

Ethnobotany and Research Trends in *Trachyspermum ammi* L. (Ajowan); A Popular Folklore Remedy

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Abstract: The present communication is based on a herb namely *Trachyspermum ammi* L. belonging to family Apiaceae. It is commonly known as “Ajowan” and is cultivated as a spice crop. Ajowan essential oil has an array of various organic and inorganic compounds. The most important of all the components from Ajowan essential oil is thymol which contributes 39.1 % of total volume of essential oil. The important compound Thymol isolated from Ajowan has many pharmacological effects like antiseptic, antioxidant, antitussive, hypertensive activity, expectorant properties, abortifacient, antihelmintic activity and much more. Other Pharmaceutical uses of Ajowan essential oils are to cure cough, digestive disorders, tonsillitis, urticaria and infections with worms. Ajowan essential oil isolated from fruit parts have antiseptic, expectorant and be used against pulmonary disorders. The present review highlights some of major characteristics of important medicinal plant Ajowan and describes the traditional and new novel uses of this plant in our daily life. With these important pharmaceutical effects, Ajowan seeds, fruits and other plant parts can be used for more clinical trials in future.

Key words: Ajowan • Essential Oils • Pharmacological uses • Thymol

INTRODUCTION

Since the beginning of human civilization, plants remained an important source of nutrition as well as medicine. Numerous folk medicinal practices have been developed across different cultures and eras such as the Greek medicine, Greco-Islamic medicine, Chinese medicine, Ayurvedic medicines etc. Folk medical practitioners (Hakeems or Panjsaars) have deep foundations in the world and still about 80% of the world population relies on medicinal plants to fulfill the vacuum of health. “Greco-Islamic medicines”, “Yunani Tibb” or “Yunani Dawakhana” are the most commonly used traditional systems in Pakistan. Out of the 250,000-500,000 plants estimated in the world; a large proportion of them is unexplored for medicinal potential. According to rough estimates there are about 35,000-75,000 medicinal plants that can be explored for their utility using high throughput techniques [1; 2].

Among the wide horizon of medicinal plants, there is Ajowan (*Trachyspermum ammi* L.) that belongs to important family Apiaceae (Umbalifireae) [3].

Table 1: Ajowan Classification

Kingdom	Plantae
SUBKINGDOM	TRACHEOBIONOTA
DIVISION	MAGNOLIOPHYTA
CLASS	MAGNOLIOSIDA
SUBCLASS	ROSIDAE
ORDER	APIALES
FAMILY	APIACEAE
GENUS	<i>TRACHYSPERMUM</i>
SPECIES	<i>AMMI</i>

Many members of Apiaceae belong to vegetation or aroma. This family comprises of about 250 genera and more than 3300 species [4]. Other names of Ajowan in different languages are Ajamoda, Ajmud, Ajamodhavoma, Bishop’s weeds, Carom and Ethiopian Cumin. Botanical names assigned to this plant are *Ammi copticum* Linnaeus; *Bunium copticum* (Linnaeus) Sprengel; *Carum copticum* (Linnaeus) C. B. Clarke; *Trachyspermum copticum* (Linnaeus) Link [5; 6].

Ajowan Nomenclature: The botanical name of Ajowan plant is *Trachyspermum ammi* (L.) [3]. Tabulated binomial nomenclature of Ajowan is listed in (Table 1).

In pharmaceuticals, this plant is known by *Fructus ajowani* and in English this plant is called Carom, Ajowan and Ajowain [6].

Plant Description: Ajowan is an erect, glabrous or minutely pubescent, branched annual spice herb which reaches upto 90 cm in height. Stem is straight, much-branched and usually puberulous and striate [4; 6]. Leaves rather distant, 2-3 pinnately divided and forms feather-like tender leaves which are petiolate (petiole 1-5cm). Segments of leaves are linear and ultimate which is 1.0-2.5 cm long [7]. Flowers are terminal or seemingly-lateral pedunculate, compound umbels, white, small, pedicels (0.5-4mm) and unequal. Calyx teeth are conspicuous, minute, ovate or obsolete. Petals 1.3×1.3 mm.; fruits $1.2-2 \times 1.2-1.8$ mm, densely covered in whitish minute papillae, ovoid, muricate, grayish brown, mericarp compressed, with distinct ridges and tubercular surface and 1-seeded. Give flowers and fruits in May-August [4; 6; 7].

Etymology and Cultivation of Ajowan: Ajowan is a grassy, annual plant which can be grown in east of India (particularly the North West), Iran, Egypt, Afghanistan and China (particularly in West Xinjiang) [4; 5]. Ajowan is the Romanized spelling of the Hindi name *ajvan*. The Hindi word *ajvan* is traced back to Sanskrit *yavanaka* which has its origination from Greek word *yavana*. Ajowan fruit (*Trachyspermum ammi* L.) is originated in Eastern Mediterranean, may be native to Egypt. It is believed that the spice originated from the Eastern Mediterranean and arrived in India and other countries of the region in the course of the Greek conquest of Central Asia [6]. It is widely cultivated in rich organic matter soil particularly around the Mediterranean Sea and in South West Asia extending from Iraq to various parts of India, Iran and Afghanistan.

Traditionally, Ajowan is cultivated in late January and the plant gives ripened fruit in late of May. The cultivation is done by traditional methods. The natural habitat of the plant is dry open rural area, sandy soil with a little bit high amount of water and generally greater aerial humidity. The different genotypes of Ajowan are widely cultivated in Central, South and South-West Asia [8].

Chemical Constituents of Ajowan: GC (Gas Chromatography) and GC-MS (Gas Chromatographic-Mass Spectrometry) analysis of Ajowan essential oil has been confirmed that it contains various organic and inorganic compounds. Among them, 26 different types of

components are identified which accounts for 96.3% of the entire amount. Ajowan have its characteristic odour and taste due to the presence of essential oil (2-4%) [9; 10]. Phytochemical analysis of Ajowan essential oil showed the following components. Moisture contents, 7.4%; protein residues, 17.1%; fats, 21.1%; carbohydrates, 24.6%. Fruits of Ajowan contain 7.9% minerals like sodium, potassium, aluminium, calcium, cadmium, copper, iron and lithium. Nitrates and nitrite are not detected in fruit parts. Ajowan fruits are also rich in Phosphorous, vitamins and other essential components. Other trace elements detected in Ajowan essential oils are zinc; manganese; iodine; cobalt; nicotinic acid; chromium [11]. Gurdip *et al.* [10] reported that Thymol contributes 39.1% of total amount of Ajowan essential oil. Other alkaloids like camphene, carvacrol, *p*-cymene, dipentene, myrcene, *a*- and *b*- pinesnes, phenol, *a*- and *b*-plellandrenes, *g*-terpinene, thymine, thymol, linoleic, oleic, palmitic petroselinic acid and resin acids have been isolated from essential oils of Ajowan fruits [11; 12]. The main constituent which has made this plant of immense importance is called “thymol” [10]. In another report, it was investigated that Thymol contributes 50% of the total volume of the Ajowan essential oils [9]. In another study it was reported that Thymol contributes 55% of total volume of the Ajowan essential oils [13]. Thymol has effects like antiseptic and antioxidant [14], antitussive [15], hypotensive activity [16] and many other activities. The chemical structure of thymol was shown in Fig.1.

Importance of Ajowan in Our Daily Life: Ajowan (*Trachyspermum ammi* L.) has imminent importance in day to day life which is briefly prescribed here.

Importance in Food: Ajowan has characteristic aromatic smell and pungent test and it's widely used as a spice in curries and soups. It is used either alone or in combination with other ingredients. Various types of pickles, biscuits, confectionery, beverages and pan mixtures are making from it. In Europe, Ajowan is mixed with coriander and fennel to make breads [7].

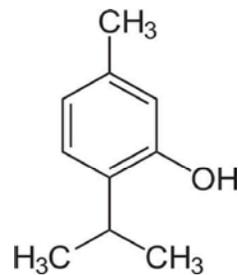


Fig. 1: Chemical structure of thymol

Importance in Flavor and Perfume: The fruit of Ajowan is used as a spice for flavoring in foods and for fragrance purposes in cosmetics [7].

Traditional and Pharmaceutical Importance: Ajowan is an aromatic annual spice and used in many traditional drugs. Ajwan-ka-arak (aqueous extract) is a well known remedy for diarrhea. Fruits of this plant have properties like antidiarrhoeal, antiseptic, antispasmodic, carminative, stimulant, stomachic and tonic. Ajowan fruits are also helpful to get relief from bronchitis, atonic dyspepsia and flatulence, dipsomania, hysteria, sore throat, plaster or poultice applied to abdomen in colic. Ajowan provides an important ingredient in various ayurvedic formulations prescribed for cough, digestive disorders, tonsillitis, urticaria and infections with worms [6; 15; 16]. Oil from Ajowan is expectorant and quite efficacious in bronchial pneumonia and other respiratory disorders. The leaves juice of this plant is antihelminthic. Roots are carminative, diuretic, febrifuge and also useful in stomach troubles [6]. It is also used to cure abdominal tumor, abdominal pains and piles [9].

Various Extracts and Parts of Ajowan Used: Ajowan Oil: Essential oil from Ajowan fruits are used as anti-septic, expectorant and against pulmonary disorders. The seeds of *Ajowan* contain many essential medicinal attributes including diuretic, anti-vomiting, analgesic, anti-asthma and antidyspnoea effects [17].

Leaf Juice of Ajowan: Juice from Ajowan leaves are antihelminthic and is also used as natural helminth infestations in animals [18].

Roots of Ajowan: Roots of *T. ammi* are: carminative, diuretic, febrifuge; useful in stomach troubles [6].

General Uses: Ajowan seeds are used in certain domestic preparations like pickles, certain types of biscuits, confectionery, beverages and pan mixtures [7]. Different researchers studied the oestrogenic content of many medicinally important herbs including *T. ammi* that are traditionally used to increase milk quantity in dairy cattle. Ajowan has also been traditionally used as a galactagogue when seeds of Ajowan is fried in oil and used as a thin soup in humans [19]. Thymol is a widely used against many types of microorganisms. Due to its bactericidal action against oral bacteria, it is normally incorporated in mouth washes. In order to keep the fragrance and flavor intact, Ajowan seeds generally crushed just before preparing dishes and added to the

cooking recipes at final stages in order to avoid the evaporation of essential oils. In Punjab provinces of India and Pakistan, the spice seeds particularly Ajowan, added to make bread known as ``Ajowan paratha``. The seeds of Ajowan are mostly used for the preparation of snacks, spicy biscuits, to flavor drinks, soups and sauces in India [20].

Pharmaceutical Importance of Ajowan: Medicinal usage of Ajowan can't be ignored. Ajowan is used in various Gastro Intestinal Tract (GIT) disorders. Ajowan oil has anti-lithiatic properties due to oestrogenic content that are conventionally used to increase milk yield in dairy farm animals and also as a galactagogue in human [21]. Gersbach and Reddy [22] verified through chemical shift method and exploited gas chromatography mass-spectrometry that thymol contributes a high proportion to Ajowan essential oil. The essential oil in Ajowan is confined to secretory structures (canals), situated in the wall of fruits. Ijaz *et al.* [23] reported the antihyperlipidaemic efficacy of *Trachyspermum ammi* (L.) in albino rabbits. They proposed that the lipid lowering mechanism may induce the removal or catabolism of the lipoprotein, inhibition of the HMG-CoA reductase and/or hang-up of lysosomal lipid hydrolytic enzymes created by the liver. They observed that 2g/Kg *T. ammi* powdered seeds induced hypolipidaemic activity, rendering 49%, 53%, 71% and 63% reduction in total lipids, triglyceroids, total cholesterol and LDL-cholesterol respectively.

The insecticidal activity of the *T. ammi* was detected against *Tribolium castaneum* (wheat flour insect pest). The essential oil reduced the oviposition potential and increased the developmental period of the *T. castaneum* in comparison to the control group. Fumigation of the Ajowan essential oil resulted in inhibition of differential stages like larvae to pupae and the pupae to adults [24].

Thangam and Ghananjayan [25] observed that *T. ammi* (L.) seeds have anti-inflammatory potentials against rat models acute rat model (carageenan induced rat paw oedema) and sub acute rat model (cotton pellet induced granuloma). They used Aspirin (ASA) (150 mg/Kg) and Phenyl butazone (PBZ) (150 mg/Kg) as control. In acute rat model, ASA and PBZ showed an inhibition of 45.23% and 43.83%, respectively, while TAE (total alcoholic extract) and TAQ (total aqueous extract) showed an inhibition of 38.32% and 41.11%. In second case, ASA and PBZ resulted 44.69% and 42.04% inhibition respectively while TAE and TAQ produced 38.05% and 43.87% inhibition. It was observed that the weight of adrenal gland was increased in animal model treated with Thymol from the essential oil of *T. ammi* (Linn) seeds was

reported for its insecticidal and repellent activities against *Anopheles stephensi* [26]. Thymol showed 1.6-fold more toxicity than the oil toward fourth-instar larvae of *A. stephensi* with LD₅₀ values of 48.88 µg/ml and 80.77 µg/ml respectively. Exposure of female *A. stephensi* to vapors of Thymol caused significant reduction in egg production, egg hatching and subsequent growth of larvae as compared to the oil of *T. ammi* seeds. A dose of 25.0 mg/mat after 1 h duration of Thymol was enough to repel *A. stephensi* completely which is achieved by the oil at the dose of 55.0 mg/mat. This showed the significance of Thymol over the oil of the *T. ammi* (L.). In another study, it was reported that essential oil from Ajowan has strong insecticidal activity against the Japanese termite (*Reticulitermes speratus* Kolbe) [27]. They exploited the principles of gas chromatography-mass spectrometry (GC-MS) and it was observed that the phenol compounds promised the strongest insecticidal activity among the test compounds. It was also verified that alcohol and aldehyde groups were more toxic than hydrocarbons.

Carum copticum fruit extracts also have antioxidant and antimutagenic activities. The characteristic antioxidant values vary for various assays. The methanol fraction showed highest antioxidant potential by phosphomolybdenum (208.77 µmol). Other fractions like ascorbic acid and BHT (butylated hydroxyl toluene) were comparatively less potent regarding the antioxidant potentials. Methanol fraction was evaluated against direct mutagenic agents like sodium azide (NaN₃) and MMS (methyl methane sulphonate) and indirect mutagens like 2-AF (2-aminofluorene) and benzo(a)pyrene (B(a)P), using various strains of *Salmoella typhimurium* (TA97a, TA98 etc). No sign of mutagenicity was observed for methanol fraction at tested concentration (25-100 µg/plate). Antimutagenicity was measured with prevention of mutagenicity ranging 10.8-83.1% in a concentration dependent assay [28]. Patel and Srinivasan [29] reported the digestive stimulant potentials of *T. ammi* when they observed a 29% reduction in food transit time during digestion. For this spice, the digestive enzymes enhancement activity and/or to cause a higher secretion of bile acids was also observed. The *T. ammi* aqueous extract has reported as abortifacient at a dose of 175 mg/kg in rats [30]. *T. ammi* is also reported to have hypotensive activity and act as detoxification agent against aflatoxins [31]. Alqasoumi [32] reported the antisecretory and antiulcer activities of Ajowan "*Carum copticum*" in model animal rat. Apart from that *T. ammi* have various characteristics like antitussive effect [15], gastric antisecretory and antiulcer effect in rats [32]. Ajowan also show the inhibitory effect against *Aspergillus ochraceus* [33; 34].

CONCLUSION

Trachyspermum ammi is an important medicinal plant and has a great potential to explore for further studies. Because of its excessive use by the local herbalist the plant may get extinct it's therefore imperative that conservational strategies should be initiated regarding Ajowan.

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