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Phytotherapy in Aspergillus: An overview of the most important medicinal plants affecting Aspergillus

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Abstract: Aspergillosis can cause wide range of diseases such as abortion, respiratory infections and food poisoning. The emergence of drug-resistant fungal species has caused attention to be focused on developing new therapies against fungi. Some plant species have been identified antifungal properties. Because of the importance of fungal diseases, such as Aspergillus, in this study the effect of antifungal medicinal plants native to Iran, was introduced. The review carried out by searching scientific databases such as Google Scholar, SID, etc, key words, including fungi, Aspergillus, herbs and Iran to relevant articles were searched and were studied. Diagram of the present review were as follows. *Zataria multiflora* Boiss., *Thymus eriocalyx*, Mentha pulegium, Satureia hortensis, *Secale montanum*, Artemisia, *Petroselinum crispum*, *Acimum basilicum*, *Anethum graveolens*, *Mentha viridis*, *Cuminum cyminum*, Cinnamomum zeylanicum, *Aloe vera*, *Rosa damascena*, *Coriandrum sativum* *Origanum majorana* , *Myrtus Communis* L and *Glycyyrhiza glabra* are the most important medicinal plants against Aspergillosis. Important compounds such as Carvacrol, Thymol, Palmitic acid, Apiol, Methyl chavicol, Caryophyllene oxide, Cimonene, Camphene, Mircen and Myrtenal, Menthol, Caryophyllene, Mentone and ect includes the active compounds of medicinal plants that have antibacterial and antifungi effects, which can be described as a combination of proven anti-Aspergillus context.

Keywords: fungus, Aspergillus, herbs, Iran.

Introduction

Aspergillosis is the name given to a wide variety of diseases caused by infection by fungi of the genus Aspergillus. Disease may be manifested by food poisoning, allergies due to inhalation of fungal conidia or due to aspergilloma, granulomatous inflammation and necrosis of lung and other visceral organs and rarely deadly visceral disease (1). These fungal diseases in animals can cause some problems such as abortion, respiratory infections and food poisoning. Primary aspergillosis is rare and more common in adult men. Whereas secondary aspergillosis in feeble patients observed, is not dependent on age or sex, and the incidence increases with certain situation such as the use of antibiotics, steroids, cytokines and toxins and due to some disease for instance cancers, blood diseases such as leukemia, renal transplantation, enterocolitis, pneumonia, alcoholism, and

tuberculosis (2). One of aflatoxin producing fungi in human and animal food is Aspergillus flavus. According to research conducted Aspergillus species is isolated from soft shell, hard shell and pistachios of Iran (3). The most important fungi are produced aflatoxin which can be separated from pistachios include A. parasiticus and Aspergillus flavus. These two species produce G1, B2, B1, G1 toxins (4).

Consumption of food contaminated with aflatoxins causes acute or chronic diseases such as cancer and liver if taken in high doses, can be fatal (5).

The medicinal plants are the rich source to treat diseases such as diabetes, kidney stones, colds, hyperlipidemia, parasitic and infectious diseases, constipation, dysmenorrhea, pain, sinusitis, and others (6-13). The presence of drug-resistant fungal species has caused attention to be focused on developing new therapies to elimination fungi diseases(14). Some plant species have been identified antifungal properties (15). Given the importance of fungal diseases, such as Aspergillus, in these study medicinal plants native to Iran with the anti-fungal effects is reported.

Method

The review carried out by searching scientific databases such as Google Scholar, SID, etc, key words, including fungi, Aspergillus, herbs and Iran to relevant articles were searched and were studied.
Diagram of the present review were as follows.

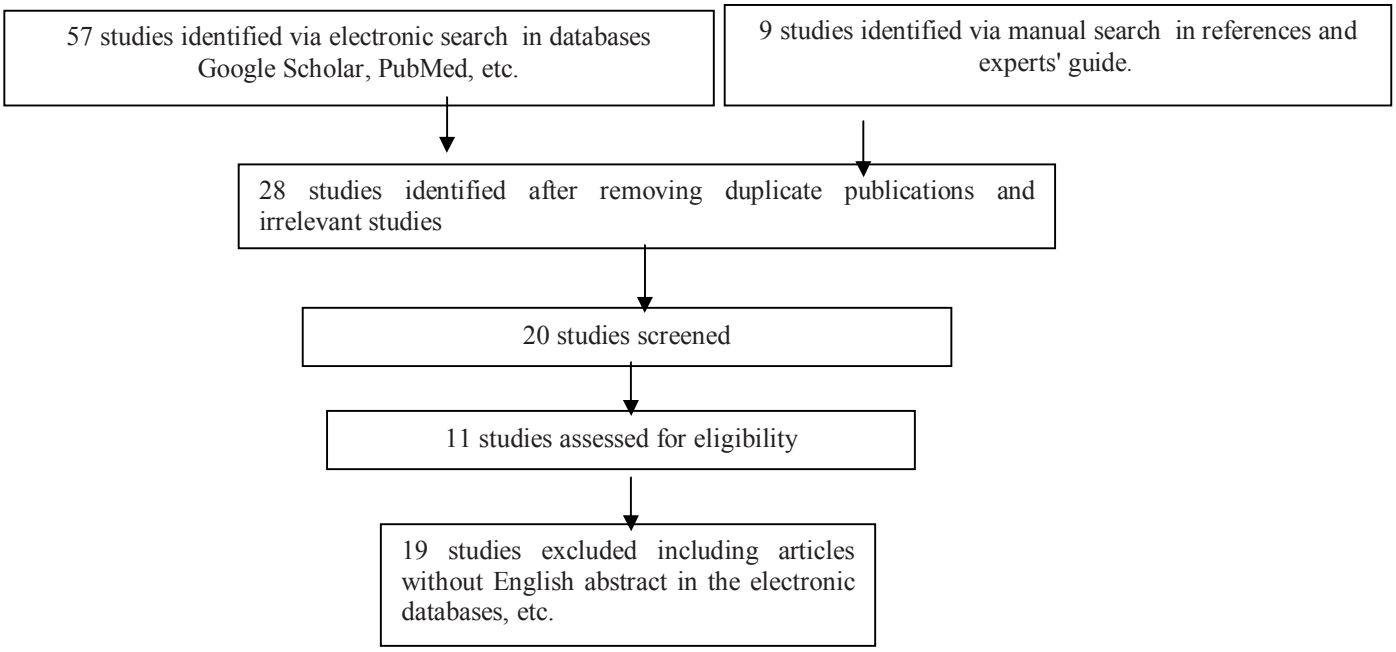

Figure. Flow diagram for the study review

Results

Based on these results, the herb *Zataria multiflora* Boiss., *Thymus eriocalyx*, Mentha pulegium, Satureia hortensis, *Secale montanum*, Artemisia, *Petroselinum crispum*, *Acimum basilicum*, *Anethum graveolens*, *Mentha viridis*, *Cuminum cyminum*, Cinnamomum zeylanicum, *Aloe vera*, *Rosa damascena*, *Coriandrum sativum Origanum majorana , Myrtus Communis* L and *Glycyyrhiza glabra* reported the most important medicinal plants are native to Iran with anti-Aspergillus. Additional information regarding the scientific name and dosage and effect of each herb mentioned in Table 1.

Table 1. The scientific name, dose and efficacy of medicinal plants native to Iran with anti-Aspergillus

Row	The scientific name of the plant	The family	The Persian name of the plant	The medical effect of plant
1	*Zataria multiflora Boiss.*	Laminaceae	Avishane Shirazi	Based on the results obtained in vitro situation, minimum inhibitory concentration of Thymus vulgaris extract on the growth of Aspergillus flavus was determined 90 ppm concentration of 30% ethanol extract. The thyme alcoholic extract at a concentration of 48% at the dose of 2500 ppm in the whey coating composition in sterile kernel , fully prevented the growth of Aspergillus flavus on the nuts (16).
2	*Thymus eriocalyx*	Laminaceae	Avishane Korki	The results of a study showed that the concentration of 500 ppm of essential oil of thyme fluffy growth hibition was 22 mm (17) which reveal extraordinary power of these Fungicides oils and preservatives.
3	*Menthapulegium*		Pooneh	Results of a study showed that the essential oil of oregano inhibited Aspergillus niger growth with MIC 2.5 micrograms per ml (18).
4	*Satureiahortensis*	Labiatae	Marzeh	Results of a study showed that savory essential oil inhibited Aspergillus niger growth the MIC 2.5 micrograms per ml (19).
5	*Secalemontanum*	Poaceae	Chavdar Koohi	Rye oregano essential oil with humidity of 65, 75 and 86% and at 15, 25 and 35 temperature with concentration of 10^6 spores per ml Aspergillus flavus applied antifungal effect (20).
6	*Artemisia*	Asteraceae	Dermaneh	The results of the effect of the Artemisia on 12 different genus of Aspergillus showed that the MIC was identified in the range of 6.25, 12.5 and 25, as well as their MFC 12.5, 25 and 50 (21).
7	*Petroselinumcrispum*		Apiaceae Jafari	Results of a study showed that at a dose of 4 micro liters per ml of parsley had antifungal effect and inhibited the growth of Aspergillus parasiticus imposed on (22).
8	*Acimumbasilicum*		Lamiaceae Reyhan	Results showed that *Acimum basilicum* with dose 3 micro liters in milliliters had antifungal effect and applied prevention the growth of Aspergillus parasiticus (22).
9	*Anethumgraveolens*	Apiaceae	Shevid	Results of a study showed that *Anethumgraveolens* at a dose of 1.5 micro liters per ml had antifungal and inhibitory effect on Aspergillus parasiticus (22).
10	*Menthaviridis*	Lamiaceae	Naana	Results of a study showed that peppermint at a dose of 1.5 ml per ml revealed antifungal and inhibitory effect on Aspergillus parasiticus (22).
11	*Cuminum cyminum*	Apiaceae	Zire Sabz	Results of a study showed that *Cuminum cyminum* at the cause the minimum inhibitory at the concentrations between 3.125 to 12.5 micrograms per ml and

				the MBC equal to 6.5 to 25 micrograms per ml on Aspergillus fumigatus and Aspergillus nidulans (23).
12	*Cinnamomumzeylanicum*	Lauraceae	Zilanikoom	The results of a study that was conducted on 27 isolates of Aspergillus was determined that the MIC for eight isolates was 1.18 micrograms per ml, 0.59 micrograms per ml for the six isolates, for four isolates was 0.29 micrograms per ml, to five isolators was 0.14 micrograms per milliliter and for four other isolates was 0.07 micrograms per ml (24).
13	*Aloe vera*	Liliaceae	Sabre Zard	Results of a study showed Aloe vera acetone extract has 100 percent antifungal activity at a concentration of 10^5. The inhibition of aflatoxin in concentrations of 2000 µl /50 ml culture medium equal to 40.94% and a concentration of 2 µl / 50 ml culture medium was reported 18.14% (25).
14	*Rosa damascena*	Rosaceae	Gole Mohammadi	Results of a study showed that MIC of the extract of *Rosa damascena* on Aspergillus fumigatus recorded 437.5 ±87.8 and MFC of extract was 500 ±20.41 mg /ml (25).
15	*Coriandrumsativum*	Apiaceae	Geshniz	Results of a study showed that MIC of *Coriandrum sativum* extract against Aspergillus fumigatus was 387.5 ±27.32 and MFC extract on the fungus was 387.5± 27.32 mg /ml (26).
16	*Origanummajorana*		Lamiaceae Marzanjoosh	Results of a study showed that the MIC and MLC of *Origanumm ajorana* - *Thymus eriocalyx* oil mixtures, was determined respectively, 63 and 500 micrograms per ml and the MIC and MLC to mix *Origanumm ajorana* - *Satureia hortensis* essential oils as well as 63 and 500 micrograms per ml for Aspergillus (27).
17	*MyrtusCommunisL*	Myrtaceae	Moort	Results of a study showed that a concentration of 100 micrograms per milliliter of *Myrtus Communis* L essential oils on Aspergillus fumigatus and Aspergillus flavus, at the dose of 50 micrograms per ml on Aspergillus nidulans and fumigatus and the dose of 25 micrograms per ml against Aspergillus niger and nidulans (28) .
18	*Glycyyrhizaglabra*	Fabaceae	Shirin bayan	Results of a study showed that the highest inhibitory of *Glycyyrhizaglabra* was observed at 500 mg /ml. HPLC analysis also showed that the most effective concentration of licorice extract was concentration of 10 mg/ml, respectively, which inhibits aflR toxin gene produces as much as 99.99 percent (29).

Discussion

Pharmaceutical active ingredients such as phenols, flavonoids, tannins, Anthocyanin and… cause having therapeutic effects in herbal pants (30-32).

Based on these results *Zataria multiflora* Boiss , *Thymus eriocalyx*, Mentha pulegium, Satureia hortensis, *Secale montanum*, Artemisia, *Petroselinum crispum*, *Acimum basilicum*, *Anethum graveolens*, *Mentha viridis*, *Cuminum cyminum*, Cinnamomum zeylanicum, *Aloe vera*, *Rosa damascena*, *Coriandrum sativum Origanum majorana , Myrtus Communis* L and *Glycyyrhiza glabra* are the most important medicinal plants against Aspergillosis native to Iran. Based on phytochemical studies, the active components of medicinal herbs analyzed and listed below. The most important phenolic compounds of thyme plant are Carvacrol and Thymol (34,35) It's known that palmitic acid and apical meristem are important compounds of Parsley. Methyl chavicol, caryophyllene oxide and limonene are important compounds extracted from Basil. The phytochemical results show that the effective ingredients of Dill includes decaron, limonene and alpha phellandrene. Menthol, pulgone, mentone, sabinene, piperitone, penine and methyl acetate are the most compound of peppermint oil (36-38). The active ingredients of Cuminum cyminum includes cumin, simonin, camphene, myrcene, myrthen, caryophyllene, phellandrene, cineole, gamma terpinene have been identified (39,40). *Glycyrrhiza glabra* contains trepens, coumarin, flavonoids and isoflavonoids which can have anti fungi effects (41). Aloe vera contains combinations such as phenolic compounds, saponins and anthraquinone (42) The combination of quercetin 3-o-glucoside, kaempferol-3-o-rutinoside in extracts of rose , kaempferol-3-o-arabinoside in rose's essence and geraniol, citronellol and nerol been identified (43). Myrtus essence contains flavonoids and tannins (44). The most important compound of Rosemary is alpha-pinene (45).

Because of the infectious diseases have high outbreak and spread (46-57), Therefore medicinal plants through their active ingredients have a good therapeutic effect (58-70). Medical plants listed in this article have antibacterial and antifungi effects, which can be described as a combination of proven anti-Aspergillus context.

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