

A Review of Plants Effective Against *Trichomonas vaginalis* (Causative Agent of Human Infections) and Their Therapeutic Properties

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ABSTRACT

Trichomonas vaginitis is the most common non-viral disease that is transmitted sexually. Although metronidazole is the most effective medication for this disease, it has some adverse effects. Herbal medicines have fewer side effects and are more popular among people. This study aimed to review the plants, which are effective against *Trichomonas vaginalis* and their therapeutic effects. For this purpose, the databases of Scopus, PubMed, Medline, Google Scholar, SID, and Magiran were searched for the articles published during 2000-2019 by keywords, such as *Trichomonas vaginalis*, complimentary, complementary therapies, herbal medicine, medicinal plants, and their Persian equivalents. All in vivo and in vitro trial studies were included in the present review. The data indicated that some compounds, including eucalyptus, case, and garlic were effective in inhibiting the growth of *T. vaginalis*.

Keywords: Antiparasitic activity, Plant extract, *Trichomonas vaginalis*



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Introduction

In the United States, vaginitis is the most common gynecological disease (1) with 21% of the cases being caused by *Candida albicans*, bacterial vaginosis, and *Trichomonas vaginalis* (2). The risk factors for *C. albicans* infection are pregnancy, diabetes, immunosuppressive agents, and antibiotics (1). Studies have shown that taking birth control pills, having a history of sexually-transmitted diseases, pregnancy, childbirth, stress, and some diseases play role in the occurrence of fungal diseases (3). Different species of *Candida* are among invasive infections and their resistance to antifungal medications is constantly increasing (4).

The most common non-viral disease transmitted through sexual contact is called trichomoniasis. This disease is caused by *T. vaginalis* single cell. Clinical signs of this disease in women include severe inflammation, itching, profuse foamy discharge, foul-smelling mucus, and burning urine. In men the symptoms entail burning when urinating, clear or

mucous discharge after itching, mucus, and itching. The infection is often asymptomatic in both genders, especially in men, even with high loads (5).

Complications of trichomoniasis in women are premature birth, abortion, babies with low birth weight, preterm rupture of membranes, ectopic pregnancy, postpartum endometritis, salpingitis, cervicitis, and cervical cancer. In men, the sequels encompass epididymo-deferentectomy, prostatitis, urethritis, urethral diseases, and even infertility (6). Nowadays, alternative therapies, especially plants are being considered and there is a greater desire for treatment using plants.

Materials and Methods

In this review, Scopus, PubMed, Medline, Google Scholar, SID, Magiran databases were searched for articles published during 2000-2019 using the keywords *Trichomonas vaginalis*, complimentary,

complementary therapies, herbal medicine, medicinal plants, and their Persian equivalents. All in vivo and in vitro trial studies were included in this review..

Results and Discussion

Taxus sbaccata (English Yew)

Yew is one of the native coniferous trees of Iran belonging to the *Taxaceae* family and growing in the forests of northern Iran (7). Studies have shown anti-tumor, antibacterial, anti-fungal, and anti-inflammatory effects for this plant (8). Moreover, it is used in the treatment of malaria, rheumatism, bronchitis, asthma (9), cysts, headaches, heart disease, and kidney disorders (11). This plant has antispasmodic, cardiac tonic, narcotic, purgative, expectorant, and emmenagogue properties (10).

Zare *et al.* studied the anti-*T. vaginalis* activity of this herb. Their results showed that the crude extract and 60% fraction of this plant at different times and the concentrations of 200, 300, 400, and 500 µg/mL had a significantly stronger antiparasitic effect than the 90% fraction ($P<0.05$). At a concentration of 200 µg, the 60% extract caused 100% growth inhibition, while the 90% extract caused 60% growth inhibition (12).

Rheum ribes

Rheum ribes belongs to the *Polygonaceae* family and its various species are found in different parts of the world, including Iran, India, China, and Turkey (13). Rhubarb is a species of rhubarb that grows in the mountainous regions of Iran and its stem is edible (14). Many therapeutic properties have been mentioned in scientific sources for various parts of rhubarb, such as leaves, bark, young stems, and flowers (15). Studies have demonstrated that the inhibitory impact of the aqueous and alcoholic extracts of rhubarb 24 and 48 h after exposure to *T. vaginalis* at a concentration of 300 µg/mL was 97.8% and 100%, respectively (16).

Foeniculum vulgare

Fennel plant (*Foeniculum vulgare* Mill) is an herbaceous, fragrant, and ostensibly dill plant with yellow umbel flowers, which has both edible and medicinal properties (17). Niyati *et al.* investigated the influence of fennel on *T. vaginalis* and the percentage of inhibiting parasite growth under different concentrations of fennel seeds. Their findings revealed an inhibitory effect of 76% on parasite growth in 24 and 48 hr

with 79.4% inhibitory power at the concentration of 800 µg/mL (16).

Stachys lavandulifolia Vahl

It is a herbaceous plant with short shrubs (60-20 cm) and antimicrobial effects widely used in traditional medicine (18). This plant is brewed in Iran and is used to treat diseases, such as headache, diarrhea, and

gastrointestinal complications, neurological disorders, wound inflammation, anxiety, cough, cold, urinary tract stones, bile, rheumatism, indigestion, and bloating (19).

In the study performed by Sereshti *et al.*, the effect of mountain tea on *T. vaginalis* was investigated and the results indicated that this parasite survived in TYIS-33, and the aqueous and alcoholic extract of mountain tea for up to 72 hr. However, all parasites were destroyed in the medium containing metronidazole (38).

Myrtus communis

Myrtus communis belongs to the *Myrtaceae* family, a small shrub with a height of 1-3 m growing in dry areas of Iran, and many medicines are prepared from its essential oil and extract. The leaves of this plant have bacteriostatic properties and in higher concentrations impose antimicrobial effect. In addition, the antifungal activity of this plant has been proven in several studies. The influence of Myrtle extract was investigated on *T. vaginalis* showing that the parasite survived for up to 72 h in a medium prepared from eggs, 1 h in the presence of metronidazole, and 6 h in DMSO medium.

It has also been reported that the effect time of Myrtle leaf methanolic extract at the concentrations of 0.1 and 0.01mg/mL at the beginning of cultivation and the effect time of essential oil at the concentrations of 0.1, 0.01, 0.001, and 0.0004 at the beginning of cultivation and the concentrations of 0.0002 and 0.0001 are 2 and 4 hr, respectively (20).

Ferula asafoetida

Asafoetida is an herbaceous plant with straight and relatively thick roots and strong stems with a lot of fiber. The resin part obtained from this plant is used and grown in different regions of Iran (21). An evaluation of the effect of Asafoetida on *T. vaginalis* showed that the concentration of 2 mg/mL of this plant extract eliminated 90% of parasites in 1 hr (22). Another study on the antiparasitic effect of Asafoetida extract on the *Hymenolepis nana* parasite indicated the lethal effect of Asafoetida hydroalcoholic extract on this parasite, in comparison with niclosamide (23).

Allium sativum

Garlic is a perennial herbaceous plant with a straight stem, slender leaves, and white flowers. Its underground glands usually have four to eight swollen lobes (21). Garlic is known in traditional medicine for suppressing appetite, aiding in digestion, lowering cholesterol and blood pressure, and imposing anti-parasitic impacts. Studies showed that a concentration of 0.1 mg/mL of garlic extract 2 h after exposure caused 95% of *T. vaginalis* to die. Furthermore, garlic extract at the concentrations of 0.05, 0.025, and 0.0125 mg/mL after 24 h even at low concentrations led to the disappearance of 90% of parasites (22).

Moringa oleifera

This plant belongs to the *Moringaceae* family and has 11 species with 8 species that have been studied. *Moringa* is one of the 11% that, as a bioactive source, has great potential for usage in the pharmaceutical industry (24). *Moringa pergrina* grows in tropical and subtropical regions of the world and the southeast of Iran with the native name Gozroghan or Gazrokh (25). Studies have demonstrated margarine to be useful in treating diseases, such as headache, back pain, burns, high blood pressure, labor pains along with antispastic, analgesic, and anti-inflammatory influences (26, 28).

The seeds and oil obtained from this plant have medicinal properties, including antimicrobial, antitumor, anti-inflammatory, and diuretic effects. Moreover, shows anti-allergic activities against mosquitoes that cause dengue fever and yellow fever (27). The study showed that margarine significantly reduced the percentage of live *Trichomonas* parasites at all concentrations in both 24 and 48 hr, compared to the control group ($P < 0.05$). After 24 hr, the IC50 and SI values were 682 and 4.1 $\mu\text{g/mL}$, respectively, and the MIC was 2 mg/mL (29).

Rosmarinus officinalis L.

A plant of the mint family, native to the Mediterranean region and also cultivated in Iran. The anti-cancer, anti-inflammatory, antimicrobial, and antioxidant properties of this medicinal plant are well known. Rosemary essential oil and nanoemulsion impose an inhibitory effect on *Trichomonas* growth and at a concentration of 100 $\mu\text{g/mL}$ over 3 h have shown 96.1% and 100% growth inhibition, respectively. In addition, essential oil and nanoemulsion at this concentration had no toxicity on macrophages (30). Saeidi *et al.* investigated the antiparasitic activity of rosemary and reported that a concentration of 0.001 rosemary extract in 4 hr inactivated the parasite (40).

Arctium lappa

Arctium lappa is an herbaceous and biennial plant. Diverse chemicals, namely inulin, polyacetylene, arctic acid, propionic acid, butyric acid, lauric acid, stearic acid, palmitic acid, plant hormones, tannins, and polyphenolic acid are obtained from its roots. Papaya roots, leaves, eggs, and fruits are used to treat cancers, rheumatism, gout, stomach diseases, kidneys, skin diseases, hair loss, eczema, sore throats, coughs, measles, ulcers, and diabetes (31). An experiment demonstrated that Baba Adam extract has an inhibitory influence on *T. vaginalis*. The minimum inhibitory concentration was 7.966 $\mu\text{g/mL}$ (32).

Satureja hortensis

An annual herbaceous plant of the mint family, which is traditionally used as a medicinal plant used as anti-flatulence, expectorant, strengthening stomach

and libido, antiseptic, and diarrhea treatment (33). Examination of the antimicrobial activity of ethanolic extracts of red pepper, roe deer, and savory against *Staphylococcus aureus* strains showed decreases in the effect of the extract with diminishing concentration. Red pepper, coriander, and savory plant extracts at the concentrations of 1.25, 2.5, and 2.5 mg/mL impose the highest inhibitory effect on the growth of *S. aureus*, respectively. Moreover, the concentrations of 5 and 10 mg/mL had the highest lethal effects (42). Summer savory extract has been found to have an inhibitory effect on *T. vaginalis* and the minimum inhibitory concentration was 8.90 $\mu\text{g/mL}$ (32).

Eucalyptus camaldulensis

Eucalyptus is the most famous medicinal plant whose antimicrobial and other characteristics have been proven. This plant is a rich source of polyphenols and terpenoids and its main leaf composition is eucalyptol or cineole (70%-80%). Eucalyptus is used to treat diverse diseases, including influenza, tonsillitis, diarrhea, and skin diseases and its leaf extract has been reported to have anti-cancer, anti-inflammatory, analgesic, antioxidant, anti-hyperglycemic, antimalarial, anti-fungal, and anti-viral properties (34). It has been reported that eucalyptus extract at the concentrations of 21 mg in the culture medium had a strong effect on *T. vaginalis*, which was similar to metronidazole (35).

Moreover, Saedi *et al.* revealed that eucalyptus extract had a remarkable MIC at the concentration of 5 mg/mL for *S. aureus*, while the highest MBC was at a concentration of 10 mg/mL. Evaluation of the antibacterial effect of several antibiotics showed a similar susceptibility for the studied strains. However, penicillin and cefixime had the lowest effect. All strains represented resistance to penicillin, while the most notable allergic reaction was observed to amikacin (41).

Salvia officinalis

Common sage is a shrub up to 60 cm tall with woody roots, erect stems, many branches, and simple leaves (36). The applications of this plant entail anticonvulsant, antipyretic, regularizing, nerve analgesia, and anti-diarrhea. A study on the impact of sage on *T. vaginalis* indicated that the parasite was inhibited at the concentrations of 10, 8, 4, 5, and 2.5 mg/mL (39).

Mentha piperita

Peppermint is a hybrid species obtained by interbreeding between *Mentha aquatic* and *Mentha spicata*. It has many genera and species and is found in variable places. Among the medicinal properties of this aromatic plant, we can mention antispasmodic, anti-vomiting, appetite suppressant, anti-flatulence, and cooling effects (37). An investigation of the mint influence on *T. vaginalis* demonstrated that the parasite

was inhibited at the concentrations of 4, 8, 5, and 5 mg/mL (39).

Conclusion

The most common non-viral sexually-transmitted disease is caused by the protozoa *T. vaginalis* and is accompanied by some complications, such as preterm delivery, low birth weight, and miscarriage. The most common treatment for this disease is metronidazole, which has side effects, including headache, weakness, insomnia, gastritis, dizziness, nausea, vomiting, and dry mouth.

Medicinal plants have been considered in the past for various reasons, such as fewer side effects, better patient acceptance due to their usage by previous generations, and low prices. Furthermore, the therapeutic effects of medicinal plants were believed to be highly compatible with the physiological function of the human body.

Trichomonas vaginitis is one of the major problems of women in advanced societies. This problem could be associated with many side effects if left untreated or treated with chemical medications. In this study, herbal compounds effective in the control and elimination of this parasite were reviewed. According to the literature, medicinal plants are influential for combating this parasite. This study is a beneficial step for identifying the active ingredients of plants and their use for treatment.

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Conflict of Interest

Authors declared no conflict of interests.

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