IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 10, March 2025
Impact Factor: 7.67

A Study on Extraction, Evaluation and Antibacterial Activity of Trachyspermum Ammi L.

Wahid H. Jummal and Asst. Prof. Naziya Sajjad Jummal
D. G. Tatkare Mahavidyalaya, Mangaon, Raigad, Maharashtra

Abstract: *Essential oil is a complex mixture of volatile compounds and can be extracted from various parts of plants. It has been used for thousands of years for medicinal and health purposes. Because of their detoxifying, antibacterial, antiviral and calming properties, it is used as a natural, safe and cost-effective therapy for a number of health concerns. Ajwain seed is very valuable for its oil contents. It is a high value medicinally important seed. It contains 53-65% Thymol as a photochemical. Thymol is reported to exhibit diverse biological activities like antibacterial, antioxidant, antiseptic, antifungal, anti- inflammatory and anticancer etc. It is also reported to show potent inhibitory activity against E. coli and Staphylococcus aureus. Resistance to antibacterial agents has become a serious problem for global health. The current study evaluated the antimicrobial activities of essential oil and respective fractions of Trachyspermum Ammi (L) Sprague. Seeds of the essential oil were extracted and fractionated using column chromatography. All fractions were then analyzed by gas chromatography/mass spectrometry. Antifungal and antibacterial activities of the oil and its fractions were assessed using micro dilution method. Compounds γ-terpinene (48.07%), ρcymene (33.73%), and Thymol (17.41%) were determined as major constituents. The effect of fraction II was better than total essential oil, fraction I, and standard Thymol. The greater effect of fraction II compared to standard Thymol showed the synergistic effects of the ingredients in this fraction. As this fraction and also total oil were effective on the studied microorganism, the combination of these products with current antimicrobial agents could be used.*

Keywords: Medicinal and health purpose, Antibacterial Activity of Trachyspermum Ammi Antioxidant, Anti- inflammatory, Anticancer.

I. INTRODUCTION

The idea of using medicinal plants to treat human being and livestock is not new and in many developing countries their use is still in vogue. Despite the fact that in developed countries modern development in allopathic medicine is at climax, there is a renewed interest in using medicinal plants to treat humans, pets and livestock. Medicinal plants are being used for therapeutic purposes in several ways. In modern medicine, many drugs are used that are mainly derived from plants, e.g. digitalis, morphine, atropine, cinchona and vinblastine [1-3]. The interest in plant products has considerably increased all over the world due to the fact that many herbal medicines are free from side effects TrachyspermumAmmi L belongs to (Apiaceous family) is a traditional medicinal plant with therapeutic properties. Ammi L seeds are used to treat a variety of gastrointestinal ailments in traditional Indian medicine system. A hot and dry fomentation of the seeds is applied to the chest to treat asthma, and a paste of powdered seeds is used externally to relieve colic pains.Aqueous extract of the seeds of the Ajwain plant is a common therapy for diarrhoea. Seeds have also been linked to the prevention of stomach cancers, aches, and piles. There are a variety of Ajwainayurvedic formulations available to treat worm infections.

Essential oil of Ajwain:

Spices have remarkable therapeutic value. It is used to increase the flavour as well as aroma. There are some other names of Ajwain in history such as omum, owa, Ethiopian cumin, carom and bishops weed. Carom seeds are belonging to the Apiaceous family. The botanical name of carom seeds is Trachyspermum Ammi. Essential oil which is extracted from carom seeds have volatile nature and have physio-chemical and organoleptic properties. Trachyspermum Ammi is

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 10, March 2025
Impact Factor: 7.67

a native of Egypt and it is cultivated in Pakistan, India, Iran, Iraq, and Afghanistan. T. Ammi is a medicinally important seed as the seeds of 7. Ammi contain excellent aphrodisiac properties and its roots are diuretic in nature. The T. Ammi seeds consisted of 2-4.4 % brown colored oil which is known as ajwain oil in which (40-50) % thymol is present. Thymol can easily be crystalized from the essential oils of ajwain and the remainder contains beta pinene, carvacrol, dipentene, beta terpinenes, and rho-cymene. Ajwain seeds are most commonly used as a household remedy for diarrhea, asthma, colic and dyspepsia and it also have antifungal, antibacterial, hypocholesterolemic, anthelminthic, antioxidant and bronchodilator effects.

Composition of Ajwain oil

The principle active components of essential oil of T. Ammi are phenols, carvacrol and mainly thymol. Both phenolic compounds carvacrol and thymol are responsible for antitussive and antiseptic properties. Thymol has antiseptic activity and carvacrol contains antifungal properties. Ajwain is rich source of thymol, y-terpinene and p-cymene and carvacrol. Major components which are present in the ajwain essential oil are a-pinene, athujene, ßmyrcene, B-pinene, B- phellendrene, o cymene, y-terpinene, limonene, 4-terpineol, dodecane, cis limonene oxide, ßfenchyl alcohol, tetra decane, thymol, ethylene methacrylate, heptadecane, diethyl phthalate.

Literature Review

Antimicrobial Activity

T. ammi's antimicrobial properties include preventing food from rotting due to microbes, doing in vitro tests to determine its effectiveness, and using it as an antibacterial. Carvacol and thymol were identified as the active ingredients believed to be in charge of ajwain's antibacterial properties. Thymol functions as a plant-based, fourth-generation herbal antibiotic formulation by eliminating bacteria that are resistant to even common third-generation antibiotics and multidrug-resistant microbial infections. Ten fungi (Acrophialophora fusispora, Curvularia lunata, Fusarium chlamydosporum, F. poae, Myrothecium roridum, Papulaspora sp., Alternaria grisea, A. tenuissima, Drechslera tetramera, and Rhizoctonia solani) were investigated for the antifungal activity of T. ammi seeds' volatile compounds. and discovered to suppress all test fungal growt by72–90%. Thymol and carvacol are examples of phenolic compounds that are known to have bacteriostatic or bactericidal properties, depending on the concentration, which was reported to suppress all test fungal growth by 72– 90%. Depending on the concentration, phenolic substances like thymol and carvacol can be either bacteriostatic or bactericidal agents.

Anti-inflammator Activity

Allergic rhinitis (AR) is an immune inflammatory-related disorder that affects the nasal mucosa. Free radicals play a crucial role in the expansion of allergic reaction and the researcher used the antioxidant therapy to treat the disease. Trachyspermum ammi L. (Ajwain oil) is popular traditional medicine. It has been proved their potential effect on various diseases. Ajwain oil showed anti-tumor, antioxidant, antidiabetic, anti-inflammatory, and anti-bacterial properties. Yet, the anti-allergic effect of Ajwain oil is still not explored. In this experimental study, an ovalbumin (OVX)-induced AR model was used to scrutinize the anti-allergic, antioxidant and anti-inflammatory effects of Ajwain oil.

Antilithiasis and diuretic activiy

Additionally investigated are T. ammi's antilithiasis and diuretic effects in vivo on preventing rat-induced oxalate urolithiasis. In an additional investigation on a potential diuretic effect, T. ammi was not successful in raising 24-hour urine production. The findings showed that there was no experimental support for the traditional usage of T. ammi to treat kidney stones. Additionally investigated are T. ammi's antilithiasis and diuretic effects in vivo on preventing rat-induced oxalate urolithiasis. In an additional investigation on a potential diuretic effect, T. ammi was not successful in raising 24-hour urine production. The findings showed that there was no experimental support for the traditional usage of T. ammi to treat kidney stones.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 10, March 2025
Impact Factor: 7.67

Antifilarial activity

It has been studied how well the methanolic extract of Trachyspermum ammi's (Apiaceae) fruits inhibits Setaria digitata worms in vitro. The active fraction and the crude extract shown noteworthy effectiveness against the adult S. digitata in both the MTT [3-(4, 5-dimethylthiazol-2-yl)-2, 5-diphenyltetrazolium bromide] reduction assay and worm motility tests. When tested for in vivo antifilarial efficacy against the human filarial worm B. malayi in Mastomys coucha, the isolated active principle phenolic monoterpene demonstrated macrofilaricidal action and female worm sterility against B. malayi. The crude extract of T. ammi shown macrofilaricidal properties. After two incubation periods of 24 and 48 hours, the isolated active principle 2-isopropyl-5-methyl phenol had IC50 values of 0.024 and 0.002 mg/ml, respectively. In a Mastomys coucha, the in vivo efficacy of the active principle 2-isopropyl-5-methyl phenol was assessed against the B. malayi parasite. model. Adults in the 50 mg/kg group experienced a mean percentage mortality of 58.93%, which was substantially($P<0.0001$) higher than that of the control group (19.05%). Using a Mastomys coucha model, the in vivo impact of the active principle 2-isopropyl-5-methyl phenol was assessed against the B. malayi parasite. Adults in the 50 mg/kg group experienced a mean percentage mortality of 58.93%, which was substantially ($P<0.0001$) higher than that of the control group (19.05%).

Antihypertensive, antispasmodic and broncho- dilating activity

T. ammi's intravenous antihypertensive impact in vivo, as well as its antispasmodic and bronchodilating properties in vitro, shown that calcium channel blockage has been discovered to mediate the spasmolytic actions of plant materials; it is thought that this mechanism supports the traditional use of T. ammi in treating hypertensive conditions and hyperactive disease states of the gut, including diarrhoea and colic.

Future Scope

Medicinally, it has been proven to possess various pharmacological activities like antifungal, antioxidant, antimicrobial, ant nociceptive, cytotoxic, hypolipidemic, antihypertensive, antispasmodic, Broncho-dilating actions, antilithiasis, diuretic, abortifacient, antitussive, nematicidal, anthelmintic and Not only does organic production help reduce public health risks, mounting evidence shows that food grown organically are rich in nutrients, such as Vitamin C, iron, magnesium, and phosphorus, with less exposure to nitrates and pesticide residues in organically grown fruits, vegetables, and grains when compared to conventionally grown products.

II. CONCLUSION

Solvent extraction is an effective method for extracting the essential oil from ajwain seeds. Theextraction of again has been successfully accomplished, resulting in the production of essential oils and beneficial compounds. This process holds significant potential for various industries, including pharmaceuticals, food, and cosmetics. The extracted oil possessessignificant antimicrobial and antioxidant activities. Trachyspermumammi has long been regarded as a valuable medicinal plant. It's been utilized for stomach problems in the past, and it's also used as a flavoring agent. It has a wide spectrum of phytoconstituents that are responsible for a variety of biological properties. Hence the antibacterial activity of T. ammi seeds provides a scientific foundation for their usage as a traditional remedy. T. ammi is a substantial natural antibacterial agent, according to our findings, and can be suggested for the treatment of a variety of microbiological illnesses

REFERENCES

[1]. R. Bentley and H. Trien, Medicinal Plants: Asiatic Publishing House, New Delhi, India (1999).
[2]. V. Krishnamurthy and M. B. Madalageri, J. Med. Aroma. Plant Sci., 21, 996 (1999).
[3]. S.G. Joshi, Medicinal Plants, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, India (2000).
[4]. F. J. Lip, Alter. Therap. Health Med., 2, 36 (1996),
[5]. T.K. Chatterjee, Herbal Options, Books and Allied Pvt. Ltd., Calcutta, India (2000).
[6]. S. Arctander, Perfume and Flavor Chemicals, Montclair, New Jersey, Vol. 2 (1969).

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 10, March 2025
Impact Factor: 7.67

[7]. A Husain, O. P. Virani, A. Sharma, A. Kumar and L. N. Misran, Major Essential Oil Be Plants of India (1988)..
[8]. Anonymous, the Wealth of India (Raw Materials), PID, New Delhi, India, Vol. 10, p 267 (1976).
[9]. G. Singh, S. Maura, C. Catalan and M.P. de. Lampasona, J. Agric. Food Chem., 52, 10 1.M. Chung. M. Ali, K. Upadhaya and A. Ahmad, Asian J. Chem., 17, 1907 (2005).
[10]. C. Katowice, C.A.N. Catalan, C.L. Griffin and W. Hers, Brioche. System at. Ecol., 33, 737(2005).
[11]. C. Katowice, C.A.N. Catalan, C.L. Griffin and W. Hers, Brioche. System at. Ecol., 33, 737 (2005).
[12]. I.M. Chung, M. Ali and A. Ahmad, Chem. Natural Compd., 41, 650 (2005)
[13]. A. Ahmad, K.K. Aggarwal and S. Kumar, Indian Perfume, 46, 145 (2002).
[14]. M. Ashraf and A. Orio, J. Arid Environ. 64, 209 (2006)
[15]. K.C. Srivastava, Prostaglandins, Leukotrienes and Essential Fatty Acids, 33, 1 (1988).
[16]. I.M. Chung, K. Upadhyaya and A. Ahmad, Asian J. Chem., 18, 1751 (2006).
[17]. I.M. Chung, S.J. Hahn and A. Ahmad, J. Chem. Ecol., 31, 1339 (2005).
[18]. SAS Institute, SAS/STAT User's Guide, 6.12 Ed., SAS Institute, Cary, NC (1997).
[19]. M. Ashraf and A. Orooj, J. Arid Environ., 64, 209 (2006)
[20]. K.C. Srivastava, Prostaglandins, Leukotrienes and Essential Fatty Acids, 33, 1 (1988).
[21]. T. Uchiyama T., T. Miyasi, A. Ueno and K. Uumanghani, Phytochemistry, 30, 656 (1991)
[22]. M. Chung, K. Upadhyaya and A. Ahmad, Asian J. Chem., 18, 1751 (2006).
[23]. I.M. Chung, S.J. Hahn and A. Ahmad, J. Chem. Ecol., 31, 1339 (2005). 31
[24]. SAS Institute, SAS/STAT User's Guide, 6.12 Ed., SAS Institute, Cary, NC (1997).
[25]. M. Sholichin, K. Yamasaki, R. Kasai and O. Tanaka, Chem. Pharm. Bull., 28, 1006 (1980).
[26]. J.L..C. Wright, A.G. Meinnes, S. Shimizu, D.G. Smith, J.A. Walter, D. Idler and W. Khalil, Can. J. Chem., 56, 1898 (1978)
[27]. Lobdell KW, Stamou S, Sanchez JA. Hospital-acquired infections. Surg Clin North Am. 2012;92:65–77
[28]. Adams RP. Identification of Essential Oil Components by Gas Chromatography/Mass Spectrometry. Carol Stream, IL: Allured Publishing; 2007.
[29]. Hejazian S. Analgesic effect of essential oil (EO) from Carum copticum in mice. World J Med Sci. 2006;1:95– 99.
[30]. Savoia D (2012) Plant-derived antimicrobial compounds: alternatives to antibiotics. Future Microbiol 7: 979-990.
[31]. Gandomi H, Abbaszadeh S, JebelliJavan A, Sharifzadeh A (2014) Chemical Constituents, Antimicrobial and Antioxidative Effects of T rachyspermum ammi Essential Oil. J Food Processing Preservation 38: 1690-1695,
[32]. Ahmad I, Mehmood Z, Mohammad F (1998) Screening of some Indian medicinal plants for their antimicrobial properties. J Ethnopharmacol 62: 183-193.
[33]. Gilani GR, Mahmood Z, Hussain M (2013) Preliminary evaluation of antimicrobial activity of cream formulated with essential oil of Trachyuspermum ammi. Pak J Pharm Sci 26: 893-896,
[34]. Hajare SS, Hajare SN, Sharma A (2005) Aflatoxin inactivation using aqueous extract of ajowan (Trachyspermum ammi) seeds. J Food Sci 70: C29-C34.
[35]. Singh G, Maurya S, Catalan C, De Lampasona MP (2004) Chemical constituents, antifungal and antioxidative effects of ajwain essential oil and its acetone extract. J Agric Food Chem 52: 3292-3296.
[36]. Hassanshahian M, Bayat Z, Saeidi S, Shiri Y (2014) Antimicrobial activity of Trachyspermum ammi essential oil against human bacterial. Int J Adv Biol Biomed Res 2: 18- 24.
[37]. Jan SA, Shinwari ZK, Zeb A, Khalil AT, Shah SH (2015) Ethnobotany and research trends in Trachyspermum ammi L.(Ajowan); A popular folklore remedy. American-Eurasian J Agric Environ Sci 15: 68-73.
[38]. uyjhmn38. Damodar K, Bhogineni S, Ramanjaneyulu B (2011) Phytochemical screening,