



Review Article

ANTIMICROBIAL ACTIVITIES OF YEMENI MEDICINAL PLANTS: A REVIEW

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ABSTRACT

Yemen situated in the southwestern brink of the Arabian Peninsula. Until now, Yemenis rely on traditional medicine, especially in rural areas due to the poor economic situation. Medicinal plants are the base of traditional medicine in Yemen. Many studies described some of these plants for their antimicrobial, antiviral, and anti-parasite activity and many others medical properties. The objective of this paper is to provide a review on antimicrobial properties of Yemeni medicinal plants that have been.

Keywords: Medicinal Plants, Yemen, Antimicrobial, Antibacterial, Anti fungal, Anti-parasite, Antiviral.

INTRODUCTION

The Republic of Yemen situated in the southwestern brink of the Arabian Peninsula.¹ Yemen is one of the developing countries that depend on traditional medicine, especially medicinal plants that provide basic medical needs, because of the poor economic case of the citizens.²⁻⁴ The number of plants in Yemen is estimated at 3000 plants with 10% of them are domestic plants.¹ The traditional use of medicinal plants of Yemen belongs to the old Arabic medicine, itself similar to Greek and Indian.⁵ According to the World health organization (WHO), more than 80% of the world population depends on traditional medicine for their primary health care needs.⁶

Medical Plants used in folk medicine are still undiscovered and may be a source and alternative to current chemical treatments that increases the resistance of microbes permanently.⁷ One study showed the traditional uses of plants for medicine in Yemen, in which 130 medicinal plants have been identified according to their vernacular name, geographical and ecological distribution, medicinal use in Yemen and pharmacological properties by.⁸

There are many studies on Yemeni medicinal plants to determine their activity against microbes, antioxidants, cancer, and so on. Although several plants species have been studied for their antimicrobial properties, most of these have not been enough assessed. These review focus on Yemeni medical plants that have been studied against microbial infection, this review can be used by other researchers as a guide to know which type of Yemeni plant that already studied, and they can start other studies or complete previous ones.

Antimicrobial properties of medical plants

Antibacterial activity

Since consumers' worry has come to focus on the toxicity of synthetic chemicals, antibacterial compounds found in normal

plants have started to get much consideration as safe food additives. Different characteristic plants are known to have antibacterial action.⁹ There are many studies that dealt with Yemeni medicinal plants as antibacterial.

An earlier study have reported the antibacterial activity of Twenty-five selected plants belonging to 19 families from the island Soqatra, extracted with the solvents chloroform, methanol and hot water, among three solvents, the methanol extracts of *Boswellia elongata*, *Boswellia ameero*, *Buxus hildebrandtii*, *Commiphora parvifolia*, *Jatropha unicostata*, *Kalanchoe farinacea*, *Pulicaria stephanocarpa*, *Punica protopunica*, *Withania adunensis* and *Withania riebeckii* showed the best inhibition effect.⁷

Fifty-two extracts from 26 plants were obtained using methanol and hot water and the best antibacterial inhibition zones were shown by extracts from *Acacia penninervis*, *Boswellia dioscorides*, *Boswellia socotrana*, *Commiphora ornifolia*, *Euclea divinorum*, *Euphorbia socotrana*, *Leucas samhaensis*, *Leucas virgata*, *Rhus thyrsoiflora*, and *Teucrium sokotranum* (inhibition zones > 15 mm and MIC values ≤ 250 µg/ml).¹⁰

Another report indicated that fourteen of the ethanol extracts out of 20 selected plant species used by Yemeni traditional healers to treat infectious diseases exhibited variable degrees of antibacterial activity.¹¹ Another study reported the effect of 13 extracts out of the 23 extracts against *Staphylococcus aureus* or *Escherichia coli*.¹² In one study, the effect of ninety crude extracts from 30 medicinal plants on bacteria have been reported, the Gram-positive bacteria were more sensitive to extracts than Gram-negative bacteria by.¹³

Moreover, another study revealed the antimicrobial activity of *Acacia harala*, *Acalypha fruticosa*, *Capparis cartilaginea*, *Euphorbia fruticosa*, *Flemingia grahamiana*, and *Plectranthus cf barbatus* against two gram-positive bacteria (*Staphylococcus aureus* and *Enterococcus faecalis*) and two gram-negative

bacteria (*Escherichia coli* and *Pseudomonas aeruginosa*), all plants showed antibacterial against at least one of the selected microbial.¹⁴

Antibacterial activities of the methanolic and aqueous extracts of thirty Yemeni plants were studied and demonstrated to be active against a range of selected microbes by the agar diffusion method and determined the minimum inhibitory concentration (MIC) with broth micro-dilution assay.¹⁰

According to Mothana RA *et al*¹⁵, activity of methanol and hot water extracts have been studied. Extracts from several plants against three Gram-positive bacteria (*Staphylococcus aureus*, *Bacillus subtilis* and *Micrococcus flavus*) and two Gram-negative bacteria (*Escherichia coli* and *Pseudomonas aeruginosa*) strains using agar diffusion method, the Methanol extracts for the following plants: *Acalypha fruticosa*, *Centaurea pseudosinaica*, *Dodonaea viscosa*, *Jatropha variegata*, *Lippia citriodora*, *Plectranthus hadiensis*, *Tragia pungens* and *Verbascum bottae*, showed the highest antimicrobial activity was exhibited.

Antibacterial activity of 33 selected Yemeni plants have been evaluated by¹⁶, the greatest antibacterial activity with inhibition zones higher than 15 mm observed for the methanol extracts of *Chrozophora oblongifolia*, *Aristolochia bracteata*, *Myrtus communis*, *Phragmanthera regularis*, *Pulicaria jaubertii* and *Rosmarinus officinalis*.

An earlier study showed antibacterial activities of extracts from *Salvadora persica*, *Acacia nilotica*, *Acacia tortilis*, *Ficus vasta*, *Commiphora foliacea*, *Ocimum forskohlii* *Plicosephalus curviflorus*, *Sansevieria aff. ehrenbergii*, *Solanum nigrum* and *Tamarindus indica* against at least four bacterial strains.¹⁷

Antibacterial activities of plants *Dendrosicyos socotrana* and *Dracaena cinnabari* from the island of Socotra, Yemen against both Gram-positive and negative bacteria have been reported.^{18,19}

Reported the chemical composition and *in vitro* antimicrobial and antioxidant activities of the essential oil of the Socotraen *Leucas virgata*. The oil showed a great antibacterial activity against the tested *Staphylococcus aureus*, *Bacillus subtilis*, and *Escheria coli*. No activity was found against *Pseudomonas aeruginosa*. Also there are some Yemeni studies about Chemical composition and antimicrobial activity of essential oil of some Yemeni plants, Studies showed that essential oils had antibacterial properties against a wide range of bacterial strains.²⁰⁻²⁶

Antifungal activity

Despite the development of fungi infection treatment, these drugs still have side effects, plants provide safe resources and have been used for long periods of time against microbes, especially fungi.²⁷ Researchers have been reported the effect of 30 plants on fungi, among these plants, only 13 showed antifungal activity against one or more human pathogenic fungi.²⁸

Another report showed activity of seven plants extract, Only hexane extract of *Plectranthus barbatus* have activity against *Candida albicans*.¹⁴ The essential oil of *Thymus vulgaris* showed a very effective antifungal activity against *Candida albicans* and *Candida vaginitis* with minimum inhibitory concentrations (MIC) ranging from 80 and 97 µg/ml.²¹ Another study showed activity of 5 plant from 23 plants against *Candida albicans*.¹²

Anti-parasite activity

According to the World Health Organization reports, one billion people are suffering from tropical diseases such as visceral leishmaniasis, African trypanosomiasis and American trypanosomiasis which could lead to death, most of the treatments available are not effective, therefore, therapeutic alternatives should be sought from plants.²⁹

Six selected plants (*Acalypha fruticosa*, *Azadirachta indica*, *Cissus rotundifolia*, *Echium rauwolfia*, *Dendrosicyos socotrana* and *Boswellia elongata*), were collected from different localities of Yemen, among the investigated 12 extracts (methanolic and water), three extracts were found to have significant antiplasmodial activity namely the water extracts of *A. fruticosa*, *A. indica* and *D. socotrana*, six extracts showed moderate activity and three appeared to be inactive.³⁰

In another study nineteen plants belonging to fourteen families were evaluated as antimalarial.³¹

Also, antiprotozoal activity of twenty medicinal plants from the island Socotra have been reported²⁴, among this medical plants, *Acridocarpus socotranus* showed activity against *Trypanosoma brucei* and *Trypanosoma cruzi* (IC50 3.5 and 8.4 µg/mL), *Punica protopunica* against *Plasmodium* (IC50 2.2 µg/mL) while *Eureiandra balfourii* and *Hypoestes pubescens* displayed activity against the three kinetoplastid parasites (IC50 < 10 µg/mL).

Another study²⁹, showed activity of twenty - five medicinal plants from Saudi Arabia and Yemen as an antiplasmodial, antileishmanial, and antitrypanosomal activity. Only seven plants showed interesting anti protozoal activity. Extracts of *Caralluma penicillata* and *Acalypha ciliata* showed fairly good activity against *Plasmodium falciparum*. Good activity against *Leishmania infantum* was got with *Verbascum bottae*. The extracts of *Caralluma penicillata*, *Leucas virgata* and *Loranthus regularis* exhibited modest activity against *Trypanosoma brucei*. Also, effect of *Solanum incanum* plant on nematodes (Steinernemafeltiae) has been studied.¹

Antiviral Activity

Scientists are trying to get natural sources as antiviral agents, as natural products are better than industrial compounds. In the previous period, many of phytochemicals of natural products were identified to control diseases caused by viruses.^{32,33} But there are no many studies interested in the effect of Yemeni medicinal plants as antiviral. The antiviral potential activity of extracts of 25 plants used in Yemeni traditional medicine (collected from island Socotra) against two viral systems, viral influenza type A/MDCK cells and herpes simplex virus type 1/Vero cells, at non-cytotoxic concentrations. The Plant extracts showed more activity on the herpes simplex virus type 1 more than influenza virus type A. have been reported.³⁴

CONCLUSION

Yemeni medical plants show activity against many microbes and can be used as antibacterial, antifungal, anti-parasite and antiviral. Although there are many other Yemeni medical plants that are not studied until now. This encourages researchers to conduct further studies on Yemeni medicinal plants and their active compounds, which can be antimicrobial drugs.

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