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Review Paper

Pharmacological Activities of *Trachyspermum Ammi*

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ABSTRACT

Ajwain, or *Trachyspermum ammi*, is a widely grown plant in India. This fruit has a long history of medicinal usage because to its antispasmodic, stimulant, and carminative action. It has been used to management of some of conditions, including flatulence, atonic dyspepsia, diarrhea, abdominal tumors, piles, bronchial troubles, nausea, vomiting, asthma, and other respiratory problems. According to scientific research, it possesses a diverse array of medicinal and pharmacological effects. These effects include pain relief, cytotoxicity, antioxidants, microbes, bronchodilation, lithiasis, diuretics, properties that induce abortion, toxoid, nematicidal, anthelmintic, and filarial infections. In addition, research has shown that there are a number of phytochemical components, and mineral matter. According to these research, T. ammi contains active chemicals that have pharmacological effects. *Trachyspermum ammi*'s taxonomy phytochemistry traditional use, medicinal value and pharmacological activity are all topics that will be covered in these review.

INTRODUCTION

Trachyspermum ammi, often known as ajwain, the annual herbaceous plant known as ajwain is petite and upright, with branching, green stems and feathery, 2.5 cm long leaves. Its 4-12 ray flower heads contain 6–16 blooms. Fruits are small, round, and have a brownish-grey hue. It was in Egypt that this shrub was first cultivated. It is native to India. In South-West Asia, it can be found from Iraq all the way to India (1).

A seed spice with great therapeutic properties, *Trachyspermum ammi* L. is a member of Apiaceae family. Aphrodisiac qualities are present in the seeds, while the roots have a diuretic effect. Ajwain oil, a brown-colored oil, is present in the seeds in a concentration of 2-4.4%. Intestinal issues, loss of appetite, and bronchial problems are all treated with thymol, the active ingredient in this oil. Humans are susceptible to oil's fungicidal, antiseptic, and anti-aggregatory actions.

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Traditional medicine practitioners have long relied on ajwain, a promising herb, to treat a broad range of illnesses in equally humans and animals. In addition to its carminative and antispasmodic effects, the fruit also a stimulant. Significant relief from flatulence, atonic dyspepsia, and diarrhea can be achieved with its help. Ajwain is an anthelmintic, carminative, laxative, and stomachic herb, and its seeds are bitter and pungent. As an added bonus, it eradicates piles, stomach pain, and tumors. A potent germicide, anti-spasmodic, and fungicide, essential oil found in seeds contains almost half thymol. Toothpaste and perfume both make use of thymol (2)



Fig. No.1 : *Trachyspermum ammi*

Table 1: Vernacular names

Language	Names
Tamil	Omam
English	Bishop's Weed
Marathi	Ova
Hindi	Ajwain
Gujarati	Ajma, Ajmo, Yavan, Javain
Bengali	Javan, Yamani, Yavan, Yauvan, Yavani
Sanskrit:	Yamini, Dipyaka, Yaminiki, Yaviniki
Telugu	Vamu
Oriya	Juani
Assamese	Jain
Malayalam	Omam

Microscopic description

Layers of extended table cells make up the epicarps, while the mesocarps are composed of long to polygonal cells that have several vittophores and veins in the carpophores. The fruit's pliable portion showcases the construction of two hexagonal linkages. The endosperm is composed of long, thin cells, an integument, a slow-moving cell-shaped coffin, tiny embryo-filled cells, and tiny, spherical oil molecules. These cells all have thin, polygonal walls. Under a microscope, the powder shows clusters of endosperm cells and oil globules.

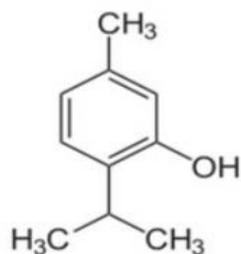
Phytochemical Constituents of Ajwain

The mineral composition of ajwain seeds is 7.1%, which includes elements like calcium, phosphorus, iron, and nicotinic acid. Protein(15.4%), carbohydrates(38.5%), tannins, glycosides, water(8.9%), fat(18.1%), saponins, and flavones3 are among the other components. Of the 2% to 4% brownish essential oil that ajwain fruits generate, thymol makes up the preponderance, ranging from 35% to 60%48. Carvacrol, dipentene, β terpinene, α -and α -pinenes, α -terpinene, and paracymene are all components of the nonthymol fraction. Other compounds found in the plant include camphene, myrcene, and α -3-carene, although in smaller amounts. There is a highly hydrating saponin in the alcoholic extracts.

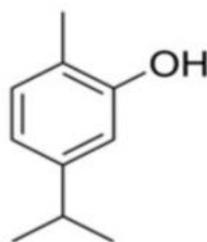


Glucoside, 6-O- β glucopyranosyloxythymol, a steroid-like molecule, and a yellow crystalline flavone are all present in the fruits. Additionally, there is 25% oleoresin and 12% volatile oil, which

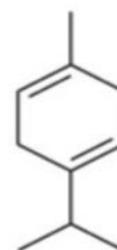
includes thymol, γ -terpinene, para-cymene, and α - and β -pinene. The oil extracted from *T. ammi* mostly contains limonene (38%), carvone (46%), and dillapiole (9%)⁽³⁾.



Thymol



Carvacrol

 γ -Terpinene

Therapeutic Effects

Antifungal

There was a fungitoxic effect against *Epidermophyton floccosum* when essential oil of *Trachyspermum ammi* fruits was tested. Even at 900 ppm, trichophyton mentagrophytes and *Microsporum canis* are still there. Temperature exploit up to 15°C, autoclaving, and storage up to 240 days did not amplify the oil's fungitoxicity. Based on the chemical analysis, thymol was identified as a fungotoxic characteristic. At a dosage of 1000 ppm, it demonstrated toxicity towards the test fungi.

Antibacterial

An agar diffusion assay was used to test antibacterial activity of Ajwain, acetone, and water extracts against a variety of bacteria, including *Pseudo-monas aeruginosa*, *Salmonella typhimurium*, *Klebsiella pneumonia*, *Enterococcus faecalis*, *Escherichia coli*, *Shigella flexneri*, and *Staphylococcus aureus*. Acetone extract showed stronger activity than water-based extract, the

study found. An additional investigation shown that eight distinct strains of *Helicobacter pylori* were successfully inhibited by an ethanolic extract of Ajwain.

Antioxidants

Through an in vivo experiment, antioxidant and ameliorative belongings of Ajwain extract were assessed in relation to the oxidative stress and toxicity caused by hexachloro cyclohexane. Thus, it was found that hepatic free radical pressure can be mitigated through consuming Ajwain extract through diet.

Insecticidal

Certain compounds, derived from plants, have the ability to eliminate insects. The interactions between plants and insects rely heavily on plant metabolites. An essential oil extracted from ajwain seeds has been found to have insecticidal effects on *Callosobruchus chinensis* during the ova-position step, as well as on the eggs themselves and on their development⁽⁴⁾.

Anti-Inflammatory Effect

The anti-inflammatory efficiency of two extracts from Ajwain seeds, one in an alcoholic form and the other in aqueous form, were studied by the researchers. Both animal models demonstrated that TAE and TAQ had statistically significant anti-inflammatory effects ($P < 0.001$). Adrenal glands were considerably heavier in rats given TAE and TAQ. The anti-inflammatory properties of Ajwain seed extracts, including TAE and TAQ, are considerable ⁽⁵⁾.

Antitussive effects

The antitussive activity of areoles was evaluated by counting quantity of coughs produced. Extracts used in study were carvacrol, codeine, saline, and aqueous and macerated extracts of two altered concentrations. Both aqueous and macerated extract concentrations significantly reduced the cough count.

Gastro protective activity

Traditional medicine has long made use of T. ammi fruit to alleviate dyspepsia and other gastrointestinal issues. Therefore, the following models were used to study the antiulcer efficacy of the T. ammi fruit ethanolic extract: cold restraint stress-induced ulcer, indomethacin-induced ulcer, ethanol-induced ulceration, and antisecretory pylorus ligation. In comparison to the control group, the animals were significantly protected against injury by a decrease in ulcerative lesions when given 100 mg/kg and 200 mg/kg doses of the extract ($P < 0.001$). A strong antiulcer effect of the T. ammi fruit extract was shown by the results.

Digestive stimulant actions

Research showed that dietary T. ammi supplementation decreased food transit time by 29%, from 780 minutes (control) to 554 minutes (T. ammi supplement), and that it also increased

bile acid secretion and/or improved the activity of digestive enzymes. One possible explanation for the shortened meal transit time was that the digestive process as a whole was sped up because digestive secretions were more readily available and more powerful ⁽⁶⁾.

Wound healing activity

In order to study the antibacterial impact of T. ammi, researchers applied a cream containing 5% EO of T. ammi to rabbit wounds while they healed, and then compared the results to those of an iodine solution. On the fifteenth day, wound contraction was 99.68% in the T. ammi group, compared to 100% in the iodine solution group and 96.57% in the non-treatment group; this suggests that T. ammi was effective in healing the wounds ⁽⁷⁾.

Antidiabetic activity

T. ammi has shown antihyperglycemic effects, and its oil has strong antidiabetic properties as well. According to Aneesa et al. (2019), T. ammi oil can inhibit enzymes involved in glucose metabolism. This suggests that T. ammi oil may join the growing number of plants found to have antidiabetic effects. Another study looked at the effects of T. ammi on rat diuretics in vivo. According to the author's experiment, T. ammi did not work very well in reducing kidney stone formation or increasing urine production.

Antihypertensive action

Both in vitro and in vivo studies have investigated the antihypertensive, bronchodilating, and antispasmodic effects of T. ammi (Naeem Khan et al., 2020). An aqueous extract of T. ammi was investigated for its antihypertensive properties. Findings showed that the extract's effect on blood pressure decreased with increasing dosage (Aftab and Usmanhani, 1995). The antihypotensive effects observed in in vivo experiments may be

due to thymol, a component of *T. ammi*, according to additional research. ⁽⁸⁾

Diuretic activity

Rats suffering from oxalate urolithiasis were studied in vivo to determine the antilithiasis and diuretic effects of *T. ammi*. There was no effect of *T. ammi* on urine output after 24 hours. Traditional use of *T. ammi* to treat kidney stones is not supported by experimental evidence, according to the results [39]. The conventional usage of ajwain to cure nephrolithiasis was thought to be unwarranted when experiments proved otherwise.

Anti-filarial activity

The potential of an ajwain fruit methanol extract to destroy *Setaria digitata* worms was examined in vitro. Active fraction then crude extract showed significant effectiveness against mature *S. digitata* in several assays, including MTT decrease and filarial worm mortality. The macrofilaricidal effectiveness was also demonstrated by the Ajwain crude extract. The effect of thymol on *B. malayi* in vivo was examined using a *Mastomys coucha* model. Additionally, it demonstrated in vivo sterility in female worms and anti-*B. malayi* macrofilaricidal activity ⁽⁹⁾.

Antihypertensive, antispasmodic and broncho-dilating action

Research on *T. ammi* has focused on its potential to lower blood pressure in living organisms as well as to relax muscles and widen airways in laboratory settings. Scientists found that, in addition to hypertension, hyperactive gastrointestinal disease states including colic and diarrhea are mediated by calcium channel blockage, which has spasmolytic effects.

Enzyme modulation activity

Thymol and demonstrated active molluscicidal action of *Lymnaea acuminata* in snail nerve tissue affected acetyl cholinesterase, succinic dehydrogenase, lactic dehydrogenase, and cyto oxidase activity. Additionally, *Trachyspermum ammi* exhibited notable protease activity. One possible explanation for Ajowan's digestive stimulating action is that it increases the activity of pancreatic lipase and amylase ⁽¹⁰⁾.

Analgesic and antinociceptive effect

The antinociceptive and analgesic properties of ajwain were determined by an in vivo study. In this regard, the tail-flick analgesiometer is a useful instrument. When tested two hours following dosing, the ethanolic extract significantly raised Tail-Flick Latency (TFL), according to the researchers. In a study comparing the antinociceptive effects of morphine sulfate with Ajwain hydroalcoholic extract, the formalin test was employed. Ajwain extract exhibited antinociceptive effects throughout the research. Consistent findings from large-scale investigations of Ajwain's essential oil point to a link between the thymol content of the oil and its outstanding effectiveness during the last stages of the formalin test.

Antihyperlipidemic Activity

The in vivo research shown that the powdered ajwain seed considerably decreased total cholesterol, total lipids, LDL cholesterol, and triglycerides. Additionally, atherogenic index and HDL cholesterol levels of albino rabbits were equally raised by organic seed extract ⁽¹¹⁾.

CONCLUSION

The medicinal plant *Trachyspermum ammi* offers vital characteristic against a number of diseases. The study's findings reveal that *Trachyspermum ammi* extracts include a variety of important



petrochemical groups, including carbs, alkaloids, flavonoids, triterpenoids, steroids, tannins, phenolic compounds, aspirins, inorganic acids, and ascorbic acid. Due to the presence of this important chemical components the *Trachyspermum ammi* is used for the management of numerous infections and diseases. Metabolite treatment derived from *Trachyspermum ammi* are completely safe because they are all natural various pharmacological activities like anti-inflammatory, antitussive, analgesic & neural, hepatoprotective, anti-hypertensive, anti-spasmodic & broncho-dilating activity, digestive stimulant action, gastro-protective activity, antifilarial activity and other potential medical uses have been subject of clinical trials. Additionally this plant may be able to prevent the growth of fungi & bacteria to a higher extent.

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