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A Comprehensive Review on the Chemical Composition and Biological Activity of *Pleurospermum angelicoides* (DC.) Benth. ex C.B. Clarke

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Abstract: *Pleurospermum angelicoides*, a perennial Apiaceae herb native to the high-altitude Himalayan region, has long been valued in traditional medicine for treating ailments such as fever, typhoid, and dysentery. Despite this ethnomedicinal relevance, comprehensive scientific syntheses on its phytochemistry and pharmacology remain limited. This review addresses this gap by systematically compiling and analysing literature on the species' distribution, morphology, traditional uses, phytochemical diversity, and biological activities. Sources were identified through targeted searches of peer-reviewed journals, ethnobotanical records, and phytochemical databases. The available evidence highlights a remarkable spectrum of bioactive constituents, including coumarins, phenylpropanoids (e.g., nothoapiole, α-asarone), and terpenoids (*p*-cymene, camphene), with notable variations in essential oil profiles across plant parts and geographic locations. Pharmacological studies confirm antimicrobial and antioxidant activities, validating several traditional claims and underscoring the therapeutic promise of its extracts and essential oils. These findings suggest that *P. angelicoides* could serve as a natural source of lead compounds for novel drug development. In addition to summarising current knowledge, this review emphasises critical research gaps, particularly regarding molecular mechanisms, pharmacodynamics, and clinical validation. Unlike earlier scattered reports, it provides the first integrative account of the species' phytochemical and pharmacological potential, thereby establishing a foundation for its broader application in modern herbal medicine and pharmaceutical innovation.

Keywords: *Pleurospermum angelicoides*; food preservation; ethnomedicine; phytochemistry; antimicrobial activity; antioxidant potential.

1. Introduction

Medicinal plants play an essential role in the evolution and discovery of new drugs. The use of herbal remedies derived from medicinal plants is increasing globally because they are found to be effective for a wide range of health issues and are generally considered safe. Among many medicinally beneficial plant species, *Pleurospermum angelicoides* (DC.) Benth. ex C.B.Clarke has attracted significant attention in research.

Trees *Pleurospermum angelicoides* is a medicinal plant species belonging to the genus *Pleurospermum* within the family Apiaceae (also known as Umbelliferae, the carrot or parsley family). *Pleurospermum angelicoides* is considered a synonym of *Pterocyclus angelicoides*. The Apiaceae family and the Pleurospermum genus are renowned for their high content of natural antioxidants. This plant is valued for its diverse applications in medicine, pharmaceuticals, nutraceuticals, cosmeceuticals,

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and food. These plants have so many uses because they're rich in bioactive phytochemicals that offer a broad spectrum of health benefits [1]. *Pleurospermum angelicoides* Benth. is a herb native to India, Yunnan Province, China, and Nepal [2]. It is highly valued for its medicinal properties, mainly attributable to its rich composition of essential oils and other bioactive compounds. These include various terpenoids, coumarins, saponins, and flavonoid glycosides. The presence of these phytochemicals confers a wide range of beneficial activities, such as antioxidant, anti-inflammatory, antimicrobial, and even analgesic effects. In traditional practices, this plant was used as a remedy for conditions such as typhoid, dysentery, and fevers. Its essential oils, present in the leaves, roots, and flowers, are particularly noteworthy for their role in natural medicine and therapeutic uses [3-9]. Essential oils are volatile secondary metabolites produced by aromatic plants and characterized by distinctive aromas. *Pleurospermum angelicoides* has significant ethnobotanical importance, deeply rooted in the traditional medicinal practices of the local regions where it thrives. Its long-standing use by indigenous communities underscores its perceived efficacy and cultural relevance in holistic health systems. This traditional knowledge often provides a valuable foundation for modern scientific inquiry into the plant's potential therapeutic applications [10-19]. These compounds are valued for their antiseptic properties, medicinal benefits, and pleasant scent [3-8]. This review primarily aims to explore the components, biological activities, and overall health potential of essential oils, with a special focus on those isolated from the significant genus *Pleurospermum angelicoides*.

2. Taxonomy of *Pleurospermum angelicoides*

2.1. Vernacular Names and Geographical Distribution

Pleurospermum angelicoides is locally known as Chipi and Choru [2]. The genus *Pleurospermum*, a member of the Apiaceae family, comprises approximately 50 species distributed across North Asia and Eastern Europe, with a significant concentration in the Himalayan region and Western China. They are characteristically found in challenging alpine zones at high altitudes, generally thriving between 3300 and 4800 meters above sea level. They are adapted to diverse microhabitats, including steep rocky slopes, moist rocky areas, and sometimes scree slopes [3,4].

Among these, P. angelicoides, in parts of the Himalayas, is a notable species within the genus. Its native distribution spans the Himalayan range, encompassing India (specifically Uttarakhand, Kashmir, and Sikkim), Nepal, Bhutan, Tibet, and Western China, particularly Yunnan province. This specific species also inhabits the high-altitude alpine zones, generally observed between 3300 and 4800 meters, with some reports noting its presence around 3600 meters in areas like the vicinity of Milam Glacier in Uttarakhand [5,6].

It prefers habitats within the broader genus, including steep, moist rocky slopes, open grasslands, and rock crevices, and adapts to the cold, temperate alpine climate and well-drained soils of these mountainous regions. The State Medicinal Plants Board, Uttarakhand, also lists *P. angelicoides* among the high-altitude medicinal and aromatic plants found in the area, particularly between 2001 and 3000 meters, highlighting its presence in the higher reaches of Uttarakhand for its medicinal uses (Figure 1).

3. Materials and Methods

This review provides an updated overview of recent investigations into the chemical composition and biological activities of the genus *Pleurospermum*. Literature was retrieved using electronic databases, including Google Scholar, PubMed, ScienceDirect, and ResearchGate. Additional searches were conducted in Scopus, Wiley Online Library, and Semantic Scholar, focusing on articles published in English through September 2025. The search strategy employed combinations of the following keywords: “*Pleurospermum angelicoides* (DC.) Benth. ex C.B.Clarke “essential oils, “anti-inflammatory,” “antioxidant,” “antibacterial,” “antifungal,” “antimicrobial,” and “antiviral.” Only experimental studies published in English were included [10-12]. Inclusion criteria were studies reporting the distribution, traditional uses, chemical composition, or biological activities of *P. angelicoides*. Exclusion criteria included duplicate records, non-English publications, conference abstracts lacking sufficient data, and studies without specific reference to this species. Additional references were identified through cross-checking the bibliographies of relevant articles.

Figure 1. Geographical distribution of *P. angelicoides*

4. Phytochemistry

The phytochemistry of *P. angelicoides* is a subject of growing interest, as its diverse traditional uses suggest a rich array of bioactive compounds. *P. angelicoides*, a member of the Apiaceae family, is rich in secondary metabolites such as coumarins, essential oils, and flavonoids that contribute to its medicinal properties [19]. Comprehensive phytochemical investigations have systematically examined various plant parts, including seeds, leaves, stems, and flowers. By analyzing fractions and extracts from distinct plant organs, a diverse array of natural compounds has been successfully identified and characterized. These secondary metabolites obtained from the plant have various medicinal properties, including antioxidant, anti-fungal, and antimicrobial activities. The phytochemical constituents obtained and identified by the researcher from various parts of the plant are listed below.

4.1. Roots

Makio and co-workers isolated two isocoumarins, Angelicoins A and Angelicoins B, from the roots of *P. angelicoides*. Angelicoins A was extracted as a white amorphous powder with chemical formula $C_{15}H_{18}O_4$, named 3-methyl-6,7,8-trisubstituted-3,4-dihydroisocoumarin ring, and Angelicoins B was extracted as a colourless amorphous solid with chemical formula $C_{11}H_{12}O_4$, which is analogous to isocoumarin of Angelicoins A [7]. Mathela et al. investigated the terpenoid composition of essential oils derived from the leaves, flowers, and roots of *P. angelicoides*. The root essential oil of *P. angelicoides* was found to be distinctively rich in phenylpropanoids (90.8%), with Nothoapiole (87.3%) as the dominant constituent. It is a highly oxygenated phenylpropanoid, structurally related to myristicin and apiole. Since nothoapiole is very uncommon, its presence suggests a potential biosynthetic pathway involving enzymatic methoxylation of related phenylpropanoids [9].

The chemical composition of essential oils varies across geographical regions, which can in turn influence their pharmacological activities. Swati et al. (2020) investigated the essential oil using gas chromatography-mass spectrometry (GC/MS) obtained from the root of *P. angelicoides* collected from the Himalayan region of Pithoragarh district, Uttarakhand. They found 24 different chemical components (Figure 2). The primary chemical components found in the essential oil from *P. angelicoides* were *β*-ocimene, butylidene phthalide, *α*-phellandrene, *β*-phellandrene, *Z*-lingustilide, *α*-phellandrene epoxide, durene, cyclopropane, 2-(1,1-dimethyl-2-pentenyl)-1,1-dimethyl, phellandral, spathulenol, cadinene, and valerophenone. These key chemical compounds extracted from the root of *P. angelicoides* show significant promise for medicinal applications [20], *β*-ocimene, which was one of

the major chemical components in the essential oil, has been shown to have antiviral, antifungal, anti-inflammatory, antibacterial, antioxidant, and antiseptic properties. Butylidene phthalide is beneficial for humans because it acts as an antispasmodic, helping relax muscles and prevent cramps and spasms. Additionally, it enhances blood flow. Its antispasmodic activity and ability to improve blood flow make *P. angelicoides* a plant of interest in health and scientific research [20]. Studies have shown that α- and *β*-phellandrene have antibacterial, antioxidant, and antimicrobial properties. Ligustilide helps reduce brain damage and enhances cognitive function. Additionally, (*Z*)-ligustilide and other phthalide lactones have demonstrated therapeutic benefits across various diseases, exhibiting both anti-proliferative and anti-inflammatory effects [20-22].

4.2. Leaves

The leaf essential oil was found to be rich in limonene (48.4%) and *α*-asarone (23.2%) with a small amount of *β*-asarone, α-pinene, and perilla aldehyde (Figure 2) [9].

4.3. Flowers

The essential oil of the flower contains *α*-pinene (22.3%), *α*-asarone (20.7%), perilla aldehyde, and limonene [9].

4.4. Seeds

Mahmood and Thakur (1981) isolated 1-propenyl-2,3,4-trimethoxybenzene ($C_{12}H_{16}O_3$), triacontane, and *β*-sitosterol from the essential oil obtained from the seed of *P. angelicoides* [10]. In continuation of their work in 1983, they isolated a new bicyclic dihydroxy monoterpene, angelicoidenol, from the methanol extract of *P. angelicoides* seeds [16]. A recent investigation by Mathela and Bisht (2025) identified monoterpene hydrocarbons in the aerial parts of *P. angelicoides*. The primary components identified were *p*-cymene (50.4%) and camphene (21.9%), with limonene and *α*-asarone present in minor quantities. *p*-Cymene can rupture cell membranes, a key property that enhances its synergistic effect with other antimicrobial drugs [11]. (Table 1).

5. Pharmacological Activity

The pharmacological activity of a medicinal herb is the specific effect of a plant's phytochemical constituent on the biological system, leading to therapeutic and other physiological responses. These activities form the scientific basis for the traditional uses of plants in various ethnomedical systems and are crucial for the discovery and development of new drugs.

5.1. Antifungal Activity

The Antifungal activity refers to the ability of a substance, whether naturally occurring or synthesized, to inhibit the growth or kill fungi, including yeasts and molds. It is essentially the power to combat fungal infections. Antifungal agents, also known as antimycotics, are used to treat a variety of fungal infections in humans, animals, and plants.

The leaf essential oil was found to be similarly effective to amphotericin B in its notable antifungal activity against both *Candida albicans* and *Candida glabrata* in the same experimental setup. Similarly, the essential oil obtained from the flowers and roots showed antifungal effectiveness against *Candida albicans*. However, the flower oil had minimal activity against *Candida glabrata*, and the root oil was ineffective against this fungus [9].

5.2. Antibacterial Activity

The ability of a substance to inhibit bacterial growth or kill bacteria is known as antibacterial activity. This activity is essential for combating bacterial infections, which are a major global health issue. Since many bacteria are becoming resistant to antibiotics, there is a strong need to discover new antibiotics from any source. Historically, many antibiotics have been derived from plants because many medicinal plants contain chemical constituents with antibacterial activity [17]. Moderate antibacterial activity was observed for essential oils extracted from the leaf, root, and flower of *P. angelicoides*. Notably, all the essential oils obtained were effective against Streptococcus mutans [9].

Table1. Major chemical components in the different parts of *P. angelicoides* and their pharmacological activity.

S.No.	Plant part	Chemical components	Bioactivity	References
1.	Root	Angelicoins A	Anti-oxidant, Anti-inflammatory activity	[7]
		Angelicoins B	Anti-oxidant, Anti-inflammatory activity	[7]
		Nothoapiole	Antioxidant, antimicrobial	[9]
		β-Ocimene	Antiviral, antifungal, anti-inflammatory, antibacterial, antioxidant, antiseptic	[20]
		Butylidene phthalide	Antispasmodic (relaxes muscles, prevents cramps), enhances blood flow	[20]
		α-Phellandrene	Antibacterial, antioxidant, antimicrobial	[20]
		β-Phellandrene	Antibacterial, antioxidant, antimicrobial	[20]
		Z-Ligustilide	Helps reduce brain damage, enhances cognitive function, anti-proliferative, anti-inflammatory	[20]
		Phellandral	Analgesic,antioxidant, anti-inflammatory	[20]
		Spathulenol	Analgesic,antioxidant, anti-inflammatory	[20]
		Cadinene	Analgesic,antioxidant, anti-inflammatory	[20]
2.	Aerial part (leaf and flower)	Limonene	Antioxidant, Anti-inflammatory, Anticancer, Neuroprotective, Analgesic, Antimicrobial	[9]
		α-Asarone	Neuroprotective, Cognitive-enhancing, Anti-inflammatory, Antioxidant	[9]
		β-Asarone	Antioxidant, Anti-inflammatory, Antiapoptotic, Antidepressant, Anxiolytic, Antithrombotic	[9]
		α-Pinene	Antimicrobial,Anti-inflammatory, Antioxidant, Neuroprotective, Analgesic	[9]
		Perilla aldehyde	antiallergic,antioxidant, antimicrobial	[9]
		p-Cymene	Ability to rupture cell membranes (synergistic effect with other antimicrobial drugs)	[11]
		Camphene	Hypolipidemic (lowers cholesterol and triglycerides) Anticancer, Analgesic, antioxidant, antimicrobial, anti-inflammatory	[11]
3.	Seed	1-propenyl-2,3,4-trimethoxybenzene	Neuroprotective, Anti-inflammatory, Antioxidant, Anticancer, Antimicrobial.	[10]
		Triacontane	Antimicrobial,anti tumor	[10]
		β-sitosterol	Anti-diabetic,antipyretic, anti-inflammatory,antioxidant	[10]
		Angelicoidenol	Anti-inflammatory, Antioxidant, Neuroprotective	[16]

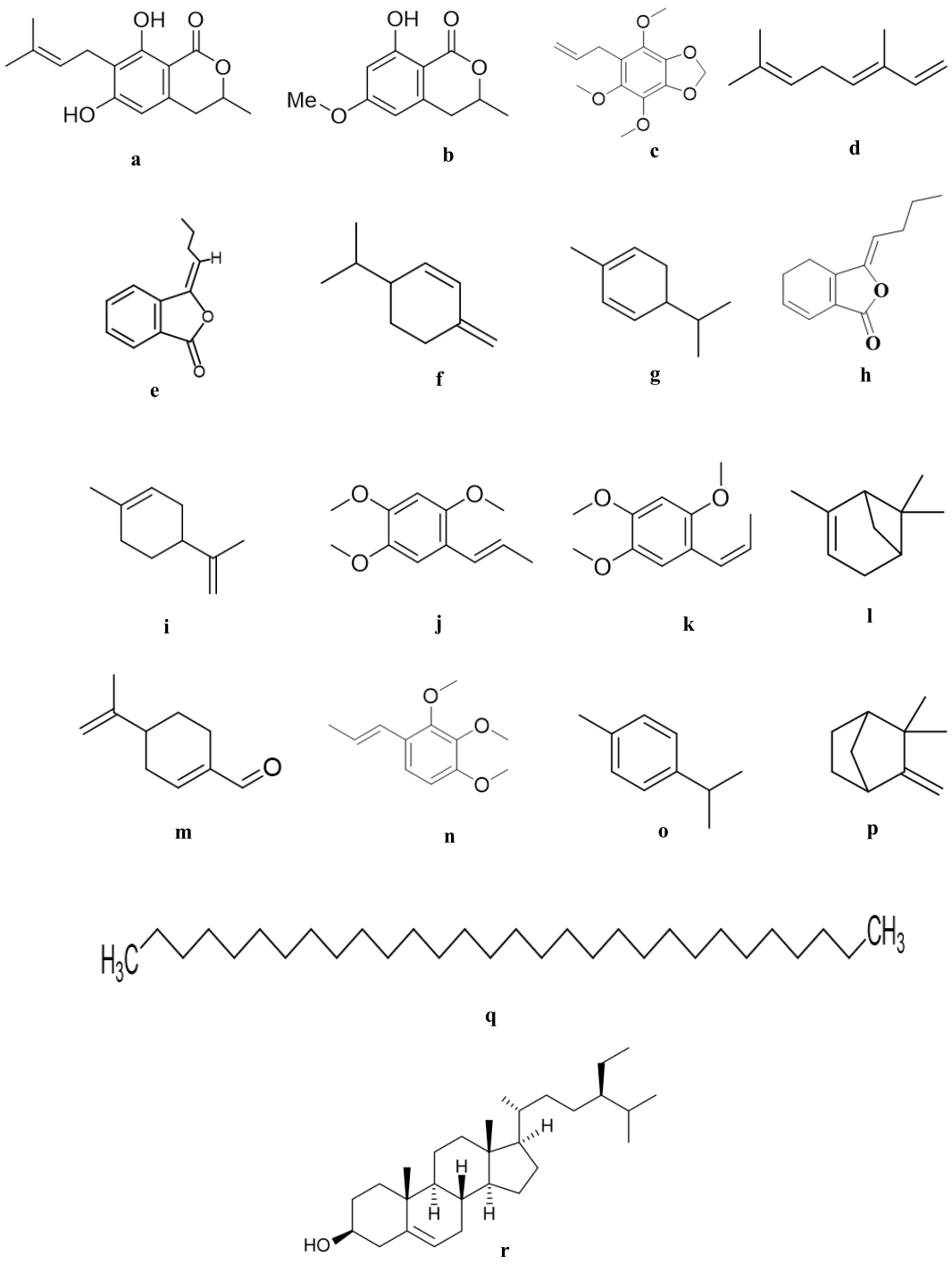

Figure 2. Structures of some major common compounds of *P. angelicoides* (a- Angelicoins A, b- Angelicoins B, c- Nothoapiole, d- *β*-ocimene, e- butylidene phthalide, f- *β*-phellandrene, g- *α*-phellandrene, h- *Z*-lingustilide, i- limonene, j- *α*-asarone, k- *β*-asarone, l- *α*-pinene, m- perilla aldehyde, n- 1-propenyl-2,3,4-trimethoxybenzene, o- *p*-cymene, *p*- Camphene, q- Triacontane, r-*β*-sitosterol)

5.3. Antioxidant Activity

Over the past few years, free radicals have garnered considerable attention in disease biology due to their role in disease pathogenesis. Free radicals are the very reactive, unstable atoms or molecules that have an unpaired electron, and they can damage the cell. They are naturally produced in the body

as byproducts of normal metabolic processes, but their levels can increase due to external factors such as pollution, smoking, radiation, and certain toxins [18]. Antioxidants are the compounds that neutralize the free radicals and stop the damaging chain reaction. Many medicinal plants, including various herbs and spices, are rich in chemical compounds that exhibit antioxidant properties in the body. To evaluate the antioxidant properties of the essential oils obtained from the leaf, root, and flower of the *P. angelicoides*, Mathela et al. (2015) performed three primary *in vitro* assays: DPPH free radical scavenging, reducing power, and ferrous ion chelating activities, assessing their capacity to neutralize free radicals, reduce oxidized species, and bind metal ions, respectively. While comparing the findings of different assays, they found that the flower essential oil demonstrated the highest DPPH free radical scavenging activity. In terms of reducing power, the root essential oil displayed the highest capacity, while the leaf essential oil showed superior ferrous ion chelating potential [9]. In the study by Swati et al. (2020), the ABTS assay showed that the hydroalcoholic extract of *P. angelicoides* root had stronger radical-scavenging (antioxidant) activity than the essential oil and aqueous extract [20].

5.4. Antipyretic Activity

Pyrexia, also called fever, occurs when the body's temperature rises and may be due to inflammation, infection, cellular damage, or certain diseases. When tissue is infected or damaged, it produces more pro-inflammatory chemicals, such as cytokines. These cytokines boost prostaglandin E2 (PgE2) production in the hypothalamus, which in turn signals the hypothalamus to raise the body's temperature. An agent that reduces elevated body temperature is known as an antipyretic agent [22]. *Pleurospermum angelicoides* has been used for a long time as an antipyretic agent in parts of China and India. Since fever can be caused by inflammation, its anti-inflammatory effects could indirectly reduce temperature.

5.5. Antispasmodic Activity

Antispasmodic activity refers to the ability of a substance to relieve or prevent muscle spasms, particularly those involving smooth muscles found in internal organs like the gastrointestinal tract, urinary system, and respiratory system [21]. Swati et al. found *P. angelicoides* to be highly effective as an antispasmodic agent due to the presence of the chemical butylidene phthalide [20].

5.6. Antiseptic Activity

An antiseptic agent works by inhibiting the growth of, or killing, microorganisms (such as bacteria, viruses, and fungi) on living tissues (such as skin and mucous membranes) to prevent infection. *Pleurospermum angelicoides* has the chemical *β*-ocimene in the root, which has antiseptic properties [20].

5.7. Anti-Inflammatory Activity

The anti-inflammatory activity of *P. angelicoides* is supported by both traditional uses and the presence of phytochemicals that modulate inflammatory responses.

6. Conclusion

This review highlights the remarkable phytochemical diversity of Pleurospermum angelicoides, encompassing terpenes, phenylpropanoids, isocoumarins, phytosterols, and other metabolites that collectively underpin its wide range of traditional and pharmacological uses. Preclinical studies consistently demonstrate potent antioxidant, anti-inflammatory, antimicrobial, anticancer, neuroprotective, and hypolipidemic activities, reinforcing its potential as a valuable medicinal resource. Beyond therapeutic applications, the antioxidant and antimicrobial properties of *P. angelicoides* also suggest promising roles in food chemistry, particularly as a natural preservative to enhance shelf life, prevent microbial spoilage, and reduce reliance on synthetic additives. Nevertheless, most of the current evidence is limited to in vitro and in vivo experimental models. To fully realise its potential, future research should focus on isolating and characterising the most active constituents, clarifying their molecular mechanisms of action, conducting systematic safety and toxicological evaluations, and progressing to rigorously designed clinical trials. Such integrative efforts will not only validate the

traditional applications of *P. angelicoides* but also pave the way for its incorporation into modern pharmaceutical, nutraceutical, and food preservation practices.

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References

[1] P. Thiviya, A. Gamage, D. Piumali, O. Merah and T. Madhujith (2021). Apiaceae as an important source of antioxidants and their applications, *Cosmetics* **8**(**4**), 111.

[2] J. D. Hooker (1889). Flora of British India (Vol. II, p. 103). L. Reeves, Kent. L. Reeve & Co., London.

[3] A. Gurav, S. Gautam, A. P. Madhusoodan, N. S. Kharayat, N. Sharma and M. A. Ramakrishnan (2022). Qualitative and quantitative phytochemical screening and *in vitro* cytotoxicity study of *Zanthoxylum armatum* DC. and *Pleurospermum angelicoides* (DC.) Benth. ex C.B. Clarke: Important medicinal plants of the upper Himalayan region, *Ann. Phytomed.* **11**(**2**), 411–420.

[4] Z. H. Pan and M. F. Watson (2005). *Pleurospermum* Hoffmann. In: *Flora of China,* Science Press in Beijing and Missouri Botanical Garden Press in St. Louis, Vol. 14, pp. 40–51.

[5] A. S. Chandwani, S. B. Jhala, K. P. Modi and M. B. Shah (2022). Phytochemical and biological properties of genus *Pleurospermum*: A review, *Int. J. Res. Ayurveda Pharm.***13**, 126–131.

[6] T. Borsch, W. G. Berendsohn, E. Dalcin, M. Delmas, S. Demissew, A. Elliott, P. W. Fritsch, A. Fuchs, D. V. Geltman, A. Güner, T. Haevermans, S. Knapp, M. M. L. Roux, P. Loizeau, C. Miller, J. S. Miller, J. T. Miller, R. Palese, A. Paton and N. Zamora (2020). World Flora Online: Placing taxonomists at the heart of a definitive and comprehensive global resource on the world's plants, *Taxon* **69**(**6**), 1311–1341.

[7] M. Shibano, H. Naito, M. Taniguchi, N. H. Wang and K. Baba (2006). Two isocoumarins from *Pleurospermum angelicoides*, *Chem. Pharm. Bull.* **54**(**5**), 717–718.

[8] F. Bakkali, S. Averbeck, D. Averbeck and M. Idaomar (2008). Biological effects of essential oils: A review, *Food Chem. Toxicol.* **46**(**2**), 446–475.

[9] C. S. Mathela, R. K. Joshi, B. S. Bisht and S. C. Joshi (2015). Nothoapiole and α-asarone rich essential oils from Himalayan *Pleurospermum angelicoides* Benth., *Rec. Nat. Prod.* **9**(**4**), 546–552.

[10] U. Mahmood and R. S. Thakur (1981). Chemical constituents of *Pleurospermum angelicoides*, *Indian J. Pharm. Sci.* **43**, 151.

[11] C. S. Mathela and B. S. Bisht (2025). Bioprospecting terpenoid-rich Himalayan plants for use in food preservation and natural flavouring agents, *Rec. Agric. Food. Chem.* **5**(**1**), 63–70.

[12] P. C. Phondani, R. K. Maikhuri and C. P. Kala (2010). Ethnoveterinary uses of medicinal plants among traditional herbal healers in *Alaknanda catchment* of Uttarakhand, India, *Afr. J. Tradit. Complement. Altern. Med.* **7**(**3**), 195-206.

[13] L. S. Kandari, K. S. Rao, K. Chauhan, R. K. Maikhuri, V. K. Purohit, P. C. Phondani and K. G. Saxena (2007). Effect of presowing treatments on the seed germination of two endangered medicinal herbs of the Himalaya (*Angelica glauca* Edgew. and *Pleurospermum angelicoides* (Wall. ex DC.) Benth. ex C.B. Clarke), *Proc. Indian Natl. Sci.* **73**(**1**), 11–16.

[14] P. Moradi, F. Aghajanloo, A. Moosavi, H. H. Monfared, J. Khalafi, M. Taghiloo, T. Khoshzaman, M. Shojaee, and A. Mastinu (2021). Anthropic effects on the biodiversity of the habitats of *Ferula gummosa*, *Sustainability* **13**(**14**), 7874.

[15] A. Elliott, R. Hyam, W. Ulate, Zenodo (2023). World Flora Online Plant List June 2023-The World Flora Online Consortium, World Flora Online Plant List June 2023 [Data set], Zenodo. https://doi.org/10.5281/zenodo.8079052

[16] U. Mahmood, S. B. Singh and R. S. Thakur (1983). Angelicoidenol, a bicyclic monoterpene from the seeds of *Pleurospermum angelicoides*, *Phytochemistry* **22**(**3**), 774–776.

[17] D. S. Arora and G. J. Kaur (2007). Antibacterial activity of some Indian medicinal plants, *J. Nat. Med.* **61**(3), 313–317.

[18] S. Škrovánková, L. Mišurcová and L. Machů (2012). Antioxidant activity and protecting health effects of common medicinal plants, *Adv. Food Nutr. Res.* **67**, 75–139.

[19] R. M. O. Sousa, A. C. Cunha and M. Fernandes-Ferreira (2021). The potential of Apiaceae species as sources of singular phytochemicals and plant-based pesticides, *Phytochemistry* **187**, 112714.

[20] H. K. Swati, A. Pandey and A. Singh (2020). Chemical composition and in vitro antioxidant activity of *Pleurospermum angelicoides* collected from Western Himalayan region, *J. Essent. Oil-Bear. Plants* **23**(**4**), 843–848.

[21] A. Rauf, M. Akram, P. Semwal, A. A. Mujawah, N. Muhammad, Z. Riaz and H. Khan (2021). Antispasmodic potential of medicinal plants: A comprehensive review, *Oxid. Med. Cell. Longev.* **2021**(**1**), 4889719.

[22] V. Garg and R. Dutt (2020). Antipyretic plants: An updated review, *Curr. Bioact. Compd.* **16**(**1**), 4–12.