IJPSR (2021), Volume 12, Issue 11 (Review Article)

INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES AND RESEARCH

Received on 07 September 2020; received in revised form, 21 May 2021; accepted, 25 May 2021; published 01 November 2021

ETHNOBOTANICAL, PHYTOCHEMICAL AND PHARMACOLOGICAL SCIENCE OF *TRACHYSPERMUM AMMI* (AJWAIN) A SYSTEMATIC REVIEW

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Keywords:

Trachyspermum ammi, Chemical composition, GC-MS, Pharmacological properties

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ABSTRACT: The aim of the present investigation was a systemic review of *Trachyspermum ammi* L. (Ajwain) coming from the family Apiaceae and its medicinal significance. The seeds of ajwain include approximate three-5% crucial brownish oil, and this species additionally incorporate thymol as the principal chemical constituent at the side of a few different important constituents like β-pinene, α-terpinene, α-pinene, p-cymene, γ-terpinene, and many others. Since ajwain possesses various phytoconstituents, it shows numerous pharmacological and biological properties which have been described. Based on the literature survey, we have focused light upon its pharmacological importance and its future perspective. The present investigation revealed information like its pharmacognostic profile, chemical composition, and its biological activity. These can help a researcher in developing novel entities in the future.

INTRODUCTION: Now a day's herbal compounds as origin of drugs as there is lots of side effects in the synthetic drug. For that reason, the researchers were taking more interest in herbal remedies. Based on the folklore importance, herbal-based medicaments gained importance in treating various ailments. In recent scenario herbal based formulation plays vital role in upbringing pharmaceutical industry [1, 2] by using considering the active additives of the plant, diverse herbal drugs being prepared.

QUICK RESPONSE CODE

DOI: 10.13040/IJPSR.0975-8232.12(11).5690-97

This article can be accessed online on www.ijpsr.com

DOI link: http://dx.doi.org/10.13040/IJPSR.0975-8232.12(11).5690-97

Many researchers have been mentioned that one of the most usually used components for herbal formulations was medicinal oil or crucial oil. *T ammi* (ajwain) is the most generally recognized vintage herb from the own family Apiaceae. The herb ajwain is a conventional lively, and it is used for healing diverse illnesses in humans. Ajwain or ammi oil is used on neurological disorders, including tremor, paralysis, and continual pains.

The extract of *T. ammi* (ajwain) has been previously used for the treatment of ophthalmic infections. The Seeds of the plant have been very powerful in curing gastrointestinal diseases. The ajwain also becomes covered as a diuretic and aphrodisiac agent. The main constituent of ajwain oil is thymol. That is received from the seed of the plant. This oil displaying extensive houses like antifungal [3], antiviral and antibacterial [4], antitussive

[5] analgesic [6] antioxidant. It is also a considerable remedial element for diarrhea, flatulence, and atonic dyspepsia.

Synonyms, Scientific Classification and Morphology of *Trachyspermum ammi:*

1. Vernacular Names [7]:

Assamese: Jain.
Hindi: Ajwain, Jevain.
English: Bishop's weed.
Tamil: Omam.
Kannada: Oma, Yom, Omu.
Telugu: Vamu.
Bengali: Yamani, Yauvan, Yavan, Javan, Yavani, Yoyana.
Sanskrit: Yamini, Yaminiki, Yaviniki.
Malayalam: Oman, Ayanodakan.
Gujrati: Ajma, Ajmo, Yavan, Javain.

2. Scientific Classification: [8]

Kingdom: Plantae.
Subkingdom: Tracheobionta.
Division: Magnoliophyta.
Superdivision: Spermatophyta.
Order: Apiales.
Class: Magnoliopsida.
Family: Apiaceae.
Genus: Trachyspermum.
Species: ammi.

Ecology and Botanical Description: Ajwain is extensively grown in desiccating and semi-desiccate areas [9]. The plant is particularly advanced within the area in which the soils comprise eminent tiers of salts [10, 11]. Probably in Egypt, this plant was additionally cultivated in Afghanistan, Pakistan, Iraq, Iran, Greeks, and India [12]. In India, the plant ajwain is advanced within the states of Uttar Pradesh, Rajasthan, Punjab, Gujarat, Madhya Pradesh, Tamil Nadu, Bihar, and Andhra Pradesh, and so on. Ajwain develops well on dirt soil at a pH variety 6.5-eight.2 at temperature of between 10 - 25 ºC and RH (relative humidity) between 65-70%. Commonly the harvesting of this plant is accomplished in the course of earlier in spring and later in wintry weather.

The plant ajwain is an abundantly branched fragrant annual herb and approximately almost 60-90 cm in peak. The Stem is a blossoming compound containing sixteen umbellets and striates every umbellet retaining up to sixteen floras. The flora are white action-morphic. It contains 5 corolla, 5 stamens petals and bilobed. Also the fruit of the plant are aromatic, cordate, and ovoid **Fig. 1**. Leaves are pinnate on the terminal and contain 7 nos of pairs of lateral leaflets **Fig. 2** [13]. Fruit are grayish-brown in color, ovoid and compressed, and it includes 2 nos of mericarps **Fig. 3.**

FIG. 1: AJWAIN FLOWER

FIG. 2: LEAVES OF AJWAIN

FIG. 3: FRUITS OF AJWAIN

Microscopic Characters: The microscopic evaluation of the transverse part of the ajwain fruit indicates the presence of two carpophores. They may be hexagonal in systems and are connected with every different. The epicarps of the end result includes a unmarried layer of tangentially extended tabular cells and the mesocarp includes averagely square to polygonal tangentially prolonged tabular cells bearing about carpophores, vittae and vascular bundles reveal as a groups of thick-walled significantly extended cells. The endosperm of the end result bearing skinny surrounded cells, which might be packed with oil globules, embryo, round and small polygonal cells [14].

Pharmacognostic Profile: A Pharmacognostical assessment of any herb serves as identification marks over and above it additionally assist in the standardization of drug concerning their purity and first-rate. Its demonstration in detail organoleptic and physicochemical residences of the crude drug Hardel Danendrakumar *et al.* [15] described in an element about Organoleptic and Physicochemical homes of the drug *Trachy-spermum ammi* L (ajwain) given in **Table 1.**

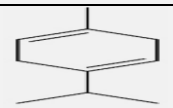
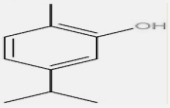
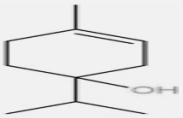
TABLE 1: ORGANOLEPTIC AND PHYSICOCHEMICAL CHARACTERISTICS OF AJWAIN POWDER

Appearance	Powder
Colour	Light brown
Taste	Pleasant
Odour	Characteristic
Foreign matter(% w/w)	2.4
Loss on drying (LOD) (%w/w)	4.7
pH of 1% w/v solution	3.23
pH of 10% w/v solution	3.35
Total ash (%)	8.6
Acid-insoluble ash (%)	0.49
Water-soluble extractive	42
Alcohol-soluble extractive	17.9

Qualitative Phytochemistry: The qualitative investigation of the *Trachyspermum ammi*, powder shows the presence of various secondary metabolites such as carbohydrates, glycosides, fixed Oils, and Steroids. The ethanolic extract of the ajwain seeds indicate the presence of Tannins, and reducing sugar along with the ether and petroleum extract demonstrate the presence of proteins, alkaloid, Sterols, amino acids. Katasani D, Srinu B *et al.* [16] described in detail about phytochemical properties of the ajwain seed.

Phytochemical Characteristics: The various phytochemical constituent obtained from the ajwain is decided by using numerous parameters including nature of the soil, climatic situations like temperature, pressure, humidity and extraction time additionally indicates the massive effect on the overall % yield and chemical composition of ajwain oil. From the GC–MS research of the vital oil oculmination of *T. ammi* are verified in **Table 2**. It disclosed that the presence of just about twenty compounds. The important oil of the ajwain accommodates two aromatic terpenes along with thymol and carvacrol. The aromatic terpenes of the oil constituted about 37.38% of thymol. However, the most important elements are acyclic monoterpene, monocyclic monoterpenes and bicyclic terpenes. The cell of acyclic monoterpene β-Myrecene. Monocyclic monoterpenes are m-Cymene (21.44 %), γ-Terpinene (26.01%), 4-Terpinenol (0.81%), and β-Phellandrene (1.60%) 17 **Table 2**. And the bicyclic terpenes are α-Pinene and β-Pinene, four-Caren, β-Pinene, and α-Thujen. similarly the crucial oil of the ajwain fruits additionally contained a few non-terpenoid kind of components that are 1-(3-isopropyliden-2.2-dimethylcyclopropyl) - isopropanon; 14.6.6-trimethyl - bicyclo [three.1.1]-hept-three-ene-2-one; 6-methyl-octene-1; 2.2-dimethyl-four.5- bis-1-propene-1.three-Dioxalane **Table 2**. Also, many of the researchers have looked at its many active phytoconstituent obtaining from the seed and leaves of the plant *T. ammi* (ajwain). They are demonstrated in **Table 3.**

TABLE 2: CHEMICAL CONSTITUENT AND THEIR STRUCTURE OBTAINED FROM *TRACHYSPERMUM AMMI* FRUITS

S. no.	Chemical Constituent	Structure	No	Chemical Constituent	Structure
1	γ-Terpinene4-methyl-1-isopropyl- 1.4-Cyclohexadiene		2	Limonene-1.2-oxperoxide	
3	Thymol 2-isopropyl-5-Methyl phenol		4	4-Terpinenol 4-methyl-1- isopropyl-3-cyclohexen-1-ol	

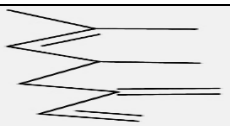
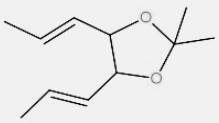
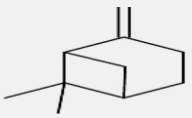
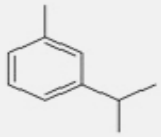
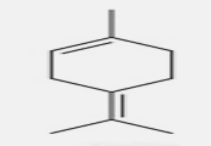
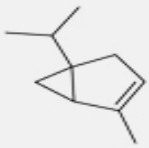
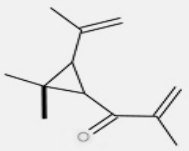
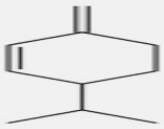
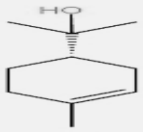
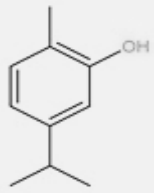
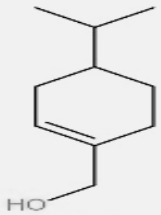
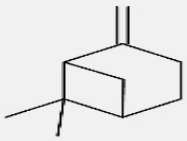
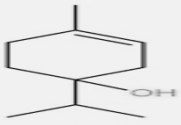
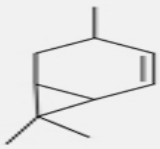
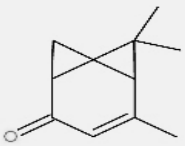
5	β-Myrcene 7-methyl-3-methylene -1.6 octadiene		6	2.2-dimethyl-4.5- bis-1-propene- 1.3-Dioxalane	
7	β-Pinene6.6dimethyl-2-methylenbicycle[3.1.1] heptane		8	6-methyloctene-1	
9	m-Cymene 1-methyl-3-isopropylbenzen		10	Terpinolene 1-methyl-4- (1-methylethylidene)-cyclohexene1	
11	α-Thujen 2-methyl-5-isopropyl bicycle [3.1.0] hex-2-ene		12	1-(3-isopropy liden-2.2- dimethyl cyclopropyl)-isopropanon-1	
13	β-Phellandrene 4-methylen-1- isopropyl-2-cyclohexen		14	α-Terpinol1-*p* menten-8-ol	
15	Carvacrol 2-methyl-5-isopropyl phenol		16	1-hydroxymethil-4-isopropyl-1.4-cyclohexadiene	
17	α-Pinene 2.6.6-trimethylbicyclo [3.1.1]hept-2-en		18	Piperitole4-methyl-1-isopropyl-3-cyclohexen-2-ol	
19	4-Carene 4.7.7-Trimethylbicyclo [4.1.0]hept-3-en		20	4.6.6 trimethylbicyclo [3.1.1]- hept-3-ene-2-one	

TABLE 3: PHYTOCHEMICALS PRESENT IN THE SEED, FRUITS AND LEAVES OF THE *T. AMMI*

S. no.	Sources	Phytoconstituent	Acknowledgement
1	Seed	Phyto screening of alcoholic extract also indicates the presence of carbohydrates, glycosides, saponins, flavones, Fiber, moisture, fat, protein, mineral remember, phosphorous, calcium, nicotinic acid and iron, and so forth	Pruthi [18]
2	Fruits	The crucial oil acquired from the ajwain fruits include especially thymol as the foremost detail and the nonthymol element contains α- and β-pinenes, para-cymene, α-terpinene and γ- terpenine, dipentene, carvacrol19	Ishikawah [19] Chopra RN [20]
		The fruits additionally incorporate steroid and flavone like content and also incorporate oleoresin, risky oil consisting of γ-terpinene, thymol, α- and β-pinene and glucopyranosyloxythymol 20	Nagalakshmi S [21]
3	Leaves	The vital oil extracted from the leaves of ajwain was also determined to comply with terpene groups like monoterpenoids, diterpene and sesquiterpenoids, and many others	Farooq [22]

Geographical Climatic and Their Relation with Chemical Constituent of Ajwain: The numerous chemical constituent of ajwain is stricken by exclusive geographical, climatic circumstance. From the various investigations, it became stated by using many scientists. The outcomes of the various findings disclosed the presence of thymol, β-pinene, o-cymene γ-terpinene, p-cymen and γ-

terpinolene as a major factor. But, the ajwain gathered from Pakistan suggests the presence of p-cymene-three-ol as a primary issue and additionally display the presence of α-pinene, carvacrol and β-myrcene as minor constituents [23, 24, 25, 26] further, the vital oil from the ajwain seed collected from Iran (Sabzevar) establishes the presence of various chemical constituent as compared to other studies research. Almost approximately 50 predominant compounds comprising ninety 5% of the full essential oil had been authenticated [27].

One research scientists from Egypt additionally has reported the presence of non-terpenoids as a wealthy supply and the δ-cadinene (3.5%), hexadecanoic acid (27.5%), germacrene D (4.3%), isobutyl phthalate (5.8%), α-cadinol (4.7%), ethyl linoleate (8.5%) and 6-methyl-α-ionone (8.0 %), as a constituent from the ajwain seed amassed from Egypt [28]. The crucial oil received from the ajwain seed accrued from India also encompass monoterpenes group including β-selinene, β-phellandrene, cymene, α-pinene, β-pinene, γ-terpinene, terpinolene, myrcene, α-thujene.

Pharmacological Properties: Primarily based on the conventional know-how, there are numerous healing makes use of ajwain *Trachyspermum ammi* culmination which include: antimicrobial, galactogogue, antiseptic, stomachic, expectorant, carminative, weight reduction, antipyretic, amoebiasis, diarrhoea, amenhorroea, colic ache, Parasiticidal, Bronchitis, anthelmintic, carminative, laxative, piles, and abdominal pains, febrifugal.

It is extensively utilized for curing belly tumors and many others, which are described briefly inside the underneath followings.

1. Antihypertensive, Broncho-dilating and Anti-spasmodic Activity: To decide the anti-hypertensive effect *T. ammi,* one *in-vivo* test becomes carried out wherein drugs are administered intravenously. The effects of *in-vitro* installed that the calcium channel blocker intermediated the spasmolytic potency within the ajwain plant and by way of considering this mechanism introduced to their locating outcome and confirmed that the conventional healing use of *T. ammi* in infection of the intestine, diarrhea, and colic as well as in the remedy hypertension [29].

2. Hepatoprotectiveand Anti-hyperlipidemic Activity: The hepatoprotecting pastime of the methanolic extract of ajwain became said with the aid of the Gilani *et al.* [29] in that file it turned into showed that *Trachyspermum ammi* established *in-vivo* hepatoprotective pastime in mice approxi-mately 80 percent against a normally-LD of the paracetamol at a dose 1g/kg of body weight. The methanolic extract of ajwain additionally indicates preventive results towards CCl_4- accelerated continuation of drug pentobarbital sound asleep time, which confirms the hepatoprotective interest of the extract other than it also balancing the extent of Alkaline Phosphatase (hepatic enzymes) and Aminotransferases (hepatic enzymes) all through the severe damaging circumstance of the liver. The investigation finished *via* the researcher gilani *et al.* [29] it additionally confirmed the anti-hyperlipidemic efficacy of aqueous and methanol extracts of ajwain at a slow dose from 1 to five gram per kg rats. It disclosed that the dose of extract at 3 g/kg and at 5 g/kg exposed led to LDL and accelerated HDL. The extract of ajwain tested the antihyperlipidemic assets.

3. Antiplatelet Aggregatory Activity: Anti-platelet-aggregatory attempts out in vitro in human volunteers, and the document hooked up that the dried ethanolic extract of ajwain seeds suppressed the accumulation of platelets decreased by using collagen, arachidonic acid, and epinephrine [30].

4. Nephrolithiasis and Diuretic Activity: The nephrolithiasis and diuretic activity of *Trachy-spermum ammi* changed into studied *in-vivo* through suppressing the oxalate urolithiasis stimulated inside the albino rats. In further examine of ajwain extract, it turned into also located that the diuretic effect of *Trachyspermum ammi* was not effective in urine production inside 24 h. From experimental evidence, it was concluded that the traditional use of ajwain within the curative cause of nephrolithiasis became now not defended [31].

5. Abortifacient and Galactogogic Actions: Based totally on the survey carried at the conventional information, it comes to recognize that the seed of *Trachyspermum ammi* (ajwain) was used within the reason of abortion in a few countries of India. Specifically in the metropolis Lucknow. In that, fifty to 75% of the pregnant girl

who was accompanied exacted to have utilized ajwain seed for abortion. From the survey, it was clean that the herb became not good, and there was a opportunities higher hazard of human fetotoxicity. [32]. The NDRI (countrywide Dairy Research Institute in India) become also appeared into the estrogenic capability of the plant *Trachyspermum ammi* based totally on traditional information that is used to boom milk production in cows. *Trachyspermum ammi* also has been used traditionally as boom milk manufacturing in humans [33].

6. Anti-ulcer Activity: An experiment changed into taken to test an aqueous extract of *T. ammi* to reveal the impact on gastric ulcers. In that test waster albino rats (woman) have been taken for this empirical look at *via* preparing 5 groups of rats, where the drug omeprazole used as a general and ajwain plant extract as a test became administered at progressively increasing doses twice an afternoon for two weeks and after of entirety of the time period gastric ulcers become examined. From the commentary, it changed into concluded that the aqueous extract of ajwain seed had a predicting effect to therapy gastric ulcers when equated with manipulate organization [34].

7. Anti-inflammatory Activity: The hobby of anti-inflammatory of the aqueous extract and alcoholic extract of the ajwain seeds became reported by using Thangam C *et al.* In that document it changed into confirmed that the extract of ajwain tested sizable ($P<0.001$) anti-inflammatory belongings inside the animal models like rats. Within the conclusion of that test it was stated that increasing inside the weights of the adrenal glands in extracted handled animals. Both the extract aqueous and alcoholic demonstrated the vital anti-inflammatory potency [35].

8. Antitussive Effects: The antitussive pastime of various concentrations of macerated and aqueous extracts as a check drug and codeine and carvacrol as a popular drug were examined via thinking about the no of coughs raised. The outcomes established that a crucial decrease within the number of cough located inside the presence of ajwain extract of various concentrations [36].

9. Gastro Protective Activity: The antiulcer property of the plant *T. ammi* fruit was studied by using dissimilar animal's models having ulcer; the observation established the gastroprotective or antiulcer activity. The animal's models were first pre-treated with ajwain extract, which depicted a significant reduction in the percentage of the entire animal models when it compared with the control groupand standard groups of animals [37].

10. Anthelmintic Activity: The anthelmintic activity of *Trachyspermum ammi* was investigated by some researchers and established that the plant ajwain shows anthelmintic activity against some particular helminthes like *Haemonchus contortus* and *Ascaris lumbricoides* in humans and in sheep. *Trachyspermum ammi* exhibits anthel-mintic activity maintain by disturbance with the parasites energy metabolism by synergism of ATPase action. The plant *Trachyspermum ammi* has also been exhibited cholinergic action with peristaltic motions of the gut, hence assisting in expulsion of enteral parasites, which may also be a contributing component to its anthelmintic property [38, 39].

CONCLUSION: *Trachyspermum ammi* (Ajwain) is an essential, widely known, and used medicinal plant on account of those historic instances; this specific plant has wide founded and hidden medicinal and dietary use. Formulating drugs from indigenous plants from conventional knowledge primarily based of drugs at gift turning into proper interest because of the secure, innocent and without difficulty available. From the final decade to present, various natural compounds of plant foundation that have ethnobotanical applications have getting to a good deal problem. *Trachyspermum ammi* (Ajwain) has various traditional applications like gastrointestinal illnesses, antihypertensive, bronchodilating, and anti-spasmodic hepatoprotective and anti-hyper-lipidemia and plenty of different illnesses. This plant is fertile in carbohydrates, protein, vital oil, phosphorus, calcium, minerals, fiber, carotene iron, and numerous nutrients like thiamine, riboflavin and niacin. Because of the presence of an expansion of essential issues, it's far answerable for its numerous organic and healing properties. This assessment is a try to furnish nicely accumulated clinical information of the *Trachyspermum ammi.*

ACKNOWLEDGEMENT: It is our profound privilege to express our gratitude and sincere

thanks to Rahman Institute of pharmaceutical sciences and Research (RIPSR) Tepesia, Sonapur, Kamrup (M). I wish to express my sincere thanks to all my well-wishers for their interests, support, and cooperation during my work.

CONFLICTS OF INTEREST: All the authors have no conflicts of interest.

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How to cite this article:
Begum M, Sharma BP and Aziz BSM: Ethanobotanical, phytochemical and pharmacological scence of *Trachyspermum ammi* (Ajwain) a systematic review. Int J Pharm Sci & Res 2021; 12(11): 5690-97. doi: 10.13040/IJPSR.0975-8232.12(11).5690-97.