Insight Into The Medicinal Plants Used In Anthelmintic Activity

Tahreen Taj*[1], Fathima Afha[2], Fathimath sambrina[2], Mohammed Shameel[2], Sindhu priya E.S[1], Singapalli Meenakshi Sheshadri[1], Mohammed Ameen M.P[1], Fathima Majida[1], Fatima Fakrudheen[1]

1. Department of Pharmacology, Yenepoya Pharmacy College and research Centre, Yenepoya (Deemed to be university), Mangaluru, India 575018
2. Research Scholars, Yenepoya Pharmacy College and research Centre, Yenepoya (Deemed to be university), Mangaluru, India 575018

***Corresponding author:**
Department of Pharmacology,
Yenepoya Pharmacy College and research centre,
Yenepoya (Deemed to be university),
Mangaluru, India 575018
E-mail address: tahreentaj6414@gmail.com
Tel: +919449587414, 8660365485.

ABSTRACT:

Pathogens of great global importance are parasitic worms, often known as helminths of the gastrointestinal (GI) tract. The gastro intestinal system's worm infection is known as Krimi roga in Ayurveda. Numerous Ayurvedic medicinal herbs used to treat Krimi roga. Utilizing textbooks of ethno botanicals, peer-reviewed journal articles, materials that are published and unpublished, scientific databases, a thorough analysis of the literature was carried out on anthelmintic activity and different medicinal plants or herbs and its chemical constituents used for it. There are numerous currently available medications. Since they have many adverse effects, around the world, 80% of the population relies on herbal remedies and plant extracts, with the active ingredients used to treat people's basic medical requirements. The goal of the research is to show how widely anthelmintic therapeutic herbs have been used in different traditional medicine. It will certainly useful study for specialists in this area of study.

KEYWORDS: Anthelmintics, Parasitic worms, Medicinal herbs, Herbal remedies, Ethnobotanical uses.

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INTRODUCTION:

Human parasitic worms, known as helminths, can transmit diseases that are chronic and occasionally fatal.These diseases are known as neglected tropical diseases (NTDs), and they have a global impact on around two billion people[1]. Human and animal effects of helminthes: In the tropics, helminthes are known to be a serious issue for livestock [2]. Numerous conventional plants and shrubs are said to possess anthelmintic properties[3]. New, secure, biodegradable, and renewable medicines can be found in plants[4]. For the Australian sheep andwool business, the pervasive and growing resistance of internal parasites to anthelmintic control is a majorissue[5]. A portion of the body that has a worm infestation, such as a pinworm, roundworm, or tape worm, is said to have helminthiasis. Although the parasites typically reside in the gastrointestinal system, they can potentially enter the liver as well as other regions of the body[6].

A parasitic worm's life cycle can be extremely complex, with multiple hosts for various stages. In addition, a worm's most adaptive parasitism is a complex life cycle incorporating trophic transmission[7]. Due to the development of resistance to anthelmintic drugs and the expensive cost of traditional anthelmintic medications, an evaluation of medicinal herbs as prospective sources of anthelmintics was undertaken[8]. An extraordinary amount of progress was made in the creation of animal anthelmintics between 1960 and 1980[9].

Pharmacological interactions between the three main categories of anthelmintics — imidazothiazoles, macrocyclic lactones and benzimidazoles — has grown in prevalence and severity in intestinal nematodes of livestock as resistance to anthelmintic drugs in both human and animal infectious helminths[10]. One of the five anthelmintics presently in use, including Albendazole, Mebendazole, Diethylcarbamazine, Ivermectin, and Praziquantel, can effectively treat nearly all significant helminth infections in humans[11]. A quarter of the world's population is chronically infected with helminth parasites, which are extremely successful pathogens that frequently cause substantial morbidity but infrequently cause death[12]. According to estimates, nearly 1,400 people worldwide[3], almost all of them in developing nations, have helminthiases[13].
Ayurveda, or the Science of Life, frequently employs herbal remedies to cure a variety of health conditions.The treatment of parasite illnesses has historically been carried out in India using a range of plants for medicinalpurposes. In Ayurveda, worm infection of the gastro intestinal system is referred to as Krimi roga. To cure Krimi roga, numerous Ayurvedic medicinal herbs have historically been employed. Humans experience severe toxic side effects when using synthetic anthelmintic medications to treat parasitic infestations. The usage of Ayurvedic herbal remedies has fewer costs and there are no adverse effects. In diverse pharmacological models, the study highlights the in vitro anthelmintic properties of some of the most significant Ayurvedic medicinal plants[14].
Among the most crucial groups from parasitic illnesses across the subcontinent of India and Pakistan, helminthiasis causes significant losses in livestock production. Animals with helminths are treated with a broad range of anthelmintic[15].
Both human and animal effects of helminthes: In the tropics, helminthes are known to be a serious concern for livestock (Adewunmi *et al*, 2001). Among the most prevalent illnesses both in underdeveloped and developed countries is helminthes infections (Krogstad et al, 1998). Intestinal worms are predicted to infect 2 billion individuals worldwide (Wen et al, 2008). The majority of helminthes-related illnesses are chronic and

debilitating in character, and they likely affect more people and animals compared to any other single group of parasites in terms of morbidity as well as economic and social distress. Inflammation in the intestines caused by parasites, including numerous types of intestinal and stomach worms, causes weakness, diminished appetite, poor feeding effectiveness, lowered growth in weight, and reduced efficiency (Gibbs, 1986).
According to how their bodies are segmented, helminths are categorized by Floron *et al*, 1914 as either trematodes (flukes), nematodes (roundworms), or cestodes (tapeworms). Helminths are multicellular organisms with intricate life cycles that involve maturation within their hosts[15].

Interior parasites:

1. Nematomorpha (Hairworms): Hairworms, often known as stomach worms and intestinal worms, frequently infect the digestive system of cattle.
2. Coccidia (Hepatozoon, Toxoplasma): the young cattle —typically age range: 3 weeks to 6 months —

can be affected by coccidia can develop intestinal illness.

3. Liver flukes (Clonorchis sinensis, Fasciola hepatica): Liver fluke infections can occur in cattle living indamp locations with alkaline soils.
4. Strategic worming: Wormers are supplied to cattle in order to prevent parasite harm and kill internalparasites.

Exterior parasites:

1. Haematobia irritans (Horn flies): From early spring to late fall, horn flies reproduce in fresh cattle manure. Late spring and late summer or early fall are often the times when horn fly numbers are attheir highest.
2. Pediculus humanus capitis (Lice): Clenching lice and blood-sucking bugs are transferred via contact among cattle, particularly in the months of November through March, when egg production increases in cold circumstances.
3. Trichlorfon, Halofenozide (Grubs): Heel fly larvae called cattle grubs (also known as warbles or wolves) deposit their eggs on the lower leg fur of cattle in the late winter and early spring[15].

Drugs used as Anthelmintics:

The following drugs are employed as anthelmintics and work through various mechanisms:

- Albendazole: is a popular oral anthelmintic with a broad spectrum that works by inhibiting microtubule production in nematodes, which hinders the absorption of glucose irreversibly. Therefore, intestinal parasites either become immobile or gradually perish. (Jay *et al*, 1979).
- Mebendazole is a potent, broad-spectrum anthelmintic that specifically and permanently prevents adultintestinal worms from absorbing glucose[16].

Herbs used to treat Anthelmintic:

1. Carica papaya latex:

The goal of the study was to see if papaya latex (*Carica papaya*) had any antihelmintic activity in mice that have been experimentally Heligmosomoides polygyrus-infected. Infected larvae of Heligmosomoides polygyruswere given to each animal in five separate groups of BALB/C mice. After patency (day 22), papaya latex suspension in water was administered to At doses of two, six, and eight g papaya latex/kg body weight in the four mouse groups (B, C, D, and E), respectively. One set of mice (group A) was used as a control group. On day 25, three days after treatment, all animals were necropsied for post-mortem worm counts. Groups B, C, D, and E comprise the antiparasitic efficacy of papaya latex was 55.5, 60.3, 67.9, and 84.5%, respectively. The findings suggest that papaya latex could be used as an anthelmintic against mammalian patent intestinal nematodes[17].

Many biologically active compounds are found in papaya. The leaves, latex, fruit, and stem are all utilized for treating a variety of conditions, including indigestion, diarrhea, lung edema, urine blockage, lack of vision, a rapid heartbeat, ringworm, and baldness. The seeds are employed as an anthelmintic. In the past few years, the creation of novel compounds, the production of baked goods and beverages and have all benefited from papaya latex as well as its commercial derivatives[18].

2. Latex of Ficus species:

In Central and South America, Some Ficus (*Moraceae*) species latex has long been used as a vermifuge. It is widely believed that a proteolytic component known as ficin is the one that causes anthelmintic activity. When *Aspiculuris tetraptera*, *Syphacia obvelata*, and *Vampirolepis nana* were spontaneously infected in NIH mice, *Ficus carica L.* and *Ficus insipida Willd* latex were tested for their anthelmintic activities. When injected intragastrically at doses of 4 ml/kg/day for three days, the latex of *F. insipida* was unable to eliminate A. tetraptera (8.4%) and segments of *V. nana* (6.3%). However, around 38.6% of the entire *S. obvelata* population could be removed. *S. obvelata* (41.7%) could be removed with the use of *F. carica* latex when 3 ml/kg/day for three consecutive days are administered, whereas *A. tetraptera* could not. These lattices are not recommended for use in conventional medicine due to the Hemorrhagic enteritis-related extreme acute toxicity and the low anthelmintic effectiveness[19].

Tannins' anthelmintic properties may be explained by their capacity to bind free protein present in feeding tubes for larvae; as a result, decreased nutritional availability might have caused larval scarcity or an immediate reduction in gastrointestinal metabolism involving suppressing oxidative phosphorylation, which would have caused larval death 30, 31. Its effectiveness is on a level with that of the standard medication metronidazole (10 mg/ml). The crude extract's activities increase as the amount of latexes increases. At 250 l and 500 l of crude latex, *F. religinosa* demonstrated paralysis in 6.2, 7.3, and 17.3 minutes, respectively. *F. elastica* and *F. bengalensis* died in 15.5, 18.4, and 26.3, 30.1 minutes at 250 l and 500 l, respectively, after being paralyzed in 6.4, 7.4, and 10.2, 13.4 minutes. Similar to metronidazole, which induces paralysis in 5 minutes and death in
13.2 minutes, worm death and paralysis were seen[20].

3. Neem

The study explored the potency of neem leaf powder (*Azadirachta indica*) against severe illnesses in cattle. According to copro-examination, 30 cattle that tested positively for a severe illness and had about 250 [eggs per gramme (EPG) of feces] were chosen. These cattle were then separated into three categories of ten animals respectively. Fendendazole and neem leaf powder were administered to Groups A and B at doses of Group C functioned as a left untreated, diseased group of controls, receiving doses of 5 and 500 mg/kg in terms of body weight, respectively. Each animal in these groups had a fecal sample that was examined, and the EPG was calculated, on days 0, 7, 14, and 28 following treatments. After day 7 following therapy, the results revealed a substantial decline in EPG in Groups A and B (p 0.05), however there was no substantial improvement in EPG in the group serving as the control. Consequently, it can be said that crude neem leaf powder possesses anthelmintic characteristics. Further research can be done to identify the active ingredient, which can then be used to create herbal anthelminthics[21].

The usefulness of leaves of neem as an anthelmintic against goats' *Haemonchus contortus* was investigated through a series of studies. According to in vitro studies, the pure azadirachtin demonstrated the strongest anti-larval action at a concentration of 1000 micrograms when evaluated at varying concentrations on the L3 larvae of *Haemonchus contortus's* mobility. Up to 400 g, the *Haemonchus contortus* L3 larva's motility was unaffected. The researchers discovered that neem leaves contain 0.0244% azadirachtin. The effectiveness of administering Neem leaves were used as a source of anthelmintics examined in a different study using twelve weaned unremarkable male children over a 63-day period by infecting animals with 5000 *Haemonchus contortus* (L3) larvae on animals served either with or without Neem leaves. In comparison to diseased animals fed a complete meal without feeding Neem leaves, it was found that administering Neem leaves dramatically reduced the Egg per Gram (EPG) count commencing on the 42nd day as well as the quantity of worms[22].

4. Aloe Vera:

The anthelmintic activity of *Aloe vera* extracts made from ethanol and water towards sheep nematodes of the gastrointestinal tract both in vivo and in vitro tests. With an ED50 value of 0.57 mg/ml, At all tested dosages,the in vitro egg hatch experiment with A. vera aqueous extract revealed a considerable suppression of egg hatch.With the maximum reduction of 56.36 percent at 500 mg/kg, which was considerably lower than the positive control result of Albendazole, the in vivo faecal egg count reduction test decreased the egg count in the feces ina dose-dependent way. Haematological and serum parameters in the treated groups were unaffected both before and after treatment, showing that the extract had no harmful effects. The Aloe Vera aqueous extract's anthelmintic activity was proven by the current study[23].

5. Curcuma longa

A range of illnesses can be treated with the help of medicinal plants, which have been utilized in India for hundreds of years. These plants are believed to be of enormous global relevance. India is appropriately renowned as the "Botanical Garden of the World" as well as is probably the largest producer of medicinal herbs in the entire world. Herbal remedies have been used by traditional medical systems including Ayurveda, Siddha, and Unani for thousands of years. The rhizomatous herbaceous perennial plant known as turmeric, or *Curcuma longa*, is a member of the ginger family, *Zingiberaceae*. It is native to tropical South Asia and needs high yearly

precipitation and temperatures between 20 and 30 degrees Celsius to thrive. Rhizomes from plants are harvested annually, while a few of those rhizomes are used to start new plants the next year. For its potential therapeutic uses in treating cancer, arthritis, Alzheimer's disease, and other medical conditions, turmeric is now being researched. An early laboratory study with turmeric showed that it lessened the degree of pancreatitis-related lung damage in mice[24].

The most common infections in people are caused by helminthes, affecting a significant portion of the global population. Onchocerciasis, schistosomiasis, and lymphatic filariasis, all parasitic diseases, can result in severe morbidities. Worldwide, the development of resistance to the majority of commercially available anthelmintics has become a serious issue[25].

6. Allium sativum

Garlic (*Allium sativum*) bulbs weighing 30 g were cleaned, dried in the sun, and in a soxhlet glass extractor for 20 to 24 hours, their oil was eliminated using petroleum ether. After the solvent had completely evaporated, a greasy substance was left behind that was suspended in distilled water after being triturated with 0.5 ml of Tween 20 to produce a 6% stock solution. The stock solution was diluted to create various concentrations of the test solution, which were then evaluated for in vitro anthelmintic action. *Heterakis gallinae* [*H. gallinarum*] were subjected to garlic oil for 10, 8, and 6 hours, respectively, and *Ascaridia galli* for 12, 10, and 8 hours, before dying at rates of 2%, 4%, and 6%. Acid and alkaline phosphomonoesterases' relative activity, glucose absorption, glycogen content, oxygen use, and other factors were all substantially decreased by garlic oil in both parasites. There is discussion of its potential method of operation. On the host intestinal or caecal tissue's metabolism, there were no noticeable impacts[26].
Garlic (*Allium sativum*), a plant in the *Liliaceae* family, is prized for its medicinal and culinary properties all over the globe. One of the oldest known medicinal plants, garlic (leaves, flowers, and cloves) has long been utilized to cure a variety of human diseases. The most important finding of the study is that garlic has a wide range of therapeutic benefits and little toxicity. Allicin, S-allylcysteine, diallyl disulfide, and diallyl trisulfideare examples of organosulfur compounds which are rapidly absorbed and metabolised, are the plant's most active components. The most researched of these naturally occurring substances is *allicin*. Anti-diabetic, antioxidant, anti-inflammatory, hepatoprotective, anti-helminthic, antibacterial, antiviral, antifungal, and wound-healing are just a few of the diseases that garlic and its compounds have been used to address. Cancer, Dementia, diseases related to cardio which includes thrombosis, atherosclerosis, hypertension, and hyperlipidemias, applications related to dermetalogy, stress, and infections are among the illnesses that may alsobe subdued by the medicinal effects of garlic[27].

7. Eclipta prostrata

The small, branched annual herb *Eclipta prostrata L.*, which belongs to the family *Asteraceae*, is indigenous to tropical and subtropical areas of the globe. Annual false daisies are typically found flourishing in unused land. Erect or prostate-shaped, completely silky stems frequently root at nodes. Leaf lengths vary from 2.5 to 7.5 cm for oppositely arranged, oblong, lance-shaped, or elliptic leaves. It has tiny, white flowers that resemble daisies on a long stalk and a short, flat or round, brown stem. Eclipta thrives in the tropics and is successfully used in Ayurvedic treatment. Hindus used bhringaraj in their Shradh ceremony, which honours lately departed loved ones. One of the Hindu religion's "Ten Auspicious Flowers" is this shrub. In Asia, *Eclipta prostrata L.* has a long history of usage in traditional medicine for the treatment of lipidemia and atherosclerosis. However, its functional characteristics and underlying mode of action are still poorly understood. The herb includes the alkaloid ecliptine and is a rich source of ascorbic acid. The plant is an excellent source of thiophene derivatives that have nematode-fighting properties. This species is notable for having mono, di, and trithiophene acetylenes as well as terthenyl. Trithienyl aldehyde, ecliptal, along with stigmasterol and B-sitosterol is likewise found in the petroleum ether extract arial portion.
Thiophene acetylenes are extremely abundant in the roots. From the four substances that were isolated from E. prostrata, stigmasterol and alpha-terthenyl were two that were recognised. These constituents, which were isolated from plants, have substantial hepatoprotective activity. Chinese herbal medicine uses the Eclipta prostrata, an aromatic plant, to treat various kidney issues. E. prostrata has the potential to be a key player in osteoblastic bone production and could influence the creation of bone-building medications. E. Prostrata leaf extract has demonstrated hypolipidemic action. Eclipta Prostrata ethanol and aqueous extracts in a dose-dependent way demonstrated anthelmintic activity, by using 100 mg/ml concentration causing the quickest paralysis and death[28].

8. *Coleus aromaticus*:

Arshad Hussain *et al*, conducted a study on *Coleus aromaticus* root's in-vitro anthelmintic efficacy on Indian adult earthworms and they found that minimum dose of 10 mg/ml, every investigational extract developed

anthelmintic action. Its effect at 10 mg/ml was considerably greater (P 0.05) in comparison to the common drug Piperazine citrate when measuring its duration to paralysis as well as death, respectively[29].
The East Indian archipelago used *Coleus aromaticus* leaves Bentham, primarily in instances of aphthous stomatitis. Due to their antiseptic properties, the Species antiaphthosae with leaves of *Coleus* as an active ingredient was introduced by the Dutch Pharmacopoeia Ed.V. Carvacrol and possibly thymol were implicated inthis action in earlier studies. Indian or country borage is the traditional name for Coleus aromaticus Benth. (*Lamiaceae*), also known as *Coleus amboinicus (Lour.) Spreng*[30].
The current research shows that *Coleus amboinicus* leaf, stem, and root alcohol extracts have athelmintic activity against the Indian earthworm Pheritima posthuma. The outcomes showed that all of the *Coleus amboinicus* extracts tested exhibited substantial dose-dependent anthelmintic activity. The activities found similar when compared to piperazine citrate and albendazole drugs as reference. The extract of leaf was discovered to be highly effective than the stem and root extracts among the examined extracts. Therefore, the current research supports its use as an anthelmintic drug in folklore remedies[31].

9. Curry leaves (*Murraya koenigii*)

Curry leaf, also known as *Murraya koenigii*, is a perennial plant in the *Rutaceae* family. Since ancient times, it has been grown all over the world and utilized as an essential oil, a food flavoring, and in traditional medicine. *Murraya koenigii* leaves extracted using various solvents, as well as the stem (branch) and leaves extracted using water, were discovered to exhibit antibacterial effects on a variety of bacterial strains such as Bacillus aureus, Bacillus licheniformis, Eschericia coli, Bacillus subtilis, Salmonella typhimurium, and Staphylococcus aureus. The outcomes supported the *Murrayakoenigii's* extract has antimicrobial activity against human pathogenic microorganisms. Investigations into antifungal action also included testing against *Macrophomina phaseolina, Rhizoctonia solanii, Fusarium moniliforme*, and *Fusarium oxysporum*. The extract prevented the test fungi's radial development. The various leaf solvent preparations of *Murraya koenigii* also contained anthelminthic activity. Additionally, Murraya leaf extract underwent phytochemical screening, which revealed the existence of numerous alkaloids, phenolics, proteins, saponins, and terpenes. Soluble phenols, flavonoids, and anthocyanins were also believed to exist in sufficient quantities. The antioxidant protein in curry leaf maybe responsible for the antibacterial action. Phenolics, alkaloids, or terpenes are likely responsible for the antifungal and anthelmintic effects[32].

Terpene, citral, linalyl acetate, menthol, menthone, carvomenthone, and caryophyllene are the main componentsof this plant, and they all add to the flavour. Depending on the species or cultivars, in addition to the conditions of cultivation and horticulture practices such as irrigation, trimming, and the type of soil each of these chemical constituents can be present in varying amounts in a given plant. Curry is a crucial component of numerous industrial goods, including food, cosmetics, and pharmaceuticals. Numerous biological benefits of this plant's formulations have been demonstrated, including antibiotic, antifungal, antidiabetic, anthelmintic, cancer- preventative, antihypertensive, antilipid-peroxidative, and wound-healing properties. Curry byproducts are constantly being given new purposes and applications. Further study is required, especially in developing nations where this plant is harvested using more conventional techniques and processed after harvest[33].

10. Ocimum (Tulsi)

In the tribal regions of Baipariguda, Koraput (Dt), Odisha, the many species of *Ocimum (Lamiaceae*), such as *Ocimum americanum Linn., Ocimum Sanctum Linn., and Ocimum basilicum Linn*., are widely dispersed and have a long history of use by the locals for treating heart disease, various poisonings, headaches, stomach. The research done was to investigate the phytochemical components and the anthelmintic properties of leaf extracts from several *Ocimum* species in methanol, as well as a comparison of their actions. The phytochemical components of the *Ocimum* extracts were examined, and the extracts' anthelmintic effects on adult Indian earthworms, Pheretima posthuma, were also assessed. With the exception of anthraquinone glycosides and thiol group, *Ocimum* species' methanolic extract passed every test for its phytochemical components. All extracts displayed anthelmintic action at a dosage level of 60 mg/ml. The effects are very comparable to those of the common medication albendazole. All of the methanolic extracts outperformed the standard medication in terms of their anthelmintic activity. In comparison to other *Ocimum* species, the methanolic extract of *Ocimum gratissimum linn* demonstrated greater anthelmintic activity. Utilizing one-way ANOVA with a 5% level of significance (p 0.05), the data were confirmed as statistically significant[34].

Plant-based anthelmintics, which have a changed site of action and are safe and non-toxic, may be a solution to this global issue. In India, *Ocimum sanctum Linn*, also referred to as Tulsi that has been used in Ayurveda for thousands of years because of its many therapeutic benefits. It is a member of the *Labiateae* family. In order to achieve this, we compared the in vitro antihelminthic action of osmium to that of albendazole. It was frequently used to address respiratory issues, gastrointestinal issues, skin issues, joint inflammation, eye diseases, fever conditions, immuno stimulants, and even bug bites, among other conditions. Additionally, the *Ocimum sanctum* has been touted for its potential anti-diabetic, hepatoprotective, anti-cancer, antifungal, anti-microbial,

cardioprotective, anti-emetic, antispasmodic, and painkiller properties. Insect-repelling tulsi has also been used as a cereal storage agent. In order to achieve this, we compared the in vitro antihelminthic action of osmium to that of albendazole[35].

11. CHROMOLAENA ODORATA

In especially in tropical developing nations like India, the use of traditional medicines offers enormous potential as a readily accessible source of efficient therapeutic agents to treat a wide spectrum of human afflictions. In this situation, individuals use a variety of plants or products derived from plants to treat wounds and treat helminth infections. It is thought that the plant *Chromolaena odorata*, formerly known as *Eupatorium odoratum*, South and Central American origin. Other names for it include jack in the bush, bitter bush, weed of siam, and triffid weed. It is a perennial herbaceous plant that can reach a height of three metres in an opensetting and up to eight metres in deep forests when it adopts a scrambling habitat fresh leaves and in countries with less amenities, extract of *C. odorata* is utilized in conventional herbal treatments for burns, soft tissue wounds, and skin infections.

Helminth infections represent some of the most common illnesses in humans and can affect a significant percentage of the global populace. They seriously endanger public health in poor nations and increase the risk of illnesses such as pneumonia, eosinophilia, anemia, and malnutrition. Although the bulk of worm illnesses areoften restricted to tropical places, some of them can arise in temperate temperatures and can affect travellerswho have visited those areas. There is a major issue with treating helminth's disorders because the gastrointestinal helminth's gets resistant to the anthelmintic medications that are now on the market. Hence, there is a rising need for natural anthelmintic. In order to determine the activity of anthelmintic various solvent extracts of *Chromolaena odorata* leaves investigation was conducted.

The continuum of normal tissue is breached by a wound, which causes a number of cellular and molecular repercussions. A wound can be caused by a physical, thermal, chemical, microbiological, or immunological attack on the tissue. Integrated cellular and metabolic processes that restore structural and functional integrity as well as the strength of wounded tissue make up the process of wound healing. Clinically, non-healing, under- healing, and over-healing are common. As a result, the aim is to treat a wound either to reduce the amount of time needed for healing or to reduce any unintended repercussions. Several medications, from straightforward, inexpensive analgesics to sophisticated, expensive chemotherapeutic medicines, used in the care of wounds have an impact on healing, either favourably or unfavourably. Finding a substance that will hasten wound healing, whether it is occurring normally or is being slowed down by different chemical agents should be the focus of research. *Chromolaena odorata* aqueous extracts improve haemostatic function and the processes of granulation tissue and re-epithelization. Hence, the plant may have significant therapeutic potential in the

process of healing wounds, which may be demonstrated by conducting the current investigation on the various solvent extracts of Chromolaena leaves.
Comparing the methanol extract to other extracts, the current analysis showed that it has powerful anthelmintic properties. Significant activity was also detected in the extracts of pet. ether and ethyl acetate. Additionally, it was shown that the extracts were poisonous to worms at levels up to 10 mg/ml for the pet. The paralysis was induced at doses of up to 5 mg/ml for the ether extract and the other two extracts[36].
Considering that it resembles human intestinal roundworm parasites both morphologically and physiologically, Chromolaena odorata leaves' aqueous and hydro alcoholic extracts have been shown to have anthelmintic efficacy against *Pheretima posthuma* adult earthworms which are native to India. The aqueous extract showed increased potency. The activities are comparable to those of the piperazine citrate reference medication[37].

12. Cassia fistula L

The need for herbal medicine is rising globally, and the majority of medicinal plants are being evaluated for their usefulness. According to the World Health Organization, more than two billion individuals worldwide have infectious parasite conditions. In light of this, efforts have been made to examine *Cassia fistula L.*'s anthelmintic activity fruit seeds and pulp. Both extracts were discovered to have killed the *Pheretima posthuma* in addition to paralysing it. Concentrations of 100 mg/ml of extracts considerably increased worm paralysis as opposed to the standard medication Piperazine citrate with a dosage of 10 mg/ml, and this resulted in their death. For *Pheretima posthuma* seeds and pulp, the correlation coefficient between paralysis and time until death was 0.9986 and 0.9976, respectively. The use of *Cassia fistula* as an anthelmintic was determined[38].
This research examines the phytochemical screening and anthelmintic and antibacterial effects of *Cassia fistula L.* bark extracts. Different solvents, including methanol, acetone, and distilled water, had been used for the extraction. By using the agar cup diffusion method, two gram +ve and two gram ve bacteria were used in the anti-bacterial assay. On *Pheretima posthuma* (an earthworm), the anthelmintic action was observed by timing the paralysis and death periods at various doses. The highest anti-bacterial and anthelmintic efficacy was demonstrated by the methanolic extract. Only bacteria with gramme +ve numbers were resistant to the extract. Between *Staphylococcus aureus* and *Streptococci faecalis*, the former was more vulnerable. There was no evidence of action against gram-negative bacteria. A concentration of 50 mg/ml was comparable to the paralysis and death times seen for the standard concentration of 10 mg/ml of albendazole in terms of its anthelmintic activity. The acetone extract was less efficient than the aqueous extract[39].
South India is home to the *Leguminosae* tree species Cassia fistula Linn. It's called the "Golden Shower Tree." There have only been a few previous studies on the *Cassia fistula pod*. The focus of the current study is on the phytochemical, anthelmintic, and antibacterial properties of the *Cassia fistula pod*. Fruit extracts were utilised for this. It was examined whether the methanolic extract of *Cassia fistula* seed has any possible antibacterial properties against crucial microorganisms for medical use. The anthelmintic properties of the water extract from *Cassia fistula Linn pods* were studied. The blessing of nature is plants. On Earth, life is not conceivable without plants because they supply all the comforts required for life. It is important to conduct research on medicinal plants because the data gained may be applied to medical practise. Herbs and medicinal plants continue to be the source of both traditional treatments and cutting-edge novel medications. It has been demonstrated via recent study on medicinal plants that these plants will be crucial to human health[40].

13. Cinnamon

Although cinnamon's *(Cinnamomum verum*) anti-inflammatory and antibacterial qualities have been demonstrated, its impact on intestinal parasitic worms has not been studied. This study found that the swine worm *Ascaris suum* is resistant to the potent in vitro anthelmintic effects of cinnamon bark extracts. Analysis revealed that the extract included significant levels of trans-cinnamaldehyde and proanthocyanidins (PAC). They possessed a mean level of polymerization of 5.2 and 21% of those inter-flavan-3-ol linkages contained A- type linkages, according to the procyanidin-only nature of the PAC, Thiolysis, and HPLC-MS analyses.

Helminths, or the gastrointestinal tract's parasitic worms, are important infections on a global scale. Helminth infections cause decreased growth rates, less ruminant and pig output of milk and meat, and they also exacerbate secondary bacterial illnesses, which reduces food security and economic growth. Helminths are a serious productivity limitation in livestock all over the world. Also, it is believed that more than a billion individuals, mostly in underdeveloped nations, are afflicted with helminths that are spread through the soil, which significantly increases morbidity.

Since there are presently no vaccinations for helminths, their control is mostly achieved through widespread administration of synthetic anthelmintic medications. In the end, this excessive reliance on a small number of chemical substances is unsustainable. In animal production systems, anthelmintic resistance is pervasive, particularly where it has reached critical levels in small ruminants. Nevertheless, it has also been discovered in pigs, cattle, and cattle, and there are still concerns regarding the long-term effectiveness of mass medication administration in people. Consumer demand for animal-derived goods which are manufactured organically preferably using the minimum synthetic chemical ingredients is also rising. Consequently, it is crucial to research cutting-edge helminth control strategies.

Numerous plants provide a plentiful source of bioactive compounds, such as secondary metabolites and essential oils, which can have antibacterial and antiparasitic properties. Plants can be used as nutraceuticals and targeted chemical identification for drug discovery is made possible by the presence of parasite-fighting compounds in plants. This method of parasite management, particularly in livestock, entails substituting or supplementing the diet with whole plant products or extracts. If and when plants are locally accessible, this strategy offers many benefits, preventing drug residues in agricultural goods is one of them a reduced danger of parasites impoverished resistance and simple assimilation into communities in poor nations with little resources[41].

Because of the development of pesticide resistance, concerns about chemical contamination and environmental harm, through means of chemical pesticides to manage monogenean illnesses is frequently banned in many nations. To combat monogenean infections, the use of plant-based antiparasitic medications has been

researched. In in vivo circumstances, the effectiveness of Cinnamomum cassia extracts against goldfish Dactylogyrus intermedius was examined. Electrospray ionization mass spectrometry and nuclear magnetic resonance (NMR) were employed to distinguish between the two bioactive substances, cinnamaldehyde and cinnamic acid[42].

13. Mentha Piperita

Water mint (*Mentha aquatica*) and spearmint were crossed to create peppermint (*Mentha spicata*) Due to its high menthol concentration; peppermint is frequently used to flavour toothpaste, ice cream, candy, and chewing gum. Menthone and menthyl esters, particularly menthyl acetate, are also present in the oil. Usually, 0.3-0.4%of the volatile oil in dried peppermint is made up of menthol (29-48%), menthone (20-31%), menthyl acetate (3- 10%), menthofuran (1-7%), and numerous trace elements like limonene, pulegone, eucalyptol, and pinene. For cancer patients receiving cancer treatment, peppermint offers potentially beneficial radioprotective benefits. Moreover, it contains a lot of naturally occurring insecticides, primarily menthone. Irritable bowel syndrome, Crohn's disease, ulcerative colitis, ailments of the gallbladder and biliary tract, and complaints of the liver are among the problems that peppermint oil is used to treat[43].

Mentha piperita and *Lantana camara* were tested for their anthelmintic effectiveness against *Pheritima posthuma* using methanol extracts from their leaves, stems, and roots. Every extract underwent a bioassay at a concentration of 20 mg/ml, which included timing the worms' paralysis and eventual demise. For *M. piperita* and *L. camara*, the extracts were more sensitive to the worms in the following order: stems, leaves, and roots. Both plant extracts have considerable anthelmintic effects. Both *M. piperita* and *L. camara* stem extracts in methanol were discovered to be the most effective. Both as a control and a reference standard, respectively, the assay used pure water and albendazole (20 mg/ml) [44].

14. Gliricidia sepium

According to Stromberg et al., 2012 one of the main obstacles to animal health and performance, gastrointestinal nematodes (GIN) result in significant financial losses for the cattle business. Because of the worldwide rapid growth of anthelmintic resistance among herds, GIN control has recently become a serious issue according to Becerra-Nava *et al*., 2014. The GIN nematodes with the highest incidence in grazing cattle worldwide have been identified as Cooperia spp in Stromberg et al., 2012 studies.

A study conducted by Wood *et al*., 1998 A tropical forage legume called *Gliricidia sepium* is frequently employed in cow production facilities as a seasonal natural defense and food source. Earlier Kabore *et al*., 2012 in vitro assessments was done with *G. sepium* against GIN nematodes indicated anthelmintic activity, relating its bioactivity to the presence of tannins, flavonoids, terpenoids, and/or lectins. According to a 2016 study by VonSon-de Fernex *et al*., *G. sepium* crude extracts totally inhibited C. punctata eggs from hatching. But the absence of tannins and polyphenols as the primary bioactive components suggests that additional phytochemicals may possibly be implicated with the ovicidal effect[45].

The *Leucaena leucocephala*, *Gliricidia sepium*, and *Pithecellobium dulce* ethanolic extracts were examined for their anthelmintic activity (AA). At different doses such as 0.3, 0.6, 1.2, 2.5, 5.0, 10, 20, and 40 mg/mL, extractswere examined. At a dosage of 40 mg/mL the maximum average resistance was shown by *G. sepium*, which was 91.2%., surpassing *P. dulce* and *L. leucocephala*, according to the results of the larval exsheathment inhibition (LEI); 22.4, 41.7, and 43.3 mg/mL, respectively, were the matching IC50 values. The compounds associated to AA were identified using Orbitrap high resolution mass spectrometry and ultra-high performance liquid chromatography (UHPLC-Q/Orbitrap/MS/MS) analysis of the species extracts utilized in this work. *G. sepium, P. dulce, and L. leucocephala,* respectively, included glycosylated phenolic acids, amino acids, phenylpropanoids, anthraquinone glycosides, and methoxyphenols. All three species also included methoxyphenols and glycosylated flavonoids. Compared to other species, *G. sepium* demonstrated a greater range of potentially useful compounds in controlling gastrointestinal nematodes, which was related to the outcomes of the applied tests[46].

15. Tamarind indica linn

Incredible two billion people have parasitic worm infections, according to the World Health Organization. Moreover, Cattle and crops are infested by parasitic worms, which lower food production consequently having anegative impact on the economy. Despite the high occurrence of parasite illnesses, anthelmintic medication research is subpar. According to the WHO, and the studies conducted by Aswar Manoj *et al*., 2008 the treatment of human helminthes is typically limited to a few number of drugs. The management of specific parasite infestations may need the use of natural anthelmintics. Tropical Tamarindus Indica Linn (*Caesalpiniaceae*) plants can be found all throughout India. In the local medical system, it has been used to treat a number of ailments. The leaves of Tamarind Indica have been used medicinally to treat wounds, scabies, jaundice, fever, and jaundice (Anonymous, 1950). According to a review of the literature, there are no reports on the anthelmintic effects of Tamarindus indica Linn leaves. Therefore study performed to assess the crude juice of Tamarind Indica Linn. leaves *in vitro* anthelmintic efficacy against *Pheretima posthuma*[47].

In Bangladesh, a large number of people rely on sheep and goat husbandry, beef fattening, dairy farming, or both directly and indirectly for their living. For appropriate human growth and development, protein is absolutely necessary. This sector's meat and milk supply satisfies the protein requirement. Yet, given the socioeconomic circumstances of the nation, farmers' knowledge is severely limited as a result of the majority of them lacking the necessary training for contemporary livestock farming. Several bacterial, viral, fungal, and parasitic diseases can occasionally affect the livestock industry, which raises the mortality rate and reduces production efficiency. One of the main obstacles to Bangladesh's thriving dairy business is gastrointestinal (GI) parasite diseases. The majority of farmers utilise chemical anthelmintics to manage parasite illness, but farmers

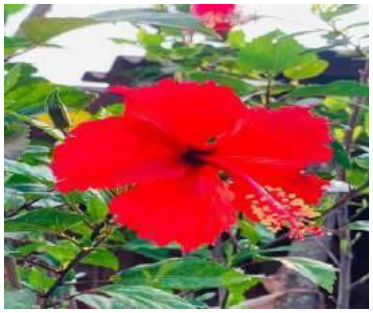
in the countryside of the nation cannot access these medications since they are sometimes pricey. Economic losses result from the use of chemical anthelmintics and the maintenance of withdrawal periods.
Also, the situation will get worse when helminths acquire resistance to different chemical anthelmintic substances when different types and dosages of anthelmintics are used. The use of anthelmintic herbs in cattle toprevent the condition is still of great scientific interest. Native to the Asian subcontinent, neem (*Azadirachta indica*) and tamarind (*Tamarindus indica*) have long been valued for their healing abilities[48].
Tamarindus indica, a tree in the Caesalpiniaceae family, is used in traditional medicine for stomach issues as well as analgesic, anti-inflammatory, diuretic, febrifuge, and anthelmintic properties[49]. Tropical Tamarindus Indica Linn (*Caesalpiniaceae*) plants can be found all over India. It has been used to cure a variety of illnessesin the native medical system[50].
Tamarindus indica L. (family: *Leguminosae*) is commonly utilized in Indian traditional medicine and other nations to address conditions like acne, blood disorders, diarrhoea, fever, and abdominal pain. Applying a leaf plaster can reduce localised pain[51].
Fruit shells are burned until they are converted to an alkaline ash that is used in pharmaceutical formulations. The tree's bark is regarded as a powerful febrifuge, stimulant, and astringent. It is used as a treatment for dyspepsia and colic after being fried with salt and ground to an ash. In instances of gingivitis, asthma, and eye inflammations, a decoction is used. Open wounds and caterpillar rashes are treated with lotions and poultices prepared from the bark. The roots are an ingredient in leprosy prescriptions and are thought to be beneficial for treating chest problems. Tamarind products are well known for their cooling effects on fevers, as well as their laxative and carminative properties[52].

16. *Allium cepa* (onion)

One of Kenya's main obstacles to livestock production is the prevalence of animal diseases, which has a significant effect on livelihoods due to associated economic losses that threaten the nation's food security. Because it can be difficult to control diseases with synthetic drugs, using medicinal plants as a treatment is a sensible option. *Ancylostoma caninum, Toxocara canis* and *Dipylidium caninum* are three canine helminths of zoonotic significance that are frequently discovered in the intestines of dogs and can infest humans in Kenya. This study's objective was to ascertain how well in-vivo canine gastrointestinal helminths might be treated by ethanol extracts from *A. cepa* bulbs.
Three sets of five puppies each were created from a total of 15 puppies of mixed sexes. The extract was given toGroup 1, the suggested amount of an approved anthelmintic was given to Group 2, and distilled water was given

to Group 3. The puppies received these single treatments when they were 8 to 10 weeks old and weighed an average of 2.2 kg. Each puppy had faeces collected on days 0 (the day before treatment), 1, 3, 5, 7, 10, and 14 after therapy to measure the number of eggs per gramme (EPG). By comparing the pre-treatment and post treatment EPG counts, the percentage faecal egg count decrease (%FECR), a measure of anthelmintic efficacy, was calculated. On days 0, 7, and 14, whole blood was drawn from each puppy to track variations in the haematological parameters. Then, two pups were chosen at random from each group and sacrificed so that they could be examined after death and have their intestinal contents collected for parasitology. For hookworms, the percentage faecal egg count decrease was 47%, while the reduction for ascarid worms was minimal. WBC showed a substantial drop seven days after therapy (P=0.035), whereas RBC and HGB showed significant increases 14 days later (P=0.04 and P=0.001, respectively). When examined between the treatment and control groups, the haematological parameters changed significantly (P 0.05) 7 days after therapy, WBC, RBC, HGB, and HCT; 14 days after therapy, MCHC. Following oral administration of the 6 mg/kg *A. cepa* ethanol extract, there were no indications of toxicity or behavioural alterations. The crude ethanol extract of *A. cepa's* anthelmintic qualities are what gave the treatment to pups a 47% success rate against hookworms. The haematological changes that happened after the extract was administered lend credence to this[53].

17. Hibiscus



Numerous problems are caused by various helminthes, which are a constant source of anxiety for both people and other animals. Since antiquity, several plants have been utilized to cure worm infestations due to their strong anthelmintic effects on these invasive worm species. The main goal of the research was to look into the various phytoconstituents & anthelmintic qualities of *Hibiscus tiliaceus's* wood and leaves. Petroleum ether, ethyl acetate, and methanol were used as solvents in a soxhlet apparatus to extract the powder from the wood, while petroleum ether, chloroform, ethyl acetate, and ethanol were used to extract the powder from the leaves. Reports of the extractive elements were made. To determine the type of phytoconstituents found in each extract,standard methods for phytochemical screening were used. Petroleum ether, ethyl acetate, and methanol were utilized as solvents for the extraction of the wood powder in a soxhlet device, as opposed to petroleum ether, chloroform, ethyl acetate, and ethanol. The extractive components were reported on. Standard techniques for phytochemical screening were employed to identify the types of phytoconstituents present in each sample[54].

Hibiscus tiliaceus and *Hibiscus mutabilis* are two species that exhibit amazing flower colour shift. The latest recent findings on their pharmacology, botany, and photochemistry, as well as their applications revised in this concise review. *H. tiliaceus* has chemical components such as Triterpenes, triterpenoids, coumarins, amides, phenolic acids, and anthocyanins are some examples of phytosterols. These chemical components have pharmacological effects such as antioxidants, antibacterial agents, tyrosinase inhibitors, cytotoxic agents, immunomodulators, anti-inflammatory agents, analgesics, anti-diabetic agents, hypolipidemic agents, and anti-

tumor agents. Anti-inflammatory, analgesic, and antidiabetic actions are shared by H. tiliaceus and H. mutabilis. A quick literature review revealed that these pharmacological characteristics are shared by at least five other *Hibiscus species*. The investigation covered the responsible extracts or compounds as well as their mechanisms of action[55].

The purpose of this investigation was to compare the anthelmintic properties of *Moringa oleifera (Lam.)* ethanolic and aqueous extracts and *Hibiscus Rosa-Sinensis Linn.* at various concentrations. *Pheritima posthuma*,an Indian earth worm, was used as the test subject for the test materials. Results were stated in terms of worm mortality and paralysis times. Distilled water served as the control group and albendazole served as thereference norm. Chemical assays were used to compare aqueous and ethanolic extracts. It demonstrated the existence of alkaloids, glycosides, polyphenols, and flavonoids. These phytoconstituents might be in charge of the aforementioned action[56].

18. Clove

In poultry, parasitic worms that live and grow in the gastrointestinal system are common. Among these worms, *Ascaridia galli* is the most prevalent variety (Fahrimal and Raflesia 2002). *Ascaridia galli* infection in poultry is extremely common, with a 92% prevalence (Offionga et al 2013). In area chickens, broilers, layers, and ducks, *Ascaridia galli* is present (Jayentakumar Singh and Mohilal 2017). To reduce the prevalence of ascaridiosis, numerous market anthelmintic medications are used (Mubarokah et al 2019)[57].

Sonalkar, M. Y *et al*,evaluated *Pheritima posthuma* test worms were used to assess the anthelmintic activity of an alcohol preparation of *Eugenia caryophyllus* and *Uncaria gambie*[58].

19. Pineapple

Many *Bromeliaceae* species are well-known for their medicinal properties, which include anthelmintic properties[59]. The skin of pineapple (*Ananas comosus (L.) Merr.*) may contain a natural anthelmintic agent. Hossain *et al.,* 2015 according to their study, one of the first plants to be used and researched for its anthelmintic action was the pineapple (*Ananas comosus*)[60]. Experiments have been carried out to assess the impacts of pineapple processing residue both *in vitro* and *in vivo*, pineapple stem bromelain, and the aqueous extract of pineapple skin (AEPS). The azocasein technique was used to assess the enzymatic activity of various substance[61].

20. Tobacco:

New anthelmintic agents are required due to the emergence of tolerance to the currently available anthelmintic medications. Alkaloid substances found in tobacco plants have an antiparasitic impact. We looked into the

aqueous and inebriated tobacco (*Nicotiana tabacum*) extract's *in vitro* anthelminthic activity against *M. marshalli*[62].

21. Betel

Since a few decades ago, scientists' interest in biologically active compounds has been sparked by the discovery of novel medicinal properties of different plant species. According to Prashant *et al*., 2008 the bioactive compounds have either minimal or no toxicity and powerful pharmacological activities. According to Jigna *et al*. in 2006, the resistance because of the widespread utilizing synthetic medications and the steadfast belief that natural therapies are preferable to drugs with dangerous side effects are the main causes of the rise in interest in herbal remedies. The *P. betel Linn*. (Betel leaf) also known as paan in Bangladesh, is a vine that belongs to the *Piperaceae* family, It has a wide geographic distribution in tropical also subtropical areas of the world Santhakumari *et al*., found that the leaves of P. betel have a variety of actions, including those that are antidiabetic, antiulcer, antiplatelet aggregation, antifertility, cardiotonic, anticancer, antimutagenic, and respiratory depressive. It is also employed as a stimulant, anthelmintic, carminative, stomachic, and aphrodisiac, according to Date *et al*,. (2012)[63].

The betel leaf, also known as 'Paan' or 'Nagvalli' (*Piperaceae* family), is an evergreen and permanent creeper. The significance of leaves has been explained in relation to every aspect of human life, including social, cultural, and religious, and is still very pertinent today. Many Asian nations have chewed betel with areca nut, slaked lime, cardamom, and clove since ancient times[64,65].

22. Wormwood

Wormwood has been effectively used in a variety of areas in recent years such as flavouring agents, plant dyes, insect repellents, and pharmaceuticals. Future applications for health care fabrics include continuous release wormwood oil encased microcapsules[66]. The herb's most potent components are volatile compounds and bitter substances[67,68].
The use of nutraceutical blends of dried traditional medicinal plants as an alternative to chemotherapeutics for preventing and treating haemorrhagic disease in ruminants[69]. In Egyptian folk medicine, Artemisia herba-alba is extensively used as a vermifuge. The early twentieth century (Mohamed *et al*., 2010). The sesquiterpene lactone,santonin, is responsible for Artemisia species' antihelmintic action. In addition to its other medical and veterinary uses, Egyptians have long used it as a vermifuge[70].

CONCLUSION:

Several plants and extracts are said to have anthelmintic properties. The present investigation is the initial one toprovide evidence of the extensive traditional usage of anthelmintic medicinal herbs. There are several drugs on the market right now. Around the world, 80% of the population relies on herbal treatments and plant extracts since they have fewer side effects and can be utilized to treat people's basic medical needs. This study is demonstrated to widespread the usage of anthelmintic medicinal plants in conventional medicine.

CONFLICT OF INTEREST:

The authors have no conflicts of interest regarding this investigation**.**

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