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WAJ TURKI (*ACORUS CALAMUS* LINN.): A PHARMACOGNOSTICAL REVIEW WITH UNANI DESCRIPTION

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ABSTRACT

Waj turki (*Acorus calamus* Linn.) commonly called as sweet flag is a medicinal plant, belonging to the family Acoraceae. It is also known by various other names in different parts of the world like Bach, Safed bach, Dekhand, Aqurun, Aqarun, Barj, Karunak, Ood-ul-waj, Wabi, Warak, Leni, Aburevan, Kamni kathi, Agar turki, and many more. It possesses diuretic, anti-spasmodic, carminative, anti-inflammatory, anti-pyretic, brain tonic, emmenagogue, aphrodisiac, phlegm resolvent and demulcent properties mentioned in classical Unani literature. The rhizome of this plant is used to treat diseases such as epilepsy, insanity, loss of memory, diarrhoea, dysentery, fever, cough, pleurisy, numbness, paralysis, diseases of eye, dribbling of urine, insect bite etc by Unani Physicians. It contains two main bioactive compounds α- asarone and β- asarone. Glucosides, glycoside, flavonoid, saponin, tannin, mucilage, volatile oil, alkaloid, essential oil, starch etc. are also present in it. Many pharmacological activities have been recently reported like anti-microbial, anthelmintic, antioxidant, anti-inflammatory, anti-diarrhoeal, anti-cancerous, hypolipidemic, anti-diabetic,

neuro-protective, nephron-protective etc. This review paper discusses the details of Waj turki (*Acorus calamus* Linn.) like macroscopic and microscopic structure, temperament, chemical constituents, adulterants, pharmacological actions, uses in diseases, recent pharmacological studies, dose, important formulations and adverse effects mentioned in Unani as well as its modern pharmacology and gives an incentive to utilize this wonderful drug in various disorders.

Keywords: Waj turki, *Acorus calamus,* Unani Medicine

INTRODUCTION

Acorus calamus (sweet flag) is a perennial monocot plant belonging to the family Acoraceae. **[1]**. This family, also known as Arum family, contains 115 genera and 2,000 species of which about 25 genera and 140 species found in India **[2]**. The word 'acorus' was first used by Greek physician Dioscorides which means 'pupil' as it was used in inflammation and diseases of eyes. It is sometime used as substitute for rhizomes of *Alpinia galanga* (Linn.) Willd. (Khulanjan) and *Aconitum* spp. (Bish) **[3]** Plant is herbaceous, can grow upto 2 meters, similar to iris with difference of crimped edges of leaves. The sympodial leaf of Acorus calamus is shorter than that of the vegetative leaves.The rhizome has a specific aromatic odour, sharp pungent and bitter taste. Root forms web like structure and the root stalk has whitish and spongy texture from inside. Flowering and fruiting are rare in this plant, mostly occurs in July-August. Weeding of this crop is done once every month for 4-5 months **[4] [5]**. The plant is mentioned in classical literatures by many great physicians like Hippocrates, Theophrastus, Galen, Ibn Sina, Razi and Ibn Baitar **[6] [7] [8] [9] [10] [4]**. Traditionally, this plant is used to treat the diseases such as dyspepsia, flatulence, cough, fever, piles and asthma. The leaves and rhizomes possess antimicrobial and antifungal activity **[11] [5]**. It also contains anti-spasmodic, carminative, anthelminthic, aromatic, expectorant and stimulant properties **[12]**. Chewing of the root protect from epidemic diseases **[13]**. It contains many bio-active compounds like α and β asarone, glucosides, glycoside, flavonoid, saponin, tannin, mucilage, volatile oil, alkaloid, essential oil, starch etc. **[14] [15] [16] [17] [18]**.

TAXONOMICAL CLASSIFICATION **[19] [2]**

Kingdom: Plantae
Division: Tracheophyta
Class: Magnoliopsida
Order: Acorales
Family: Acoraceae
Genus: Acorus
Species: Acorus calamus
Binomial name: *Acorus calamus* Linn.

VERNACULAR NAMES [20] [21] [13] [22] [23]

Arabic: Waj, Ood-ul-waj

Unani: Aqurun,

English: Sweet Flag, Cinnamon sedge, Poison flag, Blue flag

Hindi: Bach, Gora-bach

Marathi: Vaca, Vekhanda

Persian: Agar Turki, Barj, Karunak

Sanskrit: Bhadra, Bhutnashini, Jalaja Sdaparvika, Ugragandha, Ugra, Sadgrantha

Urdu: Waj Turki

Gujrati: Dekhand, Ghoduvaj, Ghodvach, Leni

Punjabi: Varch, Ghodavaca

Tamil: Vasambu, Pillai maruntho

Telgu: Vasa

Malyalam: Vayambu

Kannada: Baje, Narru Berua

Sindhi: Kamni kathi

Bengali: Safed Bach

Roman: Aqarun

Turkish: Wabi

HABITAT

Acorus calamus L. is a well-known medicinal plant that grows mostly in the Northern latitude countries along swamps, rivers and lakes **[4]**. It is native of eastern countries and indigenous to the marshes of mountains of India like Kashmir, Sirmaur (Himachal Pradesh), Manipur and Naga Hills, cultivated throughout India, ascending to an altitude of about 2200 metres. Habitually cultivated in Karnataka in peninsular India **[24] [5]**.

MACROSCOPY

Acorus calamus is a semi-aquatic or marshy, herbaceous perennial herb with long aromatic rhizome, creeping and extensively branched, cylindrical up to 20 cm long, 1 to 2 cm in diameter, peeled or unpeeled, purplish-brown to light brown externally, soft, porous, with longitudinal furrows and white internally. On the lower surface there are raised small root scars **[15] [1]**. Leaves are erect, looks like leaves of iris with the difference of crimped edges, 0.9-1.8 meter long and 1.7-3.8 cm width, alternate, bright green, acute, thickened in the middle, margin waved. Single prominent mid vein with slightly raised secondary veins and many fine tertiary veins are present. Flowers rarely grow, covered with multitude of rounded spikes, light brown, densely packed, sessile, cylindric spadix 5-10 by 1-3.2 cm diameter, obtuse, slightly curved green. Sepals as long as the ovary, scarious, anthers yellow. Fruits small, oblong turbinate berries with a pyramidal top, seeds free, hanging from the apex of the cells. **[21] [25] [26] [5]**.

Fig. 1. Waj turki (*Acorus calamus* Linn.) plant

Fig. 2. Rhizome of Waj turki (*Acorus calamus* Linn.)

MICROSCOPIC STRUCTURE

A section of rhizome shows single layer of epidermis; Cortex composed of spherical to oblong, thin-walled cells of different sizes, larger towards periphery, smaller, somewhat collenchymatous, more or less closely arranged cells towards inner side, rounded and form a network of chains of single row of cells, enclosing large air spaces, most of the cells contain small starch granules, but some of them contains essential oil, fibro-vascular bundles are numerous, especially just within the line of small cells just noticed, each bundle consists of a ring of spiral vessels surrounding a number of jointed tubes and secretory cells having light yellowish-brown contents, present in this region; endodermis distinct; stele composed of round, parenchymatous cells enclosing large air spaces similar to those of cortex and several concentric vascular bundles arranged in a ring towards endodermis, a few vascular bundles scattered in ground tissues; starch grains simple, spherical measuring 3-6 µ in diameter, present in cortex and ground tissue **[22] [27]**.

TEMPERAMENT (MIZAJ)

Hot and dry in second degree **[28] [23] [29] [30]**

PART USED (AJZAYE MUSTAMELA)

Rhizome **[3] [21]**

Root **[23] [30]**

Leaves **[1]**

PHYTOCONSTITUENTS

Dried rhizome of *Acorus calamus* consist of two main bioactive compounds α-asarone and β- asarone. Beside this it also contains glycosides (xanthone), volatile oil, sesquiterpenes, monoterpenes, flavonoids, steroids, saponins, lignin, tannins, mucilage, alkaloids, polyphenolic compounds and other essential oils such as calamenol, calameon and calamen **[17]**. The Asian varieties contains varying amount of β asarone which after ingestion causes sedation while European varieties contains sesquiterpenoids which exhibit psychoactive properties and have other therapeutic actions also **[4]**.

ADULTERANTS

The drug is adulterated with marshmallow (*Althae officinalis*), common yellow flag (*Iris pseudacorus* Linn.), siliceous earth and cereal flours **[4] [31]**.

Table 1: Pharmacological Actions (AF'AAL)

Actions of drug	Unani references	Ethno-botanical references
Muqi **(Emetic)**		[21] [27]
Mulayyan **(Laxative)**		[21]
Mudire-baul **(Diuretic)**	[13] [23] [30]	[21] [27]
Kasire-riyah **(Carminative)**	[13] [10] [28]	[21] [3] [1]
Qatile-deedan **(Anthelmintic)**	[32]	[21] [3] [33] [34]
Dafe-ishal **(Anti-diarrheal)**		[35] [5] [36] [37]
Muhallile-awram **(Anti-inflammatory)**	[32]	[21] [38]
Musakkine-alam **(Analgesic)**		[35] [5] [39] [40]
Dafe-humma **(Anti-pyretic)**	[13]	[21] [1] [12] [40]
Anti-hyperlipidemic		[35] [5] [2] [41]
Dafe-ziyabetus **(Anti-diabetic)**		[35] [33] [42] [43] [42]
Muhafize-gurda **(Nephroprotective)**		[35] [44]
Muhafize-aasaab **(Neuroprotective)**		[35] [5] [33] [45]
Muhafie-jigar **(Hepatoprotective)**		[5] [12] [46]
Dafe-sara **(Anti-epileptic)**		[21] [5] [12] [47]
Munaffise-balgham **(Expectorant)**		[21]
Dafe-taffaun **(Alexiteric)**		[21]
Muqawwi dimag **(Brain tonic)**	[13]	[21] [35]
Muqawwi meda **(Stomachic)**		[21] [27]
Dafae-sartan **(Anti-cancerous)**		[33] [17] [48]
Anti-cholinergic		[35] [5] [49] [50]
Anti-adipogenic		[5] [33] [41]
Anti-oxidant		[51] [52] [46]
Muharrik **(Stimulant)**		[27]
Mudirre-haiz **(Emmenagogue)**	[13] [32]	[27] [21]
Mubhi **(Aphrodisiac)**	[13]	[27]
Dafe-tashannuj **(Anti-spasmodic)**	[23]	[3] [35] [2] [36]
Dafe-zigtuddam **(Anti-hypertensive)**		[12] [53]
Insecticidal		[21] [5] [1] [33] [12] [54]
Munzije-balgham **(Phlegm resolvent)**	[13]	[55]
Anti-fungal		[35] [56] [11] [57]
Anti-bacterial		[35] [12] [11] [57]
Anti-microbial		[33] [2] [57] [11] [57]
Anti-malarial		[33] [58]
Mosquito larvicidal		[12] [59]
Licicidal		[60]
Insect repellent		[35] [12] [54]
Anti-depressant		[35] [2] [61] [62]
Mufatteh urooq **(Bronchodilator)**		[5] [12] [63]
Immunosuppressive		[5] [33] [12] [64]
Anti-cellular		[64]
Muqawwi hafiza **(Nootropic)**		[65]
Neuro-modulatory		[66]
Anti-HIV		[67]
Cytotoxic		[68]
Radioprotective		[69] [70]
Coronary vasodilator		[71]
Cardiac depressant		[71]
Mudammile-qurooh **(Wound healing activity)**		[12] [72]
Jali **(Detergent)**	[30] [23] [32]	[55]
Dafe-suddah **(Deobstruent)**		[55]
Mulattif **(Demulcent)**	[32] [30]	[55]

Table 2: Therapeutic Uses (MAWAQAYE ISTEMAL)

Uses	Unani references	Ethno-botanical references
Sara (Epilepsy)	[13]	[3] [21] [55]
Pagalpan (insanity)	[13]	[3]
Ishal (Diarrhoea)	[13]	[3] [55]
Zaheer (Dysentery)	[13]	[3] [21] [55]
Hummae-daira (Intermittent fevers)	[23] [32]	[3] [21] [55]
Hummae-mufattera (Remittent fever)		[35]
Sala (Tumours)		[3] [21]
Amraze-kulliya (Kidney diseases)		[3] [21]
Amraze-jigar (Liver diseases)		[3]
Hudar (Rheumatism)		[3]
Narfarsi (Eczema)		[3]
Zofe-ishteha (Decrease appetite)		[21]
Amraze-dahen (Diseases of mouth)		[21]
Darde-shikam (Abdominal pain)		[21] [1]
Distention of abdomen		[1]
Auram (Inflammation)		[21] [35]
Nisyan (Loss of memory)	[13]	[21]
Badhawasi (Delirium)	[13]	[21] [35]
Ikhtenaqur rahem (Hysteria)		[21] [35]
Zofe-aam (General weakness)		[21]
Qula-ud-dahan (Stomatitis)		[21]
Waja-ul-asnan (Toothache)		[21]
Darde-kabid (Liver pain)	[23]	[21]
Darde-seena (Chest pain)	[23]	[55] [21]
Bars (Leucoderma)		[21]
Qulanj (Colic)		[21] [1]
Sue hazm (Dyspepsia)		[21]
Suaal (Cough)	[13]	[21] [1] [55]
Sore-throat		[21]
Warame-shobaturriya (Bronchitis)		[21] [1]
Shaqeeqa (Migraine)		[35]
Khadar (Numbness)	[13]	
Falij (Paralysis)	[13]	
Amraze-ain (Diseases of eye)	[13] [23] [30]	
Taqteere-baul (Dribbling of urine)	[23]	
Insect bite	[23]	
Zatul janab (Pleurisy)	[23]	
Nazla (Coryza)		[55]
Zeequn nafas (Asthma)		[1] [55] [55]
Qabz (Constipation)		[1]
Suda (Headache)		[1] [35] [55]
Insanity		[1]
Saher (Insomnia)		[35] [55]
Neurodegenerative diseases		[35]

Table 3: Recent Pharmacological Studies

Action	Form	Model used	After treatment	References
Anti-microbial	Extract	*in vitro*	Exhibited anti-microbial activity	[11] [56] [57]
Analgesic	Extract	Mice	Inhibited writhing reflex	[39]
Anthelmintic	Extract	Rat	Reduction of eggs in faeces, Reduction of worm count of animals	[34]
Anti-epileptic	Extract	Rat	Prevent the development of epileptogenesis	[47]
Anti-oxidant	Extract	*in vitro* and Rat	Scavenged free radicle, Reactivation of hepatic glutathione reductase enzyme	[51] [52] [51] [46]
Anti-inflammatory	Extract	*in vitro*	Inhibited the production of pro-inflammatory cytokines	[38]
Anti-diarrhoeal	Extract	Mice	Reduced total weight of wet faeces	[37]
Anti-cancerous	Extract	*in vitro*	Inhibited cancerous cells	[48]
Anti-adipogenic	Extract	Rat	Shown hypolipidemic activity	[41]
Anti-diabetic	Extract	*in vitro*, Rat	Released insulin and inhibited α-glucosidase Reduced blood glucose level	[43] [42]
Anti-hypertensive	Extract	Rat	Lowered systolic and diastolic blood pressure	[53]
Neuro-protective	Extract	Rat	Improved neuro-behaviour performance	[45]

Hepato-protective	**Extract**	**Rat**	**Restoration of liver enzymes**	**[46]**
Nephro-protective	**Extract**	**Rat**	**Nephro-protective effect**	**[44]**
Anti-cholinergic	**Extract and Essential oil**	***in vitro***	**β asarone in the essential oil showed maximum AChE inhibitory potential**	**[50]**
Anti-depressant	**Extract**	**Mice**	**Reduction in immobility period in TST and FST**	**[61]**
Anti-HIV	**Extract**	***in vitro***	**Inhibition of HIV-1 reverse transcriptase**	**[67]**
Bronchodilator	**Extract**	**Isolated guinea-pig trachea and atria**	**Inhibited force and rate of contraction**	**[63]**
Cardiac depressant	**Extract**	**Isolated rabbit heart**	**Suppressed the force of ventricular contraction and heart rate**	**[63]**
Coronary vasodilator	**Extract**	**Isolated bovine coronary arterial ring**	**Inhibited U46619 (20Nm)- pre contractions**	**[63]**
Anti-spasmodic	**Extract**	**Isolated rabbit jejunam**	**Inhibited contractions**	**[36]**
Anticellular	**Extract**	***in vitro***	**Inhibited proliferation of human peripheral blood mononuclear cells**	**[64]**
Immunosuppressive	**Extract**	***in vitro***	**Inhibited production of NO, IL-2 and TNF-alpha**	**[64]**
Neuro-modulatory	**Extract**	**Mice**	**Reversed stereotypy behaviour, potentiated catalepsy**	**[66]**
Radioprotective	**Extract**	**Mice**	**Protected the cellular DNA from radiation-induced damage and enhanced DNA repair in whole-body irradiated mice.**	**[70] [69]**
Wound healing	**Extract**	**Rat**	**Enhanced wound contraction, decreased epithelialisation time, increased hydroxyproline content**	**[72]**
Insecticidal	**Extract**	***Sitophilus zeamais***	**Showed repellency and contact toxicity**	**[54]**
Mosquito larvicidal	**Extract**	**Aedes aegypti larva**	**Killed larval population**	**[59]**
Licicidal	**Extract**	***in vitro* (Goat lice Damalinia caprae)**	**Killed lice**	**[60]**
Cyto-toxic	**Extract**	***in vitro***	**Showed anti-tumor property**	**[68]**
Anti-pyretic	**Extract**	**Mice**	**Reduced rectal temperature**	**[40]**

DOSE (MIQDARE KHURAQ)

In powder form

1-3 g **[32] [13]**

3.5 g **[55] [73]**

60-120 mg **[22]**

1-2 g for inducing vomiting **[22]**

ADVERSE EFFECT (MUZIRRAT)

It may cause some harm to brain although it has been described as brain tonic **[55] [6]**.

CORRECTIVE (MUSLEHAT)

Saunf (*Foeniculum vulgare* Linn.) **[55] [6] [74] [74]**

Sikanjbeen **[55] [6] [74]**

Zeera (*Carum carvi* L.) **[55] [6] [74]**

Zarawand (*Aristolochia longa* Linn.*)* **[55] [6] [74]**

SUBSTITUTE (BADAL)

Equal part of Zeerah kirmani (*Carum carvi* L.) **[75] [76] [30] [13] [73]**

2/3 part of Zarawand (*Aristolochia longa* Linn.) **[76] [30] [13]**

1/3 part of Rewand (*Rheum emodi* Wall.) **[75] [13]**

FORMULATIONS (MURAKKABAT)

Majun Waj, Majun Biladur, Mufarrah Kabeer, Anqaruya Kabeer, Anqaruya

Sagheer, Itrifal Kabir, Itrifal Khabs-e-Akbar, Majun Harmus, Majun Nisyan, Roghan Surkh, Roghan Biladur **[77] [78] [79] [55] [2] [80] [81]**.

CONCLUSION

Through this review it can be concluded that Waj turki (*Acorus calamus*) is a well-known drug which is described in classical text by Unani Scholars for the treatment of various ailments. Many medicinal active compounds have been isolated from Waj turki. Many *in vitro* and *in vivo* studies have been done on this drug. It is used in the treatment of headache, insomnia, fevers, delirium, hysteria, migraine, bodyache, neurodegenerative diseases and inflammations. It has been explored successfully for various formulations. However, more study should be conducted to exploit the full potential of this crop as medicine.

CONFLICT OF INTEREST

Authors declare no conflict of interest.

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REFERENCES

[1] R. Balakumbahan, K. Rajamani and K. Kumanan, "Acorus calamus: An overview," *Journal of Medicinal Plant Research,* vol. 4, no. 25, pp. 2740-2745, December 2010.

[2] N. Shahzad, M. A. Alam, N. S. A. and K. Asma, "Phytochemical and pharmacological studies of Vaj Turki (Acorus calamus Linn.) & Unani Description– A Review," *International Journal of Pharma Sciences and Research,* pp. 1241- 1244, october 2015.

[3] The Wealth of India, vol. 1:A, New Delhi: Publications and Information Directorate, p. 63.

[4] R. Singh, P. K. Sharma and R. Malviya, "Pharmacological Properties and Ayurvedic Value of Indian Buch Plant (Acorus calamus): A Short Review," *Advances in Biological Research,* vol. 5, no. 3, pp. 145-154, 2011.

[5] P. V. V, S. L. Belsare, C. R. M and V. J. V, "Acorus Calamus: An Overview," vol. 2, no. 10, pp. 518-529, 2011.

[6] I. Habul, Kitab -AL-Makhtarat Fi Al-Tibb, vol. 2 and 3 (Urdu Translation: CCRUM), New Delhi: Department of AYUSH, Ministry of Heralth and Family Welfare, Government of India, 2005.

[7] I. Sina, Al-Qanun Fi Al-Tibb, English edition. (Trans: Dept. of Islamic Studies, Jamia Hamdard), New Delhi, 1998.

[8] B. Ibn, Al-Jamiul Mufradat Al-Advia

wa Al-Aghzia (Urdu Trans: Central Council for Research in Unani Medicine), vol. 4, New Delhi: Department of AYUSH, Ministry of Health and Family Welfare, Government of India., 2003.

[9] Z. Razi, Maqala Fi Abdal Al-Advia Al-Mustamla Fi Al-Ilaj (Trans: CCRUM), New Delhi: Ministry of Health and Family Welfare, Government of India, 1999.

[10] Z. Razi, Kitab-ul-Hawi (Urdu translation), vol. 22, New Delhi: CCRUM, Ministry of Health and Family Welfare, Government of India, 2008, p. 10.

[11] S. Phongpaichit, N. Pujenjob, V. Rukachaisirikul and M. O. , "Antimicrobial activities of the crude methanol extract of Acorus calamus Linn.," *Songklanakarin J.Sci.Technol,* pp. 517-523, 2005.

[12] H. Imam, Z. Riaz, M. Azhar, G. Sofi and A. Hussain, "Sweet flag (Acorus calamus Linn.): An incredible medicinal herb," *International Journal of Green Pharmacy,* vol. 7, no. 4, pp. 288- 296, 2013.

[13] H. Kabeeruddin, Mukhzinul Mufradat, Sheikh Basheer and Sons, 1951, pp. 290-291.

[14] D. Jayaweera, "Medicinal plants (indigenous and exotic) used in Ceylon (Part-1)," *National Science foundation of Srilanka,* p. 121, 1981.

[15] C. S. Shah and J. S. Qadry, A Text Book of Pharmacognosy, Eleventh ed., Ahmedabad: B.S. Shah Prakashan, 1995-96.

[16] A. Ranjan, P. Jain, B. Singh, P. Singh and H. Sharma, "Acorus Calamus L.: An Insight Review of Botany, Chemistry, Medicinal Uses and Cultural Practice," *Journal of Chemical, Biological and Physical Sciences,* vol. 6, pp. 1027-1045, July 2016.

[17] B. K. Das, A. V. Swamy, B. C. Koti and P. C. Gadad, "Experimental evidence for use of Acorus calamus (asarone) for cancer chemoprevention," *Heliyon,* pp. 1-10, 2019.

[18] A. Muthuraman and N. Singh, "Acute and sub-acute oral toxicity profile of Acorus calamus (Sweet flag) in rodents.," *Asian Pacific Journal of Tropical Biomedicine,* vol. 2, no. 2, pp. S1017-S1023, February 2012.

[19] K. M. Nadkarni, Indian Materia Medica, vol. 1, Mumbai: Bombay Popular Prakashan, 2009, pp. 35-37.

[20] Unani Pharmacopoeia of india, vol. 4, New Delhi: CCRUM, Department of

AYUSH, Ministry of Health and Family Welfare, Government of India, 2008, pp. 1-107.

[21] K. R. Kirtikar and B. D. Basu, Indian Medicinal PlantS, Vols. 1-4, Dehradun: International Book Distributers, 2012.

[22] "Ayurvedic Pharmacopoea of India".

[23] M. N. Ghani, Khazain-ul-Advia, vol. 3, New Delhi: Aijaz Publishing House, 1921, p. 413.

[24] L. V. Asolkar, K. K. Kakkar and O. J. Chakre, Glossary Of Indian Medicinal Plants With Active Principles, vol. 1, New Delhi: Publications and information directorate (CSIR), 1992.

[25] N. Prajapati, S. Purohit, A. Sharma and T. Kumar, A Handbook of Medicinal Plants, 1 ed., Jodhpur, Rajasthan: Agro bios, 2009, pp. 13-14.

[26] A. Kaushal and R. Arora, "Pharmacognostic Study of Acorus Calamus," *Int J Ayu Pharm Chem.,* vol. 2, no. 1, pp. 63-68, 2015.

[27] W. Dymock, C. Warden and D. Hooper, Pharmacographia India, vol. 2, New Delhi: Srishti Book Distributors, p. 541.

[28] M. Kabiruddin, Ilmul Advia Nafisin, New Delhi: Aijaz Publication, 2007.

[29] A. I. Abbas Majusi, Kamil-us-sana (Trans: Urdu), New Delhi: Idara kitab-us-Shifa, 2010.

[30] I. Rushd, Kitab al Kulliyat, 2nd ed., New Delhi: CCRUM, Ministry of Health and Family Welfare, 1987, p. 260.

[31] G. R. Shetty and A. M. Shruthi, "A Review on Pharmacology of Acorus calamus- An Endangered Medicinal Plant," *International Journal of Pharma and Bio Sciences,* vol. 6, no. 1, pp. 605-621, 2015.

[32] M. Kabiruddin, Ilmul Advia Nafisin, New Delhi: Aijaz Piublication, 2007.

[33] A. D. S, R. Bawankar and S. Babu, "Current status on biologicalactivities of Acorus Calamus- A review," *International Journal of Pharmacy and Pharmaceutical Sciences,* vol. 6, no. 10, pp. 66-71, 2014.

[34] P. Nath and A. K. Yadav, "Anthelmintic activity of a standardized extract from the rhizomes of Acorus calamus Linn. (Acoraceae) against experimentally induced cestodiasis in rats," *Journal of Intercultural Ethnopharmacology,* vol. 5, no. 4, pp. 1-5, 2016.

[35] D. Yadav, S. Srivastava and Y. B. Tripathi, "Acorus Calamus: A Review," vol. 6, no. 4, pp. 62-67, 2019.

[36] S. A. A. M. S. F. Gilani AH,

"Antispasmodic effect of acorus calamus Linn. Is mediated through calcium channel blockade.," *Phytother Res ,* vol. 20, pp. 1080-4, 2006.

[37] F. G. Shoba and M. Thomas, "Study of antidiarrhoeal activity of four medicinal plants in castor-oil induced diarrhoea," *Ethnopharmacol,* vol. 76, no. 1, pp. 73-76, 2001.

[38] T.-H. H. S.-G. L. Hyeri K, "Anti-inflammatory activity of a water extract of Acorus calamus L. leaves on keratinocyte HaCaT cells," *J Ethnopharmaol,* vol. 122, no. 1, pp. 149-56, 2009.

[39] S. M. Zahid Hosen, R. Das, Z. B. Rahim, N. Chowdhury, L. Paul and D. Saha, "Study of Analgesic Activity of the Methanolic Extract of Acorus calamus L. and Oroxylum indicum Vent by Acetic Acid Induced Writhing Method," *Bulletin of Pharmaceutical Research,* vol. 1, no. 3, pp. 63-67, December 2011.

[40] A. Daniel, R. Ambalavanan, E. P. Sabina and S. A. Devi, "Evaluation of analgesic, antipyretic and ulcerogenic activities of Acorus calamus rhizome extract in Swiss Aalbino mice," *Research Journal of Pharmaceutical, Biological and Chemical Sciences,* vol. 5, no. 6, pp. 503-507, 2014.

[41] R. S. Parab and S. A. Mengi, "Hypolipidemic activity of Acorus calamus L. in rats," *Fitoterapia,* vol. 73, no. 6, pp. 451-5, 2002.

[42] P. D and F. A. Zubair, "Evaluation of hypoglycemic activity of methanolic extract of Acorus calamus (Linn.) roots in alloxan induced diabetes rat model," *International Journal of Basic and Clinical Pharmacology,* vol. 6, no. 11, pp. 2665-2670, November 2017.

[43] Z. D. Z. C. F. C. L. Y. Y. B. H. Q.-j. Wu HS, "Insulin sensitising activity of ethyl acetate fraction of Acorus calamus L. in vitro and in vivo," *J Ethnopharmacol,* vol. 123, no. 2, pp. 288-92, 2009.

[44] K. T. J. T. S. S. Prasad L, "Acorus calamus extracts and nickel chloride, prevention of oxidative damage and hyperproliferation response in rat kidney," *Bio Trace Elem Res,* vol. 113, no. 1, pp. 77-92, 2006.

[45] K. V. K. A. M. M. M. R. K. M. Y. S. R. C. Shukla P K, "Neuroprotective effect of Acorus calamus against middle cerebral artery occlusion-induced ischaemia in rat," *Hum Exp Toxicol,* vol. 25, no. 4, pp. 187-194, 2006.

[46] S. K. j. S.Palani, "Therapeutic efficacy of antihepatotoxic and antioxidant

activities Acorus Calamus on acetaaminophenon induced toxicity in rat.," *International journal of integrative biology ,* vol. 7, no. 1, pp. 39-44, 2009.

[47] R. K. G. D. Hazra R, "Inhibitory role of Acorus calamus in ferric chloride-induced epileptogenesis in rat," *Hum Exp Toxicol,* vol. 26, pp. 947-53, 2007.

[48] V. D. J. S. S. S. K. K. J. N. Bains JS, "Novel lectins from rhizomes of two Acorus species with mitogenic activity and inhibitory potential towards murine cancer cell lines," *International Immunopharmacology,* vol. 5, pp. 1470-8, 2005.

[49] M. &. S. S. Mathew, "In vitro screening for anti-cholinesterase and antioxidant activity of methanolic extracts of ayurvedic medicinal plants used for cognitive disorders," *PloS One,* vol. 9, no. 1, 2014.

[50] V. K. M. M. P. J. H. Pulok Kumar Mukherjee, "In vitro acetylcholinesterase inhibitory activity of the essential oil from Acorus calamus and its main constituents," *Planta Medica,* vol. 73, pp. 283-286, 2007.

[51] G. D. Asha Devi S, "Antioxidant activities of methanolic extracts of sweet-flag (acorus calamus) leaves and rhizomes.," *Journal of herbs, spices and medicinal plants ,* vol. 17, pp. 1-11, 2011.

[52] D. R. Manikandan S, "Antioxidant property of alpha-asarone against noise-stress-induced changes in different regions of rat brain," *Pharmacol Res,* vol. 52, no. 6, pp. 467-74, 2005.

[53] P. Patel, J. Vaghasiya, A. Thakor and J. Jariwala, "Antihypertensive effect of rhizome part of Acorus calamus on renal artery occlusion induced hypertension in rats," *Asian Pacific Journal of Tropical Disease,* vol. 2, pp. S6-S10, 2012.

[54] Y. Yao, W. Cai, C. Yang, D. Xue and Y. Huang, "Isolation and characterization of insecticidal activity of (Z)- asarone from Acorus calamus L.," *Insect Science,* vol. 15, no. 3, pp. 229-236, 2008.

[55] M. A. Kalam, G. Ahmad, A. Shahzad, S. A. Ahmad Maqbul and M. S. Akhtar, "Therapeutic Potential of Rhizomatous Plants Used in Unani Medicare System," pp. 446-448, 2019.

[56] M. Ghosh, "Antifungal Properties of Haem Peroxidase from Acorus Calamus," *Annals of Botany,* vol. 98, no. 6, pp. 1145-1153, 2006.

[57] A. D. S and D. Ganjewala,

"Antimicrobial activity of Acorus calamus (L.) rhizome and leaf extract," *Acta Biologica Szegediensis,* vol. 53, no. 1, pp. 45-49, 2009.

[58] M. D. S. A. K. N. K. K. S. A. e. a. Kumar R, "Reinvestigation of structure-activity relationship of methoxylated chalcones as antimalarials, synthesis and evaluation of 2,4,5-trimethoxy substituted patterns as lead candidates derived from abundantly available natural β-asarone.," *Eur J Med Chem,* vol. 45, no. 11, pp. 5292-5301, 2010.

[59] Z. S. G. Imam H, "Mosquito Larvicidal efficacy of Acorus calamus extracts against Aedes aegypti L. larvae.," *Asian Pac J Trop Biomed ,* vol. 2, pp. 1-4, 2012.

[60] K. S. A. P. K. S. R. e. a. Nalamwar VP, " In vitro Licicidal Activity of Different Extracts of Acorus calamus Linn. (Araceae) Rhizome.," *Int J Pharm Tech Res,* vol. 1, pp. 96-100, 2009.

[61] P. S. k. S. R. N. V. P. S. K. H. L. S. A. M. S. N. Pushpa V H, "Antidepressant activity of methanolic extract of acorus calamus leaves in albino mice," *IJPT,* vol. 5, no. 2, pp. 5458-5465, 2013.

[62] S. R. Tripathi AK, "Clinical study on an indigenous drug vaca (Acorus calamus) in the treatment of depressive illness," *J Res Ayur Siddha,* vol. 16, pp. 24-34, 1995.

[63] A. J. Shah and A. H. Gilani, "Bronchodilatory effect of Acorus calamus (Linn.) is mediated through multiple pathways," *Journal of Ethnopharmacology,* pp. 471-477, 2010.

[64] M. K. P. M. R. S. R. C. Y. V. S. P. Mehrotra S, "Anticellular and immunosuppressive properties of ethanolic extract of Acorus calamus rhizome," *Int Immunopharmacol,* vol. 3, no. 1, pp. 53-61, 2003.

[65] S. R. M. M. J. T. Dwivedi P, "A traditional approach to herbal Nootropic agents: An overview.," *Int J Pharm Sci Res ,* vol. 3, pp. 630-636, 2012.

[66] G. T. V. K. N. J. K. M. V. P. Vengadesh PK, "Neuromodulatory effect of Acrous calamus leaves extract on dopaminergic system in mice.," *Int J Pharm Tech Res.,* vol. 1, pp. 1255-9, 2009.

[67] S. S. P. P. H. S. C. K. Silprasit K, " Anti HIV 1 reverse transcriptase activities of hexane extracts from some Asian medicinal plants.," *J Med Plant Res,* vol. 5, pp. 4194-201, 2011.

[68] G. G. K. R. M. L. Rajkumar V, "

Evaluation of cytotoxic potential of Acorus calamus rhizome.," *Ethnobotanical Leaflets ,* vol. 7, pp. 832-9, 2009.

[69] N. C. Sandeep D, "Radioprotection by Acorus calamus: Studies on in vivo DNA damage and repair.," *Int J Low Radiat,* vol. 7, pp. 121-32, 2010.

[70] D. Sandeep and C. K. K. Nair, "Protection from lethal and sub-lethal whole body exposures of mice to-gamma radiation by Acorus calamus L.: Studies on tissue antioxidant status and cellular DNA damage," *Exp Toxicol Pathol,* vol. 64, no. 1-2, pp. 57-64, 2012.

[71] G. A. Shah AJ, "Aqueous methanolic extract of sweet flag (Acorus calamus) possesses cardiac depressant and endothelial derived hyperpolarizing factor mediated coronary vasodilator effects.," *J Nat Med,* vol. 66, pp. 119-26, 2012.

[72] J. R. J. A. J. D. C. H. Jain N, "Evaluation of wound healing activity of acorus calamus Linn.," *Natural Product Research,* vol. 24, no. 6, pp. 534-41, 2010.

[73] M. Haleem, Mufradat e Azizi, New Delhi: CCRUM, 2009, pp. 17-18.

[74] G. M. Nabi, Makhzanul Mufradat Ba Maroof Khwas ul Advia, New Delhi: CCRUM, Department of AYUSH. Ministry of Health and Family Welfare. Government of India, 2007.

[75] I. Sina, Al-Qanun Fil-Tibb (English Translation of the Critical Arabic Text). Part 1, New Delhi: Department of Islamic Studies, Jamia Hamdard, 1993, pp. 377-378.

[76] N. Ghani, Khazain-ul-Advia, New Delhi: Idara Kitab-us-Shifa, p. 706.

[77] M. Kabiruddin, Bayaze Kabir, 5 ed., vol. 2, New Delhi: Aijaz Publication, 1935.

[78] M. Kabiruddin, Al-Qarabadeen, New Delhi: CCRUM, Department of AYUSH, Ministry of Health and Family Welfare, Government of India, 2006.

[79] I. Sina, Al Qanoon Fi Al-Tibb (Urdu Trans: Kantoori GH), Vols. 2,3,5, New Delhi: Aijaz Publication, 2010.

[80] Unani Pharmacopoeia of India, Vols. 1,5, New Delhi: CCRUM, Dept. of AYUSH, Ministry of Health and Family Welfare, Government of India, 2008, p. 42.

[81] A. E. Raja, M. Vijayalakshmi and G. Devalarao, "Acorus calamus Linn. Chemistry and Biology," *Research J. Pharm. and Tech,* vol. 2, no. 2, pp. 256-261, 2009.