WORLD JOURNAL OF PHARMACY AND PHARMACEUTICAL RESEARCH

Review Article

Coden USA: WJPPCL

2026
Volume: 03
Issue: 04
Page: 83-104

PLANT NATURAL PRODUCTS AND THEIR PHARMACOLOGICAL ACTION AGAINST PROTOZOANS, NEMATODES AND CESTODES: A REVIEW

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Received: 10 March 2026 **Revised: 31 April 2026** **Accepted: 22 April 2026**

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DOI: http://doi.org/10.5281/zenodo.19778718,

ABSTRACT

This review article examines the potential of plant-derived remedies against protozoans, nematodes, and cestodes. Natural products from plants demonstrate the capability to eliminate parasites and decrease the morbidity and mortality rates of their hosts. These parasites pose a significant threat to the health of both humans and animals, in addition to causing substantial economic losses. To combat these harmful parasites, Garlic (Allium sativum) is known to contain sulfur-containing compounds such as allicin, while flavonoid glycosides found in C. viscose, aloe-emodin from *Aloe vera,* and azadirachtin from Neem *Azedarach indica* are commonly utilized in traditional medicine. *Toddalia asiatica* is rich in coumarins and alkaloids that exhibit potent anti-parasitic properties, and Curcumin, a major polyphenolic active ingredient derived from the rhizome of turmeric (*Curcuma longa* L.), showcases a broad spectrum of pharmacological effects, including anti-parasitic activity. In addition to the aforementioned components, plant latex, gums, and various other natural products have also demonstrated antiparasitic effects. This plant-based approach is extensively employed in the management of intestinal parasites and cellular protozoans.

KEYWORDS: plant natural products; antiparasitic potential; protozoans; nematodes and cestodes

INTRODUCTION

Parasites depend on hosts to acquire the sustenance necessary for their survival. They infiltrate the host and establish their life cycle to reproduce and produce future offspring. They enter the host's body through contaminated water, food, and vector bites. Three primary classes of parasites can cause diseases in humans: protozoa, helminths, and ectoparasites. Helminths are worm-like parasites, which include both hermaphroditic and bisexual species. These invertebrates are characterized by elongated, flat, or round bodies. Intestinal helminthic infections are the most prevalent infections in tropical and subtropical regions.[1] For convenience, these groups are categorized based on the host organ they inhabit, such as lung flukes, extra-intestinal tapeworms, and intestinal roundworms. The main types of helminths that affect humans include flukes, tapeworms, and roundworms. Helminthic parasites proliferate significantly within the human intestine, leading to anaemia. They adversely affect health by impeding growth and hindering mental development. They reside within the host's intestine, resulting in substantial economic losses. To date, 342 helminth species are recognized as infecting humans.[2] Platyhelminths, which are flatworms, primarily consist of flukes and tapeworms that invade the gastrointestinal tract. Flukes (trematodes) are a type of flatworm that possess prominent oral and ventral suckers, which aid in maintaining their position in situ. Flukes are generally hermaphroditic, except blood flukes, which are bisexual. Their life cycle includes a snail as an intermediate host. The second category is tapeworms (cestodes), which are elongated, segmented, hermaphroditic flatworms that reside in the intestinal lumen. Their larval forms, which can be cystic or solid, inhabit extra-intestinal tissues. Ascaris, roundworms, or eelworms are nematodes that thrive in a wide range of environments. Roundworms are nematodes that complete their life cycle in various hosts as eggs, larvae, and adults. These are bisexual, cylindrical worms that inhabit both intestinal and extraintestinal sites. Most species are free-living, feeding on microorganisms.

Protozoans are unicellular, eukaryotic, heterotrophic organisms that can exist as either parasites or free-living entities. They display a vast array of morphologies and do not possess cell walls; examples include Entamoeba, Plasmodium, and Paramecium. Protozoans inhabit the bloodstream of hosts, where they inflict damage on blood cells, proliferate, and grow. These organisms are transmitted by various species of flies and mosquitoes. Numerous significant diseases in humans and animals are attributed to protozoans.[14] Besides being recognized as parasites, certain protozoa are classified as opportunistic pathogens, primarily impacting individuals with compromised immune systems. Protozoans are responsible for

diseases such as malaria, filariasis, African sleeping sickness, and amoebic dysentery, as well as animal Leishmaniasis affecting dogs, humans, and rodents, and Babesiosis, among others. The five most notable protozoan diseases include malaria, which is caused by four distinct species of Plasmodium. This mosquito-borne infectious disease affects both humans and animals. Trypanosomiasis is another disease caused by various species of Trypanosoma, a flagellate protozoan that inhabits the blood and impacts lymph glands, causing muscle aches, fever, and joint pain. Amoebiasis is an infection caused by the protozoan *Entamoeba histolytica*, leading to severe weight loss, diarrhoea, abdominal pain, colonic ulcerations, and potentially bloody diarrhoea. It results in anaemia.[15] Leishmaniasis is caused by over twenty species of Leishmania, with the parasite inducing fever, skin ulcers, an enlarged liver, and reduced red blood cell counts. The review article focuses on managing intestinal parasites and cellular protozoans, emphasising traditional, phytochemical, and pharmacological knowledge of medicinal herbs. It aims to develop evidence-based alternative medicine for treating diseases in humans and animals without toxicity, and lays the groundwork for future research on traditional medicinal plants.

Data collection and source of information:

In the preparation of this extensive research review, a variety of electronic databases were explored, utilizing keywords related to the anti-parasitic properties of plants and natural products derived from them. To gather pertinent information, specific terminologies such as medical subject headings (MeSH) and key phrases, including anti-parasitic terms, were employed in MEDLINE, with electronic data being extracted till December 2025. Plant species demonstrating antihelminthic and anti-protozoan effects were identified. Particularly, to retrieve all articles concerning the traditional applications of plant natural products for combating parasites, numerous electronic bibliographic databases were examined, and abstracts of published studies containing relevant information on various Hibiscus species, *Argemone mexicana,* Allium sativum, *Azedarach indica*, *Curcuma longa, Aloe vera, Capparis decidua and Capparis spinosa. Cassia sanguine, Aegle marmelos, and Tinospora* species were compiled. Additionally, further references were incorporated by reviewing the citations from studies related to the current topic. Related terms were utilized both individually and in combination to guarantee a comprehensive literature search. To remain updated on the subject and integrate recent findings, research articles, books, conference proceedings, and survey reports from relevant public health organizations were chosen. Data was gathered with a broader perspective for its interpretation in the context of the current

topic. The objective of this review is to systematically evaluate published data regarding the effects of plant constituents derived from Hibiscus species on cancer. This was accomplished by searching databases such as SCOPUS, Web of Science, EMBASE, PubMed, Swissport, Google, and the Cochrane Library. Through this general methodology, findings and results were identified and summarised in this final review. This review emphasised the antiparasitic properties of plant natural products against helminths and protozoans.

Hibiscus species

The hydroalcoholic extract, ethanolic extract, and aqueous extract of Hibiscus Cannabis L exhibit anti-helminthic properties [1]6. Additionally, ferulic acid derived from Hibiscus metabolism has demonstrated effectiveness against the filarial parasite *Setaria cervix*.[17] This compound induces an increase in pro-apoptotic gene expression while simultaneously reducing the expression of anti-apoptotic genes, accompanied by a rise in reactive oxygen species (ROS) levels and a gradual, dose-dependent decrease in the parasitic glutathione (GSH) levels.[17] Furthermore, Hibiscus rosa-sinensis is highly effective against intestinal helminthic infections. The leaf extract of H. rosa-sinensis exhibited antiparasitic activity against H. diminutive, a zoonotic tapeworm.[18] It resulted in a significant decrease in eggs per gram (EPG) of faeces and worm counts, leading to paralysis of the worms at a concentration of 40 mg/ml extract[18] (Table 1).

Argemone mexicana

Strongyloidiasis is a parasitic infection that poses a public health concern in tropical regions. The extract of Argemone *Mexicana contains* berberine (Ber), which is effective against the third-stage larvae (L3) of Strongyloidiasis Venezuelans in vitro at a very low dosage. It exhibits anti-hemolytic properties and protects human erythrocytes from Strongyloidiasis Venezuelans. In addition, the crude extract of A. Mexicana (Am) has shown LC50 response values of 1.6, 19.5, and 92.1 µg/mL at 96 hours, respectively.[19] The n-hexane fraction contains phytocompounds that significantly reduce parasitemia. Moreover, an oral administration of 200 and 400 mg/kg of Argemone Mexicana extract and its fractions over five days demonstrated high antitrypanosomal activity against Trypanosoma brucei.[20] A. Mexicana contains saponins that exhibit antitrypanosomal activity, which are absent in fractions that show no or weak antitrypanosomal effects (Table 1).

***Allium* species**

Garlic, scientifically known as Allium sativum, has been demonstrated to be highly effective against gastrointestinal parasites affecting both humans and animals. This plant contains sulfur-based compounds, including 'Allicin' and 'Ajoene,' which have exhibited antileishmanial properties.[21] Extracts of *Allium sativum* (garlic) and *Allium cepa* (onion) bulbs, when treated with dichloromethane, have shown activity against Leishmaniasis.[21] Furthermore, these extracts have also proven effective against Trypanosoma b. brucei and Leishmania tarantula.[22] Garlic has therapeutic effects against Schistosoma mansoni in experimental infections[23], as well as against Cryptosporidiosis and Toxoplasmosis.[24] It has also been found to be effective against Hymenolepis nana and giardiasis[25], as well as gastrointestinal parasites, particularly cestodes and trematodes.[26] Additionally, garlic demonstrates lethal effects on Blastocystis hominis and African trypanosomes[27], along with intestinal flagellates in poultry.[28] The consumption of crushed garlic has been shown to reduce worm burdens more effectively than PZQ[29] (Table 1). Garlic extract exhibits tidal activity against protozoans such as *Entamoeba histolytica, Hymenolepis nana,* and *Giardia lamblia*.[30] Ajoene cream has been found to be effective against Tinea pedis (athlete's foot), comparable to 1% terbinafine (Lamisil) cream.[31] Allicin has an inhibitory effect on the growth of Babesia and T. equi protozoan parasites, which primarily affect donkeys, horses, and mules [Table 3].[32] The oil from A. cepa has proven to be highly beneficial in treating worm infections, particularly against *Cryptosporidium parvum* and *Schistosoma mansoni* in experimental mice.[23] Additionally, onions are effective against eelworm (*Ditylenchus dipsaci*), a small parasitic nematode that lives in soil and causes swollen, distorted foliage (Table 1).

Neem:

Neem *Azedarach indica* is widely utilized in traditional medicine. It possesses several biologically active components, including azadirachtin, myelination, and salami.[33] These components exhibit strong anthelminthic properties. In the Indian Ayurveda system, neem has long been recognized as a treatment for malaria and intestinal parasites, with its use dating back centuries. The antimalarial effects of the neem plant are documented in Ayurveda as early as 2000 B.C. (by Charaka) and 1500 B.C. (by Sushruta). Crude neem leaf powder (Azedarach indica) demonstrates anthelmintic efficacy against bovine strongylosis. Its formulations are administered orally.[34] Azadirachtin also shows both antimicrobial and antifungal activities.[35,36] The active ingredients in neem not only safeguard cattle from

helminthic diseases, particularly Haemanthus contorts in goats[37], but also enhance the quality of meat, milk, and other dairy products (Table 1).

Curcuma longa

Curcumin [1,7-bis (4-hydroxy-3-methoxyphenyl) -1,6- heptatriene -3, 5-dione] is the primary active component of turmeric, derived from the *Curcuma longa* L. plant. This polyphenolic compound is extracted from the rhizome of *Curcuma longa*.[38] It demonstrates a broad spectrum of pharmacological effects, including an anti-parasitic action. Research has shown its efficacy against Benita Benoit[39], the pathogen responsible for bovine bismuthosis. This parasite significantly diminishes fertility and productivity in cattle, leading to substantial economic losses. It causes various conditions such as anasarca, oedema, orchitis, hyperkeratosis, and distinctive skin and mucosal cysts, with B. besnoiti tachyzoites and bradyzoites replicating within the tissues of intermediate hosts. Additionally, it replicates in primary bovine umbilical vein endothelial cells (BUVEC) in vitro. The natural compound curcumin has been shown to decrease the viability of *B. besnoiti* tachyzoites, resulting in a 56% mortality rate (IC50 5.93 3M) during treatments. Curcumin also reduces the viability, motility, invasive capacity, and proliferation *of B. Benoit* tachyzoites.[40] Furthermore, curcumin has proven to be highly effective against schistosomiasis mansion in infected mice. To enhance the anti-parasitic effects, turmeric is combined with olive oil or used alongside praziquantel (PZQ) in the treatment of schistosomiasis mansion in infected mice. Turmeric has been shown to significantly decrease the burden of parasitic worms, reduce granuloma size, and alleviate the associated liver pathology, although it remains considerably less effective than PZQ [41] (Table 1).

Aloe vera

Aloe vera is rich in natural bio-organics, its major constituent aloe-emodin was found highly effective against helminths *Heteractis gallina rum*, which infect chickens[42] and Haemanthus contortus from sheep.[43] *Aloe vera* crude extracts and latex of *Aloe pulcherrima* showed anti-plasmodial activity.[44]

Cassia sanguine

Cassia sanguinea is used against acute malaria attacks in North Nigeria.[45] The methanol extract of Cassia alata L.[46] and C. fistula[47] showed antiplasmodial activity Kaushik NK et al, 2015.[48] It kills Plasmodium falciparum Gametocytes.[49] Ethanolic extract of root and stem bark of Cassia Siberian showed ant plasmodial activity in mice model.[50] Hexane

extract from the fruits showed significant antileishmanial activity against the promastigote form of Leishmania L. Chagas.[51] *Cassia siamea* also shows ant plasmodial activity[52] that may be due to the presence of cassiris A and B, novel alkaloids [Table 1].[53]

Aegle marmelos

A, *marmelos* extracts showed the anti-filarial effect and are traditionally used to treat *Brugia malaya* microfilariae.[54,55] Decoction of A. *marmelos* plant leaves is traditionally used as an anti-malarial agent in South India.[56,57]

Calotropis procera

Ethanol extracts of *C. procera* leaves, stems, roots, flowers and buds showed in vitro schizonticide activity against chloroquine (CQ)-sensitive and CQ-resistant Plasmodium falciparum strains.[58] Similarly, the hexane-soluble portion of the chloroform extract of root bark of C. gigantea shows in vitro anti-amoebic activity against the HK-9 strain of Entamoeba histolytica.[59] Compounds isolated from dry leaves of *C. procera* were found to be active against the malaria parasite[60], while *Calotropis gigantea* non-polar fractions were found active against amastigotes of *Leishmania major.*[61] Similarly, acerogenins isolated from *C. procera* latex also showed anti-plasmodial activity and displayed inhibitory effect on P. falciparum[62], Leishmania and Trypanosoma species.[63] Similarly, solvent extracts of aerial parts of C. proceri showed antimalarial[64], antiproliferative and antiplasmodial activities.[65] Its herbal concoction showed anticoccidial activity in broiler chickens challenged with *Eimeria tremella*[66] **(**Table 1).

Aqueous extract of C. proceri flowers showed very good anthelmintic activity against nematodes in sheep.[67] A single oral dose of 0.01 ml or 0.02 ml/kg body weight reduced and obstructed nematode egg production.[68] It also shows anticoccidial activity in sheep (single oral doses of 0.02 ml/kg body weight), mainly in lambs.[69] The latex of C. proceri also exhibits acaricidal activity in vitro[70] and is effective against intestinal worms in children.[71] **(**Table 1).

Cleome viscosa

Cleome viscosa solvent extracts show very high nematocidal activity against plant parasitic nematode *Meloidogyne incognita* Chitwood. Similar nematocidal activity was observed against the root-knot nematode *Meloidogyne avania.*[72] *Cleome autosperm* ethanolic extract showed moderate activity against P. falciparum chloroquine-sensitive strain D7 in vitro

(IC50 value of 54.25 µg/mL). This activity was not found in the aqueous extract.[73] Similarly, the diethyl ether fraction was found to be the most potent fraction and showed good antiplasmodial activity (IC50 value of 8.1 µg/mL). However, certain phyto-constituents like terpenoids or flavonoids are responsible for anti-malarial activity[74][75] **(**Table 1).

Flavonoid glycoside isolated from C. viscose[76] and C. bur Manni exhibited significant anthelmintic activity.[77] Similar anthelmintic activity is also reported in C. serrulate.[78] The crude alcohol and aqueous extracts of the seeds of C. viscosa Linn. showed anthelmintic activity against *Phreesia posthuma* and *Ascardia galli* at a concentration ranging from 10 to 100 mg/mL.[77] Ethanolic leaf extract of fringed spiderflower (*Cleome autosperm*) showed the anthelmintic potential against the Indian earthworm *P. posthuma*.[79] Similar anti-helmintic activity is also reported in *Cleome viscosa* seed extracts, which possess anthelmintic Activity[80] **(**Table 1).

***Tinospora* species**

Tinospora crispa leaf extract showed good anti-plasmodial activity.[81] This plant is also found in Indonesia, where it is used for the traditional treatment of malaria and Leishmaniasis by local people. It was found to be highly active against *Plasmodium falciparum* and also against Babesia diverges and Leishmania infantum. It shows cytotoxicity to sporozoites activity (IC50 values <3> (Table 1). Similarly, dried stems (ST) of T. crisp and four other plants slowed anti-filarial activity; these have cut down the relative movability of adult worms of sub periodic *Brugia malayi.*[87]

Capparis spinosa

Capparis spinosa (EtOAc fraction) showed pronounced antiprotozoal activity against P. falciparum with an IC50 of 0.50 microg/mL in the MRC-5 cell line (CC (50) > 30 microg/mL). *Heliotropism curassavicum* (CHCl(3) fraction) showed similar activity against P. falciparum (IC50 0.65 microg/mL; MRC-5 CC(50) > 30 microg/mL).[88] C. spinosa contains lectins, which control *Leishmania major* promastigotes by agglutination inside its vector host, Phlebotomus papayas in laboratory assays. Capparis spinosa lectins do fast agglutination and kill the parasites. High mortality of promastigotes was occurred in infected flies after they ingested an extract of *C. spinosa* with the diet. The results indicate that the lectins found in the vegetation in L. major foci may decrease the transmission of the parasite[89] **(**Table 1). *Capparis spinosa* is also used to control Leishmania major infection.[59] Capparis spinosa contains cadbicine, an alkaloid, betasitosterylglucoside-6'-octadecanoate

(1) and 3-methyl-2-butenyl-beta-glucoside, which showed anti-parasitic activity.[90] The root extract of C decidua is shown to have purgative activity, while root bark and pulp are used to kill helminths. Similarly, *Capparis spinosa* fruit diet cut down alpha-amylase and alpha-glucosidase activities both inside *Phlebotomus papatasi* gut and in salivary gland preparations. Due to the inhibition of these two enzymes, *C decidua* extract shows the ability to control Leishmania major and L. infantum, *L. donovani, L. braziliensis, Cerithiid fasciculata* and *Hepatomas muscarum* parasites.[91] The plant caused significant mortality in the above parasite[91] (Table 1).

Table 1: Shows various plant species with anti-parasitic potential.

Common name	Scientific name	Plant part/active ingredient	Activity	Reference
Kenaf	*Hibiscus Cannabis*	Leaves	Anti-helminthic activity	Ravalli et al, 2015
Confederate rose	*Hibiscus mutabilis*	Ferulic acid	Filarial parasite *Setaria cervi*	Prasanta et al, 2012
Gurhal	*H. rosa-sinensis*	Leaf extract	*H. diminuta*, a zoonotic tapeworm	Nath et al, 2016
Turmeric	*Curcuma longa*	Rhizome, Curcumin a polyphenol	*Besnoitia besnoiti* tachyzoites	Cortes et al, 2014
Turmeric	*Curcuma longa*	Rhizome, Curcumin a polyphenol	Leishmaniasis	Agarwal & Saxena 2018
Turmeric	Curcuma longa	Curcumin	Schistosomiasis *mansoni*.	Hussein A et al, 2017
Katelhi	*Argemone mexicana*	alkaloid	Nematocidal *Strongyloides venezuelensis*	Joel H al, 2021
Mexican prickly poppy	*Argemone mexicana* extract	Methanol seed extract	*Trypanosoma brucei brucei* infection	Chukwu, Ifeoma L et al, 2022
Garlic	*Allium sativum*	Bulb Allicin, Ajoene	Leishmaniasis	Foroutan-Rad M et al, 2017
Neem	*Azadirachta indica*	Leaves *Azadirachtin*	Anthelmintic against strongyle infections in cattle	Jamra N et al, 2015
Neem	*Azadirachta indica*	Leaves *Azadirachtin*	Anthelmintic *Haemonchus contortus* in goats	Rajakaruna and Warnakulasooriya 2011
Eucalyptus	*Eucalyptus globulus*	methanol extracts	Antischistosomal activities	Al-Sayed et al, 2014
Prickly Paperbark	*Melaleuca styphelioides*	methanol extracts	Antischistosomal activities	Al-Sayed et al, 2014
Ginger bush	*Tetradenia riparia*	Essential Oil	Antischistosomal activities	de Melo NI,
fennel	*Foeniculum vulgare* Mill.,	essential oil	Anthelmintic against *Schistosoma mansoni*.	Wakabayashi et al, 2015

Onion	*Allium cepa*	Active ingredients	*Schistosoma mansoni*	Mantawy et al, 2011
Ghrit kumari	*Aloe vera*	Aqueous extracts	Anthelmintic Antiplasmodial potential	Maphosa et al, 2010
Ringworm bush	*Cassia alata*	Leaf extract	antiplasmodial activity	Da O et al, 2016
drumstick tree	*Cassia sieberiana*	Leaf extract	antiplasmodial activity	Abdulrazak N et al, 2015
Bel	*A. marmelos*	Extracts	Anti-filarial effect *Brugia malayi microfilariae*	Sahare KN et al, 2008
Madar	*Calotropis gigantea*	Non-polar fractions Calatropin	Amastigotes of Leishmania major	Oskuee &, Jafari 2012
Madar	*C. procera flowers*	Aqueous extract, Calatropin	Anthelmintic and Anticoccidal in sheep	Iqbal et al, 2005
Madar	*Calotropis procera*	Flower extract, Calatropin	Leishmania and Trypanosoma species	Mesquita et al, 2005
Madar	*Calotropis procera*	latex , Calatropin	Haemonchus contortus	Al-Qarawi et al, 2001
Asian spiderflower	*Cleome viscosa*	solvent extracts	*Meloidogyne incognita* and *Meloidogyne javanica*	Luis et al, 2021
Fringed Spiderflower	*Cleome rutidosperma*	Leaf Ethanolic extract	Anti-plasmodial Activity P. falciparum chloroquine	Bose et al, 2010
	Cleome viscosa L. and Cleome burmanni w	Leaf Ethanolic extract	Anthelmintic potential	Pillai & Nair 2011
Garlic	*Allium sativum*	Garlic extract	Hymenolepiasis nana and giardiasis cestodes and on trematodes	Soffar and, Mokhtar 1991
Garlic	*Allium sativum*	Aqueous extract	Protozoans such as *Entamoeba histolytica, Hymenolepsis nana,* and Giardia lamblia	Abdel-Ghaffar et al, 2011
Garlic extract	*Allium sativum*	Aqueous extract, Allicin	*Babesia* and *T. equi* parasites	Salama, et al, 2004
Petawali	*Tinospora crispa*	Leaf extract	Anti-plasmodial activity, Leishmaniasis	Kaushik et al, 2015
Petawali	*Tinospora rumphii*	Stem extract	Cutdown the Eimeria species oocysts per gram counts	Kaushik et al, 2015
Guduchi	*Tinospora cordifolia*	Stem extract	Anthelmintic activity amphistome *Gastrothylax crumenifer*	Jogpal et al, 2021
Fenugreek	*Trigonella foenum-graecum*	Seed , sapogenins, isoleucine, and galactomannans	Anthelmintic activity	Swarnakar et al, 2014
Caper bush	*Capparis spinosa*	Seed Extract	Cadabicine *Leishmania major*	Khanfar et al, 2003
Kareel	*C decidua*	Stem extract	Leishmania species *Crithidia fasciculata* and *Herpetomonas muscarum*	Schlein & Jacobson 1994

Samrong	Sterculia	Gum is used to coat ornidazole on poly(vinylpyrrolidone)	*Trypanosoma brucei rhodesiense, Leishmania donovani* (Kala-Azar), and *P.falciparum*	Schmidt et al, 2011
Zigzag Plant,	*Pedilanthus tithymaloides* latex	Poly-o-acylated jatrophene diterpenes	Antiplasmodial activity	Adzu et al, 2008
Papita	*Carica papaya*	Papaya latex	Anthelmintic *Heligmosomoides polygyrus*	Satrija et al, 1995
Orange climber	*Toddalia asiatica*	Nitidine an alkaloid	Antimalarial	Shan et al, 2014
Tulsi	*Ocimum sanctum*	Leaves	*Plasmodium falciparum*	Asha et al, 2001

CONCLUSION

Plants contain a variety of bioorganic compounds that exhibit numerous pharmacological activities, including antiparasitic properties. Alongside these components, substances such as plant latex, gums, alkaloids, terpenes, ferulic acid, and other natural products have also demonstrated antiparasitic effects. The majority of these elements have undergone testing in in vitro cultures. Consequently, it is essential to evaluate them in suitable in vivo animal models to ascertain pharmacokinetics, bioavailability, and pharmacodynamics. Nonetheless, the affordability and ease of producing herbal antiparasitic preparations render them cost-effective options for ensuring the health of cattle and other livestock globally, particularly in regions such as Africa, South America, and Asia. Furthermore, preventive measures, hygienic practices, and proper sanitation should be implemented to address infections caused by parasites. It is advisable to take precautions by keeping children away from waste, contaminated soil, polluted water, and areas with unpleasant odors. Always wash vegetables in salt water to eliminate eggs and parasite larvae, consume well-cooked meat, and drink purified water.

ACKNOWLEDGEMENTS

The authors are thankful to HOD Zoology for the facilities.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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