A Review On Various Essential Oils In Treatment Of Mucour Mycosis

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Abstract: In accordance with the earlier reports, the results of the present work suggested that some essential oils can be applied as mold inhibitors to prevent growth of toxigenic fungi. The results suggest the potential use of some essential oils as antimicrobial preservatives in food. Further studies on the combined effects of many local plant essential oils and components in food products are in progress in our model systems. The selected essential oils showed good inhibitory effect against all the tested organisms that are known food pathogens. Sage and rosemary essential oils were found to more potent against A. niger and F. oxysporum.

Key words: Mucormycosis , Covid 19 , Ayurveda medicine , Anti fungal , Ayush , Fungicidal , Plant derived Compounds , plant extract

Introduction: Black fungus also known as Mucormycosis, has recently devastated some states of India. It has been declared pandemic now. Inhibitors of glucon synthesis pathways have been evaluated to curtail the Mucormycosis but still at infancy stage. Due to key role in glucon synthesis, in the present study β-glucan synthase has been regarded as a suitable target for drug design. In-silico docking and pharmacological study was designed to evaluate the effect of potent bioactive molecule 1-8 cineole present in essential oils of eucalyptus plant leaves against β-glucan synthase enzyme. Till date there is no work is undertaken on in-silico analysis of this compound against β-glucan synthase. Patch-dock analysis was used for docking. Ligand Protein 2D and 3D Interactions were also studied. Drug likes and toxicity profile was also evaluated. Cancer cell line toxicity profile was also studied. The calculated parameters such as docking score indicated effective binding of 1-8 cineole to β-glucan synthase-protein. Interactions results indicated that, β-glucan synthase enzyme and 1-8 cineole complexes forms hydrogen and hydrophobic interactions. 1-8 cineole also depicted sufficient level of cancer cell line toxicity. Drug likeliness profiles by assaying absorption, distribution, metabolism, excretion and toxicity (ADMET) studies provided guidelines and mechanistic scope for identification of 1-8 cineole as potent anti-fungal drug. Therefore, essential oil from eucalyptus may represent potential herbal treatment to act as anti-fungal drug.

Allopathy Treatment and It's side effects:

The diagnosis and treatment of mucormycosis are challenging. The incidence of the disease seems to be increasing. Hematological malignancies are the most common underlying disease in countries with high income and uncontrolled diabetes in developing countries. Clinical approach to diagnosis lacks sensitivity and specificity. Radiologically, multiple (≥10) nodules and pleural effusion are reportedly associated with pulmonary mucormycosis. Another finding on computerized tomography (CT) scan, which seems to indicate the presence of mucormycosis, is the reverse halo sign. Microscopy (direct and on histopathology) and culture are the cornerstones of diagnosis. Molecular assays can be used either for detection or identification of mucormycetes, and they can be recommended as valuable add-on tools that complement conventional diagnostic procedures. Successful management of mucormycosis is based on a multimodal approach, including reversal or discontinuation of underlying predisposing factors, early administration of active antifungal agents at optimal doses, complete removal of all infected tissues, and use of various adjunctive therapies. Our armamentarium of antifungals is slightly enriched by the addition of two newer azoles (posaconazole and isavuconazole) to liposomal amphotericin B, which remains the drug of choice for the initial antifungal treatment, according to the recently published guidelines by ECIL-6, as well as those published by ECMM/ESCMID. Despite the efforts for better understanding of the pathogenesis, early diagnosis and aggressive treatment of mucormycosis, the mortality rate of the disease remains high.(1, 2,3)

Plants having essential oils:

- ***Eucalptus oil :***

Synonyms

Eucalyptus, Stringy Bark Tree, Blue gum, Blue Gum Tree.

Biological Source

Eucalyptus oil is the essential oil obtained by the distillation of fresh leaves of Eucalyptus globulus and other species like E. polybractea, E. viminalis, and E. smithii, belonging to family Myrtaceae.

Geographical Source

It is mainly found in Australia, Tasmania, United States, Spain, Portugal, Brazil, North and South Africa, India, France, and Southern Europe.

History

Eucalyptus globulus has been used since a long time for intermittent fever. The leaves and their preparations have been successfully used as a tonic, stimulant, stomachic, in dyspepsia, in catarrh of the stomach, in typhoid fever, in asthma, in whooping cough, etc. More recently it has been recommended as a diuretic in the treatment of dropsy.

Characteristics

Eucalyptus is a tall, evergreen tree, the trunk, which grows to 300 feet high or more, is covered with peeling papery bark. The leaves on the young plant, up to five years old, are opposite, sessile, soft, oblong, pointed, and a hoary blue colour. The mature leaves are

alternate, petioled, leathery, and shaped like a scimitar. The flowers are solitary and white, without any petals.Eucalyptus oil is a colourless or straw-coloured fluid, with a characteristic odour and taste, soluble in its own weight of alcohol. According to the British Pharmacopoeia Eucalyptus oil should contain not less than 55%, by volume of Eucalyptol, have a specific gravity 0.910 to 0.930, and optical rotation –10 degrees to 10 degrees.

Microscopy

Eucalyptus leaf is isobilateral. Stomata are of anomocytic type and sunken, on both surfaces. Epidermal cells are polygonal with thick cuticle; anticlinal walls are straight on both surfaces. There are three to four layers of elongated palisade cells below each epidermis. Between these palisade regions, two to three layers of spongy parenchyma occur and some of its cells contain cluster and prismatic calcium oxalate crystals. Palisade regions exhibit large subglobular oleoresin cavities. The midrib region shows no collenchymatous cells. Transverse section through the midrib region shows nearly uninterrupted arc of lignified pericyclic fibres just outside the vascular bundle.

Chemical Constituents

Eucalyptus oil contains volatile oil of which 70 to 85% is 1,8-cineole also known as eucalyptol. The other constituents present are p-cymene, α-pinene; small quantity of sesquiterpenes like ledol, aromadendrene; aldehydes, ketones, and alcohols. It also has polyphenolic acids like ferulic acid, caffeic acid, gallic acid; flavonoids such as eucalyptin, hyperoside and rutin.

Uses

The oil is used as stimulant, antiseptic, flavouring agent, aromatic, deodorant, expectorant, antimicrobial, febrifuge, diuretic, and antispasmodic. It is also used in the treatment of lung diseases, sore throat, cold, as a vapour bath for asthma and various respiratory ailments and in bronchitis.

Marketed Products

It is one of the ingredients of the preparations known as Cold Balm, Muscle and Joint Rub, Canisep, Erina-EP, Scavon Vet (3,5)

- ***Leamone grass:***

Synonyms :-

East India lemongrass, Malabar, or Cochin Lemongrass.

Biological Source :-

Lemongrass oil is obtained form *Cymbopogon flexuosus* Stapf. (syn. *Andropogonnardus* var. *flexuosus* Hack.), belonging to family Poaceae. It contains not less than 75% of aldehydes calculated as citral.

Geographical Source :-

Lemongrass is indigenous to India and is found in Tin-nevelli, Travancore, and Cochin. Two principal varieties of Lemongrass are recognized as the red-stemmed variety, the true *C. flexuosus,* which is a source of East Indian Lemongrass oil and the white-stemmed variety which is designated as *C. flexuosus* var. *albescens.* The oil from the latter is low in aldehyde content and is slightly soluble in 70% alcohol.

- It is tropical perennial aromatic grass with stiff strap like leaves emerged from short branched rhizomes.
- It is grow in approximately 1 to 2 m height with 0.5 cm to 1 cm wide.
- It is rarely produce flowers.
- It is nodding and pinkish colour in florescence with length of 30 to 60 cm
- The pedicel is oblong linear, tinged with reddish globous grows in 6 mm to 10 mm long.
- Microscopic Characteristics :-

Chemical Constitution :-
Monoterpenes :- Terpinolene, Limonene, Myrcene
Terpenoids :- Grenial, Neral, Citral
Phenolic Compound :- Terpinol, Geraniol, Borneol

Purity Test :-
Total Ash value :- NMT 11%
Acid Insoluble Ash value :- NMT 6%
Foreign Matter :- NMT 2%
Uses :-

- Citral used for preparation of violet perfumes.
- Mosquito repellent
- It also used in manufacturing of soaps, cosmetic and perfume.(4, 6, 7)
- ***Clove oil:***

Synonyms
Clove buds, Clove flowers.
Biological Source
Clove consists of the dried flower buds of *Eugenia caryophyllus* Thumb., belonging to family Myrtaceae.
Geographical Source
Clove tree is a native of Indonesia. It is cultivated mainly in Islands of Zanzibar, Pemba, Brazil, Amboiana, and Sumatra. It is also found in Madagascar, Penang, Mauritius, West Indies, India, and Ceylon.
Cultivation and Collection
Clove tree is evergreen and 10 to 20 m in height. The plant requires moist, warm and equable climate with well-distributed rainfall. It is propagated by means of seeds. The seeds are sown in well-drained suitable soil at a distance of about 25 cm. The plants should be protected against pests and plant diseases. Initially it has to be protected from sunlight by growing inside a green house or by con-structing frames about 1 m high and covering them with banana leaves. As the banana leaves decay gradually more and more sunlight falls on the young seedlings and the seeds are able to bear full sunlight when they are about 9 months old. The seedlings when become 1 m high, they are transplanted into open spaces at a distance of 6 m just before the rainy season. The young clove trees are protected from sun even for a longer period by planting banana trees in between. The drug can be collected every year starting from 6 years old till they are 70 years old.
Clove buds change the colour as they mature. At the start of the rainy season long greenish buds appear which change to a lovely rosy peach colour and as the corolla fades the calyx turns yellow and then red. The buds are collected during dry weather in the month of August to December. The collection is done either by climbing on the tree or by using some ladders or with the help of mobile platforms. In some places the trees are even beaten using bamboo sticks for the collection of the bud. The drugs which are collected are then separated from the stalks and then placed on coconut mats for drying under sun. The buds loose about 70% of its weight, whereas drying and change their colour to dark reddish-brown. The dried clove is graded and packed.
Characterisitics
Clove is reddish-brown in colour, with an upper crown and a hypanthium. The hypanthium is sub-cylindrical and tapering at the end. The hypanthium is 10 to 13 mm long, 4 mm wide, and 2 mm thick and has schizolysigenous oil glands and an ovary which is bilocular. The Crown region consists of the calyx, corolla, style and stamens. Calyx has four thick sepals. Corolla is also known as head, crown or cap; it is doineshaped and has four pale yellow coloured petals which are imbricate, immature, and membranous. The ovary consists of abundant ovules. Clove has strong spicy, aromatic odour, and pungent and aromatic taste.

Microscopy

The transverse section should be taken through the short upper portion which has the bilocular ovary and also through the hypanthium region. The transverse section through the hypanthium shows the following characters. It has a single layer of epidermis covered with thick cuticle. The epidermis has ranunculaceous stomata. The cortex has three distinct region: the peripheral region with two to three layers of schizolysigenous oil glands, embedded in parenchymatous cells. The middle layer has few layers of bicollateral vascular bundle. In the inner portion it has loosely arranged aerenchyma cells. The central cylinder contains thick-walled parenchyma with a ring of bicollateral vascular bundles and abundant sphaeraphides. The T.S. through ovary region shows the presence of an ovary with numerous ovules in it.

Chemical Constituents

Clove contains 14–21% of volatile oil. The other constituents present are the eugenol, acetyl eugenol, gallotannic acid, and two crystalline principles; α- and β- caryophyllenes, methyl furfural, gum, resin, and fibre. Caryophyllin is odourless component and appears to be a phytosterol, whereas eugenol is a colourless liquid. Clove oil has 60–90% eugenol, which is the cause of its anesthetic and antiseptic properties.

Chemical Tests

1. To a thick section through hypanthium of clove add 50% potassium hydroxide solution; it produces needle-shaped crystals of potassium eugenate.
2. A drop of clove oil is dissolved in 5 ml alcohol and a drop of ferric chloride solution is added; due to the phenolic OH group of eugenol, a blue colour is seen.
3. To a drop of chloroform extract of clove add a drop of 30% aqueous solution of sodium hydroxide saturated with sodium bromide; Needle and pear shaped crystals of sodium eugenate arranged in rosette are produced immediately.

Uses

Clove is used as an antiseptic, stimulant, carminative, aromatic, and as a flavouring agent. It is also used as anodyne, antiemetic. Dentists use clove oil as an oral anesthetic and to disinfect the root canals. Clove kills intestinal parasites and exhibits broad antimicrobial properties against fungi and bacteria and so it is used in the treatment of diarrhea, intestinal worms, and other digestive ailments. Clove oil can stop toothache. A few drops of the oil in water will stop vomiting, eating cloves is said to be aphrodisiac. Eugenol is also used as local anaesthetic in small doses. The oil stimulates peristalsis; it is a strong germicide, also a stimulating expectorant in bronchial problems. The infusion and Clove water are good vehicles for alkalies and aromatics.

Adulterants

The clove is generally adulterated by exhausted clove, clove fruits, blown cloves

and clove stalks. The exhausted cloves are those from which volatile oil is either partially or completely removed by distillation. Exhausted cloves are darker in colour and can be identified as they float on freshly boiled and cooled water. Clove fruits are dark brown in colour and have less volatile oil content. These can be identified by the presence of starch present in the seed of the fruit. Blown Cloves are entirely developed clove flowers from which corolla and stamens get separated. While sepa-ration, sometimes the stalks are incompletely removed and the percentage of volatile oil in clove stalk is only 5%. As clove stalks contain prism type of calcium oxalate crystals and thick-walled stone cells which are absent in clove the clove stalk can also be detected.

Marketed Products

It is one of the ingredients of the preparation known as Himsagar tail (Dabur). (4, 7)

- ***Papermint oil :***

Synonym

Brandy Mint.

Botanical Source

It is the oil obtained by the distillation of *Mentha piperita*, belonging to family Labiatae.

Geographical Source

It is mainly found in Europe, United States, and also in damp places of England.

Cultivation and Collection

Peppermint thrives best in a fairly warm, preferably moist climate, with well-drained, deep soils rich in humus. Peppermint will grow successfully, if once started into growth and carefully cultivated. The usual method of cultivation is to dig runners in the early

spring and lay them in shallow trenches, 3 feet apart in well-prepared soil. The growing crop is kept well-cultivated and absolutely free from weeds and in the summer when the plant is in full bloom, the mint is cut by hand and distilled in straw. A part of the exhausted herb is dried and used for cattle food.

Characteristics

The leaves are shortly and distinctly stalked, 2 inches long and 3/4 to 1.5 inches broad. The margins are finely toothed, with smooth upper and lower surfaces The stems are 2 to 4 feet high, frequently purplish in colour. The flowers are reddish-violet in colour, present in the axils of the upper leaves, forming loose, interrupted spikes. The plant has a characteristic odour and if applied to the tongue has a hot, aromatic taste at first and afterwards produces a sensation of cold in the mouth caused by menthol present in it. Oil is colourless, yellowish or greenish liquid, with penetrating odour and a burning, camphorescent taste. On storage it becomes thick and reddish but increases the mellowness even if it is stored for 14 years .

Chemical Constituents

The chief constituent of Peppermint oil is Menthol, along with other constituents like menthyl acetate, isovalerate, menthone, cineol, inactive pinene, limonene, and other less important bodies. Menthol separates on cooling it to a low temperature (–22°C). The flavouring properties of the oil are due to both the ester and alcoholic constituents, whereas the medicinal value is attributed only due to the alcoholic components. The English oil contains 60 to 70% of Menthol, the Japanese oil containing 85%, and the American has only about 50%.

Uses

It is stimulant, stomachic, carminative, inflatulence, and colic; in some dyspepsia, sudden pains, for cramp in the abdomen and also in cholera and diarrhoea. Oil of peppermint allays sickness and nausea, as infants cordial. Peppermint is good to aid in raising internal heat and inducing perspiration. It is also used in cases of hysteria and nervous disorders.

Adulterants

Camphor oil, Cedarwood oil, and oil of African Copaiba are occasionally used as an adulterant of Peppermint oil, the oil is also adulterated with one-third part of rectified spirit. If adulterated with rectified spirit it can be identified by agitating it with water which produces milkiness. Rosemary oil and Turpentine oil are also sometimes used as adulterants.

Marketed Products

It is one of the ingredients of the preparation known as Dabur lal tooth powder (Dabur). (4, 7)

- ***Thymus:***

Thyme Plant. Scientific name. Identification, origin, content and active ingredients. Medicinal properties of Thyme. Health benefits. Uses of Thyme. Contraindications. Preparation and Dosage.

Identification and origin of Thyme

Thyme leaves

Scientific name: Thymus vulgaris

Thyme is a perennial shrub from to the Labiatae family that reaches about 15-30 cm tall. It´s bushy with small leaves shaped ovate to lanceolate, in these leaves there´re tiny hollows stuffed with a drop of essence.

At the ends of the stems grow inflorescences in spikes of 3 to 6 flowers. The most characteristic feature of this plant is the intense essence it gives off, is the classic scent of thyme, due to essential oil containing (thymol). The leaves of the variety Thymus citriodorus are wider and with lemon scent.

It´s not known the time when the thyme was first cultivated in Europe. Some scholars believe it was the Romans who introduced the plant in England, while on the other hand, there are indications that the plant began to be popular in the north of the Alps between 850 and 1250. In the XVI century the Thyme was already cultivated everywhere.

It is a plant known since ancient times; the Egyptians used it in the embalming and later the Greeks used the plant to scent. The Romans also used the thyme in their baths.

Content – Active ingredients of the Thyme

The main active ingredients of Thyme are the essential oils although contain other substances.

Essential oil (Thymus vulgaris 1.5-2.5%, Thymus zygis 0.3%) of variable compositions depending on the type of plant, the components in largest amounts are the thymol and/or carvacrol, and other quantities of geraniol, terpineol, linalool, trans-tuyanol-terpineol.

Flavonoids: derivatives of apigenol and luteolol. Phenolic acids: caffeic, rosmarinic. Abundant tannins (10%). Saponosides.

Health benefits of the Thyme

The essence of Thyme is responsible for the following benefits: toning, appetite stimulants, eupeptic, choleretic, spasmolytic, expectorant, antiseptic, anthelmintic and antifungal. Phenolic acids and flavonoids reinforce the antiseptic action, and the latter also gives a diuretic action.

Thyme has been used against whooping cough, chronic inflammation of the bronchial tubes, asthma, stomach pain, digestive disorders and diarrhea. It´s also been used as a mosquito repellent. It has expectorant effects, which make it special in inhalations for dry cough and bronchial tube. It energizes, stimulates, tones, strengthens, cleanses and purifies.Due to its properties, the thyme is indicated in respiratory conditions: colds, flu, sore throat, irritating cough, tonsillitis, bronchitis, asthma, emphysema. In digestive disorders: biliary dyskinesia, slow digestion, chronic gastritis, flatulence, gastrointestinal spasms, parasites, colitis, anorexia, asthenia, convalescence, cystitis, urethritis, pyelonephritis.

For external use: dermatitis, boils, skin infections, dermatomycosis, vaginitis, conjunctivitis, otitis, rhinitis, sinusitis, rheumatic pain, stomatitis, dental pain, alopecia, ulcers, bruises, sprains, burns.

Uses of Thyme

Contraindications

As with the other essences, must remember that the thyme can lead to allergic reactions, especially in children, and in excessive doses can even cause seizures. In general, is not recommended the use of this substance for long periods of time.

The thymol, at high doses, can cause liver toxicity, albuminuria and hematuria. Prolonged use of thymol-based mouthwash can cause thyrotoxicosis.

Preparation and Dosage

Internal use:

- Thyme infusion: A teaspoon per cup, infuse for 10 minutes. Three cups a day, before or after meals.

External use:

- Decoction: 50 g/l, boil for 3 min, applied in the form of compress, lotions, baths, mouthwashes, gargles, nasal or ear instillations, douches, etc…(8, 9)

Conclusion:

Fungal contamination of indoor buildings and indoor air quality is a health issue of increasing concern. There is a need for greater guidance regarding appropriate antifungal agents to treat fungal contamination of buildings, as well as a drive from consumers and other groups to consider the potential of essential oils as a ‘natural’ alternative to commercially available fungicides. This review identifies the studies assessing the fungicidal potential of essential oils against fungi relevant to indoor air quality. The biggest challenge with comparing the fungicidal efficacy of essential oils from different studies is the lack of a standard method and reporting language. Additionally, the efficacy of essential oils is also dependant on the fungal species being challenged which makes it difficult to compare studies using different fungal isolates.

However, despite these challenges, clove oil was identified as the best-performing essential oil within the more robust studies. Additionally, there appears to be some evidence to support the essential oils tea tree oil, oregano, thyme and lemon as potential antifungal agents with relevance to indoor air quality. Heartwood, marjoram, cinnamon, lemon basil, caraway, bay tree, fir, peppermint, pine, cedar leaf and manuka were also identified in at least one study as having antifungal potential; however, there is a need for more robust studies to examine these further.

Future studies should focus on comparing the efficacy of these essential oils against a large number of fungal isolates from indoor environments. Studies will then need to focus on translating these results with in situ studies investigating the effectiveness in actual buildings and assessing the potential for long-term antifungal persistence. The studies identified in this review, which were either moderately or comparatively translational (23), (28), (31), (38), (39), (40), can inform the design of these studies. However, they should additionally compare the efficacy of essential oils to commercially available fungicides and examine the effect of time on fungicidal activity. Furthermore, when considering the application of these essential oils in building environments, the effect of different concentrations, mechanisms of application and the potential human side effects must also be examined.

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