Anthelmintic herbs: An update knowledge

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ABSTRACT

Phytochemicals have played a vital role in the treatment of diseases in past and will continue to do so in the future. Synthetic drugs are also produce same results but the side effects are more. The use of herbs for its pharmacological activity had been started in ancient times. Medicinal plants which are used in the traditional system of medicine must be scientifically tested inorder to bring its active principle that is used for phytomedicine. Wide variety of medicinal herbs possess potent anthelmintic activity. The present review summarizes the important medicinal herbs which had been used for anthelmintic activity. Further investigations are needed for the isolation of active constituent which is responsible for the anthelmintic activity.

KEY WORDS: Phytomedicine, medicinal plants, anthelmintic activity, phytochemicals

INTRODUCTION

Helminth word is derived from the Greek “meaning worm”. Helminths are referred to various types of parasitic worms that reside in the body (Bhatia).

Classification (Derek Wakelin.)

The helminths include the flatworms (flukes and tapeworms) which are covered by the plasma membrane and the Nematoda or roundworms, these are covered by tough cuticle.

Flukes (Trematodes)

These are covered by plasma membrane, these are bisexual. The life-cycle includes a snail intermediate host.

Tapeworms (Cestodes)

Adult tapeworms are elongated, segmented, hermaphroditic flatworms that inhabit the intestinal lumen. These are covered by tough cuticle.

Roundworms (Nematodes)

Adult and larval roundworms are bisexual, cylindrical worms. They inhabit intestinal and extraintestinal sites. These are covered by tough cuticle.

Screening of anthelmintic activity

The worms used in the invitro assay are (RG Mali et al., Tandon V, et al., Sambit Parida et al.)

- Phereithma posthuma
- Ascardia galli
- Ascaris lumbricoids
- Raillietina spiralis

According to WHO, Helminth infections are among the most common infections in man, affecting a large proportion of the world’s population (Rajesh R et al.). The parasites can be acquired by contact with a) infected water b) infected meal c) infected animal. (Manoj Salhan et al). Gastro intestinal Helminthes are resistant to currently available drugs So the discovery and development of new chemical substances for helmint control is greatly needed and has promoted studies of traditionally used anthelmintic plants, which are generally considered to be very important sources of bioactive substances (Jitendra Patel et al.).

In present review, a variety of screening procedures made by researchers to explore the potent anthelmintic active molecules. An attempt is made to provide a direction for further research in finding new molecules with possible mechanisms.

Antigonon leptopus

Family: Polygonaceae

Major Constituents: 2-anthocyanins, Pelargonin, Malvin quercetin, rhamnetin and quercetin-3-ß-D-glucopyranoside. The ethyl acetate and methanol extracts of Antigonon leptopus has showed significant paralysis in doses (10, 20, 40 & 80mg/ml) and also caused death of worms at higher concentration of 80mg/ml as compared to standard drug piperazine citrate. The Methanolic extract of Antigonon leptopus had showed potent anthelmintic activity in comparision with ethyl acetate fraction (p<0.001) (N. Jaya raju et al.).

Mussaenda erythrophylla

Family: Rubiaceae

Major Constituents: mussaendosides A-C, M and N with cyclolanostene type aglycone and aureusidin, iridoid glycosides. Ethyl acetate and methanolic extracts of A. leptopus roots & rhizomes and the ethyl acetate and methanolic extracts from roots of M. erythrophylla showed concentration dependent anthelmintic activity against earthworms. The ethyl acetate and methanol extracts of Mussaenda erythrophylla significantly exhibited paralysis in doses (10, 20, 40 & 80mg/ml) and also caused death of worms especially at higher concentration of 80mg/ml as compared to standard drug (piperaquine hydrate). Ethyl acetate extract of Mussaenda erythrophylla had showed more potent than the methanol extract. (N. Jaya raju et al.)

Acalypha indica

Family: Euphorbiaceae

Traditional Uses: Expectorant against asthma and pneumonia and also as an emetic, emenagogue and anthelmintic. Acalypha indica having the chief constituents as acalypheine, cyanogenic glycosides, inositol methyl ether, resin, triacetamin and volatile oils. The alcoholic extract of Acalypha indica...
root exhibit anthelmintic activity dose dependent manner and at the dose of
50mg/ml caused paralysis in 20min and death in 30 min against Pheretima
posthuma , which shows potent anthelmintic activity in comparison with
standard Albendazole (10 mg/ml)( B.chengaihal et al.) .

*Alocasia indica*
Family: *Araeacee*
Traditional Uses: Rheumatic arthritis, inflammation, diseases of spleen and
abdomen. Different fractions (Petroleum benzene, ethyl acetate, hydroalcohol)
of alocasia indica containing 10, 25 and 50 mg/ml, produced dose-dependent
paralysis ranging from loss of motility to loss of response to external stimuli,
which eventually progressed to death. hydroalcoholic extract exhibited an-
thelmintic activity in shortest time of paralysis (P) and death (D) with 50
mg/ml concentration in comparison with piperazine citrate as standard at
concentration of 10mg/ml(Wahid A Mullah et al.)

*Amaranthus viridis*
Family: *Amaranthaceae*
Traditional Uses: Vermifuge, antiinflammatory of the urinary tract and in
venereal diseases antipyretic, diuretic, antirheumatic, antitumor, analgesic,
antiemetic; laxative, improves appetite, antileptopric, respiratory problems,
eye treatment and for asthma. Methanol extract of A. viridis showed dose
dependent paralysis ranging from loss of motility to loss of response to
external stimuli, which eventually progressed to death . At the dose of 60, 80
and 100 mg/ml concentration shows paralysis at 14.33, 10.2 and 7.8 min and
death at 26.6, 18.6 and 12.75 min respectively in compared with standard
drug piperazine citrate at 10mg/ml concentration. The possible mechanism
of anthelmintic activity is due to presence of polyphenolic compounds(Ashok
Kumar et al.,)

*Annona sqamosa*
Family : *Annonaceae*
Traditional Uses: clarification of urine , diarrhea, abortifacient, insecticidal
and in destroying lice in hairs. The plant consist of It contains annoine,
moupinamide, sachanonic acids, alkaloids, s quamocin, reticulin and s quamocin
as a chief constituents. The methanolic extract had showed potent anthelm-
intic activity at higher concentrations in comparision with albendazole ,
standard drug on esenia fetida.The possible anthelmintic activity is may be
due to presence of alkaloids,phenolic compounds and tannins(Swati B Pokale
et al.,)

*Anogeissus leiocarpus*
Family: *Combretaceae*
Traditional Uses: cancer, stem bark is bitter tonic, astringent, polyuria,
aunaemia, piles, leprosy, snake bite, scorpion sting. Ethanic extract had
potent anthelmintic activity which shown in dose dependent manner on
earthworm Pheritima posthuma. At the dose 60mg/ml it shows potent activ-
ity. The different concentration of alcololic extract had showed paralysis
and death of in comparision with albendazole as reference drug(Hemamalini
K et al.,)

*Caesalpinia pulcherrima*
Family : *Caesalpiniaceae*
Traditional Uses: pyrexia, menoxenia, wheeling, bronchitis and malarial
infection. The aqueous, ethanolic and Pet. ether extract of flowers was tested
for the anthelmintic activity in comprd with albendazole standard drug using
perthimia posthuma earth worms .In anova one-way ANOVA, all extracts
data data was found to be statistically significant at 5 % level of significant
(p<0.05)( Dhaked P.S et al).

*Clitoria ternatea*
Family: *Fabaceae*
Traditional Uses: Brain tonic ,promote memory and intelligence and anhel-
mintic. The anthelmintic activity of Aqueous and ethanolic extracts of leaves
of Clitoria ternatea using Eisenia foetida worms at three different concentra-
tions (100, 50, 25 mg/ml) was carried away. At the concentration of 100 mg/ 
ml both the ethanolic and the aqueous extracts showed very significant ac-
tivities as compared to the standard drug levamisole (0.55 mg/ml). In case of
aqueous extract the time of paralysis and death time was observed as 18 ±
1.57 and 53.33 ± 0.33 and in case of ethanolic extract 12.33 ± 0.80 and 32.33
± 0.71 respectively. Phytochemical study suggest that leaves contains
alkaloids and tannins which are responsible for anthelmintic activity(Manoj
Salhan et al.,)

*Eclipta prostrata*
Family:*Asteraceae*
Traditional Uses:lipidemia and atherosclerosis. Ethanolic and aqueous ex-
tracts of Eclipta Prostrata exhibited anthelmintic activity in dose-dependent
manner , which had given shortest time of paralysis and death with 100 mg/ 
ml concentration. The ethanolic extract caused paralysis from 2.502 ±0.19min
and time of death at 8.658 ±0.36 min., while aqueous extract revealed paralysis
of 14.40±0.63min and time of death of 24.81±1.73 min against the
earthworm Pheretima posthuma in comparison with standard drug
Albendazole at 25 mg/ml concentration showed paralysis (P) and death (D)
the same at 9.36 ± 0.05and 14.02 ± 0.57 minutes, respectively(Somnath d
bhinge et al.,)

*Eupatorium odoratum*
Family:*Asteraceae*
Traditional Uses:Dengue fever, arthritis, certain infectious diseases, mi-
graine, intestinal worms, malaria, and diarrhea. The whole plant extract was
 carried out by the successive soxhlet extraction by various solvent such as
petroleum ether, chloroform, ethanol and hydroalcohol. Three concentra-
tions (10, 50 and 100 mg/ml) was carried away. At the concentration of 100 mg/
ml the ethanolic and the aqueous extracts showed very significant ac-
tivity. Among all extracts ethanolic extract exhibited significant anhel-
mintic activity at highest concentration of 100 mg/ml in comparision
with Piperazine citrate in 10 mg/ml concentration as standard and 1% Gum
acacia in normal saline as control. The potency of anthelmintic activity of
ethanolic extract was significant followed by hydroalcoholic extract of Eupa-
torium Odoratum against Pheretima posthuma(Jitendra Patel et al.,)

*Fenugreek seeds*
Family:*Leguminaceae*
Traditional Uses: aphrodisiac, diuretic, emmenegagogue and tonic
Ethanolic and aqueous extracts of the fenugreek seeds had showed anhel-
mintic activity in dose dependant manner . The different concentrations of
both aqueous and alcoholic extracts had posses anthelmintic activity in
comparision withstandard drug, albendazole . Alcoholic extract in the
concentration of 60 mg/ml had showed potent anthelmintic activity on perthimia
posthuma (Chandrashekar D et al.,)

*Manihot esculenta*
Family: *Euphorbiaceae*
Traditional Uses: Rheumatism, fever, headache, diarrhea, and loss of appe-
tite. The leaves of the Manihot esculenta observed for anthelmintic activity
on perthimia posthuma. methanicol extract at concentration of 50mg/ml
shows more potent than petroleum ether, ethyl acetate and water extracts
even though chloroform and ethyl acetate extracts were not accomplished
with anthelmintic property when compared with control and standard group
,Albendazole. The activity of different extracts is in dose dependent
manner(Jayasri p et al)
Mentha piperita
Traditional Uses: Antispasmodic, aromatic, antiseptic and also in the treatment of cancers, colds, cramps, indigestion, nausea, sore throat and toothaches. Peppermint is a hybrid mint, a cross between the water mint (Mentha aquatica) and spearmint (Mentha spicata). Chloroform and acetone extracts of the plant Mentha Piperita was investigated for their anthelmintic activity against Pheretima posthuma using standard as Albendazole. chloroform extract of M. piperita showed the best anthelmintic activity when compared with acetone extract(Nikesh M. et al.)

**POLYHERBAL PREPARATION**

**FORMULATION**
Theespesia populnea (bark), Terminalia alata (bark), Clematis triloba (roots) Ceratophyllum demersum (leaves) The polyherbal preparation of aqueous and ethanol extracts showed significant anthelmintic activity. The ethanolic extract showed marked and potent anthelmintic activity, than the aqueous extract in compare with standard drug piperazine citrate on adult earth worms(Dwivedi A et al.)

**Praecitrullus fistulosus**
Family: Cucurbitaceae
Petroleum ether and methanol extract of Praecitrullus fistulosus not only produced paralysis but also cause death of all species of worms compared with standard drug Albendazole. Pet-ether extract showed better anthelmintic activity in comparison to the methanolic extract. The predominant effect of Albendazole on the worm is to cause a flaccid paralysis that result in expulsion of the worm by peristalsis. Albendazole, by increasing chloride ion conductance of worm muscle membrane, produces hyperpolarisation and reduced excitability that leads to muscle relaxation and flaccid paralysis. Phytochemical screening of crude extract of Praecitrullus fistulosus revealed presence of tannins, which are polyphenolic compounds, which showed potent anthelmintic activity(Sweta Gautam et al.).

**Pterocarpus marsupium**
Family: Fabaceae
Traditional Uses: astringent, anti-inflammatory, anthelmintic, leprosy, skin diseases, diabetes, diarrhoea, asthma, bronchitis

Ethanolic extract of Pterocarpus marsupium (EEPM) was investigated for an in-vitro anthelmintic activity at various concentrations (5, 10 and 25 mg/ml) using earthworms Pheretima posthuma using Albendazole (20 mg/ml) as a standard drug, whereas, distilled water used as a control. At the concentration of 25 mg/ml, Ethanolic extract of Pterocarpus marsupium showed significant anthelmintic activity. It showed paralysis at 50.40 ±2.69 min and death at 58.60 ± 2.83 min in coparision with Albendazole, which shows paralysis at 72.40 ± 4.16 min and death at 80.60 ± 2.54 min(Dilpesh Jain et al.).

**Punica granatum**
Family: Punicaceae
Traditional Uses: antibacterial, anti-diabetic, anti-diarrheal, inflammation

The methanolic extracts of Punica granatum Bark and Seed showed anthelmintic activity in dose dependent manner and shortest time of paralysis and death was found at the dose of 100mg/ml. As compared to seed, Bark exhibited more potent activity at all concentrations. The standard drug Piperazine Citrate showed predominant effect at dose of 10mg/ml on the earth worm and cause paralysis. However, at the dose of 100mg/ml of bark extract showed paralysis as well as death of worms comparable to reference drug Piperazine citrate at dose of 10mg/ml. Both extracts showed significant (p<0.05) anthelmintic activity(Shilpa Subhedar et al.).

**Ramalina conduplicans**
Family: Ramalinaeaceae
Traditional Uses: dyspepsia, bleeding piles, bronchitis, scabies, stomach disorders and many disorders of blood and heart. Ramalina conduplicans contains usnic acid, salanizic acid and sekikaic acid and preliminary phytochemical analysis of methanol extract showed the presence of tannins and steroids. The methanolic extract of R. conduplicans at different concentrations shows potent anthelmintic activity in compare with piperazine citrate as standard drug. Methenolic extract exhibit a dose-dependent inhibition of spontaneous motility (paralysis). With higher doses (10 mg/ml and more) the effects were comparable with that of 1 % piperazine. The possible mechanism due to presence of tannins(K.S. Vinayaka et al.).

**Spinacia oleracea Linn**
Family: Amaranthaceae
Traditional Uses:Anemia, nightblindness, tooth disorder, urinary disorder, cancer, and respiratory disorder. The methanolic extract of Spinacia oleracea Linn showed the presence of cyogenetic glycosides, protein, aminoacid, carbohydrates, flavanoids, phenol and tannins whereas fresh juice extract contains alkaloids, cyogenetic glycosides, protein, amino acid, carbohydrates, flavanoids, phenol and tannin.

Fresh juice extract and methanol extract showed anthelmintic activity in dose dependent manner in comparision with standard drug, Albendazole. At the dose or 50 mg/ml both extracts showed significant activity(P<0.05).Phytochemical investigations showed the presence of tannins, which are responsible for anthelmintic activity by binding to free proteins in the gastrointestinal tract of host animal or glycoprotein on the cuticle of the parasite and may cause death(U.K.Patil et al.).

**Symplocos racemosa**
Family: Symplocaceae
Traditional Uses: ulcers, watery eyes, ophthalmia and is good for all diseases of the eye. It also diseases of the blood, dysentery, inflammations. The ethanolic extract was endowed with potent anthelmintic property in compare with pet. ether and chloroform extracts .The Potency of the extracts was found to be inversely proportional to the time taken for paralysis / death of the worms. The activities were comparable with the standard drug Piperazine citrate and Albendazole. The anthelmintic activity was found to be due to presence of tannins(Narasimha Rao R et al.).

**Tamarindus indica**
Family: Caesalpiniaceae
Traditional Uses: Fever, jaundice, scabies, Anthelmintic and wounds

Concentrated Juice of Tamarindus indica linn exhibited Anthelmintic activity in dose dependent manner. At the dose of 100mg/ml it shows potent effect against earth worms in comparison with piperazine citrate, standard drug. The anthelmintic effect is due to presence of tannins , which are interfere with energy generation in helminth parasites by uncoupling oxidative phosphorylation. Another possible anthelmintic effect of tannins is that they can bind to free proteins in the gastrointestinal tract of host animal or glycoprotein on the cuticle of the parasite and may cause death of earth worm(Vaishali M et al).
Methanolic extract of *Tribulus terrestris* showed maximum activity against Earth worm (Parimala devi R et al.). The methanolic extract at the dose of 100 mg/ml showed significant anthelmintic activity which is comparable with the standard drug Albendazole in concentrations (25, 50, 100 mg/ml). The methanolic extract of *Amaranthus caudatus* and *Amaranthus viridis L* showed significant anthelmintic activity on earthworms (Phertima posthuma). It was concluded that the alcoholic extract of *Tribulus terrestris* Retz. showed marked and potent anthelmintic activity than the aqueous extract. At higher concentration of 100 mg/ml the alcoholic extract was found to be more potent anthelmintic activity in comparison with standard drug albendazole and aqueous extract of *Terminalia chebula* Retz (S. Dwivedi et al.,).

**Amaranthaceae family**

The three plants used for anthelmintic assay are *Amaranthus spinosus, Amaranthus caudatus and Amaranthus viridis L* using earthworms (Pheretima posthuma). They belong to the Amaranthaceae Family and are traditionally used as vermicides. Methanol extracts of the three plants at different concentrations (10, 20, 40, 60, 80, 100 mg/ml) showed dose-dependent vermicidal activities. At concentrations of 80 and 100 mg/ml all three plant extracts showed potent anthelmintic activity which is comparable with standard drug, Piperazine at a concentration of 10 mg/ml. Phytochemical studies reveal that plant contains polyphenolic compounds, which are responsible for anthelmintic activity (Ashok kumar et al.,).

*Solanum lycopersicum*

Family: *Solanaceae*

Methanolic extract of *Solanum lycopersicum* leaf showed significant anthelmintic activity comparison with standard drug, Albendazole on pheretima posthuma earth worms. At the concentration of 40 mg/ml it shows onset of paralysis at 1.34±0.01 min and death time at 4.24±0.03 min which is comparable with Albendazole (Sarvari Manthri et al.,).

**Terminalia chebula**

Family: *Combretaceae*

Traditional Uses: Urinary disorders, heart disease, parasitic infection, fevers, flatulence and constipation.

The alcoholic and aqueous extracts of fruits of *Terminalia chebula* Retz. showed significant anthelmintic activity on earthworms (Phertima prosthuma). It was concluded that the alcoholic extract of *Terminalia chebula* Retz. showed marked and potent anthelmintic activity than the aqueous extract. At higher concentration of 100 mg/ml the alcoholic extract was found to be more potent anthelmintic activity in comparison with standard drug albendazole and aqueous extract of *Terminalia chebula* Retz (S. Dwivedi et al.,).

**Trikatu churna**

FORMULATION:

- *Piper nigrum L* (*Piperaceae*)
- *Piper longum L* (*Piperaceae*)
- *Zingiber officinale Roscoe.* (*Zingiberaceae*).

The ethanolic extract of Trikatu churna showed potent anthelmintic activity with varying magnitudes which is equal in effectiveness to standard Piperazine citrate. The difference in the time taken for induction of paralysis in both Piperazine citrate and Trikatu churna was insignificant or almost same. However, significant difference was observed when compared paralysis time of Piperazine with aqueous extracts (N. Lakshmi Narasimha Reddy et al.,).

**Triumfetta pilosa**

Family: *Tiliaceae*

Traditional Uses: diarrhoea, diabetes, leprosy, and migraine

Anthemintic activity of the alcoholic fraction of *Triumfetta pilosa* was conducted on adult earthworms and roundworms. Various concentrations of (10-50 mg/mL) of the crude extract were tested for the anthelmintic activity, which involved determination of time of paralysis and time of death of worms. At higher doses (50 mg/mL), the extract of *Triumfetta pilosa* causes paralysis at 4 min 28 sec and death at 13 min 23 sec. The crude extract exhibited significantly comparable results with the standard drug Albendazole. Deepak Reddy Gade et al., concluded that the alcoholic extract of *Triumfetta pilosa* possess potential anthelmintic activity.

**Mechanism of Phytoconstituents:**

The Proposed mechanism of action of alkolids, tannins and pphenolic compounds had been given in Figure 1 (Manoj Salhan et al.,)

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