SCOPE OF HERBAL ANTHELMINTICS: AN AYURVEDIC PERSPECTIVE

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Received on: 07/05/13 Revised on: 21/06/13 Accepted on: 14/07/13

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E-mail: drksverma82@gmail.com
DOI: 10.7897/2277-4343.04428
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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 harbour 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 shiroroga, 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 the 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 shiroroga, 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 babhayakrmi (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 Strongyloids 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). Further Acharyas also had clear vision about visibilities or non-visibilities 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). According to Sushruta, general symptoms which mark the presence of worms in the system are fever, paleness of complexion, sula, cardiac troubles (hridroga), lasitudo, vertigo, aversion to food and diarrhoea (atisara) are the complaints (Sushruta Samhita Uttaratantra 54/19). 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 asthapana vasti and anvayasa vasti (Sushruta Samhita Uttaratantra 54/21-24). Similarly Acharya Charaka (Charaka Samhita Vimansthantha 7/14-15) has given certain principle for treating the patient of krimis. These are krimis apakarashana (extraction of worms with the help of sansodhana therapy) (Sansodhana refers to the cleansing methods which includes: Vaman (therapeutic vomiting or emesis), Virchan (purgation), Vasti (medicated enema), Nasya (elimination of toxins through the nose)), prakriti vighata (means utilising anti-helminthic drugs having toxic effect on helminths along with dietary regimen non-congenial to proliferation of helminthes) and nidan-parivarjana (means avoidance of all etiological factors of helmithiasis). 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 helmith control is school deworming programs. Anthelminthic 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. Anthelminthic 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 anthelminthic 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, Pheritima postuma and reported potent anthelminthic 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. Another study also describes the in vitro and in vivo anthelmintic activity of Adhatoda vesica.6

Aerva lanata: The methanol and aqueous extracts of Aerva lanata were assessed for anthelmintic activity against Indian earthworm, Pheritima 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 vermicidal activities against (Pheretima posthuma).10 The aqueous extract of Amaranthus spinosus showed anthelmintic activity for both the worms - Pheretima posthuma and Tubifex tubifex.11

Amorphophallus paeoniifolius: Methanolic extracts of the tuber of Amorphophallus paeoniifolius showed vermicidal activity against Pheretima posthuma 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 anthelmintin.13

Artemisia pallens: The essential oil of Artemisia pallens Wall. showed the strong anthelmintic activity against Pheretima posthuma (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 Ascardia 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.17

Butea monosperma: The anthelmintic activity of alcohol and ethyl acetate extracts of leaves of Butea monosperma were noticed against earthworms (Pheretima posthuma), roundworms (Ascardia 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 anthelmintic 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 cappitum: 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 Ascardia galli.22

Clerodendrum viscosum: The ethanolic and aqueous extracts of leaves and roots of Clerodendrum viscosum were tested against Pheretima posthuma and Ascardia 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 (Ascardia 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 Ascardia 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 (vermicide).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 anthelminthic activity against adult earthworms.²⁸

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

**Mentha piperita**: Chloroform and acetone extracts of *Mentha piperita* were investigated for their anthelminthic activity against *Paederia foetida* and showed significant inhibition of spontaneous motility (paralysis) and death of the extracts. It was observed 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

**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

**Mimosa elengi**: The crude extract of *M. elengi* roots and *D. sepiaria* leaves exhibited significant anthelminthic activity with respect to standard and control by using adult Indian earthworms, *Pheretima posthuma*.³²

**Mimosa pudica**: Anthelminthic 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.⁴⁵

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

**Naucea orientalis**: Antianthelminthic activity of extracts (chloroform, acetone, ethanol and aqueous) of *Naucea 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 anthelminthic 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 anthelminthic activity against Indian adult earthworms (*Pheretima posthuma*).⁴⁹

**Rumex vesicarius**: Anthelminthic 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 anthelminthic activity.⁵⁰

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

**Semecarpus anacardium**: The anthelminthic 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 anthelminthic activities on adult Indian earthworms, *Pheretima posthuma*. All the doses of aqueous and ethanolic extract of *Solanum surattense* showed better anthelminthic activity than the standard drugs.⁵³

**Tecoma stans**: The anthelminthic 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 Albenzole. During study, aqueous, alcoholic, hydro-alcoholic methanolic extract (soxhlet) of leaves of *Tecoma stans* showed better anthelminthic activity than the standard drugs.⁵⁴

**Terminalia chebula**: The alcoholic and aqueous extract of the fruits *Terminalia chebula* showed significant anthelminthic 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 anthelminthic property of *T. cordifolia* extracts was evaluated using *Pherithea 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 anthelminthic activity using earthworms (*Pheretima posthuma*), tapeworms (*Raillietina spiralis*) and roundworms (*Ascaridia galli*) and extract exhibited significant anthelmintic activity at highest concentration.⁵⁷
Trihus terrestris: The extracts of Tribulus terrestris fruit shown exerting significant and much better anti microbial and anthelmintic activities. 

Trichilia connaroides: The effect of the extracts of different parts of Trichilia connaroides, Ajuga bracteosa, Ajuga macroserpa, Ajuga parviflora of Indian Himalayan region were evaluated using Ascarrida galli and showed anthelmintin potency. 

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. 

Verbascum thapsus: V. thapsus extracts were tested against roundworms (Ascarrida galli) and tapeworms (Rallitettina spiralis) and showed potency against tested worms.

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

CONCLUSION
Nature has provided a storehouse 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


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