



Review Article

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SCOPE OF HERBAL ANTHELMINTICS: AN AYURVEDIC PERSPECTIVE

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ABSTRACT

Diseases caused by helminthes are quite common and comprise a very large group of infestations and infections in human beings. The Krimi Roga (worm infestation) is one of the most common diseases found in paediatric practice. Helminthiasis is prevalent globally (1/3 of world's population harbours them), but is more common in developing countries with poorer personal and environmental hygiene. In Vedic and Ayurvedic literatures, the word krimi is vague term used to denote tiny living being. Acharyas described krimis in various Samhitas in detail and they also believed that krimi also act as an etiological factor in various disease e.g. krimija shiorroga, hridaroga etc. Because of the fewer side effects, the importance of herbal drugs in remedy has tremendously increased in the recent years. A wide variety of plants possess narrow or broad spectrum anthelmintic activities which are naturally available.

Keywords: Krimiroga, Helminthins, *Pheritima posthuma*, anthelmintic activities.

INTRODUCTION

Diseases caused by helminthes are quite common and comprise a very large group of infestations and infections in human beings. The Krimi Roga (worm infestation) is one of the most common diseases found in paediatric practice. Helminthiasis is prevalent globally (1/3 of world's population harbours them), but is more common in developing countries with poorer personal and environmental hygiene. It is known that every child suffers 2-3 attacks of worm infestation in a year and this affects the growth and development of the child. India is a developing country where thousands of children suffer from epidemics due to atmosphere, social problems and economic problems. For much of our past history, plant parts or extracts have been used to combat worm infections, and in many parts of the world natural products are still in use as herbal remedies. Plants are always an exemplary source of drugs; in fact many of the currently available drugs were derived either directly or indirectly from them. Helminthic infections continue to be major health hazard of people, especially those living in tropical developing countries. Helminthes harm the host by depriving him of food causing blood loss, injury to organs, intestinal or lymphatic obstruction and by secreting toxins. In Vedic and Ayurvedic literatures, the word krimi is vague term used to denote tiny living being. The word Krimi is derived from the root "Kramu" which means to step or to walk. Different meaning of krimi are those which move with the legs, one capable to break or injure the surroundings, the living being which are born from the vapour of faecal material in the intestinal tract or such environment else were. In Ayurveda, parasitic infection and helminthic infections are included under Krimi roga. Different varieties of Krimi are described in Ayurvedic literature. Anthelmintic treatments are described and these were widely tried. Acharyas described krimis in various Samhitas in detail and they

also believed that krimi also act as an etiological factor in various disease e.g. krimija shiorroga, hridaroga etc. So, at that time, concept of the krimi as well as their relation to development of disease was quite known. But details of each krimi's pathology are not found in our texts. But the classification morphology etc. was described very well. Acharya Charaka (Charaka Samhita Vimanasthana 7/9)¹ classified krimis into two broad groups i.e. sahaja (means which live in human body right from birth until death and the name indicate that they are not harmful to human body) and vaikarika (are harmful or cause disease or deformity in body i.e. pathogenic in nature. Acharya Charaka also further classified vaikarika krimi into two sub groups as bahyakrimi (external) and abhyantara krimi (which literally means internal). Helminthiasis is infestation with one or more intestinal parasitic worms roundworms (*Ascaris lumbricoides*), whipworms (*Trichuris trichiura*), or hookworms (*Necator americanus* and *Ancylostoma duodenale*). This disease when untreated gradually leads to mild to severe malnutrition, which in turn adversely affects the physical and mental growth of children. Soil transmitted helminthes infection has been increasingly recognized as an important public health concern, predominantly in developing countries. Typically the helminthes involved include *Ascaris lumbricoides*, *Ancylostoma duodenale*, *Trichuris trichiura* and *Strongyloides stercoralis* etc. Worm transmission is enhanced by many factors like poor socio-economic conditions, improper disposal of human faeces, deficiencies in sanitary facilities, insufficient supplies of clean water, poor individual hygiene, inadequate housing and lack of education.

Types, General Features and Treatment

Acharya Sushruta describes twenty types of internal krimis in detail with their causative factors, clinical features, pathogenesis and treatment (Sushruta Samhita

Uttaratantra 54).² Further Acharyas also had clear vision about visibilities or non-visibility of worms as Acharya Sushruta describes that some krimis were visible to naked eyes and some were non-visible to naked eyes (Sushruta Samhita Uttaratantra 54/20).² According to Sushruta, general symptoms which mark the presence of worms in the system are fever, paleness of complexion, sula, cardiac troubles (hridroga), lassitude, vertigo, aversion to food and diarrhoea (atisara) are the complaints (Sushruta Samhita Uttaratantra 54/19).² Detailed treatment of krimis are described in the texts. According to Acharya Sushruta first of all ascertain the nature of the worms and, with a view to destroy their colony in the body one should treat the patient with a sneha (clarified butter or oil), emetic formulations, drugs of the Sursadi group, strong purgative and treat him with an aasthanavasti and anuvasanavasti (Sushruta Samhita Uttaratantra 54/21-24).² Similarly Acharya Charaka (Charaka Samhita Vimansthana 7/14-15)¹ has given certain principle for treating the patient of krimis. These are krimis apakarashna (extraction of worms with the help of sansodhana therapy [Sansodhana refers to the cleansing methods which includes: Vaman (therapeutic vomiting or emesis), Virechan (purgation), Vasti (medicated enema), Nasya (elimination of toxins through the nose)], prakriti vighata (means utilising anti-helminthic drugs having toxic effect on helminthes along with dietary regimen non-congenial to proliferation of helminthes) and nidan-parivarjana (means avoidance of all etiological factors of helminthiasis). The aim of present work was to review such anti-helminthic herbs having properties as stated above in various Ayurvedic texts. On the contrary, a general approach nowadays towards intestinal helminth control is school deworming programs. Anthelmintic drugs used are Mebendazole, Albendazole, Pyrantel pamoate, Levamisole, Praziquantel etc. Different adverse effects occur during their uses such as diarrhoea, nausea, abdominal pain, allergic reactions, loss of hairs etc. Likewise albendazole has exhibited embryo-toxicity in animal; use in pregnant woman is contraindicated. In this light, it is pertinent to explore the scope of Ayurvedic anti-helminthic treatment.

Scope of Herbal Anthelmintics

So, Anthelmintic from the natural sources may play a key role in the treatment of these parasitic infections. Plants had been used for medicinal purposes long before ancient time. In the last few decades, there has been an exponential growth in the field of herbal medicine. Owing to its natural origin and lesser side effects, it is getting popularized in developing and developed countries. In many developing countries, a large proportion of the population relies on traditional practitioners and their armamentarium of medicinal plants in order to meet health care needs. Ayurveda and traditional medicine system uses herbal medicines to treat patients. Researches are being carried out now days on a large scale to discover the herbal alternatives for various allopathic medicines. Anthelmintic drugs are one such example for which herbal alternatives are being searched. Because of the fewer side effects, the importance of herbal drugs as a remedy has tremendously increased in the recent years. Consequently, the need for the herbal formulation has

been felt in routine life. There are currently an increasing number of controlled experimental studies that aim to verify, validate and quantify in a scientific manner such plant activity. This paper reviews the present state of knowledge regarding the use of some traditional medicinal plants in curing worm infestations in different regions of the world:-

Acacia oxyphylla: The anthelmintic activity of *Acacia oxyphylla* stem bark extract was tested against *Ascaridia galli* (Nematoda), the intestinal roundworm of domestic fowl and it showed concentration-dependent efficacy of the plant extract.³

Acorus calamus: Combination of rhizomes of *Acorus calamus* and root part of *Vitex negundo* were screened for anthelmintic activity using Indian earthworm, *Pheretima postuma* and reported potent anthelmintic activity.⁴

Adhatoda vasica: The anticestodal efficacy of *Adhatoda vasica* leaf aqueous and ethanolic extracts was evaluated and exhibited ovicidal and larvicidal activity against gastrointestinal nematodes.⁵ Another study also describes the *in vitro* and *in vivo* anthelmintic activity of *Adhatoda vasica*.⁶

Aerva lanata: The methanol and aqueous extracts of *Aerva lanata* were assessed for anthelmintic activity against Indian earthworm, *Pheretima postuma* and possessed good anthelmintic activity.⁷

Allium sativum: The extract effect of *Allium sativum* showed anthelmintic activity in *Haemonchus contortus*.⁸

Alstonia boonei: The aqueous and ethanolic bark extracts of *Alstonia boonei* and leaf extract of *Vernonia amygdalina* showed anthelmintic activity when evaluated using earthworms (*Lumbricus terrestris*).⁹

Amaranthus sp.: Methanol extracts of the three plants (*Amaranthus spinosus*, *Amaranthus caudatus* and *Amaranthus viridis* L.) at different concentrations showed vermifugal activities against (*Pheretima postuma*).¹⁰ The aqueous extract of *Amaranthus spinosus* showed anthelmintic activity for both the worms - *Pheretima postuma* and *Tubifex tubifex*.¹¹

Amorphophallus paeoniifolius: Methanolic extracts of the tuber of *Amorphophallus paeoniifolius* showed vermifugal activity against *Pheretima postuma* and *Tubifex tubifex*.¹²

Anthocephalus cadamba: Extracts of the root of *Anthocephalus cadamba* (Roxb.) Miq. was evaluated and the results indicated that the chloroform and methanolic extracts were more potent as antihelminth.¹³

Artemisia pallens: The essential oil of *Artemisia pallens* Wall. showed the strong anthelmintic activity against *Pheretima postuma* (earthworm), *Taenia solium* (tape worm) and *Ascaris lumbricoides* (round worm).¹⁴

Artrmisia siversiana: Chloroform extracts of stem and root of *Artrmisia siversiana* and *Punica granatum* were investigated for activity against *Syphacia obvelata*, *Nippostrongylus brasiliense* and *Hymenolepis nana in vivo* and results showed that both extracts were able to eliminate *Hymenolepis nana* from mice.¹⁵

Baliospermum montanum: Alcohol and aqueous extracts from the roots of *Baliospermum montanum* Muell. Arg were investigated for their anthelmintic activity against *Pheretima posthuma* and *Ascaridia galli* and both the extracts exhibited significant anthelmintic activity.¹⁶

Benincasa hispida: The ethanolic extract of *Benincasa hispida* seeds was studied for its anthelmintic activity using earthworms (*Pheretima posthuma*) and anticonvulsant activity in Swiss albino mice. The anthelmintic activity increased with increasing concentrations.¹⁷

Butea monosperma: The anthelmintic activity of alcohol and ethyl acetate extracts of leaves of *Butea monosperma* were noticed against earthworms (*Pheretima posthuma*), roundworms (*Ascaridia galli*.) and tapeworms (*Raillietina spiralis*).¹⁸

Caesalpinia pulcherrima: Various extracts of pod of *Caesalpinia pulcherrima* (Linn.) (e.g. petroleum and chloroform extracts) reported anthelmintic potency while using Indian earthworms (*Pheretima posthuma*).¹⁹

Carissa spinarum: The antihelmintic activity of methanolic, aqueous and chloroform extracts of root of *Carissa spinarum* on *Pheretima posthuma* was carried out and results show anthelmintics property.²⁰

Carum capticum: *Carum copticum* seeds possess anthelmintic activity against nematodes when evaluated in sheep naturally infected with mixed species of gastrointestinal nematodes.²¹

Cassia tora: The anthelmintic activity of alcohol and aqueous extracts of *Cassia tora* has been demonstrated when used against *Pheretima posthuma* and *Ascaridia galli*.²²

Clerodendrum viscosum: The ethanolic and aqueous extracts of leaves and roots of *Clerodendrum viscosum* were tested against *Pheretima posthuma* and *Ascaridia galli* to ascertain their anthelmintic potential and the extracts showed significant anthelmintic activity in dose dependent manner.²³

Clitoria ternatea: The anthelmintic activity of aqueous and ethanolic extracts of leaves of *Clitoria ternatea* using *Eisenia foetida* were tested and the results confirmed their anthelmintics activity.²⁴

Cocculus hirsutus: The anthelmintic activity of all six fractions of *Cocculus hirsutus* and *R. dentatus* was noticed wormicidal activity which suggests that it could be effective against parasitic infections of humans.²⁵

Crataeva nurvala: The ethanol extract of the roots of *Crataeva nurvala* was investigated for anthelmintic activity using earthworms (*Pheretima posthuma*), tapeworms (*Raillietina spiralis*) and roundworms (*Ascaridia galli*) and extract exhibited significant antibacterial and anthelmintic activity.²⁶

Curcuma Longa: The hydroalcoholic extracts of *Curcuma longa* and *Zingiber officinale* were evaluated for anthelmintic activity using *Pheretima posthuma* model and results showed that rhizomes extracts bearing a potential anthelmintic property.²⁷

Cyperus tegetum: The aqueous extract of rhizomes of the plant *Cyperus tegetum* reported anthelmintic activity as compare to piperazine citrate when assessed on adult Indian earthworms, *Pheretima posthuma*.²⁸

Emblica officinalis: The alcoholic and aqueous extract of *Emblica officinalis* show potent anthelmintic activity in experimental adult earthworm's *Pheretima posthuma*.²⁹

Enicostemma littorale: Petroleum ether and ethanolic extracts of aerial parts of *Enicostemma littorale* were evaluated for the activity on adult Indian earthworms, *Pheretima posthuma* and results showed good efficacy of this extract.³⁰

Euphorbia thymifolia: *Euphorbia thymifolia* Linn. were investigated for their anthelmintic activity against *Pheretima posthuma* and *Ascaridia galli*. Both the extracts showed significant anthelmintic activity.³¹

Ficus sp.: The methanolic, aqueous, chloroform, petroleum ether extracts of *Ficus benghalensis* were used and studied for paralysis and death of earthworm. All the extracts were found not only to paralyze (vermifuge) but also to kill the earthworms (vermicidal).³² Similarly, methanolic extract of *Ficus benghalensis* possesses significant anthelmintic property when evaluated using worms as experimental models in study.³³ In another study, the result shows that methanol and aqueous extracts of *Ficus carica* were showed significant anthelmintic activity.³⁴ Aqueous extract of fruits of some commonly occurring plants of genus *Ficus* (*F.benghalensis*, *F.carica* and *F.religiosa*) compared for their in-vitro anthelmintic activity and results showed all plants had anthelmintics activity but *Ficus benghalensis* was found to be potent than *F. religiosa* and *F. carica*.³⁵

Garcinia indica: *Garcinia indica* reported anthelmintic activity against earthworm infections.³⁶

Gloriosa superba: The ethanol and water extract of whole plant of *Gloriosa superba* Linn. (Liliaceae) were investigated against Indian earthworms, *Pheretima posthuma* and both extract (aqueous and ethanol) at the tested dose level produced significant activity when compared with piperazine citrate.³⁷

Justicia gendarussa: The extracts of *Justicia gendarussa* showed anthelmintic activity against adult earth worms.³⁸

Lawsonia inermis: *In-vitro* anthelmintic potency of the petroleum ether extract of *Lawsonia inermis* leaves using Indian earthworms (*Pheretima posthuma*) was evaluated and found to have anthelmintic property.³⁹

Mentha piperita: Chloroform and acetone extracts of *Mentha piperita* were investigated for their anthelmintic activity against *Pheretima posthuma* and result exhibited considerable anthelmintic activities.⁴⁰

Millingtonia hortensis: Different extracts of stem bark of *Millingtonia hortensis* (Bignoniaceae) were tested against adult earthworm *Pheretima posthuma* and showed anthelmintic activity in comparison with piperazine citrate.⁴¹

Mimusops elengi: The crude extract of *M. elengi* roots and *D. sepiaria* leaves exhibited significant anthelmintic activity with respect to standard and control by using adult Indian earthworms, *Pheretima posthuma*.⁴²

Mimosa pudica: Anthelmintic activity of leaves of *Mimosa pudica* evaluated using *Pheretima posthuma* as a test worm to the different concentrations. The results indicated that the crude alcoholic extract and aqueous extracts significantly demonstrated paralysis and also caused death of worms in dose dependent manner as compared to standard reference albendazole.⁴³

Moringa oleifera: Oil of *Moringa oleifera* was investigated for its anthelmintic activity on adult Indian earthworms, *Pheretima posthuma* and shows anthelmintic activity.⁴⁴

Nauclea orientalis: Antianthelmintic activity of extracts (chloroform, acetone, ethanol and aqueous) of *Nauclea orientalis* leaves were evaluated on adult Indian earthworm (*Pheretima posthuma*) and it was found that the extracts exhibited dose-dependent action and inhibition of spontaneous motility (paralysis) and death of earthworms.⁴⁵

Paederia foetida: Methanolic extract of the leaves of *Paederia foetida* were screened for its anthelmintic activity against *Pheretima posthuma* and *Tubifex tubifex* and the extract exhibited significant anthelmintic activity at highest concentration as compared with piperazine citrate as standard reference.⁴⁶

Pongamia glabra: The seed of *P. glabra* found anthelmintic activity which was evaluated on Indian adult earthworms, *Pheretima posthuma*.⁴⁷

Psidium guajava: Leaf extract of *P. guajava* possesses anticestodal efficacy when used in *H. diminuta* infections in rats. Study supports its folk medicinal use in the

treatment of intestinal-worm infections in northeastern part of India.⁴⁸

Punica granatum: *Punica granatum* also exhibited the anthelmintic activity against Indian adult earthworms (*Pheretima posthuma*).⁴⁹

Rumex vesicarius: Anthelmintic prospective of crude benzene, ethanol and aqueous extracts on aerial parts of *Rumex vesicarius* was evaluated against Indian adult earthworms (*Pheretima posthuma*) and all extracts showed significant anthelmintic activity.⁵⁰

Saraca indica: The present study reports anthelmintic activity of various extracts obtained from the leaves of *Saraca indica* Linn (Leguminosae) against adult earth worms *Pheretima posthuma*.⁵¹

Semecarpus anacardium: The anthelmintic activity of different extracts of nuts of *Semecarpus anacardium* were evaluated separately on adult Indian earthworm (*Pheretima posthuma*) and results showed that petroleum ether, chloroform extract of *S. anacardium* showed better anthelmintic activities than ethanol and aqueous extract of it.⁵²

Solanum surattense: The various doses of aqueous and ethanolic extracts were evaluated for their anthelmintic activities on adult Indian earthworms, *Pheretima posthuma*. All the doses of aqueous and ethanolic extract of *Solanum surattense* showed better anthelmintic activity than the standard drugs.⁵³

Tecoma stans: The anthelmintic activity of aqueous, alcoholic, hydro-alcoholic and methanolic extract of leaves of *Tecoma stans* was carried out on adult Indian earthworm (*Pheretima posthuma*) and the activities were compared with the standard drug Albendazole. During study, aqueous, alcoholic, hydro-alcoholic methanolic extract (sohxlet) of leaves of *Tecoma stans* showed better anthelmintic activity than the standard drugs.⁵⁴

Terminalia chebula: The alcoholic and aqueous extract of the fruits *Terminalia chebula* showed significant anthelmintic activity and further it was noticed that the alcoholic extract activity is higher than aqueous extract and the standard drug of albendazole.⁵⁵

Tinospora cordifolia: The anthelmintic property of *T. cordifolia* extracts was evaluated using *Pheretima posthuma* as an experimental model and the ethanol extract showed significant results.⁵⁶

Thespesia lampas: The aqueous extract of *Thespesia lampas* roots (Ranibhendi) was investigated for anthelmintic activity using earthworms (*Pheretima posthuma*), tapeworms (*Raillietina spiralis*) and roundworms (*Ascaridia galli*) and extract exhibited significant anthelmintic activity at highest concentration.⁵⁷

Tribulus terrestris: The extracts of *Tribulus terrestris* fruit shown exerting significant and much better anti microbial and anthelmintic activities.⁵⁸

Trichilia connaroides: The effect of the extracts of different parts of *Trichilia connaroides*, *Ajuga bracteosa*, *Ajuga macrosperma*, *Ajuga parviflora* of Indian Himalayan region were evaluated using *Ascaridia galli* and showed antihelminth potency.⁵⁹

Trikatu: The alcoholic extract of Trikatu churna and its ingredients were screened for preliminary phytochemical studies and also tested for anthelmintic activity against *Pheritima posthuma* and exhibited potent anthelmintic activity.^{60, 61}

Verbascum thapsus: *V. thapsus* extracts were tested against roundworms (*Ascaridia galli*) and tapeworms (*Raillietina spiralis*) and showed potency against tested worms.⁶²

Zanthoxylum zanthoxyloides: Extracts of *Celosia laxa*, *Neocarya macrophylla* and *Zanthoxylum zanthoxyloides* leaves were screened for anthelmintic activities on *Ascaris lumbricoides* and showed anthelmintic activity.⁶³

CONCLUSION

Nature has provided a store-house of remedies to cure all ailments of mankind and commonplace diseases. In this light, a wide variety of anthelmintic activities can be explored amongst plants which possess such narrow or broad spectrum activity innately to be a viable option. Hence, more extensive studies are needed to be directed towards experimental validation of plants, their molecular studies, active constituents, clinical evaluation and ascertaining of their specific mode of action so as to establish an effective alternative treatment against various helminths. Herbs have remained vital source of drugs since the ancient times. The above review is an attempt to highlight the anthelmintics property of certain credible herbs as described in the most ancient of medical sciences i.e. Ayurveda - the Indian system of medicine.

REFERENCES

- Charaka Samhita of Agnivesa elaborated Vidyotini Hindi commentary by Pandit Shastri Kashinatha and Dr Chaturvedi Gorakha Natha, Part-I, Chaukhamba Bharati Academy, Varanasi, India, reprint year; 2006.
- Susruta Samhita edited with Ayurveda Tattva Sandipika Hindi commentary by Kaviraj Shastri Ambikadutta, Part-II, Chaukhamba Sanskrit Sansthan, Varanasi, edition reprint; 2006.
- Kholhring Lalchandama. Nematocidal effects of piperazine and the extract of *Acacia oxyphylla* stem bark on the poultry nematode, *Ascaridia galli*. Pharmacologyonline 2008; 3: 864-869.
- Merekar Abhijit N, Pattan Shashikant R, Parjane Smita K, Nirmal Sunil A, Patel Daina S, Shitre Mayuri R. Synergistic anthelmintic activity of rhizomes of *Acorus calamus* and roots of *Vitex negundo*. Pharmacologyonline 2011; 3: 209-212.
- IRM Al Shaibani, MS Phulan, A Arijoad TA Qureshi. Ovicidal and larvicidal properties of *Adhatoda vasica* (L.) extracts against gastrointestinal nematodes of sheep *in vitro*. Pakistan Vet. J 2008; 28(2): 79-83.
- Lateef Muhammad, Iqbal Zafar, Khan MN, Muhammad Akhtar Shoaib, A Jabbar. Anthelmintic activity of *Adhatoda vasica* roots. International Journal of Agriculture and Biology 2003; 05(1): 86-90.

- Rajesh R, Chitra K, Padmaa M Paarakh. *In vitro* anthelmintic activity of aerial parts of *Aerva lanata* Linn Juss. International Journal of Pharmaceutical Sciences and Drug Research 2010; 2(4): 269-271.
- Iqbal Zafar, Qazi Khalid Nadeem, Khan MN, MS Akhtar, Faisal Nouman Waraich. *In vitro* anthelmintic activity of *Allium sativum*, *Zingiber officinale*, *Curcubita mexicana* and *Ficus religiosa*. International Journal of Agriculture and Biology 2001; 3(4): 454-457.
- CA Danquah, GA Koffuor, K Annan, EC Ketor. The anthelmintic activity of *Vernonia Amygdalina* (Asteraceae) and *Alstonia Boonei* De Wild (Apocynaceae). Journal of Medical and Biomedical Sciences 2012; 1(1): 21-27.
- Kumar Ashok BS, Lakshman K, Jayaveera KN, Nandeesh R, Manoj B, Ranganayakulu D. Comparative *in vitro* anthelmintic activity of three plants from the Amaranthaceae family. Archives of Biological Sciences 2010; 62: 185-189. <http://dx.doi.org/10.2298/ABS1001185K>
- Baral Manik, Chakraborty Subrata, Chakraborty Pranabesh. Evaluation of anthelmintic and anti inflammatory activity of *Amaranthus spinosus* Linn. Int J Curr Pharm Res 2010; 2(4): 44-47.
- Yadu Nandan Dey, Ajoy Kumar Ghosh. Evaluation of anthelmintic activity of the methanolic extract of *Amorphophallus paeoniifolius* tuber. IJPSR 2010; 1(11): 117-121.
- Acharyya S, Rathore DS, HK Sundeep Kumar, N Panda. Screening of *Anthocephalus cadamba* (Roxb.) Miq. root for antimicrobial and anthelmintic activities. International Journal of Research in Pharmaceutical and Biomedical Sciences 2011; 2(1): 297-300.
- Nakhare Seema, Garg SC. Anthelmintic activity of the essential oil of *Artemisia pallens* wall. Anc Sci Life 1991; 10(3): 185-186.
- KC Singal. Anthelmintic activity of *Punica granatum* and *Artemisia siversiana* against experimental infections in mice. International Journal of Pharmacy 1983; 15(2): 119-122.
- Mali RG, Wadekar RR. *In vitro* anthelmintic activity of *Baliospermum montanum* Muell. Arg roots. Indian J Pharm Sci 2008; 70(1): 131-133. <http://dx.doi.org/10.4103/0250-474X.40352> PMID: 20390101 PMCID: PMC2852054
- Zulfkar Latief Qadrie, R Anandan, Md Mushtaque, K Asok Kumar, Humaira Ashraf. Anthelmintic and Anticonvulsant studies of ethanolic extract of *Benincasa hispida* seeds. Pharmacologyonline 2011; 2: 1298-1302.
- Borkar VS, Gangurde HH, Gulecha VS, Bhojar PK, Mundada AS. Evaluation of *in vitro* antihelminthic activity of leaves of *Butea monosperma*. International Journal of Phytomedicine 2010; 2(1).
- Kumbhare Manoj, Thangavel Sivakumar, Kalantri Manisha, Mahajan Vijay. Investigation of anthelmintic activity of pods of *Caesalpinia pulcherrima*. Journal of Pharmaceutical Research and Opinion 2012; 2: 63-65.
- Harwansh Ranjit Kumar, Garabadu Debapriya, Md Akhlaquer Rahman, Garabadu Priyanka S. *In vitro* anthelmintic activity of different extracts of root of *Carissa spinarum*. IJPSR 2010; 1(10): 84-88.
- M Lateef, Z Iqbal, U Rauf, A Jabbar. Anthelmintic activity of *Carum capticum* seeds against gastrointestinal nematodes of sheep. J. Anim. Pl. Sci 2006; 16(1-2).
- Deore SL, SS Khadabadi, Kamdi KS, Ingle VP, Kawalkar NG, Sawarkar PS, Patil UA, Vyas AJ. *In vitro* anthelmintic activity of *Cassia tora*. International Journal of Chem Tech Research 2009; 1(2): 177-179.
- Das Jayanta Kumar, Choudhury S, Adhikary S, Das B, S Samanta, Mandal SC, Dey SP. Anthelmintics activity of *Clerodendrum viscosum*. Oriental Pharmacy and Experimental Medicine 2011; 11(2): 119-122.
- Salhan Manoj, Kumar Bimlesh, Tiwari Prashant, Sharma Pardeep, Sandhar Harleen Kaur, Gautam Mayur. Comparative anthelmintic activity of aqueous and ethanolic leaf extracts of *Clitoria ternatea*. International Journal of Drug Development and Research 2011; 3(1): 68-69.
- Imran Ashab, Shah Marzia Mahjabin Lina. *In-vitro* phytochemical and anthelmintic activity of *Cocculus hirsutus* Linn. and *Rumex dentatus* Linn. Stamford Journal of Pharmaceutical Sciences 2011; 4(2): 63-65.
- Kamath Rajesh, Shetty Devraj, Bhat Pratibha, Shabaraya AR, Hegde Karunakar. Evaluation of antibacterial and antihelminthic activity of root extract of *Crataeva nurvala*. Pharmacologyonline 2011; 1: 617-622.
- Singh Rohini, Mehta A, Mehta P, Shukla K. Anthelmintic activity of rhizome extracts of *Curcuma Longa* and *Zingiber Officinale* (Zingiberaceae). Int J Pharm Sci 2011; 3: 236-237.

28. Sinha Urna, Chaulia Nitai Chand, Chatterjee Tapan Kumar. Anthelmintic activity of aqueous extract of the *Cyperus tegetum* Roxb. rhizomes. International Journal of Advances in Pharmaceutical Research 2013; 4(1): 1352-1357.
29. Dwivedi Gaurav. Anthelmintic activity of *Emblica officinalis* fruit extract. IJPRD 2011; 3(1): 50-52.
30. Mishra Shilpi, Mishra Ashish, Shukla Padmini, Shukla Prabodh. *In-vitro* anthelmintic activity of *Enicostemma littorale* Blume. International Journal of Pharmaceutical Sciences and Research 2011; 2(5): 1193-1196.
31. Kane Sandeep R, Mohite Shrinivas K, Shete Jaykumar S. Anthelmintic activity of aqueous and methanolic extracts of *Euphorbia thymifolia* Linn. Int. J. Pharm Tech Res 2009; 1(3): 666-669.
32. Aswar M, Aswar U, Watkar B, Vyas M, Wagh A, Gujar KN. Anthelmintic activity of *Ficus benghalensis*. Int J Green Pharm 2008; 2: 170-2. <http://dx.doi.org/10.4103/0973-8258.42737>
33. Tuse Trupti, Bidkar AA, Bhale SA, Patankar RD. *In-vitro* anthelmintic activity of aerial roots of *Ficus benghalensis*. IJPR 2011; 1(1).
34. Patil Amol P, Patil Vikas V, Patil Vijay R, Chaudhari Rajesh Y. Anthelmintic and preliminary phytochemical screening of leaves of *Ficus carica* Linn. Against intestinal helminthiasis IJRAP 2010; 1(2): 601-5.
35. Sawarkar HA, Singh Mukesh Kumar, Pandey Ajit Kumar, Biswas Deepak. *In vitro* anthelmintic activity of *Ficus Benghalensis*, *Ficus Carica* and *Ficus Religiosa*: a comparative study. International Journal of Pharmacy and Pharmaceutical Sciences 2011; 3(Suppl 2): 152-3.
36. P Swapna, A Elumalai, P Jayasri. Evaluation of anthelmintic activity of *Garcinia indica* choisy fruits. International Journal of Advanced Life Sciences (IJALS) 2012; 1: 85-88.
37. Pawar Bhushan M, Wavhal Vishal P, Pawar Nayana D, Agarwal Mohan R, Shinde Prashant B, Kamble Hemant V. Anthelmintic activity of *Gloriosa superba* Linn (Liliaceae). Int. J. Pharm Tech Res 2010; 2(2): 1483-87.
38. Saha Monika Rani, Debnath Pankaj Chandra, Rahman Md Ajjur, Islam Md Anwar Ul. Evaluation of *in vitro* anthelmintic activities of leaf and stem extracts of *Justicia gendarussa*. Bangladesh J Pharmacol 2012; 7: 50-53.
39. Bairagi GB, Kabra AO, Mandade RJ. Anthelmintic activity of *Lawsonia inermis* L. leaves in Indian adult earthworm. International Journal of Research in Pharmaceutical and Biomedical Sciences 2011; 2(1): 237-40.
40. Rekha S. Comparative *in vitro* anthelmintic activity of chloroform and acetone extracts of *Mentha piperita*. International Journal of Pharmaceutical and Biological Archives (IJPBA) 2011; 2(3): 945-48.
41. Nagaraja MS, Paarakh Padmaa M. *In vitro* anthelmintic activity of stem bark of *Millingtonia hortensis* Linn. International Journal of Pharma and Bio Sciences 2011; 2(2): 15-19.
42. Gadamsetty Ganesh, Lakshmiopathy R, Sarada NC. Phytochemical analysis and *in-vitro* anthelmintic activity of *Mimusops elengi* Linn and *Drypetes sepiaria*. International Journal of Pharmacy and Pharmaceutical Sciences 2013; 5(1): 126-28.
43. Bendgude RD, Maniyar MG, Kondawar MS, Patil SB, Hirave RV. Anthelmintic activity of leaves of *Mimosa pudica*. International Journal of Institutional Pharmacy and Life Sciences 2012; 2(1): 120-25.
44. Nilani P, Pinaka Mani Kumar, Duraisamy B, Dhamodaran P, Jeyaprakash MR. Anthelmintic activity of *Moringa oleifera* seed oil - validation of traditional use. Journal of Advanced Scientific Research 2012; 3(2): 65-66.
45. Raghavamma S, Rao NR. *In vitro* evaluation of anthelmintic activity of *Nauclea orientalis* leaves. IJPS 2010; 72(4): 520-1.
46. Pal Manas Kumar. Evaluation of anthelmintic activity of leaves of *Paederia foetida*. International Journal of Pharma and Bio Sciences 2011; 2(1): 227-31.
47. Rao Sunil Ashok, Malwadkar Nirmal G, Laware RB. Anthelmintic activity of *Pongamia glabra*. Songklanakarin Journal of Science and Technology 2007; 29(3): 755-57.
48. Tangpu TV, Yadav AK. Anticestodal efficacy of *Psidium guajava* against experimental *Hymenolepis diminuta* infection in rats. Indian J Pharmacol 2006; 38: 29-32. <http://dx.doi.org/10.4103/0253-7613.19849>
49. Subhedar Shilpa, Goswami Pushpendra, Rana Nikita, Gupta Abhishek, Shukla Pawandeep. Herbal alternatives: Anthelmintic activity of *Punica granatum* (Pomegranate). Int. J. of Drug Discovery and Herbal Research (IJDDHR) 2011; 1(3): 150-152.
50. Rao KNV, Ch Sumitha, S Sandhya, T Rajeshwar. Anthelmintic activity of different extracts on aerial parts of *Rumex vesicarius* Linn. International Journal of Pharmaceutical Sciences Review and Research 2012; 12(1): 64-66.
51. Sharma Ajay, Gupta Sumit, Sachan Sandeep, Mishra Ashutosh, Banarji Anshu. Anthelmintic activity of the leaf of *Saraca indica* Linn. Asian Journal of Pharmacy and Life Science 2011; 1(4): 391-95.
52. Pal Dilip kumar, Mohapatra Tapas Kumar, Das Apurba. Evaluation of anthelmintic activity of nuts of *Semecarpus anacardium*. Ancient Science of Life 2008; XVII (3): 41-44.
53. Nayak Bhabani S, Jena Prabhat K, Sahu Nigam P, Nayak Udaya K, Patro K Balakrishna. Comparative study of anthelmintic activity between aqueous and ethanolic extract of *Solanum surattense* Linn. International Journal of Pharmacy and Pharmaceutical Sciences 2009; 1(1): 103-107.
54. Kumanan R, Sridhar C, Jayaveera KN, Sudha S, Rubesh Kumar S, Duganath N. Comparative study of anthelmintic activity of different leaf extracts of *Tecoma stans* (L.) on adult indian earthworms. International Journal of Pharmaceutical and Clinical Research 2010; 2(2): 63-65.
55. Dwivedi S, Dwivedi A, Kapadia R, Kaul S. Anthelmintic activity of alcoholic and aqueous extract of fruits of *Terminalia chebula* Retz. Ethnobotanical Leaflets 2008; 12: 741-43.
56. Reddy M Rajeshwar, Reddy K Tirumal, Vedamurthy AB, Krishna V, Hoskeri H Joy. A study on anthelmintic activity of *Tinospora cordifolia* extracts. International Journal of Pharmacy and Pharmaceutical Sciences 2011; 3(Suppl 5): 78-80.
57. Kosalge Satish B, Fursule Ravindra A. Investigation of *in vitro* anthelmintic activity of *Thespesia lampas* (Cav.). Asian Journal of Pharmaceutical and Clinical Research 2009; 2(2): 69-71.
58. Kumar Sanjeeva A, Rao Rama BV, Narendra Y, Rao Madhusudana G, Setty Venkata Kullai N, Raghuvveer R. Proximate analysis and comparative *in vitro* antimicrobial and anthelmintic activities of different parts of *Tribulus terrestris* Linn. International Journal of Pharmaceutical Research and Development 2011; 3(8): 37-44.
59. Agarwal G, Pant AK, Hore SK. *In vitro* evaluation of anthelmintic efficacy of *Trichilia* and *Ajuga* species on *Ascaridia galli*. Hygeia. J. D. Med 2010; 2(2): 43-53.
60. PR Malvankar. Anthelmintic activity of water extracts of Trikatu churna and its individual ingredients on Indian earthworms. International Journal of Pharma and Bio Sciences 2012; 2(3): 374-78.
61. Reddy N Lakshmi Narasimha, K Yamini, V Gopal. Anthelmintic activity of aqueous and ethanolic extract of Trikatu Churna. Journal of Applied Pharmaceutical Science 2011; 1(3): 140-142.
62. Ali Niaz, Syed W Ali Shah, Ismail Shah, Ahmed Ghayour, Mehreen Ghias, Khan Imran, Ali Waqar. Anthelmintic and relaxant activities of *Verbascum thapsus* Mullein. BMC Complementary and Alternative Medicine 2012; 12: 29.
63. Barnabas BB, Mann A, Ogunrinola TS, Anyanwu PE. Screening for anthelmintic activities from extracts of *Zanthoxylum zanthoxyloides*, *Neocarya macrophylla* and *Celostia laxa* against ascaris infection in rabbits. International Journal of Applied Research in Natural Products 2011; 3(4): 1-4.

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