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Anthelmintic activity- a comprehensive review

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ABSTRACT:
The helminths that infect the intestine are cestodes, e.g., tapeworms [Tania solium], nematodes, roundworms [Ascaris lumbricoids], termatodes or flukes [Schistomamansoniand Schistosoma hematobolium]. Most of the screenings reported are in vitro studies using worm samples like the Indian worm Pheretimaposthuma, Ascaris lumibricoids, etc. Adult Indian earthworms, Pheretimaposthuma, have been used as test worms in most of the anthelmintic screenings as they show anatomical and physiological resemblance to the intestinal roundworm parasite of humans. Anthelmintics are the agents that expel worms from the body, either by killing [vermicides] or stunning [vermifuges]. Plant infusions, decoctions, powders and juices are mainly preferred for this activity. In this review, attempts have been made to learn about some plants that may be used in the treatment of helminthiasis. Journals searched electronically using research tools such as Gate.in, Google Scholar, Science Direct, academia, and Pub Med Journals were issued from 1986 to 2023. I searched in anthelmintic activity articles. Basically, these results shown, dose-dependent on the activity; Ficus benghalensis, Trigonella foenum and Trachyspermumammishown more activity. Bridelia micrantha and Anogeisussleiocarpusboth plantsshownless activity. Tamarindus indica and Ziziphus nummulariaboth plantsshownvery less anthelmintic activity. And mostly Cassia species having more anthelmintic property. In this study, we reviewed the research work and found promising results given by various extracts obtained from various parts of medicinal plants.

Keywords: Anthelmintic activity, medicinal plants, worms, animals.

I. INTRODUCTION:

People living in poverty in developing countries often suffer from helminth infections. The most possible reasons are poor sanitation, ignorance of hygiene, and malnutrition. The infection is common in humans as well as in livestock, which affects a large population of the world and contributes to undernutrition, Anaemia, eosinophilia, pneumonia, etc. [1] Helminth eggs usually lodge in the intestine, hatch, grow, and multiply. They can sometimes infest other body sites. Worldwide, helminth diseases or contamination impact a large number of populations, particularly in rising nations, with about 819 million individuals around the world infected by ascaris, 438 million by hookworm and 464 million by trichuris. [2]

The economic impact of parasitic gastroenteritis [PGE], which is caused by mixed infection with several species of stomach and intestinal round worms, as a production disease in ruminants lies not only in direct losses such as mortality associated with the clinical form of the disease but also in indirect, insidious losses as a result of weakness, loss of appetite, decreased feed efficiency, reduced weight gain, and decreased productivity. [3]

Although the majority of infections due to worms are generally limited to tropical countries, they can occur to travelers who are in those areas, and some of them can develop in temperate climates. [4] The helminths that infect the intestine are cestodes, e.g., tapeworms [Tania solium]. Nematodes, roundworms [Ascaris lumbricoids], termatodes, or flukes [Schistomamansoni and Schistosoma hematobolium] Most of the screenings reported are in vitro studies using worm samples like the Indian worm Pheretimaposthuma, Ascaris lumibricoids, etc. Adult Indian earthworms, Pheretimaposthuma, have been used as test worms in most of the anthelmintic screenings as they show anatomical and physiological resemblance to the intestinal roundworm parasite of humans. Because of their easy availability, earthworms and

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Asacaridia galli worms are used as suitable models for the screening of anthelmintic drugs. [5]

Anthelmintics are the agents that expel worms from the body, either by killing [vermicides] or stunning [vermifuges]. But the emergence of resistance to anthelmintic drugs is now a worldwide common fact, which is the foremost problem in helminthiasis treatment. Plant infusions, decoctions, powders, and juices are mainly preferred to anti-6. In this review, attempts have been made to learn about some plants that may be used in the treatment of helminthiasis. [6] Various plants like Ficus benghalensis, Jasminum mesnyi, Trigonella foenum, Trachyspermumammi, Tamarindus indica, Ziziphus nummularia, Artemisia absinthium, Bridelia micrantha, and Anogeissusleiocarpus

II. METHODOLOGY:

Electronic journal searches were conducted using research Gate.in, Google Scholar, Science Direct, Academia, and Pub Med. Journals are issued from 1986 to 2023 in this period of journals. I'm searching for anthelmintic activity in plants. The scientific names of some plants with anthelmintic properties were the search terms used in the query. This article demonstrating the preclinical proof of plants anthelmintic activity has to be included in the journals. I'm mentioning the part using worms and extraction methods as well as the type of evaluation being done for anthelmintic activity plants. This study is included in a comprehensive review method.

1. Literature search databases: Science Direct, Google Scholar, PubMed, Research Gate, and Academia
2. Period: 1986 to 2023.
3. Key words: anthelmintic activity, worms, medicinal plants.
4. Studies included in this comprehensive review

Ficus benghalensis:

Ficus benghalensis is also known as the banyan tree, Vata tree, or vada tree in Ayurveda. Ficus benghalensis belongs to the family Moraceae (mulberry)[7]. Ficus benghalensis is a tree of Indian origin. Various extracts of Ficus benghalensis were screened for their antiallergic and antistress potential in asthma by milk-induced leucocytosis and milk-induced eosinophilia, respectively[8]. Other species of Ficus, viz. Ficus inspida[9], Ficus carica, and Ficus religiosa[10], were found to be reported to have anthelmintic activity. This attempt has been made to evaluate the anthelmintic potency of Ficus benghalensis. A coarse powder of the root is prepared in aqueous extract by the decoction method. The methanolic, chloroform, and petroleum extracts of the root of Ficus benghalensis were prepared by Soxhletion. Indian adult earthworms (Pheretimaposthuma) were used to study anthelmintic activity. Albendazole acts as a standard drug for comparison with root extraction. Preliminary phytochemical analysis showed the presence of leucocyanidin, carbohydrates, flavonoids, amino acids, steroids, saponins, and tannins as phytoconstituents in the extract of Ficus benghalensis. The aqueous extract of the roots of Ficus benghalensis at normal concentration showed high anthelmintic activity, alcohol showed low anthelmintic activity, and high-polar solvents like petroleum showed good anthelmintic activity. Albendazole has high anthelmintic activity. The aqueous extract of Ficus benghalensis at a concentration of 20 mg/mL shows paralysis at 3.44 min and death at 4.34 min, whereas the methanolic extract shows paralysis at 3.02 min and death at 4.36 min. These two extracts show good anthelmintic activity compared to other extracts. Chloroform at 20 mg/mL causes paralysis at 3.71 min and death at 4.91 min, and petroleum ether at 20 mg/mL causes paralysis at 4.03 min and death at 6.18 min. The standard drug albendazole shows paralysis at 2.68 minutes and death after 5.29 minutes[11].

Jasminum mesnyi:

Jasminum mesnyi is commonly known as primrose jasmine or Japanese jasmine. Jasminummesnyi belongs to the family Oleaceae. It is also known as Peelichameli in the villages of Himachal[12]. The plant is reported to possess antioxidant activity[13], antiulcer activity[14], and wound healing activity[15]. Jasminum mesnyicontains a variety of phytoconstituents like ceryl alcohol, -sitisterol, -amyrin, mannitol, ursolic acid, jasminin, quercetin, rutin, bitter glycosides like jasminin, secoiridoid glycosides like jasmoside, jasmesoside acid, jasmosidic acid, and caffiec glycoside esters like poliumoside, forythoside B, and verbascoside[16]. Extracts of leaves in powder were prepared from petroleum ether and methanol by the hot extraction method. Adult earth-warming Eisenia foetida (red worm) were used for the evaluation of in vitro anthelmintic activity. The dose of extract and fractions were prepared in 1% carboxymethylcellulose (CMC). 1% CMC was taken as the control group and albendazole as the

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standard drug. The statistical significance between groups was analyzed using a one-way ANOVA followed by Dunette's test. Jasminum mesnyi, as well as its ethyl acetate, n-butanol, and chloroform fractions, possessed potent anthelmintic activity and were comparable with the standard drug Albendazole. Jasminummesnyi extract has a normal concentration of 40 mg/mL. The hydroalcoholic extract of Jasminum mesnyi at 200 mg/mL shows the time of paralysis at 27.7±1.65 min and death at 35.6± 1.76 min; the chloroform fraction extract at 40 mg/ml causes paralysis at 63.5±1.16 min and death at 89.6± 2.65 min. The ethyl acetate extract at 40 mg/ml shows paralysis at 13.5±0.46 min and death at 21.4±0.67 min; the n-butanol fraction at 40 mg/mL causes paralysis at 18.2±0.12 min and death at 20.1±0.29 min. The standard drug (albendazole), shown at 20 mg/mL, caused paralysis at 11.3±0.32 and death at 19.8±0.65 minutes[17].

Trigonella foenum:

Trigonella foenum is popularly known as fenugreek. Trigonella foenum belongs to the family Leguminosae. It is native to the area from the eastern Mediterranean to central Asia and Ethiopia and is much cultivated in India and China[18]. Plant seeds and leaves are used not only as food but also as an ingredient in traditional medicine[19]. It has been mentioned in Ayurveda and Siddha that these plants are used to treat fever, dysentery, and heart diseases, while in the Unani system, they are used as an aphrodisiac, diuretic, emmenagogue, and tonic[20]. The seeds have been reported to contain diosgenin, trigonelline, gitogenin, vicenin I and II vitexin, quercetin, luteolin, kaempferol, sitosterol, etc., and the endosperm of the seeds is rich in galatomannam. Therefore, an attempt has been made to evaluate the anthelmintic activity of seeds on adult earthworms, Pheritima posthuma[21]. Trigonella foenum seed extract was using alcohol and aqueous solutions as solvents. The solutions of alcoholic extract, aqueous extract, and albendazole were made in concentrations of 20, 40, and 60 mg/mL in normal saline as vehicle[22]. Alcohol and aqueous solutions were used to evaluate anthelmintic activity and showed dose-dependent activity. Alcoholic extraction at a concentration of 60 mg/mL has taken less time to cause paralysis and little more time to cause the death of earthworms as compared with the same concentration of the reference drug. The present study reveals that seeds of Trigonella foenum show marked and potent anthelmintic activity. Alcohol extract has shown promising results in anthelmintic activity, and water extract has shown activity to a lesser extent. The aqueous extract shown at 60 mg/ml concentration causes paralysis at 1.96 ±0.62 minutes and death at 6.85± 0.14 minutes; the alcoholic extract shown at 60 mg/ml causes paralysis at 1.05± 0.67 minutes and 3.67 ±0.15 minutes; and the standard drug albendazole shown at 60 mg/ml causes paralysis at 1.18± 0.32 minutes and death at 3.20±0.95 minutes[23].

Trachyspermumammi:

Ajwain is another name for Trachyspermumammi. Trachyspermumammi is a small, egg-shaped seed-like fruit that belongs to the family Umbelliferae or Apiaceae. Ajwain originated in Egypt but is now primarily grown and used in South Indian countries. Pakistan, India, and Saudi Arabia are the leading users of Ajwain[24]. Trachyspermumammi contains p-cymene, carvacrol, thujene, terpinene 4-ol, thymol, glycosides, saponins, and carbohydrates. The seed of Ajwain is biting and pungent, and it acts as an asthmatic, antibacterial, antifungal, and anthelmintic, hypocholestrolemic, bronchodilator, and antioxidant, as well as carminative, laxative, and stomachic[25]. Seeds of Trachyspermumammi extract are prepared in two methods: the maceration method and the soxhlation method[26]. The standard drug, albendazole suspension[27]. Alcoholic extract and aqueous extract from the seed of Trachyspermumammi were investigated for their anthelmintic activity against Pheretimaposthuma. The alcoholic extract of Trachyspermumammi exhibited anthelmintic activity in a dose-dependent manner, giving the shortest time to paralysis and death. The aqueous extract of seeds of Trachyspermumammi at higher concentrations showed good anthelmintic activity, and the alcoholic extract of Trachyspermumammi at normal concentrations showed good anthelmintic activity. This is compared with the effect produced by the reference standard drug albendazole. The alcoholic extract ofTrachyspermumammi has a 40 mg/mL concentration, resulting in a paralysis time of 35.63±1.22mins and a death time of 52.42±0.68mins. The aqueous extract's 40 mg/mL concentration is caused by the paralysis time of 34.18 ±1.25mins and the death time of 48.21±1.86mins. The standard drug (albendazole) concentration of 40 mg/mL is caused by paralysis time at 40.99±1.41mins and death time at 49.00±1.93mins[28].

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Tamarindus indica:

Tamarindus indica is commonly known as tamarind. The tamarind is a tree belonging to the family Caesalpiniaceae. Different parts are used in traditional medicine as analgesics, anti-inflammatory agents, diuretics, febrifuges, anthelmintics, antifungals, and in gastrointestinal problems[29]. Tamarindus indica contains the phytoconstituents -amyrin, comp sterol, -sitosterol, and 7-hydrocarbons. Tamarind is native to tropical Africa and India. Tamarindus indica bark extract was using aqueous and alcoholic solvents. Pheretimaphosthuma earthworm is used for treating anthelmintic activity. The time of paralysis and the time of death were studied, and the activity was compared with piperazine citrate as a reference standard[30]. The alcohol and aqueous extracts of the bark of Tamarindus indica exhibited significant anthelmintic activity, as evidenced by decreasing paralyzing time and death time. The wormicidal activity of the aqueous and alcohol extracts against earthworms suggests that they are effective against parasitic infections in humans[31]. The alcohol extract of the bark of Tamarindus indica caused paralysis at 22.33 minutes and death at 45 minutes for Pheretimaphosthuma. And 14.66 minutes as paralysis time and 20.66 minutes as death time. The fraction of treatment of the earthworm Pheretimaphosthuma worm with aqueous extract resulted in a paralysis time of 58.33 mins and 23 mins, respectively, while the time of death was 87.66 and 26 mins, respectively. The reference drug piperazine citrate showed a time of paralysis and a time of death of 25 and 64 mins, respectively[32].

Ziziphus nummularia:

Ziziphus nummularia is also known as jhahrberi or wild jujube. Ziziphus bark belongs to the Pakistan subcontinent, and its bark is known to have antibacterial and analgesic activity for diarrhea, indigestion, inflammation of the gums, and tonic. Ziziphus nummularia is native to the Thar Desert of western India and southeastern Pakistan, Iran, Afghanistan, and Zimbabwe[33]. Phytochemical reports on Ziziphus species revealed the presence of polysaccharides, a pectin composed of D-galacturonic acid, L-rhamnose, D-galactose, and L-arabinose; D-galacturonic acid as a methyl ester; and O-acetyl groups; cyclopeptides; peptide alkaloids; flavonoids; Ziziphine N, O, P, and Q; saponins and fatty acids; and triterpenoids[34]. This attempt was Heamonchuscontortus of sheep tedtreated,he reference drug is levamisole. The in vitro anthelmintic activity of the plant was assessed separately through the egg hatch test (EHT), the larval development assay (LDA), and the adult motility assay (AMA). Adult motility assays were collected on mature live Haemonchuscontortus of sheep, adult male worms were collected from the abomasums of freshly slaughtered sheep in the local abattoir. The worms were washed and suspended in phosphate buffered saline (PBS). The c de powder of the of bark of Ziziphus nummularia is prepared withethanol extract. IIn vitro anthelmintic activity of the the crude methanolic extract of the plant was determined against Haemonchuscontortus. The plant exhibidose-dose-and-time-dependent anthelmintic effectcausing theusing the mortalityof worms and inhibiting egg hatching and larval development. fecalmfecal egg count reduction (84.7%) was treatment in sheep treated with Ziziphus nummularia crude methanolic extract/kg)35.5[35].

Artemesia absinthium:

Artemesia absinthium is commonly called wormwood and is locally known as Tethwen in the Kashmir Valley, India. Artemisia absinthium belongs to the family Compositae (Asteraceae). Artemisia species are native to north Africa and temperate regions of Eurasia and widely naturalized in Canada and the northern United States. It is used in indigenous systems of medicine as a vermifuge, an insecticide, in the treatment of chronic fevers and for inflammation of the liver, as an antispasmodic, and as an antiseptic. Its essential oil has antimicrobial and antifungal activity. Chemical analysis of A. absinthium has shown that its volatile oils are rich in thujone (α and β), -terpinene, 1,4-tterpinol, myrcene, guaiazulene, camphor, organic acids, resins, tannins, and lactones[36]. Artemesia absinthium has been used as an antipyretic, antiseptic, tonic, diuretic, and for the treatment of stomach aches[37]. Artemesia absinthium powder extract is prepared by using ethanol and aqueous extracts. This study was to evaluate the anthelmintic efficacy of crude aqueous extracts and crude ethanolic extracts of the aerial parts of Artemisia absinthium in comparison to albendazole against the gastrointestinal nematodes of sheep. In the evaluation of the anthelmintic activity of the crude aqueous extract and crude ethanolic extract under in vitro conditions against adult Haemonchuscontortus, the worm motility inhibition assay was adopted. Both extract types tested caused a significant level of death in Haemonchus contortus[39]. Crude ethanolic extract

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exhibited greater and quicker anthelmintic activity than crude aqueous extract at the same concentration in terms of mortality and paralysis of worms. The crude aqueous extract of A. absinthium resulted in mean inhibition (%WMI-percent worm motility inhibition) of 73.6, while the crude ethanolic extract resulted in a mean %WMI of 94.7 when worms were observed after 30 minutes of exposure to Luke worm after treatments. The mean mortality index (MI) of CAE was 0.75, while for CEE, the mortality index was 0.95[38].

Bridelia micrantha:

Bridelia micrantha is commonly known as mitzeerie or coastal golden leaf. Brideliamicrantha is a small to medium-sized tree belonging to the family Phyllanthaceae or Euphorbiaceae. Bridelia micrantha is widespread in Africa, especially in tropical Africa and Ghana[40]. Bridelia species have been utilized in traditional medicine, mostly as an antidote, a cathartic, or a purgative, to treat various ailments such as eye infections, constipation, the common cold, gastritis, and are also used as a mouthwash. The treatment of wounds, aphrodisiacs, and purgatives is mostly by the bark; it is the cure for headache, stomach ache, diarrhea, sore joints, and fever[41]. The decoction of leaf and root is applied as an antiparasitic in other African countries to treat trypanosomiasis[42]. These plants contain some phytoconstituents like diosgenin, essential oil, saponins, terpenoids, esters, cyanogenic glycosides, phenolic compounds, alkaloids, tannins, flavonoids, anthraquinones, sterols, oxalates, carbohydrates, minerals, and anthocyanidins, which have all been determined to be present in Bridelia micrantha. Bridelia micrantha has been found to contain an extensive range of typical nutrients that include proteins and various alcohols, especially hexahydroxy alcohol. In terms of chemical constituents, the plant has been found to contain cobalt, magnesium, potassium, calcium, lead, phosphorus, manganese,chromium, iron, sodium, and copper[43]. This study was aimed at determining the anthelmintic properties of a methanol extract of Bridelia micrantha (hochst) Baill leaves. Bridelia micrantha leaf extract is prepared by using methanol. BME (Bridelia micrantha extract) has anthelmintic activity against Lumbricusterrestris. The anthelmintic activity of the methanol extract of Bridelia leaves was good, but it recorded a very high paralysis and death time at a concentration of 0.125, 0.25, 0.5, and 1 mg/mL at a 400-minute exposure time. When extract concentrations were 4,8,16, and 32 mg/mL. In the presence of 0.125 mg/mL of the extract reference anthelmintic (albendazole), it showed potentiated activity against the test organism. The presence of 0.25 mg/mL of the extract of the reference anthelmintic (Mebendazole) also showed potentiated activity against the test organism. In the presence of 0.125 and 0.25 mg/mL of the extract, the reference anthelmintic (praziquantel) showed similar results[44].

Anogeissusleiocarpus:

Anogeissusleiocarpusis commonly known as African birch or Bambara. Anogeissusleiocarpusbelongs to the family Combretaceae. Leiocarpus is a tall deciduous tree native to the savannas of tropical Africa. Anogeissusleiocarpus is reported to contain phenolic compounds like gallic acid, ellagic acid, saponins, tannins, resins, alkaloids, carbohydrates, and proteins. It is used in traditional medicines in Africa to cure various diseases. A.leiocarpus is antibacterial, antifungal, antiplasmodial, anthelmintic, trypanocidal, hepatoprotective, antihyperlipidemic, antioxidant, and leishmanicidal[45]. The safety and anthelmintic activity of crude aqueous leaf extract of Anogeissusleiocarpus were investigated in sheep naturally infected with gastrointestinal nematodiasis using the fecal egg count reduction test and the controlled test. Anogeissusleiocarpus leaf extract is prepared by aqueous extraction. The study was conducted on thirty sheep of both sexes of the Ouda breed, weighing 15–39 kg and ranging in age from 6 months to 3 years. The animals were divided into 6 groups of 5 animals each, placed on a semi-intensive system of management, and screened for helmintic infection. Animals in groups 1, 2, and 3 were given single graded doses (100, 200, and 400 mg/kg) of the extract orally, while those in groups 4 and 5 were given 10 mg/kg of albendazole and 0.5 ml/kg of physiological saline through the same route. This aqueous leaf extract does not produce signs of toxicity (salivation, diarrhea, or skin reactions)[46]. The extract produced a dose-dependent reduction in the fecal egg counts of the treated groups. Treatment with 200 and 400 mg/kg produced 15.2 and 20.5% reductions in egg count, respectively, while consecutive administration of 400 mg/kg for 3 days produced 39.5% when compared to the untreated control. The group treated with 10 mg/kg of single-dose albendazole showed a 98.4% reduction in FECR[47]. Consecutive administration of the highest dose of

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the extract, 400 mg/kg, produced only 40% FECR, while graded single doses were either not effective or did not produce a substantial effect against strongylid worms. The overall efficacy of the controlled test was 33% for the 400 mg/kg treated group after 3 days of consecutive treatment. This is an indication that the extract is either not sufficiently active against adult parasites or that the dose was inadequate. This study has shown that the aqueous crude leaf extract of Anogeissusleiocarous could be tolerated by sheep and produced limited dose-dependent anthelmintic activity[48].

III. CONCLUSION:

In conclusion, this review mainly focused on anthelmintic activity, which is exerted by the various easily available and effective phytoconstituent samples. In this study, we reviewed the research work and found promising results given by the samples (especially in the extracts obtained from leaves). Adult Indian earthworms, Pheretimaposthuma, have been used as test worms in most of the anthelmintic screenings as they show anatomical and physiological resemblance to the intestinal roundworm parasite in humans. Which is taken as a base for various research efforts to overcome the emerging resistance shown by conventional anthelmintic drugs.

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