REVIEW ON MEDICINAL PLANTS HAVING ANTI-FUNGAL ACTIVITY

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Summary

Fungi are eukaryotes and despite the presence of a cell wall, fungi are more similar to mammalian cells on a cellular level than to bacteria, making the treatment of mycotic infections difficult. Antifungal therapy has been limited by toxicities and resistance. The commonly used antifungal drugs such as amphotericin B, has toxic effects. Other drugs like ketoconazole, fluconazole and clotrimazole are limited in their spectrum and their use may produce strain resistance. Additionally, fungi replicate more slowly than bacteria and are often difficult to quantify, particular moulds, which complicate efficacy assessments. This topic will cover the herbal treatment for antifungal infection because herbal plants have less toxicity and no limits of treatment while synthetic treatment have limited criteria.

Keywords: Antifungal activity, *Aloe lateritia, Withania somniferum, Ocimum sanctum.*

Introduction

It has been shown that up to 90% of all HIV/AIDS patients contract fungal infections at some point during the course of the disease [1] and that 10–20% die as a direct consequence of fungal infection [2]. Over the past two decades, fungal infections have increased significantly in frequency and as causes of morbidity and mortality [3].

Fungi are ubiquitous in the environment, infection due to fungal pathogens has become more frequent [4, 5]. Both bacteria and fungi are responsible for large number of human and other animal diseases, part of them are life threatening. The time required for the identification of such pathogens plays an important role and, in some cases, a critical role in the course of treatment and can affect significantly the affectivity of such treatment [6]. Several plant species are used by many ethnic groups for the treatment of various ailments ranging from minor infections to dysentery, skin diseases, asthma, malaria and a horde of other indications [7].

Candida spp. and Aspergillus spp. are responsible for more than 80% of all fungal infections in solid organ transplant recipients [8]. The clinical relevance of fungal diseases increases enormously due to the increasing of the immunocompromised host in the second half of the 20th century including individuals infected with HIV, transplant recipients and patients with cancer [9]. Invasive fungal infections of the bloodstream and organs within the body (e.g. meningitis, pneumonia, peritonitis) are important causes of morbidity and mortality in liver, pancreas, heart, kidney and lung (i.e. solid organ) transplant recipients The crude mortality from opportunistic fungal infections still exceeds 50% in most human studies and has been reported to be as high as 95% in bone marrow transplant recipients infected with Aspergillus sp [10]. Fungi are ubiquitous in the environment, and infection due to fungal pathogens has become more frequent [11]. The inclusion of Coccidioidesimmitis as a potent agent of bioterrorism [12]. Antifungal agents used for treatment and prophylaxis can be administered orally or intravenously

Aspergillosis in neutropenic patients is usually caused by *A. fumigatus* or *A. flavus* [13].

Herbal plants for the treatment of fungal infections:

***Leptadenia lancifolia* [14]**

Leptadenia lancifolia (*Asclepiadacea*) is a common herb with several creeping stem which contains phytoconstituent responsible for antifungal activity against some fungal pathogens. This is used for mycotic infection which is a very common health problem worldwide and especially in developing countries. The plant has various food and medicinal uses as salad (Nigeria) and as " hungrer food" (Niger). Medicinally the dried whole plant is grounded to powder and administered to pregnant women in order to relief labour pain . The boiled root extract are also used in the treatment of stomach pain, while sap from leaves is applied topically for the treatment of fungal infections (Ring worm) [15].

***Aegle marmelos Cor* [16]**

Aegle marmelos (*Rutaceae*) *Cor* commonly known as "Beal" or Koovalam (Malayalam) is very common use in the day to day life of people, certainly based on its medicinal utility [17]. A clinical study on diabetic patients and experimental study on animals, reported the blood glucose lowering effects of the green leaves of *Aegle marmelos* [18]. Other actions like antifungal, antibacterial and anti-protozoal effects have been studied using various parts of plant. The flavonoids rutin and marmesinin have been isolated from the leaves of *A. marmelos*. The flavonoids found in citrus fruits are water soluble compounds. The smooth muscle relaxant effect of the bio-flavonoids may be mediated through α adrenergic or opiate receptors [19].

***Ocimum sanctum L* [20]**

Ocimum sanctum Linn. *(Labiaceae)* is found throughout the semitropical and tropical parts of India [21]. Pharmacologically important active principles of *Ocimum sanctum* are a large group of polyphenolic flavonoids like epigenin, vicenin-1, vicenin-2, caffeic and ursolic acid [22, 23]. It show wound healing effects by different mechanisms like free radical scavenging, metal chelation as well as immune modulation at different levels individually or in combination [24].

Essential oils (EO) of *O. sanctum* L. (holy basil) has been used in cure of many diseases in Indian system of medicine [25, 26, 27]. It has application as antimicrobial ingredient in food preservation to control the fungal infestation. Eugenol is a phenolic compound and major constituent of essential oils extracted from different parts of Tulsi plant. The therapeutic

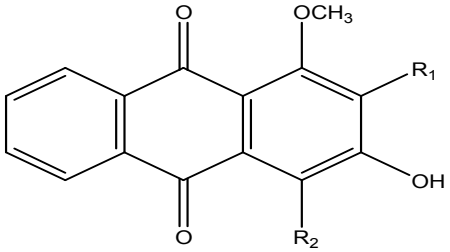
potential of Tulsi has been established on the basis of several pharmacological studies [28].

***Syzygium jambolanum* [29]**

Syzygium jambolanum Linn. (*Myrtaceace*) is commonly known as Jambol. It is widely found in India. The seeds are traditionally used to treat diabetes mellitus and glycosuria. The fruit is astringent, stomachic, carminative and diuretic. The seeds contain fatty oil, tannin, steroids, triterpenes and flavonoids [30]. Medicinal plants are natural resources, yielding valuable herbal products which are often used in the treatment of various ailments. *Syzygium jambolanum* DC (Holland) (*Eugenia jambolana* Lam.) is widespread in India, Ceylon, Malaysia and Australia. *Syzygium jambolanum* seeds are used by the village people to treat illnesses caused by bacterial, fungal and viral pathogens. The seed extract of *Syzygium jambolanum* is used to treat cold, cough, fever and skin problems such as rashes and the mouth, throat, intestines and genitourinary tract ulcers (infected by *Candida albicans*).The seeds are sweet, astringent to the bowels and good for diabetes. It also stops urinary discharges [31].In an investigation made to evaluate the antibacterial and antifungal activity of seeds of *Syzygium jambolanum,* it was found to be very effective against *Candida albicans*, *Aspergillus flavus*, *Aspergillus fumigatus*, *Aspergillus niger*, *Bacillus subtilis* and *Staphylococcus aureus* [32].

***Saprosma fragrans* [33]**

Saprosma fragrans (Rubiaceae) is found in Kerala (Silent Valley), India, on the western slope at the alt. 2000 ft. The fungal threat will continue to increase, as shown by the occurrence of aspergillosis in severe acute respiratory syndrome (SARS) and by the inclusion of Coccidioides immitis as a potent agent of bioterrorism. The ethanolic extract of the aerial part (whole plant without root) of this plant exhibited significant antifungal activity. The principle constituents of this plant, anthraquinones exhibited prominent antifungal activity. 3, 4-dihydroxy methoxy anthraquinone-2-carboxaldehyde is the main constituent which is responsible for antifungal activity [34].



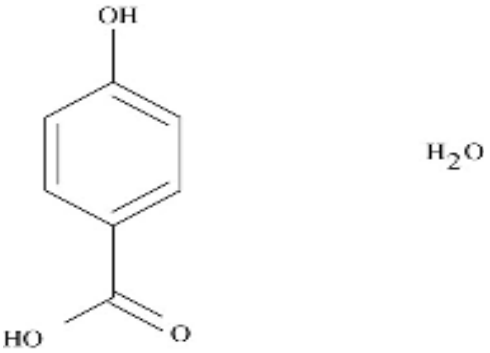
Compound	R^1	R^2
1	CHO	OH
1R	CH2OH	OH
2	CHO	H

3,4-dihydroxy-1- methoxy anthraquinone-2-

carboxaldehyde

***Cassia fistula* [35]**

Cassia fistula L.(*Leguminosae*) a semi-wild Indian Labernum (also known as the Golden Shower) is distributed in various countries including Asia, South Africa, Mexico, China, West Indies, East Africa and Brazil. It is an ornamental tree with beautiful bunches of yellow flowers. The pulp of the ripe fruits has a mild, pleasant purgative action and is also used as an anti-fungal drug [36]. This plant is widely used by tribal people to treat various ailments including ringworm and other fungal skin infections [37]. It is used by Malaialis tribe in India to treat nasal infection [38].The pulp of the ripe fruits has a mild, pleasant purgative action and is also used as an anti-fungal drug [39]. Indian people are using the leaves to treat inflammation, the flowers as a purgative, and the fruit as anti-inflammatory, antipyretic, abortifacient, demulcent, purgative & refrigerant. The plant is good for chest complaints, eye ailments, flu, heart and liver ailments and rheumatism [40, 41, 42, 43]. It is useful in treating haematemesis, pruritus, leucoderma and diabetes [44, 45].*Cassia fistula* plant parts are known to be an important source of secondary metabolites, notably phenolic compounds. Fistucacidin (3,4,7, 8, 4-pentahydroxyflavan) was first extracted from the heartwood [46]. Kaempferol and a proanthocyanidin have been isolated from the acetone extract of the flower [47]. A bianthraquinone glycoside, fistulin together with kaempferol and rhein have been isolated from ethanol extracts of *Cassia fistula* flowers [48]. Besides phenolics and their derivatives, a certain amount of alkaloids have also been reported in the flowers [49].



4-Hydroxy benzoic acid hydrate.

Benzoic acid derivatives are shown to have various biological activities [50].

***Azadirachta indica* [51]**

Azadirachta indica (Meliaceae) is a tree used worldwide in traditional medicine. *Azadirachta* is a genus of two species of trees in the flowering plant. Numerous species have been described in the genus but only two are currently recognized, *A. excelsa* (Jack) Jacobs, and the economically important Neem tree. The tree is considered a"village pharmacy" because its every part has an application in curing human diseases. Its constituents have been demonstrated to exhibit immunomodulatory, anti-inflammatory, antihyperglycemic, antiulcer, antimalarial, antifungal, antibacterial, antiviral, antioxidant, antimutagenic and anticarcinogenic properties [52].

***Allium sativum* [53]**

Allium sativum (Liliaceae) Garlic is a common medicinal plant which is widely cultivated in India. It has been used from the earliar times for flavouring soups, salad, and sausages. It has medicinal properties and is administered in cases of all fevers and debilitating condition. It possesses anti-septic and bacterial properties. Recent characterization of the pharmacokinetics and metabolism of organosulfur compounds in garlic has revealed that allicin is not biologically active in the body therefore compounds in Allium spp. other than allicin may very well be responsible for the beneficial activities [54, 55].

***Abutilon indicum* [56]**

Abutilon indicum (L.) Sweet (*Malvaceae*) known in Hindi as Atibala, found in the outer Himalayan tracts from Jammu to Bhutan up to an altitude of 1500m and extending through the whole of northern and central India. They are beneficial in treating gout, tuberculosis and raktapitta bleeding disorders and anti-fungal activity. Phytochemical investigation of *A. indicum* showed the presence of amino acids, glucose, fructose and galactose have been isolated from the leaves [57].

***Artemisia annua* [58]**

The genus *Artemisia* (*Compositae*) belongs to a useful group of aromatic and medicinal plants comprising about 300 species found in the northern hemisphere [59]. Many secondary metabolites of terpene peroxides are isolated from *Artemisia annua* L., such as artemisia ketone, artemisinic alcohol, arteannuin B and myrcene hydroperoxide [60]. Some of them also can also be found in essential oil. The antimicrobial and antifungal activities of the essential oil were determined against *Staphylococcus aureus* (ATCC 29737), *Echerichia coli* (ATCC 8739), *Pseudomonas aeruginosa* (ATCC 9027), *Saccharomyces cerevisiae* (ATCC 16404) and *Candida albicans* (ATCC 14053) [61].

***Sphaeranthus indicus* [62]**

Sphaeranthus indicus L. (*Compositae*) is a multi-branched herb with round purple flowers that grows plentifully in rice fields and is distributed throughout India, Ceylon, Malay, China and Africa. It is used indigenously in the Indian system of traditional medicine as a remedy for various ailments, being used as a tonic, laxative, digestive, anthelmintic, and the

treatment of insanity, tuberculosis, diseases of the spleen, anaemia, bronchitis, elephantiasis, pain of the uterus and vagina, piles, asthma, leucoderma and hemicrania. Almost every part of the plant is useful. Leaves of the plant are eaten as a pot-herb and have anxiolytic, macrofilaricidal, antimicrobial and insecticidal activities [63].

***Euphorbia fusiformis* [64]**

Euphorbia fusiformis Buch.- Ham. ex. D.Don (*Euhorbiaceae*). *Euphorbia fusiformis* possess antifungal properties against *Candida albicans* and *Cryptococcus neoformans*. It has been used extensively in herbal medicine for the treatment of rheumatism, gout, paralysis and arthritis, inflammation and bacterial. The combined formulations of the extracts also had better activity against *C. albicans* than *C. neoformans* [65].

***Solanum trilobatum* [66]**

Solanum trilobatum (*Solanaceae)* a thorny creeper with bluish violet flower, more commonly available in Southern India has been used traditionally in Siddha system of medicines to treat various diseases. It has been widely used to

treat respiratory disorders, especially bronchial asthma and antifungal activity. Various chemical constituents are reported to be isolated from Solanum species, which includes alkaloids, phenolics, flavanoides, sterols saponins and their glycosides. Alkaloides such as soladunalinidine and tomatidine were isolated from leaf and stem of Solanum species which are used for the treatment of microbial disease [67].

***Coccinia indica* [68]**

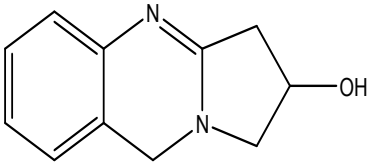
Coccinia indica (*Cucurbitaceae*) commonly known as 'Ivy gourd' and 'Kundru' in Hindi is a perennial tendril climber, available in wild and cultivatedform. It is the native of Central Africa, India and Asia. Every part of this plant is valuable in medicine for ring worm, psoriasis, small pox, scabies and other itchy skin eruptions and ulcers *C. indica* has antidiabetic, hypoglycemic, anti-inflammatory, analgesic, hepatoprotective, antioxidant, antilitihic and antimutagenic activities [69].

***Datura metel* [70]**

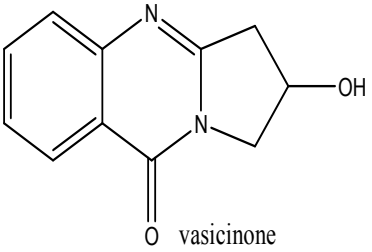
Datura metel (Solanaceae) is cultivated by sowing the seeds and it is found in India, England and other tropical and subtropical region. *Datura metel* is well known for tropane alkaloids and with asteroids. *D. metel* shows antimicrobial activity of *D. metel in vitro* against *Rhizoctonia solani* and *Xanthomonas oryzae.* The antifungal activity of n-hexane extracts of *Datura metel* was investigated against *Ascochyta rabiei* [71].

***Adhatoda vasica* [72]**

Adhatoda vasica (Acanthaceae) is found in sub-Himalayan track upto an altitude of 1000m, and in Maharashtra especially, in Konkan region.Besides India, it is found Myanmar, Sri Lanka and Malya. Vasaka leaves contain quinoline derivative such as vasicine, vasicinone and 6-hydroxy vasicine. Leaves are reported to be used for the treatment of various diseases and disorders, particularly for the respiratory tract ailments [73].



vasicine



vasicinone

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