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Article

The Role of Medicinal Plants in Treating Intestinal Parasites

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Abstract: Intestinal parasites are a widespread health problem globally, especially in developing countries, as the rate of infection is closely related to health, social, and environmental conditions, in addition to soil, water, and food contamination with the infectious stages of parasites. Despite the availability of many antiparasitic drugs, their frequent and indiscriminate use has led to the emergence of undesirable side effects, as well as the development of drug resistance in some parasites, which has limited their therapeutic effectiveness. In this context, medicinal plants have gained increasing attention in recent years because they contain effective bioactive compounds that possess antiparasitic properties, as well as being relatively safe natural sources compared to manufactured drugs. This review article aims to examine the therapeutic role of medicinal plants in combating intestinal parasites, highlighting the mechanisms of action of the extracted active compounds and their proven bioavailability in laboratory, animal, and some clinical studies. The results from previous studies indicate that many medicinal plants possess inhibitory activity against the growth and reproduction of intestinal parasites, as well as the ability to enhance the immune response and reduce the severity of infection. This review concludes that medicinal plants represent a promising therapeutic option that could contribute to the development of effective and safe alternatives or complementary therapies for controlling intestinal parasites, while emphasizing the need for deeper future studies to assess safety and clinical efficacy.

Keywords: Intestinal parasites, Medicinal plants, Antiparasitic activity, Natural compounds

Introduction

Medicinal plants are defined as plants used to treat and prevent diseases. Their extracts are a rich source of medicines with therapeutic properties. The World Health Organization reports that various plant parts and their chemical compounds are used as traditional medicines by 80% of the world's population [1]. Medicinal plants have been used in healthcare, as they play a vital role in disease prevention, and their use and promotion are consistent with all current prevention strategies [2]. They produce bioactive compounds with medicinal properties, and these compounds play a role in regulating parasite-host interactions. Medicinal plants are also being researched as sources of antioxidants and for their diuretic properties. They are important for the development of new drugs

due to their high efficacy and better safety compared to synthetic drugs. However, many medicinal plants are threatened with extinction due to indiscriminate harvesting and human activities [1]. Medicinal plants are a primary treatment for various diseases such as intestinal parasites, diabetes, and diarrhea. Diarrhea, dysentery, fever, food poisoning, indigestion, nausea, and vomiting [3].The overuse of antibiotics leads to increased microbial resistance or alterations in the natural flora. Researchers must find alternatives to commonly used antibiotics, and one such alternative is the use of medicinal herbs and plant extracts, as these are primary sources for producing medicines and drugs to treat various infections [4]. Medicinal plants contain a wide range of active compounds with pharmacological properties. These bioactive compounds include flavonoids, steroids, alkaloids, terpenoids, and saponins, which have been isolated from various plant species [5]. Complex compounds extracted from medicinal plants are secondary metabolites with strong antimicrobial activity, such as terpenoids, steroids, esters, alkaloids, and flavonoids, as well as essential oils, which are complex chemical compounds with varying concentrations. However, the components that determine the biological properties are 2-3 essential components. Many oils and their components have proven to be highly effective against parasites, especially protozoa. Therefore, they have been widely used in pharmacology due to their biological properties as a general analgesic, antispasmodic, and anti-inflammatory agent. Many essential oils have shown inhibitory activity against many parasites and bacteria [6]. Intestinal parasite infections are an indicator of poor health, environmental, and social conditions. They are closely linked to socioeconomic status and are a significant cause of morbidity and death in many infected individuals [7]. Studies confirm that chronic intestinal parasite infections increase the risk of anemia, and parasitic infections in children can cause iron deficiency [8]. Intestinal parasites are generally prevalent in tropical regions (including Iraq) due to inadequate healthcare, particularly when human feces are used as fertilizer, and due to high population density [9]. Diarrhea is a common disease worldwide, affecting all age groups. It causes dehydration and electrolyte imbalances, such as potassium and sodium, leading to increased acidity in the blood and tissues and consequently, muscle cramps [10]. The prevalence of the pathogen causing diarrhea is linked to nutrition levels and sanitation services. Living in developing countries, where most diseases are spread through water and food contaminated with feces or from person to person due to low levels of personal hygiene [11].

Materials and Methods

The World Health Organization defines medicinal plants as herbal preparations produced by subjecting plant material to extraction, concentration, fractionation, and other physical or biological processes that can be produced as a basis for herbal products or for direct consumption. These compounds act either on different animal systems, including humans, or by interfering with the metabolism of the microorganisms that infect them. The microorganisms may be symbiotic or pathogenic. In both cases, the bioactive compounds of medicinal plants play a role in regulating the parasite's interaction in favor of the host [12].

Result and Discussions

These medicinal plants include:

Zingiber officinale:

It is an aromatic plant belonging to the Zingiberaceae family. It is a perennial rhizomatous medicinal plant and includes about 70 species. It is distributed in tropical regions where there is heavy rainfall [13], as in Figure (1).

Figure 1. ***Zingiber officinale*** **[14]**

It is a traditional folk plant that has been used for more than 2000 years to treat many diseases. It is also used as a cooking spice all over the world, especially in India and China [15]. Its roots contain polyphenol compounds that have high antioxidant activity, which is considered one of the main possible mechanisms for the plant's protective effects against various diseases [16].

Classification of plant:
The plant is classified according to [17]:
Kingdom: plantae
Phylum: Magnoliopsida
Class: Liliopsida
Order: Zingiberales
Family: Zingiberaceae
Genus*: Zingiber*
Species: *Zingiber officinale*

Medicinal uses of *Zingiber*

The resinous compounds derived primarily from gingerol and shogaol are the main active ingredients in ginger. Ginger has been scientifically proven beneficial and effective in treating various medical conditions and is listed as one of the best-selling dietary supplements in the United States [18]. Ginger exhibits numerous pharmacological activities, including antiemetic, antioxidant, cholesterol-lowering, antimicrobial, anticancer, anti-inflammatory, anti-ulcer, antispasmodic, antidepressant, antidiarrheal, and anti-motion sickness properties [19]. Ginger is used to reduce stomach pain, nausea, and joint pain. It is an anti-inflammatory, naturally occurring because it is rich in the enzyme protease. Ginger oil contains curcumin, an anti-inflammatory compound with a potency equivalent to 50% that of cortisone. It is also a food preservative, a powerful antioxidant, a blood sugar reducer, and an anticancer agent [20]. Ginger contains hydrocarbons (10% to 80% curcumene and farnesene) with smaller amounts of β-sesquipalene, β-androgen, and bisabolene. A small percentage (at least 40%) consists of various terpene hydrocarbons, with geraniol, linalool, borneol, and 8-cineole being the most abundant. The alcoholic compound zingiberol was also isolated [21]. Ginger also contains several vitamins, including thiamin, riboflavin, ascorbic acid, and niacin [22], [23] demonstrated in their study on mice infected with *Trichinella spiralis* that ginger significantly reduced the number of adult worms in the intestines compared to the untreated infected group, showed a marked improvement in intestinal wall structure, and reduced inflammation and tissue damage caused by the parasitic infection [24]. In his study on laboratory mice infected with Cryptosporidium parvum, one of the intestinal parasites

that cause diarrhea, treatment with ginger showed a significant decrease in the number of cysts excreted in the feces compared to the untreated infected group. It also led to an improvement in the immune response by reducing inflammatory cytokines and increasing immunoregulatory cytokines.

***Thymus vulgaris*:**

Thymus vulgaris is a small, perennial shrub [25] cultivated worldwide. It is a semi-evergreen ground cover, rarely reaching a height of 40 cm, and grows horizontally or upright [26]. Figure 2 shows common *Thymus vulgaris* Its stems become woody with age. Thyme leaves are very small, typically 2.5–5 mm long, and vary considerably in shape and hairiness depending on the cultivar. Each species has a distinctive aroma. Common thyme leaves are oval to oblong in shape, and some of their somewhat fleshy aerial parts are used in the production of essential oil, particularly by steam distillation. Native to the Mediterranean region [27], it grows in Mediterranean countries, southern Europe, and many other temperate regions of the world [28].

Figure 2. *Thymus vulgaris* [29]

Classification of plant:

Thyme is classified according to [29]:

Kingdom: plantae
Class: Magnoliopsida
Order: Lamiales
Family: Lamiaceae
Subfamily: Nepetoideae
Genus: *Thymus*
Species: *T. vulgaris*

The medicinal importance of *thymus* plant:

Thyme is a plant of great medicinal importance as a traditional remedy for various ailments, supported by its rich chemical composition and therapeutic properties [30]. It is used in the food, pharmaceutical, and cosmetic industries due to its essential oils, which have pharmaceutical applications. This makes it valuable in treating disorders of the respiratory, nervous, digestive, and cardiovascular systems, as well as menstrual cramps [31]. Studies have highlighted the therapeutic effects of thyme. Thyme exhibits a wide range of medicinal properties and is rich in bioactive compounds. Its antioxidant, antimicrobial, and anti-inflammatory activities have been demonstrated [32]. The phytochemicals of thyme, such as carvacrol, thymol, and various acids, contribute to its pharmacological potential, including antifungal and antibacterial actions [33]. Thyme oil has been shown to boost the immune system through various mechanisms. Studies have shown that thyme extracts can stimulate lymphocyte proliferation, enhance phagocytic activity and cell proliferation and

induce apoptosis in cancer cells, ultimately aiding immune system function [34]. In addition, thyme extract has been found to have antiviral effects against viruses such as influenza virus and human papillomavirus, further demonstrating its immune-boosting properties [35]. The amazing benefits of thyme are attributed to its high nutritional value. The nutrients it contains have disease-preventive and health-promoting properties. This aromatic herb is rich in phytonutrients, minerals, and vitamins essential for good health [36] explained that thyme has a clear effect as a natural antiparasitic, and this is due to its content of active compounds such as thymol and carvacrol, as well as improving the tissue changes resulting from infection, which makes it a promising option as an alternative or adjunctive treatment in combating intestinal parasites [37] also indicated that the essential oils of medicinal plants, which include thyme oil, are among the natural treatments against diseases caused by parasitic organisms, thanks to their content of active compounds such as terpenes and phenols that work to penetrate the cells of parasites and cause distortions in their cellular structure and loss of their function.

Eucalyptus globulus:

It is a large tree belonging to the Myrtaceae family, which includes various genera of flowering trees and is dominant in the tree plants of Australia. *Eucalyptus* species are cultivated all over the world for their desirable qualities, such as rapid growth, oil extraction, and timber production [38]. *Eucalyptus* is an aromatic plant that is in the form of a tree with simple leaves, as in Figure (3). The percentage of essential oils in the leaves of the *eucalyptus* plant is 0.33%, and the most important component in the essential oils of *eucalyptus* is eucalyptol found in *E. globules*, as it represents 70% of it and is mainly composed of terpene and cymene, which work to repel mosquitoes from plants [39].

Figure 3. *Eucalyptus globulus* [40]

One type of eucalyptus plant in Iraq [41]:

1- *E. globulus*
2- *E. camaldulensis*
3- *E. torquata*
4- *E. incrassate*
5- *E. bicolor*
6- *E. griffithsii*
7- *E. incrassate*
8- *E. microtheca*

***Eucalyptus* plant classification**:
Eucalyptus plants are classified according to [42]:
Kingdom: plante
Sub kingdom: Tracheobionta
Super division: Spermatophyta
Division: Magnoliophyta
Class: Tracheobionta
Sub class: Rosidae
Order: Myrtales
Family: Myrtaceae
Genus: *Eucalyptus*
Species: *Eucalyptus globulus*

The medical importance of *Eucalyptus* plant

It is considered one of the important medicinal plants in treating many diseases, as it has been known for its wide uses as an anesthetic, antiseptic, sedative, deodorant, analgesic, disinfectant, sedative, insect repellent, and especially as an antimalarial. In addition, it is used to treat many diseases such as respiratory diseases, colds, flu, coughs, skin infections, and other beneficial uses due to the plant having active substances and few side effects compared to antibiotics. *Eucalyptus* oil has medical importance in its inhibitory activity against microorganisms, as the presence of the two phenolic compounds thymol and carvacrol inhibits several types of bacteria. The compound cineole (eucalyptol) is among the volatile oils of the *eucalyptus* plant responsible for giving the microbial killing activity [39]. The essential oil extracted from eucalyptus leaves contains many beneficial properties, including antibacterial, antifungal, antiviral, anti-inflammatory and antioxidant effects [43]. *Eucalyptus* trees have been widely cultivated in Ethiopia for multiple purposes, including soil erosion control, wildlife habitats, and fuelwood production [44]. In vivo experiments [45] showed that eucalyptus seed extracts inhibited parasite egg hatching at different concentrations compared to the control group [46] showed that eucalyptus essential oil emulsions in nano form exhibit enhanced biological activity in several areas compared to the essential oil alone, making them promising for future medical, pharmaceutical, and agricultural applications.

Aloe vera

The *Aloe* genus includes many species that differ in size, shape, and height, ranging from 60 to 100 cm. Among them is *Aloe vera*, a perennial plant that lives up to 15 years. Its leaves are swollen and sessile, attached to a short, star-shaped disc stem. It is a succulent desert plant with tissues adapted to store water in the leaves, especially in dry, low-rainfall areas. Its leaves are green, dagger-shaped, fleshy, smooth, and pointed at the end, with thorny edges. The leaf color may vary from green to gray and sometimes the leaves are striped [47], as in Figure (4)

Figure 4. ***Aloe vera*** **[48]**

It is one of the plants that has been used since the beginning of the first century A.D in herbal medicine, and its extract is used in alternative medicine industries and in cosmetics. It has been marketed as a cell-regenerating, healing, and moisturizing substance (49). The content of *Aloe vera* is divided into two substances: gel and latex. The gel is characterized by being colorless and tasteless, and it is found in the inner mesophyll part of the leaf. As for the latex, it represents 20-30% of the leaf's weight and is characterized by being a yellow secretion found in the vascular bundles of the anatomical parenchyma tissue [50], as in Figure (5).

Figure 5. ***Aloe vera*** **gel [48]**

It has played a significant role in medical practices; it has been used in traditional medicine for approximately 2,000 years and is a key ingredient in many food products. Its effectiveness and versatility make it an indispensable component of any natural remedy [51]. It continues to be used in many modern societies, with countries such as India, Africa, and China relying on it as a fundamental component of their traditional medicine [52].

Classification of plant

The *Aloe* plant was formerly classified within the Liliaceae family, but the modern classification places the *Aloe* within the Asphodelaceae family [53]:

Kingdom: Plantae
Division: Magolio
Class: Liliopsida
Order: Liliales
Family : Asphodelacea
Genus*:* *Aloe*
Species: *Vera*

The medical importance of the *Aloe vera* plant:

Aloe vera has a significant effect, as it works to lower cholesterol levels, helps treat heart disease, and reduces blood sugar [54]. *Aloe vera* gel contains antioxidants, anti-inflammatory agents, and antiviral, antibacterial, and antifungal substances. It is rich in carbohydrates, minerals, vitamins, phenolic compounds, polysaccharides, and organic acids that promote overall health (55). *Aloe vera* gel also contains organic acids such as lactic, malic, salicylic, isocitric, and succinic acids. These acids are closely related to aspirin, which has the ability to inhibit inflammation by suppressing prostaglandin production [56]. *Aloe vera* also contains other active compounds, such as saponins, flavonoids, tannins, sterols, resins, anthrones, and terpenoids [57].

Studies have shown that *Aloe*-emodin, an extract from . *Aloe vera* leaves, increases white blood cell count and TNF-alpha and Interleukin beta. *Aloe* emodin increases white blood cell count and TNF-alpha and interleukin beta [58]. *Aloe vera* is a stimulant for the nervous system and a powerful antiseptic, as well as an antiviral [59]. *Aloe vera* is used to treat many diseases and health conditions, including superficial wounds, skin diseases, inflammations, burns, fungal infections, arthritis, immune diseases, digestive system diseases, high blood pressure, diabetes, and other diseases [55]. The results of the study [60] showed that *Aloe vera* gel has an effective antiparasitic effect against intestinal parasites, especially against *Cryptosporidium parvum*. The results showed a significant decrease in the number of parasitic cysts in laboratory animals treated with *Aloe vera* gel compared to the untreated group, with a clear improvement in the histological changes of the intestines. It was also noted that *Aloe vera* has a supportive role in reducing inflammation and regulating the immune response, which enhances its therapeutic ability. The study indicates that *Aloe vera* gel can be an alternative to traditional drug treatments against some intestinal parasites.

***Allium sativum* :**

Allium is considered one of the oldest agricultural crops and the second most important plant crop after onions, belonging to the Amaryllidaceae family. It is a winter crop grown in the regions of Babylon, Basra, and Nineveh [61]. *Allium* is the most important commercially important edible plant in the world, serving as a food, nutritional, and medicinal substance. It is an aromatic flowering plant with multiple cloves covered by a thin white or purple skin, as shown in Figure 6. It belongs to the *Allium* family. *Allium* is widely cultivated throughout the world, and there are 7 species out of 750 genera of the genus *Allium*, grown in different soil types [62].

Figure 6. The external appearance of *Allium* [63]

Classification of plant:

Garlic is classified according to [64]

Kingdom: plante

Phylum: Magnoliophyta

Order: Asparagales

Family: Alliaceae

Genus: *Allium*

Species: *sativum*

The active ingredients found in the *Allium* plant:

The properties of garlic have been extensively studied as a therapeutic component, such as antibacterial, antiviral, antifungal, anticoagulant, antibiotic, anticancer, antioxidant, immunomodulatory, anti-inflammatory, and hypoglycemic effects (63). In recent years, attention has been drawn to its main active components, especially polyphenols, tannins, and flavonoids as well as polysaccharides and saponins [65].

Medical uses of *Allium*:

Allium has been used extensively to prevent colds and flu. Consuming *Allium* at the first sign of mouth pain can prevent oral infections and colds. It is believed that *Allium* boosts the body's immunity against diseases. The secret to *Allium* power lies in a compound called allicin, the main biological substance produced by the *Allium* plant. Allicin has the ability to reduce the incidence of the common cold by more than half and is used to treat whooping cough, asthma, and coughs [66]. Ancient Egyptians used garlic to treat diarrhea, as evidenced by prescriptions found on ancient temple walls dating back to 1500 BC. Greek physicians used it to treat intestinal diseases, headaches, influenza, ear infections, sore throats, and fever [67]. Furthermore, garlic prevents or slows the growth of tumors. Cancer patients are advised to consume garlic because it has been found that disulfide, a substance formed when *Allium* is cut or crushed, can reduce tumor size by half when injected into cancer cells (68) Therefore, garlic is considered a preventive and therapeutic substance against malignant diseases, especially skin cancer and colon tumors [69]. Research has shown that the volatile vapors of peeled or unpeeled *Allium* are sufficient to kill many bacteria, including those causing tuberculosis, diphtheria, and dysentery, which die when exposed to garlic or onion vapor for six minutes [70]. Furthermore, consuming garlic helps prevent blood clots, platelet aggregation, and heart disease due to its content of ajoene, a compound with anticoagulant effects [71]. A study by [72] demonstrated the effectiveness of garlic against common intestinal parasites in lambs. The study showed that at doses of 10 ml and 15 ml, *Alllium* reduced the number of worm eggs in the feces to a similar extent as a commercial anthelmintic after 14 days. A study by [73] showed that garlic extract significantly reduced the number of *Cryptosporidium* oocysts in infected mice, with a marked improvement in intestinal tissue compared to the uninfected group. Thus, it appears that *Allium*, at the appropriate dose, can be effective. A natural alternative to traditional anthelmintics.

***Artemisia herba- alba*:**

It is a perennial wild shrub with wide branches and compound leaves, which may reach a height of about 40 cm. Its roots are strong and erect. The first leaves have an oval to spherical shape, are double pinnate with elongated lobes, and have two spikelets. The plant contains the substance santonin. At the beginning of its growth, its stems are red, while the stems of other species are green, as in Figure (7). All types of wormwood produce aromatic oils with a pungent smell, which are used as incense [74].

Figure 7. ***Artemisia herba- alba*** **[74]**

Classification of plant

The plant is classified according to [75]:

Kingdom: plantae
Phylum: Tracheophyta
Order: Asterales
Family: Asteraceae
Genus: *Artemisia*
Species: *Artemisia herba- alba*

Types of *Artemisia herba- alba* plants:

It includes about 380 species and is widespread [76]. Locally known as wormwood and sage, according to Iraqi sources, the following species are currently found in Iraq only within the genus *Artemisia*:

A.campestris; A.splendens; A.scoparia ; A. herba-alba; A.housslnechtill

In addition to the discovery of a new species that recently entered Iraq, namely Artemisia vulgaris, which is highly toxic [77].

The medical importance of the *Artemisia herba- alba* plant:

Plants of the genus *Artemisia* have been used in folk medicine since ancient times. These species have been found to be an analgesic, antibacterial, antispasmodic, and blood-thinning agent [74]. In addition, they have been used as a stimulant, tonic, heart tonic, and emmenagogue. Furthermore, some types of wormwood have shown antibacterial, insecticidal, antifertility, and antipyretic activity [78]. The activity of wormwood extract and its essential oil as antibacterial, antifungal, and antiparasitic agents has also been recorded [79].

Active compounds in the *Artemisia herba- alba* plant:

Several chemical compounds have been isolated from *Artemisia herba-alba*, most notably sesquiterpenes, flavonoids, and essential oils:

1. Actonetic Sesquiterpenes:

These are prominent natural products found in *Artemisia* species and are responsible for the importance of these plants in pharmacy and medicine. Many varieties are found in the aerial parts of *Herba-albe* and are considered germacronolides and eudesmanolides, which are the most common types of lactones in this species [74].

2. Flavonoids:

These are compounds commonly found in plants. They contribute to plant mucilage, and some play a role in the formation of intoalaxins, compounds produced by plants to defend against parasites. The flavonoids discovered in *Artemisia herba* exhibit structural diversity. Common types include flavones, glycosides, and flavonoids, such as: flavones, glycosides, and methyl flavonoids, including glycoside-quercetin-glycosides. There are also rare flavonoids found in the genus *Artemisia* and the entire Asteraceae family [80].

3. Essential oils:

The essential oils found in the wormwood plant are usually monoterpenes, especially oxygenated monoterpenes such as thujones, camphene, cineole, and chrysanthenone [81]. A study by (82), showed that the wormwood plant is effective in expelling intestinal worms in sheep. The results showed that the aqueous extract at higher concentrations (5-10 mg) was able to inhibit the movement and activity of adult worms compared to the control group.

Nerium oleander

It is an evergreen shrub, ranging in height from 2 to 6 meters, with fragrant flowers and thin, dark or brown fruits containing many seeds, as shown in Figure (8). One of its components is the milky liquid that comes out when any part of it is cut [83], which is known for its broad medicinal activity [84]. the great medicinal benefits of these plants are attributable, on the one hand to some phenolic compounds with antioxidant properties, while on the other, to several non-phenolic compounds, including terpenoids, essential oils or saponins with anti-inflammatory properties [85]. *Nerium oleander* has proved its efficiency in medicine by treating different pathologies. Identifying the metabolites present in the plant is based on various approaches, some of which could be fluid or enzymatic methods, giving different content of chemical compounds [86]. *Oleandrin* plays role in traditional medicinal practices globally as a highly herb beneficial biological and pharmacological activities [87]. *Oleandrin* is of medical and toxicological interest, often used in folk medicine to treat various diseases, including congestive heart failure, abscesses, asthma, dysmenorrhea, herpes, leprosy, malaria, ringworm, scabies, indigestion, strokes, sores, eczema, epilepsy, and neurodegenerative diseases **(**88**).**

Figure 8. ***Nerium oleander*** **L [89]**

Classification of plant

Oleander is classified according to [90]:

Kingdom: plantae

Phylum: Spermatophyte

Class: Dicotyledonae

Order: Gentianales
Family: Apocynaceae
Genus: *Nerium*
Species: *Oleander*

The two most common species in Europe are *V. major* and *Vinca minor* L., while in Turkey and Greece the dominant plant is Rhazya orientalis; in the Mediterranean we find *Nerium oleander*, and on the Aegean Sea and the shores of the Black Sea we find *Apocynum venetum* L. [91].

Active compounds in the *oleander* plant:

Oleander leaves contain a group of neridiginosides that exhibit activity similar to compounds found in the well-known digitalis plant. Two of the active compounds are Digitalium verum and Oleandrin. *Oleander* also contains many secondary metabolites, including

1. **Flavonoids:**
   Oleander contains 0.5% flavonoids, including rutin, which has a diuretic effect.
2. **Oils:**
   Oleander seeds are rich in fatty substances, estimated at 18%, including: (inoleic acid, hydrocyanic acid, and hydrocyanic acid) [92]
3. **Alkaloids:**
   The oleander plant contains a small percentage of alkaloids, represented by the alkaloids vincristine and vinblastine [93]. A study by [94] demonstrated the effect of *oleander* on the parasite *Echinococcus granulosus*, showing a decrease in the viability of *E. granulosus* protoscolices after exposure to the extracts. The alcoholic extract was more effective than the aqueous extract of the *oleander* plant.

Conclusion

Medicinal plants play an effective role in combating intestinal parasites, as they contain active compounds such as alkaloids, flavonoids, terpenes, and volatile oils that possess antiparasitic properties. These compounds work through multiple mechanisms, including inhibiting the growth of parasites, damaging their cell walls, and disrupting their metabolic processes. However, the effectiveness of these plants depends on several factors, including the type of plant, the dosage used, and the extraction method. Therefore, more clinical studies are still needed to determine safe and effective dosages and standardize their use in the medical field.

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