Traditional Uses and Modern Applications of *Planthranthus mollis*: A Review"

Deepan. N[1], Venkatachalam T[1*] and Senthilkumar SR[2]

[1]JKKMMRFs Annai JKK Sampoorani Ammal College of Pharmacy, Komarapalayam, Namakkal – 638183.The Tamil nadu Dr MGR Medical university,Chennai-600032

[2]Arulmigmu Kalasalingam College of Pharmacy, Krishnankoil – 626126, The Tamil nadu Dr MGR Medical university,Chennai-600032

Absrtact:

Plectranthus mollis belongs to the family: Laminaceae. With containing various kinds of ethnopharmacological uses. *P. mollis* has been widely used to treat snakebites, respiratory stimulants and vasoconstrictors, heart depressants, haemorrhage, mental retardation, and rheumatism. The secondary phytochemical constituents of *P. mollis* is claimed to possess relaxing activity on smooth and skeletal muscles, and having cytotoxic, anti-microbial, anti-inflammatory and has tumor promoting activity. A preliminary phytochemical investigation of the finely ground substance found the presence of flavonoids, terpenoids, steroids, phenols, and tannins. The overview focuses on the chemical composition of *P.mollis*, current new developments in chemistry, and its pharmacological properties.

Key words: Heart depressants, respiratory stimulant, vasoconstrictors, mental retardation, *Plectranthus mollis.*

**Correspondence address*
Dr.T,Venkatachalam
Professor & Head
Dept of Pharmaceutical chemistry
JKKMMRFs Annai JKK Sampoorani Ammal
College of Pharmacy, Komarapalayam, Namakkal – 638183

1. Introduction:

India affords a wealth variety of possibilities for research on multiple aspects of folk medicine because of its wide variety of plant types and distinct tribal areas. From this standpoint, *Plectranthus mollis* grows on Mount Abu, commonly known as "The Hill of Wisdom," a noticeable hill station in Rajasthan situated on the Aravalli hills. It is the tallest peak between the Himalayas, the Nilgris, and other Indian hills. Tribal medicine men provided firsthand information on medicinal plants and their therapeutic uses. *Plectranthus mollis* (Aiton) Spreng is the genus of Plectranthus, belongs to the Family Laminaceae, and has a wide range of ethnopharmacological uses. This genus (Plectranthus) has more than 300 species in tropical Africa, Asia, and Australia[1].

Natural products are golden gifts from the earth that play an essential part in human illness and disease. The current review suggests that natural products have a greater impact on novel drug development. Natural products include curcumin from Curcuma longa, epigallocatechin-3-gallate from green tea, resveratrol from grapes, indole-3-carbine from cabbage, vitamin D from milk, and sunlight, celastrol from trypterigium wilfordii hook. F. chrysin from oraxylum indicum (L.) vent, Betulinic acid from White-barked birch tree[2].They treat various diseases and disorders such as Cancer, arthritis, Microbial infections, Neurodegenerative disorders, and cardiovascular diseases.

Furthermore, the US Food and Drug Administration (FDA) approved 547 natural compounds and their derivatives for use as drugs (1827–2013). Natural products, among 50%, are essential to the treatment as they have anti-cancer properties, which are approved by the US Food and Drug Administration (FDA)[3]. Herbal medicinal products, plant extracts, and isolated biomolecules all have medicinal uses. The Medicinal plants are capable to treat and prevent various diseases and illness.

P. mollis seeds treat arthritis, and crushed seeds milk is taken internally as a drink[4]. The plant leaves are used in siddha medicines. The leaf paste was utilized on the skin to treat snakebites, tied to drive out evil spirits, and the seeds with mustard oil for fever. It is also have mosquito-repellant properties[5]. *P. mollis* has β-sitosterol and stigmasterol constituents that can control auto-antigen production in rheumatic diseases by preventing protein denaturation and free radical synthesis[6]. *P. mollis* essential oil exhibits antibacterial characteristics, treating various infectious disorders caused by bacteria and fungi[7]. In India, *P. mollis* is used to stimulate the respiratory system, constrict the blood vessels, is a cardiac depressant and arrest the bleeding of blood and has Smooth and skeletal muscle relaxant properties[8]. *P. mollis* improves mental disability[9].

P. mollis also has cytotoxic, anti-tumor-promoting activity and is used in cancer treatment[10] .

2. Description

Plectranthus mollis Spreng. is an annual herb that can grow up to 80 cm tall. Its stems are hardy and coarsely hairy, while its leaves are ovate-cordate, membranous, and pubescent. The flowers are pale lilac to light blue, with a broad campanulate calyx - 0.4-0.5 cm long (1 cm in fruits) and a slightly decurved corolla with 1 cm length. The nutlets are subglobose, subglobose, and have purplish-brown markings. The plant grows up to 80 cm tall.

2.1. Taxonomy:

Root: Root
Kingdom: Plantae
Phylum: Tracheophyta
Class: Magnoliposida
Order: Lamiales
Family: Lamiaceae
Genus: Plectranthus
Species: *Plectranthus mollis* (Aiton) spreng.

Fig.1. *Plectranthus mollis* (Aiton) spreng.

2.2. Regional name:

Common name: Heart-leaved, mint leaf, soft-stem Mint leaf, Malayalam: Perim-Tolassi, Kannada: Nonakasa, Nepali: Guhya Silam, Oriya: Gondri and Marathi: Lal Aghaada.

2.3. Morphology:

Plectranthus mollis (Aiton) Spreng. Synonym: *Plectranthus incanus. Link.*

2.3.1. Habit:

It is an herbaceous perennial plant that often has a sprawling or spreading growth habit. Leaves are typical ovate to elliptical in shape, large in size depending on the growth. The leaves texture are characterized by soft, velvety texture, which is where the species name is "Mollis" (Meaning soft), leave color is green, but the exact shade can vary, the stem are usually square and slightly woody at the base and they are often branched and having a soft, pubescent (hairy) texture. Flowers are arranged in dense, terminal spikes and racemes. Flowers are tubular and bilabiate in structure and display shades of blue to lavender. The fruits are a small, four –parts nut let, which is typical for members of the mint family. The root is fibrous and can be quite extensive grows in various soil types.

2.3.2. Habitat:

Plectranthus mollis is adaptable to a range of conditions, including shade and semi-shade. It is often grown for ornamental purposes and can also be used as a ground cover. It is appreciated for its soft, attractive foliage and charming flowers, making it a popular choice in gardens and as an indoor plant.

2.3.3. Macroscopical features:

The leaves are ovate in shape, about 7-7.2cms in length, rough to touch, both upper and lower surface having glandular and non-glandular trichomes. Smell unpleasant in fresh or damp conditions, but nice and pleasing in dry conditions, with a slightly pungent taste[10].

2.3.4. Microscopical features:

The leaves have flattened and notches of petiole with 2-5 rides and 4-5 meristeles. It has epidermis with thick cuticle and numerours trichomes in single layer. The upper side contains a epidermis is covered with a thick cuticle and features a deep grooves and the convex towards the lower side and it has complete developed by meristeles with bicollateral xylem and phloem. It has numerous cuticles, noticeable single cell to glandular trichomes. 1-2 layered of collenchymatous cells and 4-5 layers of parenchymatous region[10].

2.4. Chemical constituents:

P. Mollis has reported that the presence of secondary metabolites terpenoids, steroids, flavanoids, tannins, phenolic compounds[10].

The most significant part of *P. Mollis* has fenchone (32.3%), followed by α-humulene (17.3%), piperitenone oxide (8.5%), cis-piperine oxide (6.0%), and E-β-farnesene (5.9%). The oil includes a high percentage of oxygenated monoterpenes (52.0%), followed by

sesquiterpene hydrocarbons (40.2%), oxygenated sesquiterpenes (4.9%), and monoterpene hydrocarbons (1.5%) exhibit anti-microbial activity (Rajesh K. Joshi, 2013). *P. Mollis* seeds contain fatty acids and oils palmitic oil (7.2%), stearic oil (13.6%), oleic oil (21.1%), linolenic oil (46.5%), malvalic acid (2.3%), sterculic acid (3.2%) and vernolic oil (6.1%)**[11].**

Monoterpenes are a diverse group of naturally occurring compounds found in essential oils and resins of various plants. They are characterized by their distinctive aromas and have numerous applications in fields such as medicine, agriculture, and cosmetics. It has Anti-inflammatory, anti-microbial Agents and anti-cancer Agents.

Fenchone is a monoterpene ketone found in essential oils of various plants, including fennel (Foeniculum vulgare) and wormwood (Artemisia absinthium). It has a range of uses and is the subject of scientific research due to its diverse biological activities. It has exhibit anti-microbial[12], Antioxidant Properties[13], diuretic activity[14] Anti-inflammatory and Analgesic Effects[15] and Anti-fungal activity**[16].**

α-Humulene, also known as α-caryophyllene, is a sesquiterpene found in essential oils of various plants, including hops (Humulus lupulus) and black pepper (Piper nigrum). It has a range of applications and biological activities. Anti-inflammatory and Analgesic Properties, Anti-microbial Activity, Anti-oxidant Activity and Anti-cancer[16].

Piperitenone oxide is a naturally occurring compound found in various essential oils, notably in peppermint and other mint species. It's of interest due to its diverse biological activities. Anti-microbial properties**[17],** Anti-cancer Activity**,** Anti-inflammatory Effects[18] and larvicidal properties**[19]**.

Cis-piperine oxide, a compound derived from piperine (an alkaloid found in black pepper), has been studied for its various biological activities. Anti- Microbial properties**,** Anti-cancer Activity, Anti-inflammatory Effects and larvicidal activity and Cognitive and Neuroprotective Effects and Anti-oxidant activity **[20]**.

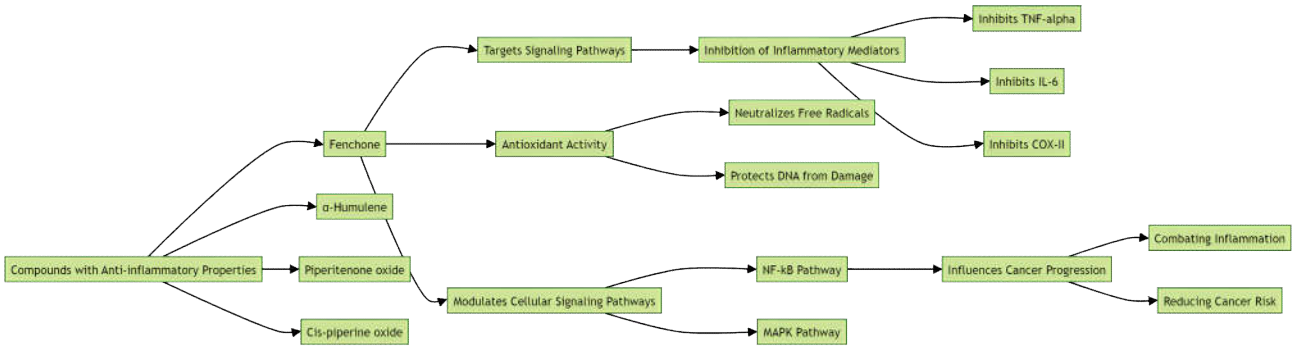
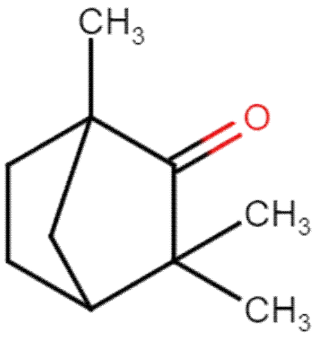
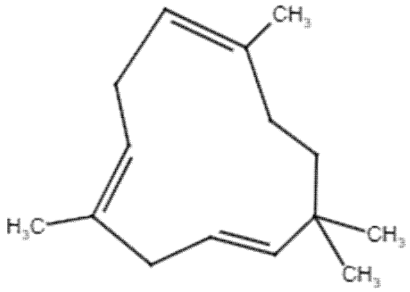


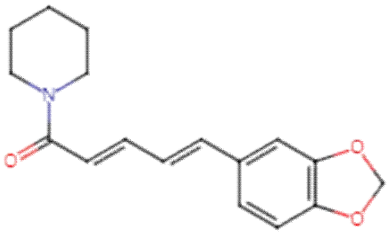
Fig.2. Role of active chemical constituents



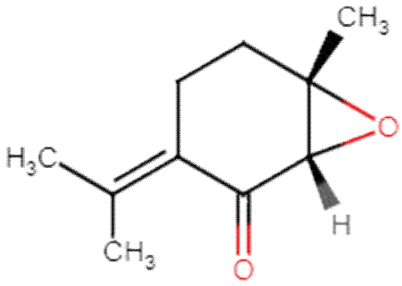
Fenchone



α-Humulene



Cis-piperine oxide



Piperitenone

3. Pharmacological activity:

Before research work has reported on the leaves exhibit the anti-oxidant activity, anti-inflammatory, anti-microbial activity, larvicidal activity and having cytotoxic activity in *in-vitro*-models.

3.1. Anti-oxidant activity

The ethanolic extract of *Plectranthus mollis* leaves has possessed that free radicals terminates the chain reaction due to the presence of phenolic constituents. Nitric oxide scavenging, hydrogen peroxide scavenging, ferric reducing antioxidant power assay and lipid peroxidation methods was used to perform the plant leaves extract of *Plectranthus mollis* exhibit anti-oxidant property and having higher amount of flavanoid and phenolic content.[21].

3.2. Anti-inflammatory activity

The PMC-I & PMC-II technique on the arial part of *Plectranthus mollis* extracts were reported by two *in-vitro* methods of HRBC Membrane Stabilization and Inhibition of protein denaturation. *Plectranthus mollis* produce anti-inflammatory activity due to the presence of β-sitosterol and stigmasterol which indicates to supperess lysosomal enzymes or by declined the lysosomal membrane and to

control auto-antigen formation by preventing protein denaturation via reduce free radicals activity.[22].

3.3. Anti-microbial activity

The hydro-alcoholic distillation method of the arial parts of *Plectranthus mollis* extracts contains oils were screened for anti-microbial activity against fungi (Penicillium chrysogenum, Aspergillus niger and Aspergillus fumigates) and various gram-positive and gram-negative bacteria has been demonstrated that oils extract significantly inhibited the growth of bacteria and fungi organism[7].

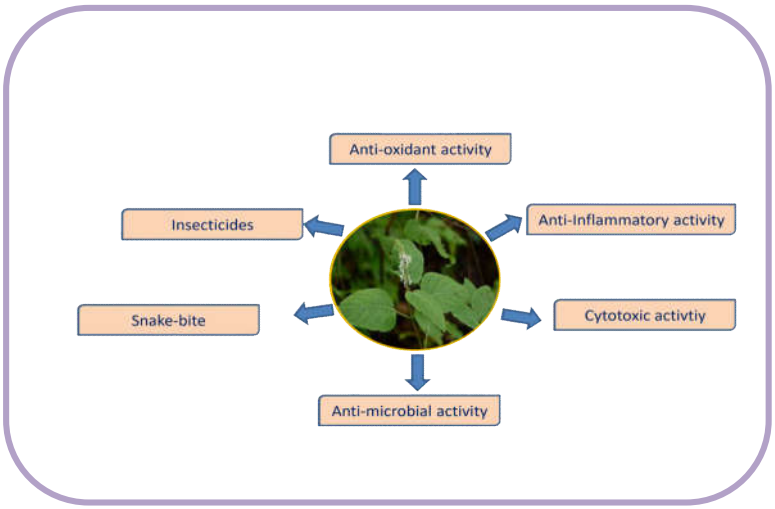


Fig.3. Pharmacological uses of *Plectranthus mollis*

4. Conclusion:

Our review concludes that *P.mollis* has ethno-pharmacological properties and is used as a folk medicine to treat common illnesses in humans. It contains flavonoids, terpenoids, steroids, phenols, and tannins. Traditionally used to treat snakebites, respiratory issues, rheumatism, and mental disabilities and exhibit anti-inflammatory, anti-microbial, cytotoxic, and anti-tumor activities. The chemical composition has Fenchone, α-humulene, and piperitenone oxide with various biological activities. The conclusion of P. mollis shows potential for drug development and therapeutic applications. Extrapolating positive results from animal models to humans can be promising but isn't always straightforward. Animal studies, such as those involving rats or mice, can provide valuable insights into the potential effects of a treatment or compounds. For meaningful extrapolation of dosage, safety, and efficacy must be carefully evaluated in clinical trials with humans. Positive results in animal models are a critical step, but they require further validation through well-designed human studies before being deemed convincing or actionable for human use.

5. Acknowledgement:

The author would like to thank Dr. N. Senthilkumar, Principal & Professor and Dr. T. Venkatachalam, Head & Professor, Department of Pharmacetical chemistry, JKKMMRFs Annai JKK Sampoorani Ammal College of Pharmacy, Komarapalayam, Namakkal, Tamilnadu, India for their technical support and valuable guidance.

6. Reference:

1. Lukhoba CW, Simmonds MS, Paton AJ. Plectranthus: A review of ethnobotanical uses. J Ethnopharmacol. 2006;103 (1):1–24.

2. Wang J, Jiang YF. Natural compounds as anticancer agents: Experimental evidence. World J Exp Med. 2012;2(3):45.

3. Patridge E, Gareiss P, Kinch MS, Hoyer D. An analysis of FDA-approved drugs: natural products and their derivatives. Drug Discov Today. 2016;21(2):204–7.

4. Sebastian MK, Bhandari MM. Medico-ethno botany of mount Abu, Rajasthan, India. J Ethnopharmacol. 1984;12(2):223–30.

5. Jain SP, Singh SC, Puri HS. Medicinal Plants of Neterhat, Bihar, India. Int J Pharmacogn. 1994 Jan;32(1):44–50.

6. Ushir Yogesh V, Morankar Pravin G, Dhake Avinash S. Phytochemical Compositions and in-vitro Anti-inflammatory Activity of Plectranthus mollis.

7. Joshi RK. Chemical composition and antimicrobial activity of the essential oil of Plectranthus mollis (Lamiaceae) from Western Ghats region, Karnataka, India. Rev Biol Trop. 2014;62(2):423–31.

8. Yoganarasimhan SN. Medicinal plants of India: Tamil... - Google Scholar [Internet]. [cited 2024 Aug 27].

9. Singh, V. K. & Ali, Z. A. (1992). A contribution to the ethnopharmacological study of the Udaipur forests of Rajasthan, India. Fitoterapia, 63, 136-144. - Google Search [Internet].

10. Ramu G, Shantha TR, Mohan GK, Reddy MP, Jayaveera KN. Pharmacognostical evaluation on the leaves of Plectranthus mollis Spreng.(Syn. P. incanus Link.). Pharmacogn Eval Leaves Plectranthus Mollis SprengSyn P Incanus Link. 2015;4(9):556–69.

11. Mahmood C, Daulatabad JD, Mirajkar AM. Vernolic and cyclopropenoid fatty acids in *Plectranthus mollis* , syn. *Plectranthus incanus* , link seed oil: A rich source of oil. J Chem Technol Biotechnol. 1989 Jan;45(2):143–6.

12. Ahmad W, Ansari MA, Yusuf M, Amir M, Wahab S, Alam P, et al. Antibacterial, Anticandidal, and Antibiofilm Potential of Fenchone: In Vitro, Molecular Docking and In Silico/ADMET Study. Plants 2022, 11, 2395 [Internet]. s Note: MDPI stays neutral with regard to jurisdictional claims in published …; 2022 [cited 2024 Aug 27]. Available from: https://www.academia.edu/download/98100940/pdf.pdf

13. El Omari N, Balahbib A, Bakrim S, Benali T, Ullah R, Alotaibi A, et al. Fenchone and camphor: Main natural compounds from Lavandula stoechas L., expediting multiple in vitro biological activities. Heliyon [Internet]. 2023 [cited 2024 Aug 27];9(11). Available from: https://www.cell.com/heliyon/fulltext/S2405-8440(23)08430-X

14. Bashir A, Mushtaq MN, Younis W, Anjum I. Fenchone, a monoterpene: Toxicity and diuretic profiling in rats. Front Pharmacol. 2023;14:1119360.

15. Araruna MEC, Júnior EBA, Serafim CA de L, Pessoa MMB, Pessôa ML de S, Alves VP, et al. (-)-Fenchone Prevents Cysteamine-Induced Duodenal Ulcers and Accelerates Healing Promoting Re-Epithelialization of Gastric Ulcers in Rats via Antioxidant and Immunomodulatory Mechanisms. Pharmaceuticals. 2024;17(5):641.

16. Mimica-Dukić N, Kujundžić S, Soković M, Couladis M. Essential oil composition and antifungal activity of *Foeniculum vulgare* Mill. obtained by different distillation conditions. Phytother Res. 2003 Apr;17(4):368–71.

17. Oumzil H, Ghoulami S, Rhajaoui M, Ilidrissi A, Fkih-Tetouani S, Faid M, et al. Antibacterial and antifungal activity of essential oils of *Mentha suaveolens*. Phytother Res. 2002 Dec;16(8):727–31.

18. Dinç H, Yiğin A, Koyuncu İ, Aslan M. Investigation of the anticancer and apoptotic effect of Micromeria congesta under in vitro conditions and detection of related genes by real-time PCR. In: Veterinary Research Forum [Internet]. Faculty of Veterinary Medicine, Urmia University, Urmia, Iran; 2022 [cited 2024 Aug 27]. p. 7. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9094590/

19. Tripathi AK, Prajapati V, Ahmad A, Aggarwal KK, Khanuja SP. Piperitenone oxide as toxic, repellent, and reproduction retardant toward malarial vector Anopheles stephensi (Diptera: Anophelinae). J Med Entomol. 2004;41(4):691–8.

20. Tiwari A, Mahadik KR, Gabhe SY. Piperine: A comprehensive review of methods of isolation, purification, and biological properties. Med Drug Discov. 2020;7:100027.

21. Ramu G, Dhanabal SP. Antioxidant studies on ethanol extracts from two selected genera of Indian Lamiaceae. Indian J Pharm Sci. 2015;77(6):780.

22. Ushir Yogesh V, Morankar Pravin G, Dhake Avinash S. Phytochemical Compositions and in-vitro Anti-inflammatory Activity of Plectranthus mollis. J Adv Pharm Educ Res Apr-Jun [Internet]. 2013 [cited 2024 Aug 28];3(2). Available from: https://www.academia.edu/download/68499182/2013_JAPER.pdf.