that administration of *Acorus calamus* with phenytoin and Phenobarbital showed the synergistic effect. Hence it is confirmed that the combined administration of *Acorus calamus* with phenytoin and phenobarbital showed the better effect in the epileptic treatment.

Mehrotra et al. [34]: Evaluated anti cellular and immunosuppressive potential of ethanolic extract of *Acorus calamus*. The ethanolic extract of *Acorus calamus* rhizome showed anti proliferative and immunosuppressive properties. This extract causes the tumor necrosis through which inhibits the proliferation of mitogen, antigen stimulated peripheral blood mononuclear cells in humans, nitric oxide and interleukins-2.

Kumari et al. [35]: Evaluated antioxidant defense system in a *Acorus calamus* through the response of UV-B radiations. It has been found that reactive oxygen species (ROS) is produced due to the oxidative stress in plant cells create through UV-B radiation. ROS denatures and damage the cellular components. Through their studies they concluded that exposure of *Acorus calamus* rhizome to UV-B radiation affected the secondary metabolites with activation of anti oxidative defense system.

Mittal et al. [36]: Studied the potential of *Acorus calamus* in biotechnology and pharmaceutical field. They found that *Acorus calamus* is widely used in Unani, Ayurveda and Local Health Care Systems. It is used in the different treatment of a variety of ailments and as insecticides, anti bacterial, anti fungal, toxicant etc. It is belonging to the monocotyledons group which is used in the medicinal plants during the Ancient and Vedic periods. It is a stress

tolerator that causes the plasticity in the rhizome and shoots density with respect to the availability of a nutrient. β asarone 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.

Jabbar and Hassan [37]: Studied the effect of *Acorus calamus* on bronchodilation, which is mediated through multiple pathways. Crude extract of *Acorus calamus* in the guinea pig tracheal segments was more effective in the carbachol response with the blockade of calcium channels. In the crude extract of *Acorus calamus* the calcium channel blockers and phosphodiesterase in the n-hexane has a novel combination shows anti cholinergic and anti depressant effect that provides the pharmacological basis for various uses of *Acorus calamus* in airways disorders.

Meena et al. [38]: Studied the preliminary and physicochemical studies on the rhizome of *Acorus calamus*. 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 [39].

Faruq et al. [40]: Show the antimutagenic activity through the methanolic extract of four Ayurvedic medicinal plants i.e, *Acorus calamus*, *Hemidesmus indicus*, *Holarrhena antidysentrica* and *Plumbago zeylanica*. These extracts are then tested at different concentrations that showed no signs of mutagenicity to *Salmonella typhimurium* tester strains. The four extract was found to be in the order of *A. calamus* > *H. indicus* > *H. antidysentrica* > *P. zeylanica* all showed the antimutagenic activity. Mutagens are involved in mutation and promotion of several diseases like cancer which is most important in counteracting the promutagenic and carcinogenic effects. Such chemicals that help in reducing the mutagenicity are known as antimutagens. The antimutagenic or protective effect has been attributed towards many classes of phytochemicals

Table 1: Marketed Formulations of Buch plant

Formulations	Company
1.Scavon Vet cream[45]	Himalaya Drug Company, Makali, Banglore, India.
2. <i>Acorus calamus</i> Herbal Extract[46]	Vidya Herbs Private Limited, Banglore, Karnataka, India.
3.Ayurvedic and Herbal Chemicals of <i>Acorus calamus</i> [47]	Jenson Enterprises Private Limited, Chengalpattu, India.
4.Bulk Drugs of <i>Acorus calamus</i> [48]	Hindustan Pharmaceuticals, Amritsar, India.
5.Varch oil[49]	Herbotech Pharmaceuticals, Amritsar, India.
6.Ayurvedic tablets[50]	Krishna Herbal Company, Chandigarh, India.
7.Anxi- 6[51]	Kalhan Pharmaceuticals Private Limited, Jalandhar, Punjab, India.
8. Manufacturer and Exporter of Medicinal Herbs of <i>Acorus calamus</i> [52]	Karthik Enterprises, Arokiapura Shanmugapura, Chottaian Thoppu, Tuticorin, Tamil Nadu.
9.Herbal preparations of <i>Acorus calamus</i> [53]	Sydler Remedies Private Limited, Mumbai, India.
10.Ayurvedic Preparations of <i>Acorus calamus</i> [54]	Kebee Pharmachemie Private Limited andheri, Mumbai, India.
11.Perfumes, Vach oil, Alcoholic Drinks,toothpastes[55]	Ram Prakash Company, Khari Baoli, New Delhi.
12.Botanical Insecticide (Vasambu)[56]	Coimbatore, Tamil Nadu Agricultural University and Bhuvicare Private Limited, Tirunelveli.
13.Wholesale suppliers of <i>Acorus calamus</i> herbs[57]	Tripti Herbal and Plantation Services, Jabalpur, Madhya Pradesh.
14.Nervine tonic, Antispasmodic[58]	Salem Impex, Salem, Tamil Nadu.
15.Stresnil[59]	Universal Pharmaceuticals Limited, Chennai, Tamil Nadu.
16.Calamus Oil[60]	Modern Natural Products, Mumbai.
17.Spices, Herbs, Essential oil and Natural products of <i>Acorus calamus</i> [61]	The Pioneer Enterprises, Raudat Tahera, Mumbai.
18.Natural oil of Vacha [62]	Bhagat Aromatics Limited, New Delhi.
19.Calamus Essential Oil[63]	Katyani Exports, Pitam Pura, New Delhi.
20.Insecticides[64]	Ajinkya Chemtech Private Limited, Pune.
21.Krush capsules[65]	Prakruti Remedies Pvt. Ltd Karnataka (India).
22.Brainokan[66]	Kangra Herb Private Limited, Kangra, HP.
23.Mahavishgarba Oil[67]	Herbs forever, Los Angeles, California, U.S.A.
24.Herbal Skin Cream[68]	EcoPure Naturals, Fairport Harbor,OH 44077.

present in foods like flavonoids and phenolic compounds[41]. In these plant extracts the mutagens (NaN₃ and MMS) show the inducing effect in one or more tester strains. *Acorus calamus* extract showed the decrease in revertants colonies against NaN₃ induced mutagenicity. The variations in the antimutagenic activity are due to the differences in the active constituents and combinations of other extracts [42].

Bhuvneshwari et al. [43]: Derives the derivatives against fish pathogen *Aeromonas hydrophila* from *Acorus calamus* residue for showing the antibacterial activity of the plant. Eighteen compounds are isolated from the *Acorus calamus* which is 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 β asarone. The extracts of *Acorus calamus* have been found to be possess an anti bacterial activity. β asarone in *A. calamus* has stronger antibacterial property [44]. However β asarone concentration varies markedly among the oil from *A. calamus* varieties.

CONCLUSION

Through this review it can be concluded that *Acorus calamus* is a wonderful herb through which different diseases have been cured from the Ancient and Vedic periods. Hence it has been proved from the different literature reviewed that *Acorus calamus* can be explored successfully for various marketed formulation.

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