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Labiatae (The Mint Family) Phytochemicals and Medicinal Uses to Humankind

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ABSTRACT

Labiatae (The Mint Family**)** has more than 3,000 species and at least 150 genera, primarily annual or perennial herbs but with some shrubs or climbers; a few are small trees. Most of the economically important species are employed because of their essential oils and bitter principles. The most familiar species of Labiatae are aromatic herbs or shrubs such as the household favourites: peppermint; lemon balm and basil. Mentha species and their hybrids have been investigated chemically for mint oil, menthol, and various other phytochemicals. Spearmint is used for cooking purposes, but it is also used in the aroma and flavour industry. The properties of the Spearmint oil resemble those of the Peppermint, being mildly stimulant, carminative, anti-spasmodic, stomachic, expectorant, and flavouring agent, but its effects are less powerful, and it is less used than peppermint. A few Mentha species and their hybrids have been investigated chemically for mint oil, menthol and various other chemical constituents like piperitol, menthylacetate, *l*-menthol, p-cymene, dl-neoisomenthol, piperitenone, aroma-dendrene and a mixture of phenols. The oil from the leaves of M. longifolia reported the presence of dl-menthol, alpha-menthone, dihydrocarveol, *l*-piperitone, piperitone oxide an aldehyde, cadinene, beta-caryophyllene and cedrene. Apart from these constituents, the presence of carvacrol, piperitol, isopulegol and citronellal have also been reported from the oil. Histidine and glycine were the only amino acids identified in *M longifolia*.

KEYWORDS: Mint, various species of mint, Medicinal uses, Phytochemicals

INTRODUCTION

Labiatae (The Mint Family**)** has more than 3,000 species and at least 150 genera, primarily annual or perennial herbs but with some shrubs or climbers; a few are small trees. The centre of distribution is the Mediterranean area where occasionally they are dominant members of the flora. Most of the economically important species are employed because of their essential oils and bitter principles. Rosemary, basil, oregano, peppermint, spearmint, thyme, and others are important as herbs or spices or in perfumery, medicine, or other minor applications[1-12]. Most of the species grow in open areas,but some occur as under shrubs; while a few occur in rain forests, many

are adapted to xerophytic conditions. The most familiar species of Labiatae are aromatic herbs or shrubs such as the household favourites: peppermint and basil[13-17].

(Fresh mint leaves)

(Dried mint leaves during the different time periods)

Plants of the mint family generally have square stems with opposite or sometimes whorled leaves without stipules (appendages at the base of the leaf). The leaf margins or edges may or may not be toothed (ragged and pointed like teeth). They can also be deeply and repeatedly divided into many slender parts,resembling a tattered leaf-shaped flag. The flowers exhibit diverse sorts of inflorescences in which the terminal flower blooms first. The usually perfect flowers are often arranged in whorls or in small groups in the axils of leaves or bracts.

The mint family have played an important role in herbal medications. When tea is made using mint, its healthful properties ease stomach ailments, sleeplessness, nervousness, and dizziness. It is tall shrubs with purple flowers growing in round spikes[13-45]. Initially, it was used as an insect repellant to fight fleas, bugs, and mosquitoes. The leaves can be crushed and rubbed on the skin as a quick defence against these pests. It is found rarely in disturbed areas of Western Cascades or as a cultivated plant. Many plants from the mint family such as the low growing ajuga ***(****Ajuga reptans)* are used for decorative purposes and ground cover. Some species are used as culinary

herbs like Savory *(Satureja acinos)* or garden sage *(Salvia officinalis)* and wild marjoram *(Origanum vulgare).* Some varieties are added to the bathtub for their aromatic qualities and using them as soaps, toothpaste, and cosmetics.

Mentha Linnaeus

The 35 to 40 species of mint, branching herbs, shrubs or trees comprise this genus. Most of them are native to the north temperate regions, Australia, and South Africa. Many species are perennials with leafy runners, underground rootstocks. About half of the species are native to or naturalized in North America.

Genus and Common Name of some species of Mentha Linnaeus

Agastache - Horsemint ; *Ajuga* – Ajuga ; *Lycopus* - Bugleweed ; *Marrubium* – Horehound ; *Melissa* – Balm ; *Mentha* – Mint ; *Monarda* – Monarda; *Salvia* – Sage; *Satureja* – Savory ; *Scutellaria* – Skullcap ; *Stachys* - Hedge-nettle ; *Teucrium* – Germander; *Thymus* – Thyme

List of some Mentha Species

Mentha dahurica Fisch. ex Benth.; *Mentha dalmatica* Tausch ; *Mentha diemenica* Spreng. ; *Mentha dumetorum* Schult ; *Mentha gattefossei* Maire ; *Mentha gentilis* L. (= *Mentha arvensis* L.) ; *Mentha gentilis* auct. (= *Menthll x gracilis* Sole); *Mentha gracilis* Sole ; *Mentha haplocalyx* Briq. ; *Mentha* hybrid ; *Mentha insularis* Req. *(=Mentha suaveolens* subsp. *insularis* (Req.) ; *Mentha japonica* (Miq.) Makino ; *Mentha kopetdaghensis* Boriss. ; *Mentha lavanduliodora* ined. (= *Mentha piperita* L.) ; *Mentha longifolia* (L.) Huds. ; *Mentha longifolia* subsp. *capensis* (Thunb.) Briq. ; *Mentha longifolia* subsp. *hymalaiensis* Briq. ; *Mentha longifolia* subsp. *Longifolia ; Mentha longifolia* subsp. *polyadenia* (Briq.) Briq.; *Mentha longifolia* subsp. *typhoides* (Briq.) Harley ; *Mentha maximilianea* F. W. Schultz ; *Mentha micrantha* (Benth.) Des.-Shost. ; *Mentha alopecuroides* Hull (= *Mentha villosa* var. *a/opecuroides* (Hull) Briq.) *Mentha aquatica* L. ; *Mentha aquatica* var. *crispa* (L.) Benth. (= *Mentha spicata* L.) ; *Mentha arvensis* L. ; *Mentha arvensisf glabrata* (Fernald) S. R. Stewart (= *Mentha canadensis* L.) ; *Mentha arvensisf piperascens* Malinv. ex Holmes (= *Mentha* canadensis L.) ; *Mentha arvensis* var. *glabrata* Fernald (= *Mentha canadensis* L.) ; *Mentha arvensis* var. *piperascens* Malinv. ex L. H. Bailey (= *Mentha canadensis* L.) ; *Mentha australis* R. Br. ; *Mentha allstriaca* Jacq. (= *Mentha arvensis* L.) ; *Mentha cablin* Blanco (= Pogostemon *cablin* (Blanco) Benth.) ; *Mentha canadensis* L. ; *Mentha capensis* Thunb. (= *Mentha longifolia* subsp. *capensis* (Thunb.) Briq.) ; *Mentha cardiaca* J. Gerard ex Baker (= *Mentha x gracilis* Sole) ; *Mentha cervina* L.; *Mentha citrata* Ehrh. (= *Mentha piperita* nothosubsp. *citrata* (Ehrh.) Briq.) ; *Mentha cordifolia* Opiz ex Fresen. (= *Mentha ,spicata* L.) ; *Mentha crispa* L. (= *Mentha spicata* L.) ; *Mentha cunninghamii* Benth.; *Mentha microphylla* K. Koch (= *Mentha spicata* subsp. *Condensata* (Briq.) Greuter & Burdet) ; *Mentha niliaca* Juss. ex Jacq. *(=Mentha rotundifolia* (L.) Huds. ; *Mentha palustris* Mill. (= *Menthaaquatica* L.) ; *Mentha piperita* L. ; *Mentha piperita* nothosubsp. *citrata* (Ehrh.) Briq. ; *Mentha piperita* nothosubsp. *Piperita ;Mentha piperita* nothosubsp. *pyramidalis* (Ten.) Harley ; *Mentha pulegium* L. ; *Mentha pulegium* var. *micrantha* Benth. *(=Mentha micrantha* (Benth.) Des. -Shost.) ; *Mentha pyramidalis* Ten. (= *Mentha piperita* nothosubsp. *Pyramidalis* (Ten.) Harley) ; *Mentha requienii* Benth. ; *Mentha rotundifolia* (L.) Huds. ; *Mentha rotundifolia* auct. (= *Mentha suaveolens.* Ehrh.) ; *Mentha royleana* Benth. (= *Mentha longifolia* subsp. *Hymalaiensis* Briq.) ; *Mentha rubra* Mill. (= *Mentha* sp.) ; *Mentha satureioides* R. Br. ; *Mentha smithiana* R. A. Graham ; *Mentha* sp. ; *Mentha spicata* L. ; *Mentha spicata* subsp. *condensata (Briq.) Greuter* & *Burdet.*

VERNACULAR NAMES		
SPEARMINT *(Mentha spicata)*	Synonyms	
	Bengali	*Pudina*
	Bombay	*Pahadipudina, Pudina*
	Gujarati	*Phudino*
	Hindi	*Paharipudina, Pudina*
	Marathi	*Pudina*
	Punjab	*Paharipodina, Pudina, Pudinakuhi*
	Sanskrit	*Pootihaa*
	Sind	*Phudina*
	Telugu	*Pudina*
	English	*Brown Mint, Garden Mint, Spearmint, Lamb Mint, Mackerel Mint*
	French	*Menthe verte, Menthe romaine, Baume vert, Menthe de Natre-Dame*
	German	*Frallenmllenze, Gruene Muenze, Roemische Minze*
	Italian	*Menta romana*
	Malta	*Spearmint, Menta commune, Naghnieh*
	Spanish	*Costo, Menta romana, Yerba Buena*
PEPPERMINT *(Mentha piperita)*		
	Bengali	*Pudina*
	Bombay	*Pahadipudina, Pudina*
	Gujarati	*Phudino*
	Hindi	*Podina*
	Marathi	*Pudina*
	Punjab	*Pudina,*
	Kannada	*Chetnimara*
	Malayalam	*Putiyina*
	Tamil	*Jech-chak, kirai, Pothina*
	Telugu	*Pudina*
	Arabic	*Nanah, Eqama*
	Chinese	*Bo he, Pak hom ho, Bok hoh, Heung-Fa-Chio, Xiang Hua Cai*

	English	*Brandy Mint, Peppermint*
	French	*Menthe anglaise, Menthe poivree, Sentebon*
	German	*Pfefforminze, Minze, Edelminze, Englische Minze*
	Italian	*Menta pepe, Menta Peperina, Menta piperita*
	Portuguese	*Menta*
	Spanish	*Hierbabuena, Menta Piperita*
CORNMINT ***(Mentha arvensis)***		
	Bengali	*Podina*
	Bombay	*Pudinah*
	Gujarati	*Pudina*
	Hindi	*Pudinah*
	Marathi	*Pudina*
	Urdu	*Pudinchkohi*
	Malayalam	*Putiyina*
	Tamil	*Pudina, Yechakkirai*
	Telugu	*Igaenglikura, Pudina*
	Arabic	*Fodanajihindi, Fotanajehindi, Habakjabllli, Habaqulhind, Naanaaehindi, Naanaaulhind*
	Chinese	*Po Ho*
	English	*Corn Mint, Marsh Mint, Field Mint*
	French	*Menthe des champs, Pouliot thym*
HORSEMINT *(Mentha sylvestris)*		
	Hindi	*Podina*
	Bombay	*Pudina, Vartalau*
	Punjab	*Babllri, Belanne, Koshu, Pudnakushna, Vien, Yura*
	Sanskrit	*Ajirnahara, Pudina, Rochani, Rlichishya, Shakashobhana, Sugandhipatra, Vantihara, Vyanjana.*
	Urdu	*Pudina*
	Pushtu	*Shamshabai*
	Burma	*Boodeema*
	Arabic	*Fudanajhabak, Flidanajnaanna*
	Spanish	*Mastranzo nevado, Menta silvestre*

	English	*Horse Mint*
	French	*Mentastre, Menthe Sauvage*

SPEARMINT

BOTANICAL SOURCE: Spearmint consists of the dried leaf and floweringtops of *Mentha spicata* Linn.
SYNONYMS: *Mentha Viridis* Linn.
FAMILY: Labiatae

Mentha spicata L. more commonly known as Spearmint. *Spicata* is from the Latin ***Spica*** meaning a spike and refers to the arrangement of the flowers. Spearmint is a plant with subterranean spreading shoots that grow in gardens under a great variety of climatic conditions. It is a glabrous to hairy lasting herb grown all over the world. In Indian gardens, it is cultivated in the plains of Punjab, Uttar Pradesh, Delhi, and Maharashtra. In Europe the occurrence of the plant is scattered to rare, the drug is imported from Egypt, Yugoslavia, and Hungary.

CHEMICAL CONSTITUENTS

The constituents obtained from the chemical analysis of fresh Spearmint leaves are:

Moisture: 83.0 %,
Protein: 4.8 %,
Fat: 0.6 %,
Carbohydrates: 8.0 %,
Fiber: 2.0 %,
Mineral Matter: 1.6 %,
Calcium: 200 mg,
Phosphorous: 80 mg,
Iron: 15.6 % mg,
Carotene (Vitamin A): 2,700 IU.,
Nicotinic Acid: 0.4 mg,
Riboflavin: 80 µg,
Thiamine: 50 µg /100g,
The traces of copper in leaves contain 1.8 microgram /g.

Spearmint contains an essential oil differing markedly from that of peppermint; called spearmint oil. It does not contain menthol but contains carvone (as in Caraway), resin and tannin. The chief constituent is *l*-carvone 45 to 60 %, which sometimes causes allergy in users of Spearmint preparations, 6 to 20 % of alcohols, terpenes chiefly *l*--phellandrene, *l*--limonene, *l*-pinene, dipentene, dihydrocarveol and dihydrocarveol acetate, dihydrocarvone, carvomenthone, isomenthone, linalool etc., 4 to 18 % of esters of butyric, caprylic acids and acetic, are also present. The carvone present is *l*- carvone and is optically isomeric with the d-carvone found in the oil of Caraway and oil of Dill. Leaves gave flavonoids diosmetin-7-glucoside, diosmin, diosmetin-7-0-beta-D-glucuronide and luteolin-3' -O-beta-D-glucuronide. As with Mentha piperita limonene is the precursor of the monoterpenoids and in this case, the action of a (-)-limonene-6-hydroxylase predominates to give the alcohol (-)-trans-carveol, which is oxidized to carvone. Oil production is influenced by the age of the plant, time of collection, types of the plant used, and its hybridization.

SPEARMINT OIL

Spearmint yields an essential oil in which reside the medicinal virtues of the plant. The oil yielded a considerable amount of steraoptene. According to Gladstone, it consists of a hydrocarbon almost identical to oil of turpentine mixed with oxidized oil, which is due to the peculiar smell of the plant. In different

countries, confectioners employ it as a perfume by soap manufacturers and as a flavouring agent. The yield of essential oil is less than in Mentha piperita.

SPEARMINT OIL	
Product Name	Spearmint Oil
Characteristics	A clear greenish-yellow liquid is visibly free from water, odour, that of spearmint.
Optical Rotation	-45° to 60°
Refractive Index	1.484 to 1.491
Specific Gravity	0.925-0.940
Boiling Point	320°c
Solubility in Ethanol	Soluble in 80% ethanol
Weight per mL.	0.917 to 0.934 g
Chemical Constituents	Carvone: Not less than 55% W/W
Packing	180 Kg. in galvanised iron drums
Storage	Spearmint oil should be kept in a well-filled, well-closed container, protected from light and stored at a temperature not exceeding 25°.
Applications	Cough Drops Analgesic, Balms, Inhalers, Tobacco Products, Cosmetics, Confectionery, Mouth fresheners, Chocolates, Chewing Gums, Medicated Oils,

MEDICINAL ACTION AND USES

Spearmint is chiefly used for culinary purposes, but it is also used in the aroma and flavour industry. The properties of the Spearmint oil resemble those of the Peppermint, being mildly stimulant, carminative, anti-spasmodic, stomachic, expectorant, and flavouring agent, but its effects are less powerful, and it is less used than peppermint. Spearmint oil is added to many compounds on account of its carminative properties and because its taste is much more pleasant & less strong than Peppermint. In India, it is used as a spice in the form of fresh and dried leaves. Fresh green leaves are used for making chutney and for flavouring culinary preparations. A tea prepared from the leaves is used as an antidote for poison; in bronchitis and a decoction is used as a lotion for Aphthae. Spearmint water is used as a vehicle for other medicines. A distilled water of Spearmint will relieve hiccup and verbosity as well as the nausea of indigestion. Spearmint also has anti-fungal, anti-viral, anti-microbial, insecticide, antioxidant, anti-amoebic, anti-hemolytic, anti-ancylostomiasis, anti-helminthic CNS depressant and allergenic activities.

OTHER SPECIES OF MENTHA

PEPPERMINT

BOTANICAL SOURCE: Peppermint consists of the aerial parts of *Mentha piperita* L.
FAMILY: Labiatae
COMMON NAME: Peppermint; Brandy Mint.

CHEMICAL CONSTITUENTS

Peppermint yields an essential oil of 0.3 to 0.4% but may be as high as 1.5%. Menthol is the main active constituent 56 %, American oil contains up to 78 % and Japanese oil contains from 70 to 90 % menthol. Indian pharmacopeial limit of menthol is 50 %. Esters of menthol with acetic acid and valeric acid are not less than 5 % but are usually from 5 to 15 %. Menthone is about 10 %. Further, the oil contains menthofuran, menthyl acetate, jasmone, phellandrene, pinene, cineole, and piperitone. Jasmone & esters of menthol are responsible for the aromatic smell. If menthofuran is more, the smell is unpleasant, and the oil gets resinified. Other constituents include tocopherols, tannins, flavonoids, azulenes carotenoids, betaine, and choline. All these compounds give peppermint a pungent or spicy taste with a cooling and drying energy.

Medicinal actions and uses:

There are 25-30 species of Peppermint. It is a stimulant, a tonic and helps digestive system disorders. Studies have found that it is effective for the treatment of conditions such as dysentery. It is an anti-diarrheal agent, a vermifuge working especially well against hookworms. It has anti-inflammatory properties, so it is also used to treat rheumatism. It has anti-viral, antifungal, antibacterial activity, and anti-inflammatory.

PEPPERMINT OIL	
Product Name	Peppermint Oil
Characteristics	A colourless, pale greenish-yellow liquid.
Optical Rotation	-10° to -30°
Refractive Index	1.457 to 1.467
Relative density	0.900 to 0.916
Acidity	Neutral
Solubility in Ethanol	Soluble in 70% ethanol
Weight per mL.	
Chemical Constituents	Menthone: 15 to 32% Constituents Esters (Menthyl Acetate): 3 to 10% Menthol: 30.0 to 55.0%
Packing	180 Kg. in galvanised iron drums
Storage	Store in an airtight container
Applications	Cough Drops, Analgesic, Balms, Inhalers, Cosmetics, etc.

HORSEMINT (Mentha sylvestris)

Synonyms Horsemint.

Chemical Constituents

The phytochemical compounds obtained from the horsemint essential oil are

1. Piperitone oxide,
2. Cineole,piperitenone
3. Cadinene,
4. *L*-piperitone,
5. alpha and beta-pinene,
6. Limonene,
7. *L*-menthone, ,
8. Dihydrocarveol,

9. Beta-caryophllene,
10. *Dl*-menthol,
11. Cedrene,
12. Iso-pulegol,
13. Piperitol,
14. Carvacrol and citronellal.
15. Quercetin and vitamin k have also been reported from the plant.

CORN MINT

Scientific name: *Mentha arvensis*
Family: Labiatae/Lamiaceae
Common Name: Field Mint, Corn Mint.

Chemical Constituents

The phytochemical compounds obtained from the corn mint essential oil are

1. Menthol (Major component)
2. Menthone (Major component)
3. *l*-limonene,
4. Beta phellandrene,
5. Alpha-thujene,
6. Furfural,
7. Methyl cyclohexanone,
8. Alpha and beta-pinene, and
9. Camphene.

PHYTOCHEMICAL STUDIES

A few Mentha species and their hybrids have been investigated chemically for different phytochemicals and various other constituents[46-82].

Jammu and Kashmir	*M. piperita* on steam distillation gives oil that contained the following phytochemicals 1. Menthone, 2. Menthylacetate, and hydrocarbons .	The following phytochemicals are obtained from the leaves of *Mentha longifolia* 1. Piperitol 2. menthylacetate, 3. *l*-menthol, 4. p-cymene, 5. dl-neoisomenthol 6. piperitenone, 7. Aroma-dendrene and a mixture of phenols. 1. The oil from the leaves of *M. longifolia* contained the following phytochemicals dl-menthol 2. Alpha-menthone 3. Dihydrocarveol 4. *l*-piperitone 5. piperitone oxide	The oil of *M. spicata* var.*lacinata* contained the following phytochemicals 1. *l*-limonene, piperitol, 2. d-menthone, 3. isopulegone, 4. Dihydrocarvyl, isovalerate, 5. pulegol, 6. geraniol, 7. linalool, and the acetate of unidentified alcohol. 8. Four flavonoids, diosmetin, diosmin, diosmetin-7-0-beta-D-glucuronide	The oil of *M arvensis* contained the following phytochemicals 1. alpha-menthol 2. d-menthone, 3. menthylacetate, 4. carvomenthone, 5. limonene, 6. beta-phellandrene and 7. piperitone.

		6. An aldehyde, 7. Cadinene		
Nainital and Haldwani	*M. piperita* var. *Officinalis* contained the following phytochemicals 1. *l*-menthol, 2. menthone, 3.d-limonene, 4. Menthylacetate, 5. alpha-pinene, 6.beta- hellandrene and small quantities of piperitone	The essential oil of *M. piperita* grown at Haldwani contained the following phytochemicals 1. alpha-pinene, 2. sabinene, 3. terpinolene, 4. alpha-phellandrene, 5. gamma-terpinene, 6. p-menthane, fenchone, 7. beta- thujone, 8. ocimene, 9. menthol, 10. menthone, 11. isomenthone, 12. pulegone, 13. piperitone, 14. piperitenone, 15. menthofuran, 16. menthylacetate, 17. cadinene and some unidentified terpenes.		
Sikandra Bagh & Rampur (Uttar Pradesh)	*M. piperita* at Sikandra Bagh and at the research station of Banthra contained the following phytochemicals 1. alpha-pinene, menthol 2. beta-pinene, 3. limonene, 4. sabinene hydrate, 5. sabinene acetate, 6. cineole, 7. menthofuran, 8. isomenthone, 9. menthone, 10. neomenthol, 11. menthylacetate 12. pulegone, 13. piperitone and 14. piperitone oxide	The dementholised oil from *M piperita* from Rampur (Uttar Pradesh) contained the following phytochemicals 1. thymol, 2. carvacrol, 3. menthone, 4. isomenthone, 5. carvone, 6. piperitone, alpha-pinene, 7. beta-pinene, 8. eugenol, 9. cadinene, 10. menthofuran, 11. menthyl acetate, linalool, 12. menthol, 13. isomenthol, 14. neomenthol, 15. 1,8-cineole and 16. dipentene.		

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