

Ayurvedic Significance of World’s Ancient Spice, *Trachyspermum ammi* Linn. (Ajwain)

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Abstract— Medicinal plants have a significant role in maintaining the well-being of human kind. *Trachyspermum ammi*, commonly known as ‘Ajwain’ in Hindi, is among the most ancient spices of the world. It is considered as the world’s topmost herbal spice because of its economic significance and important applications in the drug industry. It has significant place in Ayurvedic pharmacopeia and also extensively used in many folkloric medication system of the world to treat variety of human ailments. The plant has a rich phytochemical profile consisting of many important phytochemicals including carvone, thymol, limonene, hygroscopic saponin, crystalline flavone and dillapiole which are associated with many important therapeutic activities like anti-bacterial, anti-ulcer, anti-platelet, anti-oxidant and anti-inflammatory etc. The main objective of the present study is to summarize the overall importance of *Trachyspermum ammi* in terms of its photochemistry and therapeutic uses.

Keywords— Ajwain, Rasapanchak, Thymol, Limonene, Antibacterial.

I. INTRODUCTION

As per World Health Organization's (WHO), approximately 4000 million individuals around the globe use restorative plant as remedies consistently. Though the allopathic medications are available in these nations, still therapeutic plants have stayed a mainstream treatment, attributable to the confidence in their efficacy [1]. There are almost 2000 ethnic groups world which has their own traditional medication systems [2]. Since ancient times herbal plants are being in use in the health care practices. Herbal plants usually contain numerous chemical constituents which have numerous biological activities [3,4]. *Carum copticum* L. syn *Trachyspermum ammi* (Linn.) is an important aromatic herbal spice which is commonly known as Ajowan or Ajwain (Figure 1). The genus name *Trachyspermum* has originated from two Greek words, “*Trachy*” means rough and “*spermum*” means “seeded”, while species ‘*ammi*’ is a Latin word. The plant belongs to the family *Apiaceae*(*Umbelliferae*) [5-7]. The Hindi name Ajwain is originated from two Sanskrit words Vavanaka or Ajomoda which are derived from the Greek word *yavnaha* [8]. This plant has great medicinal importance and also used as a spice which is used in Indian dishes like in curry due to its aromatic smell and pungent taste [9,10]. Each parts of this plant exhibit many important pharmacological activities [11]. The main utilizing parts of this plant are its fruits and seeds. Seeds are mainly used in snacks, pastries and as a spice. Decoction of ajwain seeds is utilized as first line treatment in Ayurveda for abdominal discomfort, loose bowels, cough and stomach inconvenience [12]. While the fruits of Ajwain is found to have antiseptic, anti-fungal/anti-bacterial and anthelmintic properties [13]. The main active phytochemical constituents of the plant i.e. thymol and carvacrol are associated with many important therapeutic activities like antispasmodic, germicide, anti-fungal properties, antitussive, antiseptic and expectorant properties [14-16]. The Ajwain seeds also have carminative,

diuretic, anesthetic, anti-microbial, antiviral, anti-ulcer, anti-platelet and hepatoprotective properties [17]. Taxonomy and vernacular names of *Trachyspermum ammi* are given in table 1 and 2.



Fig. 1. *Trachyspermum ammi*

TABLE 1. Taxonomy of *Trachyspermum ammi*

Taxonomic rank	Taxon
Kingdom	Plantae
Division	Magnoliophyta
Order	Apiales
Class	Magnoliopsida
Family	Apiaceae
Genus	<i>Trachyspermum</i>
Species	<i>ammi</i>
Common name	Ajwain

TABLE 2. Vernacular Names of *Trachyspermum ammi* [18-25]

English	Bishop's weed, Carom, falsly lovage seeds, ajwan seed, Ethiopian cumin
Hindi	Ajwain, Spairkai
Sanskrit	Dipyaka, Yamini, Yaminiki, Yaviniki
Punjabi	Lodhar
Bengali	Yamani, Yauvan, Yavan, Javan, Yavani, Jain, Jowan
Gujrati	Ajma, Ajmo, Yavan, Javain
Kannada	Oma, Yom, Omu
Kashmiri	Kath
Malayalam	Omam
Marathi	Onva
Oriya	Juani
Tamil	Omam
Telugu	Vamu
Arabic	Kamun Mulki
Persian	Nankhah, Zenyan
Urdu	Azwain Desi
Armenian	Hounastan
China	Xi Ye Cao Guo Qin
Dutch	Ajwan
Arabic	Kammun or Al-Yunan

Botanical Description

Ajwain is a small, highly branched annual herbaceous plant belongs to the *Apiaceae* (*Umbelliferae*) family. The stem of the plant is striated erect and including glabrous or minutely pubescent properties which may grow up to 90 cm tall [26]. It consists of feathery leaves that are 2.5cm long with 16 umbellets which bears 6-16 flowers towards the head portion. The flowers of this plant are white and actinomorphic in nature. The leaves are pinnately shaped with a terminal and 7 pairs of leaflets. The fruits of the plant are small, egg shaped, aromatic and greyish-brown in colour [27].

Geographical Distribution

Trachyspermum ammi is known to be originated in Egypt and the eastern Mediterranean region [28]. It is cultivated in Iraq, Iran, Afghanistan, Pakistan and in India [29]. It is broadly grown in arid and semi-arid regions [30] and mainly cultivated in black soil where soil contain significant concentration of salt [31,32]. In India, ajwain is primarily cultivated in Rajasthan and Gujrat whereas it is least cultivated in states like Madhya Pradesh, Uttar Pradesh, Maharashtra, Bihar and West Bengal and other states [33].

Phytochemicals Constituents

Trachyspermum ammi seeds contain various chemical constituents such as fiber (11.9%), carbohydrates (38.6%), tannins, glycosides, moisture (8.9%), protein (15.4%), fat (18.1%), saponins, flavone and mineral matter (7.1%) like calcium, phosphorus, iron and nicotinic acid. Thymol and essential oil (2-4%) present in the fruits are considered as the major constituents (35%-60%) of the plant [34,35]. The non-thymol constituents which are present in Ajwain are paracycymene, γ - terpinene, α - and β -pinenes, dipentene, α - terpinene, and carvacrol [36]. Camphene, myrcene, and α -3-carene are present in small quantity in the plant. The alcoholic extract of plant consists of a highly hygroscopic saponin. A yellow coloured crystalline flavone extracted from the fruits which is a steroid like substance in nature contains glucopyranosyloxythymol, [37] glucoside and 25% oleoresin

which have 12% volatile oil (thymol, γ -terpinene, paracycymene, and α - and β -pinene [38]. The major oil components of *T. ammi* are carvone 46%, limonene 38%, and the dillapiolene 9% [39]. Two novel glycosyl constituents are found namely 6-hydroxycarvacrol 2-O- β -D-glucopyranoside and 3,5-dihydroxytoluene 3-O- β -D-galactopyranoside [40]. Many other chemical constituents are identified via Gas Liquid Chromatography and Gas Chromatography –Mass Spectroscopy analysis and those constituents are α -thujene, α -pinene, sabinene, β -pinene, α -phyllanderene, γ -terpinene, β -phyllanderene, terpinene-4-ol, thymol, carvacrol, styrene and δ -3-carene [41]. Ajwain fruits have various minerals like aluminium, calcium, cadmium, copper, iron and lithium, chromium, cobalt, copper, iodine, manganese, phosphorus and zinc and also have vitamins like riboflavin, thiamine, carotene [42]. 25 compounds are extracted from the water-soluble part of the methanolic extract of the fruits. Some of them are (2S,6Z)-3,7-dimethyloct-3(10)-ene-1,2,6,7-tetrol 1-O- β -D-glucopyranoside; 6-hydroxythymol 6-O- β -D-glucopyranoside; 6-hydroxythymol 3-O- β -D-glucopyranoside 10; C₁₆H₂₄O₇ as 7-hydroxythymol 3-O- β -D-glycopyranoside; C₁₆H₂₈O₇ as (4R,6S)-p-menth-1-ene-4,6-diol 4-O- β -D-glucopyranoside; C₂₂H₃₄O₁₂ as 6-hydroxythymol 3,6-di-O- β -D-glucopyranoside; C₁₆H₂₈O₇ as (4S)-p-menth-1-ene-4,7-diol 4-O- β -D-glucopyranoside; C₁₆H₂₈O₇ (4R,6S)-p-menth-1-ene-4,6-diol 4-O- β -D-glucopyranoside ; C₁₆H₂₆O₇ as 3 β -hydroxy-p-menth-1-en-4 β , 5 β -oxide 3-O- β -D-glucopyranoside 3,7-dimethyloct-3(10)-ene-1,2,6,7-tetrol (a mixture of two stereoisomers), p-menth-3-ene-1 β , 2 β , 5 β -triol, (2S, 3R)-2-methylbutane-1,2,3,4-tetrol[12] and (3R)-2-hydroxymethylbutane-1,2,3,4-tetrol respectively [43-45].

Traditional and Modern View

Folk View

Ethnobotany is truly an accepting field of science around the globe that unites men to plants. Around 80% of the overall population utilize native plants as their 1st aid therapy [46,47]. Drugs derived from medicinal herbs have a very significant role in local regions of several nations for balancing up the essential medical services in the absence of modern system of medicine [48,49]. In these zones, there are additional social factors that support the use of medicinal plants, for instance, the possibility of correlation of culture with the environment, a "man-earth" relationship [50]. *Trachyspermum ammi* was first used across the globe for its diuretic and kidney stone evacuation properties [51]. It is utilized as a folk medicine in cough, gas, and scanty menstruation in Pakistan [52]. Rural People of Jhansi, use fruits and leaves in dyspepsia, diarrhoea and cough [53]. The seeds are utilized as carminative. Seeds are effective against stomach and liver related problems. In Sargodha, Pakistan seeds are taken orally with salt for menstrual cramp relief [54]. The seeds are utilized as an antispasmodic, stimulant, tonic, carminative, for kidney stone pain in Mauritius [55]. In some tribes of Madhya Pradesh, ajwain is mixed with jaggery and warm ghee and taken orally to provide strength right after the pregnancy [56]. Seeds are taken with milk/water to treat stomach ache and gut issues.

Seeds are utilized against fever in Swat, Pakistan [57]. Seed powder along with black salt is effective in abdominal pain [58,59]. Seed powder in mixture with ghee and raw sugar is utilized in the management of scanty menstruation and to clear out the uterus. It is effective in maintaining the menstrual

cycle after parturition. These folk practices are popular in Samahni valley, Pakistan [60]. Persian traditional healers use eye and ear drop formed from ajwain seeds to control the tainted conditions and to hear-able shortcomings [61].

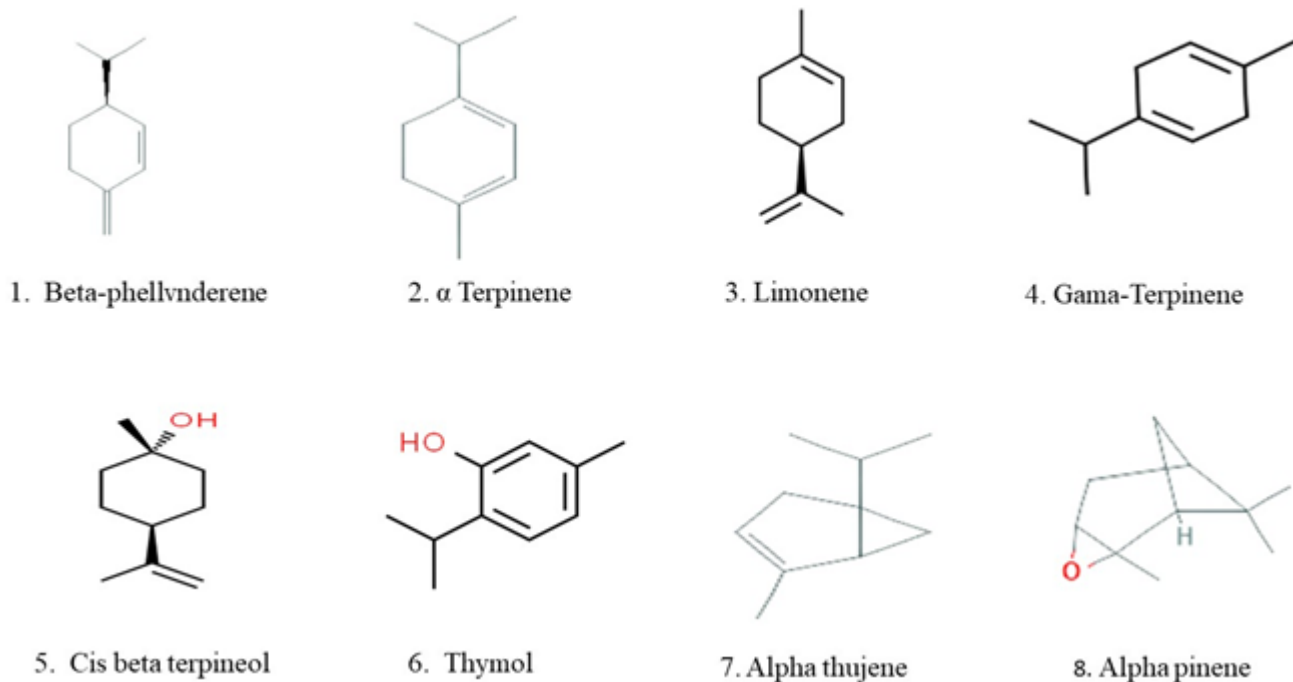


Fig. 2. Chemical Structures of some of phytochemical constituents of *Trachyspermum ammi*

Ayurvedic View

(*Trachyspermum ammi* is a commonly used in Ayurvedic practices in India. In the Ayurveda literature it is mostly called as ‘Ajmoda’. According to Ayurveda, ajwain is a strong cleanser. It is helpful in emesis, bracing the appetite and enhancing digestion. It is widely recommended to alleviate gas and discomfort in the stomach. Ajwain is useful for balancing the *Vata* and *Kapha*, and increases *Pitta*. It contributes the pungent taste, with a slight bitter undertone [62]. Rasapanchak of *Trachyspermum ammi* is given in table no. 3.

TABLE 3. Rasapanchak of *Trachyspermum ammi* as per Ayurveda [63]

Sanskrit/English	Sanskrit/English
Virya/Potency	Ushna/Hot
Vipak/Metabolic Property	Katu/Pungent
Guna/Physical Property	Laghu/Light, Ruksha/Dry, Tikshan/Sharp
Rasa/Taste	Katu/ Pungent

Actions of Ajwain as per Ayurveda

- Sansthanik karam wahay: Locally it is used as an Vedna sansthapak analgesic or pain killers.
- Abhyantar pachansanstan: It works on the gastro-intestinal tract and also used to kill the parasites.
- Raktavah sanstan: It increases the blood circulation.
- Sawashan sanstan: It decreases the Kapha (lubrication) present in the human body.
- Mutrvah sanstan: It is helpful in urination.

- Prajanan-sansthan: It has significant fertility properties.

Modern View

In the modern scenario contamination, adulteration, and misidentification are the leading factors in the quality degradation of herbal drugs. Substitution, fraudulent substitution, admixture, mislabelling, contamination and filler etc. are most frequently used terminologies in the species adulteration in the drug market. The reasons behind adulteration are over exploitation of specific plants, unfavourable natural conditions, afforestation, and all these have directly or indirectly caused endangerment and extinction of some important plant species. Adulteration has severe adverse impacts on the consumer health [64-66]. To ensure the quality of herbal drugs, proper authentication and standardization protocols must be implied. The manufacturing of herbal drugs must be done carefully by inducing more checkpoints throughout the process i.e. from the collection of the raw plant material to the formation of the end product i.e. herbal drug [67].

Reported Therapeutic Properties of *Trychspermum ammi*

Trychspermum ammi is associated with many important therapeutic properties. Some of the reported studies on therapeutic properties are discussed below:

Anti-microbial

Hassanshahian et al., evaluated the anti-bacterial potential of *Trychspermum ammi* against *Klebsiella pneumoniae*, *E. coli* and *Staphylococcus aureus* which were isolated from the urine

culture of hospitalized patients of urinary tract infection. It was revealed from the study that essential oil of the plant exhibited activity against *E.coli* at minimum inhibitory concentration (MIC) of 100ppm whereas MIC was observed highest against *Klebsiella pneumoniae* i.e. 250ppm [68]. Usha et al., reported the effective anti-bacterial actions of *Trichyspermum ammi* against gram negative microbial strains. It was observed that ethanol extract of the plant was effective against gram negative bacteria *Pseudomonas sp.*, whereas acetone extract showed potent activity against *Escherichia coli* [69]. Hussein et al., reported the anti-viral potential of methanolic extract of *Trichyspermum ammi* against Hepatitis C Virus (HCV) protease in an *in-vitro* study. The extract was found to be potent inhibitory agent against the tested virus [70]. Abtahi et al., reported the anti-fungal activity of flavonoid extract of *Trichyspermum ammi* on pro-inflammatory bio-markers such as interleukin-18 (IL-18) and tumor necrosis factor (TNF- α) [71].

Anti-oxidant

Umar et al., evaluated the anti-oxidant potential of *Trichyspermum ammi* in collagen induced arthritis (CIA) in Wistar rat models. The treatment of models with the oral administration of the plant extract at the dosage of 100 mg/kg caused changes in all the associated parameters like decrease in the levels of oxidative stress markers like thiobarbituric acid reactive substances and inflammation markers like elastase. Whereas it increased the activities of enzymatic antioxidants like superoxide dismutase and catalase [72]. Ranjbaran et al., carried out a study to investigate the anti-oxidant activity of essential oil of the plant and its main constituents. Lipopolysaccharide (LPS)-stimulated macrophages were used to evaluate the inhibitory actions of essential oil and its constituents against superoxide and nitric oxide production and NADH oxidase (NOX) and nitric oxide synthase (NOS) expression. Essential oil and thymol exhibited more potent anti-oxidant actions than γ -terpinene and p-cymene [73]. Suryawanshi et al., reported the potent anti-oxidant activity of hexanolic extract of *Trichyspermum ammi* leaves in 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging activity, nitric oxide radical scavenging activity, hydrogen peroxide radical scavenging activity, hydroxyl radical assays [74].

Anti-inflammatory

Aslam et al., examined the anti-inflammatory activity of *Trichyspermum ammi* different seed extracts prepared from n-hexane, chloroform and methanol solvents. The study was carried out on Carrageenan induced paw edema Wistar rat models. The minimum and maximum doses (500 and 1000 mg/kg) of the extracts were tested. It was found that 1000mg/kg dosage of n-hexane solvent extract showed maximum anti-inflammatory activity [75]. Korani et al., studied the anti-inflammatory behaviour of *Trichyspermum ammi* in on type II collagen-induced arthritis (CIA) in Wistar rat models. The study revealed the effective actions of *Trichyspermum ammi* seeds individually or in combination with ibuprofen in terms of reduction in paw thickness, arthritis score, and mRNA level of *COX2* and *iNOS* genes [76].

Anti-platelet

Srivastva et al., reported the anti-platelet activities of ethereal extract of *Trichyspermum ammi* against platelet aggregation induced by arachidonic acid (AA), epinephrine and collagen. The extract exhibited more potent inhibitory actions AA-induced aggregation. The extract had effective actions on platelet thromboxane production [77].

Anti-hyperlipidemic

Javed et al., subjected the chloroform, methanol, petroleum ether extract of *Trichyspermum ammi* against butter fed ad libitum and orally intubating cholesterol induced hyperlipidaemia rabbit models. The methanol and petroleum ether extracts at the dosage of 2 g/kg body weight powder were found to very effective against hyperlipidaemia in the models. It was found that petroleum ether extract produced more potent results in increasing HDL-cholesterol level and decreasing LDL-cholesterol level than that of methanolic extract. Also, petroleum ether extract helped in effective reduction of atherogenic index [78]. Saleem et al., reported the potent anti-hyperlipidemic activities of aqueous extract and methanol extract of the plant in triton induced hyperlipidemia rat models. The study revealed that both the extracts at the dosage of 3 g/kg and 5 g/kg significantly reduced the levels of total cholesterol, triglyceride, and low-density lipoprotein along with the remarkable increase in the high-density lipoprotein concentration in serum [79].

Anti-ulcer

Ramaswamy et al., evaluated the *Trichyspermum ammi* plant for its anti-ulcer potential. The study was carried out on different ulcer rat models. The pre-treatment of the models with the ethanolic extract of the plant at the dosage of 100mg/kg and 200mg/kg exhibited a significant lowering in the ulcer index. It significantly reduced the ulcerative lesions which suggested the effective anti-ulcer activity of *Trichyspermum ammi* [80].

Anti-amnesic

Soni et al., carried out an *in-vivo* study on mice models to evaluate the anti-amnesic activity of *Trichyspermum ammi* seed powder supplementation for 10 days. Amnesia was induced by alprazolam, scopolamine and electroshock. Various parameters were estimated during the study such as brain acetylcholinesterase activity (AChE), serum cholesterol, brain monoaldehyde (MDA), brain reduced glutathione (GSH) and brain nitrite. A remarkable increase in the step down latency of passive avoidance paradigm (PAP) and in discrimination index of object recognition task (ORT). An effective fall in the brain AChE activity, brain MDA level and brain nitrite level was observed along with the increase in brain glutathione (GSH) level [81].

Hepato-protective

Suryawanshi et al., carried out an *in-vivo* study on carbon tetrachloride (CCl₄) induced hepatotoxic rat models to investigate the hepato-protective activity of hexanolic leaves extract of *Trichyspermum ammi*. The treatment of the models with the extract caused a remarkable change in the serum levels of aspartate aminotransaminase (AST), alanine aminotransaminase (ALT) and alkaline phosphatase (ALP) and bilirubin. The extract caused a significant hepatic regeneration [82]. Zangeneh et al., reported the remarkable

hepato-protective activity of essential oil of the plant against carbon tetrachloride (CCl₄) induced hepatotoxic rat models. An effective reduction in the increased levels of alkaline phosphatase and alanine aminotransferase was observed. A decrease in the liver volume and weight along with hepatocytes and sinusoids volume was also seen [83].

II. CONCLUSION

Medicinal plants have contributed a lot to the traditional and Western medicine systems. *Trachyspermum ammi* is an ancient aromatic spice of the world that is commonly used in many home remedies to treat many diseases. It has a specific place in Ayurvedic system of medication. Various studies done on this plants have concluded that it is just not an ordinary spice but also have therapeutic actions of utmost significance. The present study also suggested the overall importance of this plant and believed that its extraordinary phytochemistry can be explored more to derive maximum benefit from the plant.

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Conflict of Interest
None

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