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A Review on Analysis of Medicinal Plants with Leishmanicidal Properties

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ABSTRACT

The protozoan genus Leishmania, which belongs to the Trypanosomiases family, is the source of the infectious parasitic disease leishmaniasis. Leishmaniasis is third in importance among vector-borne diseases worldwide, behind malaria and sleeping sickness. Leishmaniasis is treated with a variety of drugs, however side effects and drug resistance have been noted. There are countless opportunities to find new drugs to cure infectious diseases by researching plant remedies. Some plant medicines and natural products have a new candidate for treatment of leishmaniasis. Medicinal plants are believed to be an important source of new chemical substances with potential therapeutic effects. This review work is focused on the therapeutically active plants which are used in the treatment of leishmaniasis and have less side effects and less cost.

Keywords: Leishmania, vector-borne, Promastigote, Amastigotes, Visceral

INTRODUCTION

Leishmaniasis is a neglected public health problem in tropical and subtropical regions that primarily affects the poor populations. Leishmania parasites of several species are the cause of the disease. Leishmaniasis is a vector borne disease that is transmitted by sand flies. Female sandflies transmit the pathogenic protozoa (promastigote parasites into the skin during a blood meal then these promastigotes transform to amastigotes,) [1,2]. Three clinical forms of leishmaniasis have been reported concerning parasite location in the infected tissues, Visceral leishmaniasis (VL), cutaneous leishmaniasis (CL), mucocutaneous leishmaniasis (MCL). Visceral leishmaniasis (VL) causes spleen and liver [5,6,7] destruction, cutaneous leishmaniasis (CL) affect only localized skin parts and mucocutaneous leishmaniasis (MCL) has ability of mucus tissue destruction [3,4]. Visceral leishmaniasis (VL) is also known as KALA-Azar or Black fever or Dum-dum fever is the most sever forms of leishmaniasis. Synthetic agents and current drugs on the market have side effects and high cost. As a result, the public is becoming more interested in drugs that are less expensive, safer, and have less side effects. Another major problem is that many of these synthetic drugs were developed resistant to parasites, so herbal pharmaceuticals are gaining popularity due to its efficiency as a source of natural and secure medications. [1,2].

LITERATURE REVIEW

Plants used in the treatment of leishmaniasis

Fig.1 ***Marigold***

Fig.2 ***Thyme***

Marigold

Calendula officinalis (Marigold) (Figure 1) belongs to family *Asteraceae*. The extraction of marigold at a concentration of 500 mg/mL killed all the parasites and in lower concentrations revealed anti-leishmania activity which was dose-dependent with LC_{50} of 17 mg/mL and 215 mg/mL, in alcoholic and water extracts, respectively [8].

Thyme

Lawsonia inermis (Thyme) belongs to family *Lamiaceae*. *Thyme* (Figure 2) and yarrow extract had positive effects on wound healing of cutaneous leishmaniasis [9]

Fig.3 ***Almond***

Fig.4 ***Garlic***

Almond

Amygdalus communis (Almond) (Figure 3) belong to family *Rosaceae*. The number of promastigotes of Leishmania reduced compared to control group. Significant reduction on the of scars and cutaneous nodules at the base of the tail of the mice was also observed compared with the control group [10]

Garlic

Allium sativum (Garlic) (Figure 4) belongs to family *Alliaceae*. Garlic at the dose of 37 mg/mL in 48 h destroyed the existing promastigotes [11].

Fig.5 ***Periwinkle***

Fig.6 ***Kalanchoe Pinata***

Periwinkle

Vinca major (Periwinkle) (Figure 5) belongs to family *Apocynaceae Periwinkle* Purified extract of the plant *Vinca* caused significant reduction in the number of L. major promastigotes. Additionally, a purified extract of *Vinca* in the chloroform phase by injection form, prevented the development of ulcers caused by L. major in Balb/ C mice compared to the untreated controls [12]

Kalanchoe Pinata

Kalanchoe pinata (Figure 6) commonly known as cathedral bells, air plant, life plant, miracle leaf belongs to family *Crassulaceae*. Flavonoids isolated from the from *Kalanchoe pinnata* were evaluated in vivo in a murine model of cutaneous leishmaniasis. Daily oral doses of quercetin 3-O-alpha-L-arabinopyranosyl (1-->2)-alpha-L-rhamnopyranoside, quercetin 3-O-alpha-L-rhamnopyranoside, and free quercetin (16 mg/kg body weight) all were able to control the lesion growth caused by Leishmania amazonensis and to significantly reduce parasite load [13]

Asafetida

Asafetida is oleo gum resin obtained from *Asafetida* (Figure 7) several species of Ferula. They are part of the celery family *Umbelliferous*. Ferula *asafetida* oleo gum resin (asafetida) was evaluated for Leishmaniasis. Amastigotes were isolated from mice spleens and then transformed to promastigotes in Novy-Nicolle-Mac Neal (NNN medium. A fixed initial density of the parasites was transferred to screw-capped vials containing 5 ml of RPMI1640 media to which different concentrations of 2.5, 5, 10 and 20 µg asafetida were added. The mortality of parasitosis was measured. After 72 h, asafetida inhibited growth of parasites in all doses in stationary and logarithmic phases. The ELISA measurement suggested that the viability of parasites significantly decreased after 48h [14].

Fig.7 ***Asafetida***

Fig.8 ***Liquorice***

Liquorice or licorice

Liquorice or licorice is the common name of *Glycyrrhiza glabra*, (Figure 8) a flowering plant of the bean family *Fabaceae*. Glycyrrhizic acid (GA) the main component of *Glycyrrhiza glabra* was evaluated for its efficacy as antileishmanial agent and its mode of action explored. GA inhibits promastigotes and intracellular amastigotes in a dose dependent manner. GA was found to inhibit recombinant Leishmania donovani HMG-CoA reductase (LdHMGR) enzyme [15]

Artemisia aucheri

The *Artemisia* (Figure 9) genus as an aromatic perennial herb belonging to *Asteraceae* family. The ethanolic extracts of A. persica, A. spicigera, and A. fragrance were evaluated for anti-leishmaniasis activity. In-vitro anti-leishmanial activity of ethanolic extracts on both promastigotes and amastigotes was determined by using MTT method. Artemisia specie significantly reduced the number of parasite promastigotes. Among them, A. persica had the highest leishmanicidal activity against parasite promastigotes. By increasing the dose of extracts, the parasite number in both phases (promastigotes and amastigotes) was reduced significantly. [16]

Fig.9 ***Artemisia aucheri***

Fig.10 ***Eucalyptus camaldulensis***

Eucalyptus camaldulensis

Eucalyptus camaldulensis, (Figure 10) commonly known as the river red gum is a species of flowering plant in the family *Myrtaceae*. The effect of methanolic and aqueous extracts of Eucalyptus camaldulensis on the promastigotes of Leishmania major was evaluated. The methanolic and aqueous extracts of E. camaldulensis leaves were prepared and evaluated for anti leismenial activity by MTT method. The results indicated that the methanolic extract was more effective than aqueous extract, although there was no significant difference. The extracts were less effective as compared to the control drug. [17].

Chenopodium ambrosioides

Dysphania ambrosioides, (Figure 11) formerly *Chenopodium ambrosioides*, known as Jesuit's tea, Mexican-tea is an annual or short-lived perennial herb native to Central America, South America, and southern Mexico belongs to family Amaranthaceae. The leishmanicidal effect was seen of an essential oil from Chenopodium ambrosioides against Leishmania amazonensis. The tested product had a potent inhibitory action against promastigote and amastigote forms. The essential oil showed a moderate toxicity on macrophages from BALB/c mice. An optimal dose of 30 mg/kg/day was effective when administered during 15 days by intraperitoneal route to BALB/c mice infected experimentally. These studies

revealed a potential source for the discovery of novel drugs to combat the leishmaniasis based on the traditional medicine. [18]

Fig.11 ***Chenopodium ambrosioides***

Fig.12 ***Haplophyllum myrtifolium***

Haplophyllum myrtifolium

Haplophyllum (Figure 12) is a flowering plant belonging to the family rutaceae. The in vitro and in vivo leishmanicidal activity of an endemic Turkish plant and compare its efficacy with a reference drug. In addition to the in vitro activities of the ethanol, acidified and alkaloid extracts and furoquinoline alkaloids skimmianine and γ-fagarine, in vivo antileishmanial activity of the acidified extract of Haplophyllum myrtifolium Boiss. (Rutaceae) were also investigated against Leishmania tropica All the extracts and pure compounds showed in vitro inhibitory activity against the promastigotes of. L. tropica. In vivo results of Haplophyllum myrtifolium acidified extract showed that this plant has a limited effect on decreasing the lesion size of experimental mice infected with Leishmania tropica.[19]

Table 1: A short summery of some plants which is used for Leishmaniasis Treatment.[20]

Plants	Family	Figures
Byrsonima bucidaefolia bark	*Malpighiaceae*	
Byrsonima crassifolia bark	*Malpighiaceae*	
Clusia flava leaves	*Clusiaceae*	

Diphysa carthagenensis leaves	*Fabaceae.*	
Dorstenia contrajerva whole plant	*Moraceae*	
Milleria quinquefolia	*Asteraceae*	
Tridax procumbens whole plant,	*Asteraceae*	
Vitex gaumeri bark.	*Lamiaceae*	

CONCLUSION

Throughout the world, leishmaniasis is a parasitic disease. No effective vaccination or medication for the treatment of leishmaniasis has been reported up to this point. In this review article we discuss medicinal plants exhibited anti-leishmanial activity with inhibitory effect in both promastigotes and amastigotes forms of Leishmania. Different groups of plants that have proved anti-leishmanial activity bring about hope to produce novel anti-leishmanial drugs. From this review we also concluded that natural plants and herbs are safe as compare to synthetic drugs.

Declaration by Authors

A thorough review of the literature was conducted, the information was acquired and reviewed on all the discussed plants. The above work is totally collected from review articles

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