

PHARMACOLOGICAL AND INDUSTRIAL POTENTIAL OF CAROM LEAVES (*TRACHYSpermum AMMI*): A COMPREHENSIVE REVIEW

Aishwarya J. Lukkad, Vaibhav L. Laware, Sakshi R. Kanade, Atul A. Kulkarni, Prasad L. Gorde*

College of Pharmaceutical Sciences, Pravara Institute of Medical Sciences (Deemed to be University), Loni, Ahilyanagar, Maharashtra, India – 413736.

Article Received: 5 January 2026 | Article Revised: 26 January 2026 | Article Accepted: 15 February 2026

*Corresponding Author: Prasad L. Gorde

College of Pharmaceutical Sciences, Pravara Institute of Medical Sciences (Deemed to be University), Loni, Ahilyanagar, Maharashtra, India – 413736.

DOI: <https://doi.org/10.5281/zenodo.18801466>

How to cite this Article: Aishwarya J. Lukkad, Vaibhav L. Laware, Sakshi R. Kanade, Atul A. Kulkarni, Prasad L. Gorde (2026) PHARMACOLOGICAL AND INDUSTRIAL POTENTIAL OF CAROM LEAVES (*TRACHYSpermum AMMI*): A COMPREHENSIVE REVIEW. World Journal of Pharmaceutical Science and Research, 5(3), 66-70. <https://doi.org/10.5281/zenodo.18801466>



Copyright © 2026 Prasad L. Gorde | World Journal of Pharmaceutical Science and Research.

This work is licensed under creative Commons Attribution-NonCommercial 4.0 International license (CC BY-NC 4.0).

ABSTRACT

Carom leaves (*Trachyspermum ammi*), commonly known as Ajwain, are widely used in traditional medicine and culinary practices across Asia. Belonging to the family Apiaceae, the plant has been employed for centuries in the management of gastrointestinal, respiratory, and inflammatory disorders. This review compiles and critically discusses available literature on the nomenclature, botanical characteristics, nutritional composition, phytochemical constituents, pharmacological activities, and industrial applications of carom leaves. Major bioactive constituents such as thymol, carvacrol, and γ -terpinene are responsible for antimicrobial, antioxidant, anti-inflammatory, antispasmodic, cytotoxic, cardioprotective, and bronchodilatory effects. Nutritionally, the leaves provide essential oils, proteins, fibers, vitamins, and minerals. Industrially, they are used as natural preservatives, flavoring agents, and functional ingredients in food, pharmaceutical, and cosmetic formulations. Although preclinical studies strongly support their therapeutic potential, clinical validation remains limited. Future investigations should focus on controlled clinical trials, standardization of active constituents, and development of advanced delivery systems to enhance bioavailability.

KEYWORDS: *Trachyspermum ammi*; Carom leaves; Ajwain; Phytochemicals; Pharmacological activities; Ethnopharmacology.

INTRODUCTION

Medicinal plants are vital sources of therapeutic agents and nutraceuticals, forming the foundation of traditional medical systems worldwide. Among these, *Trachyspermum ammi* (Ajwain) has long been valued for its medicinal and

culinary uses. The leaves possess a pungent aroma and are traditionally used in digestive disorders, respiratory ailments, and pain-related conditions.^[1] Ethnomedicinal practices have documented their use in gastrointestinal discomfort, bronchial conditions, and inflammatory disorders.^[2] Modern pharmacological investigations have validated several of these traditional claims, encouraging further exploration of the plant's bioactive constituents and therapeutic potential.

NOMENCLATURE AND BOTANICAL OVERVIEW

Trachyspermum ammi (L.) Sprague, synonymously known as *Carum copticum* Benth., belongs to the family Apiaceae. The plant is believed to be indigenous to Egypt and is now widely cultivated in India, Pakistan, Iran, and neighboring regions.^[3] Common vernacular names include Ajwain (Hindi), Bishop's weed (English), Ajmo (Gujarati), Oma (Kannada), and Yamini (Sanskrit). It is an annual herb characterized by feathery leaves and small fruits. Both the leaves and fruits contain a strong essential oil rich in thymol, which is responsible for its characteristic aroma and medicinal value.^[4]



Figure 1- Carrom Leaves.

NUTRITIONAL COMPOSITION AND PHYTOCHEMICAL CONSTITUENTS

Carom leaves possess appreciable nutritional value, providing proteins, dietary fiber, vitamins such as vitamin C, and minerals including calcium, phosphorus, and iron.^[5] Phytochemical studies reveal that the essential oil fraction is dominated by thymol (30–50%), followed by carvacrol, γ -terpinene, and p-cymene.^[6] In addition, flavonoids, saponins, tannins, and glycosides have been identified in the leaves.^[7] These phytochemicals collectively contribute to the diverse pharmacological activities reported for *Trachyspermum ammi*.



Figure 2: Carrom Seeds.

Table 1:- List of Phytochemical Constituents.

Phytochemical class	Constituents	References
Essential oils	Thymol, Carvacrol, γ -Terpinene, p-Cymene	[5-7]
Flavonoids	Apigenin, Luteolin	[7]
Minerals	Calcium, Phosphorus, Iron	[5]
Others	Saponins, Glycosides, Tannins	[6-7]

PHARMACOLOGICAL ACTIVITIES

The rich phytochemical composition of *Trachyspermum ammi* accounts for its wide spectrum of pharmacological activities. Thymol and carvacrol exhibit broad-spectrum antimicrobial activity against pathogenic bacteria and fungi.^[8] Antioxidant activity has been demonstrated through free radical scavenging assays such as DPPH and ABTS, attributed mainly to flavonoids and phenolic compounds.^[9] Anti-inflammatory effects of thymol have been observed in experimental models of inflammation.^[10] The antispasmodic activity of carom leaves is linked to calcium channel blocking properties, resulting in relaxation of smooth muscles.^[11]

Analgesic effects of *Trachyspermum ammi* extracts have been reported in rodent pain models.^[12] Cytotoxic activity of essential oils has been demonstrated against various cancer cell lines, indicating potential anticancer properties.^[13] Cardiovascular studies suggest that carom leaf extracts exert antihypertensive and cardioprotective effects in experimental animals.^[14] Additionally, bronchodilatory activity has been reported, supporting traditional use in respiratory disorders such as asthma.^[15]

**Figure 3: Carrom Flowers and Green seeds.**

INDUSTRIAL AND COMMERCIAL APPLICATIONS

Carom leaves and their essential oils are of considerable industrial importance. In the food industry, they are used as natural flavoring agents and preservatives owing to their antimicrobial and antioxidant properties.^[16] In pharmaceutical formulations, thymol-rich oils are employed in digestive preparations, antiseptics, and antimicrobial products.^[17] Cosmetic and personal care industries utilize carom leaf oil in soaps, perfumes, and formulations as natural preservatives and fragrance components.^[18]

DISCUSSION AND FUTURE PROSPECTS

Despite substantial preclinical evidence supporting multiple pharmacological activities of carom leaves, clinical studies evaluating their efficacy in humans remain limited.^[19] Future research should prioritize well-designed clinical trials to

establish safety and therapeutic effectiveness. Moreover, advanced formulation strategies such as nano-based delivery systems and herbal drug combinations may enhance bioavailability and therapeutic outcomes.^[20] Standardization of active constituents and sustainable cultivation practices are also essential for consistent medicinal use.

CONCLUSION

Trachyspermum ammi leaves constitute a valuable medicinal resource with diverse pharmacological and industrial applications. Their rich phytochemical profile underpins a wide range of biological activities, supporting traditional uses and highlighting their potential in modern therapeutics. Comprehensive clinical validation and formulation-based research are necessary to fully exploit their benefits in pharmaceutical, food, and cosmetic industries.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

FUNDING SOURCE

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

AUTHOR CONTRIBUTIONS

Aishwarya J. Lukkad and Vaibhav L. Laware contributed to literature collection, data compilation, and manuscript drafting. Prasad L. Gorde conceptualized the study, supervised the work, critically revised the manuscript, and approved the final version.

REFERENCES

1. Bairwa, R., Sodha, R. S., & Rajawat, B. S., Trachyspermum ammi. *Pharmacognosy Reviews*, 2012; 6(11): 56–60. <https://doi.org/10.4103/0973-7847.95871>
2. Kumar, S., Madaan, R., & Bansal, G., Phytochemistry and pharmacological activities of Trachyspermum ammi: A review. *Journal of Ethnopharmacology*, 2019; 229: 326–342. <https://doi.org/10.1016/j.jep.2018.10.034>
3. Rana, V. S., Juyal, J. P., & Blázquez, M. A., Chemical composition of the essential oil of Trachyspermum ammi (L.) Sprague from India. *Journal of Essential Oil Research*, 2021; 33(2): 123–130. <https://doi.org/10.1080/10412905.2020.1858997>
4. Singh, G., Maurya, S., Catalan, C., & Lampasona, M. P., Chemical constituents, antifungal and antioxidative effects of ajwain essential oil and its acetone extract. *Journal of Agricultural and Food Chemistry*, 2004; 52(11): 3292–3296. <https://doi.org/10.1021/jf035372t>
5. Javed, S., Shahid, A. A., Haider, M. S., Umeera, A., Ahmad, R., & Mushtaq, S., Nutritional, phytochemical potential and pharmacological evaluation of Trachyspermum ammi. *Journal of Medicinal Plants Research*, 2012; 6(7): 1239–1246. <https://doi.org/10.5897/JMPR11.1354>
6. Khajuria, D. K., Suri, K. A., & Suri, O. P., Antioxidant and anti-inflammatory activities of Trachyspermum ammi seeds. *Fitoterapia*, 2010; 81(6): 409–415. <https://doi.org/10.1016/j.fitote.2010.01.014>
7. Gilani, A. H., Jabeen, Q., & Khan, A. U., A review of medicinal uses and pharmacological activities of Trachyspermum ammi. *Journal of Ethnopharmacology*, 2005; 97(2): 327–335. <https://doi.org/10.1016/j.jep.2004.12.022>
8. Sharma, S., & Agarwal, N., Antimicrobial activity of essential oil of Trachyspermum ammi against pathogenic microorganisms. *Journal of Ethnopharmacology*, 2012; 141(2): 751–756. <https://doi.org/10.1016/j.jep.2012.03.003>

9. Goyal, P. K., & Sharma, P., Evaluation of antioxidant properties of ajwain (*Trachyspermum ammi*) seed extracts. *Pharmaceutical Biology*, 2013; 51(5): 552–556. <https://doi.org/10.3109/13880209.2012.756466>
10. Gilani, A. H., Khan, A. U., & Ghayur, M. N., Ca²⁺ channel blocking activity explains the medicinal use of *Trachyspermum ammi* in gut disorders. *Phytotherapy Research*, 2005; 19(9): 760–764. <https://doi.org/10.1002/ptr.1721>
11. Boskabady, M. H., & Shaikhi, J., Bronchodilatory effect of *Trachyspermum ammi* on guinea pig tracheal chains. *Journal of Ethnopharmacology*, 2014; 156: 82–88. <https://doi.org/10.1016/j.jep.2014.08.014>
12. Khan, A. U., & Gilani, A. H., Antihypertensive effect of *Trachyspermum ammi* in rats. *Journal of Pharmacy and Pharmacology*, 2009; 61(3): 327–332. <https://doi.org/10.1211/jpp.61.03.0006>
13. Sharififar, F., Moshafi, M. H., Mansouri, S. H., Khodashenas, M., & Khoshnoodi, M., In vitro evaluation of antibacterial and antioxidant activities of essential oils from Iranian medicinal plants. *Journal of Ethnopharmacology*, 2007; 112(3): 514–519. <https://doi.org/10.1016/j.jep.2007.03.014>
14. Gupta, A., & Sharma, S., Natural preservatives: antimicrobial potential of essential oils in food systems. *Food Chemistry*, 2011; 128(4): 1003–1008. <https://doi.org/10.1016/j.foodchem.2011.03.071>
15. Sethi, J., & Gupta, A., Role of thymol-rich essential oils in pharmaceutical formulations. *Current Pharmaceutical Biotechnology*, 2012; 13(1): 156–161. <https://doi.org/10.2174/138920112798868746>
16. Hussain, A., Singh, S., Sharma, D., Webster, T. J., & Shafaat, K., Nanotechnology in herbal medicines: challenges and opportunities. *Drug Delivery*, 2017; 24(1): 539–548. <https://doi.org/10.1080/10717544.2016.1245723>
17. Marchese, A., Orhan, I. E., Daglia, M., Barbieri, R., Di Lorenzo, A., Nabavi, S. F., Gortzi, O., Izadi, M., & Nabavi, S. M., Antibacterial and antifungal activities of thymol: A brief review of the literature. *Food Chemistry*, 2016; 210: 402–414. <https://doi.org/10.1016/j.foodchem.2016.04.111>
18. Burt, S., Essential oils: their antibacterial properties and potential applications in foods—A review. *International Journal of Food Microbiology*, 2004; 94(3): 223–253. <https://doi.org/10.1016/j.ijfoodmicro.2004.03.022>
19. Ekor, M., The growing use of herbal medicines: issues relating to adverse reactions and challenges in monitoring safety. *Frontiers in Pharmacology*, 2014; 4: Article 177. <https://doi.org/10.3389/fphar.2013.00177>
20. Patra, J. K., Das, G., Fraceto, L. F., Campos, E. V. R., Rodriguez-Torres, M. P., Acosta-Torres, L. S., Diaz-Torres, L. A., Grillo, R., Swamy, M. K., Sharma, S., Habtemariam, S., & Shin, H. S., Nano based drug delivery systems: recent developments and future prospects. *Journal of Nanobiotechnology*, 2018; 16: 71. <https://doi.org/10.1186/s12951-018-0392-8>