
Indigenous plants active against helminthiasis of animals in India: An overview

IMPETUS FOR VALIDATION OF PLANT-BASED ANTHELMINTICS

- **45000 plant species in India**
- **Several thousands possess medicinal properties**
- **About 2000 species appear in the literature**
- **500 species commonly used in indigenous system**
- **About 90% species available for screening**
- **4000 species screened for various activities**

GENERAL ASPECTS

Helminthic infection	Major limiting factor in livestock production
Warm & humid climate	Favours development of worm eggs to infective larvae throughout year
Helminth species	>300 species parasitize livestock in India

COMMERCIAL SYNTHETIC ANTHELMINTICS

- **Strategic, tactical use, suitable rotational strategies**
- **Development of anthelmintic resistance**
- **Higher cost**
- **Non-availability in rural areas**
- **Toxicity/environmental pollution**

Major helminth parasites against which plants have been evaluated *in vitro*

Ascaridia, Ascaris, Bunostomum, Dipylidium, Fasciola, Fasciolopsis, Gastrothylax, Gigantocotyle, Haemonchus, Heterakis, Hymenolepis, Moniezia, Oesophagostomum, Paramphistomum, Rallietina, Setaria, Strongylus, Taenia

Major helminth parasites against which plants have been evaluated *in vivo*

*Ascaridia, Bunostomum,
Dipylidium, Fasciola,
Fasciolopsis, Haemonchus,
Hymenolepis, Oesophagostomum,
Paramphistomum, Rallietina,
Strongylus, Taenia*

Plant parts and preparations studied against helminths

Parts	Leaves, seeds, flowers, roots, tubers, stems, fruits
Preparations	Decoction, aqueous extract, alcoholic extract, essential oil, dried powder of plant parts

EVALUATION

In vitro studies

- Gross visual motility of whole worms
- Isometric recording of SMA of nematodes/trematodes
- Alterations in parasite enzymes/metabolism
- Disruption of tegument

In vivo studies

- Egg count
- Dead/live parasites in slaughtered animals

Active principles possessing anthelmintic activity

Plant species	Active principle
<i>Semecarpus anacardium</i>	Anacardic acid
<i>Carica papaya</i>	Benzylisothiocyanate
<i>Ananas comosus</i>	Bromelain
<i>Calotropis procera</i>	Calotropain
<i>Embelia ribes</i>	Embelin
<i>Flemingia vestita</i>	Genistein
<i>Butea frondosa</i>	Palasonin

In vitro activity of plant preparations against helminth parasites of domestic animals

Plant species	Part/extract/active principle of the plant used	Helminth parasite	Reference
<i>Allium sativum</i>	Bulb alcoholic extract	<i>Gigantocotyle explanatum</i>	Singh et al., 2008
<i>Andrographis paniculata</i>	Leaf aqueous extract	<i>Haemonchus contortus</i>	Singh et al., 2011
<i>Arecha catechu</i>	Nut aqueous extract	<i>Fasciola gigantica</i>	Jeyathilakan et al., 2010

<i>Azadirachta indica</i>	Leaf and flower extract	<i>Setaria digitata</i>	Banu et al.,1992
	Alcoholic extract	<i>Fasciola gigantica</i>	Kushwaha et al., 2004
	Aqueous and alcoholic extracts of flowers	<i>Setaria cervi</i>	Mishra et al., 2005
	Leaf aqueous extract	<i>Haemonchus contortus</i>	Singh et al., 2008
	Leaf methanolic extract	<i>Haemonchus contortus</i>	Arora et al., 2010
<i>Bauhinia variegata</i>	Leaf methanolic extract	<i>Haemonchus contortus</i>	Bhardwaj et al., 2010

<i>Butea frondosa</i>	Decoction of seeds	<i>Ascaridia galli</i>	Sharma & Sisodia, 1976
	Benzene extract of seeds	<i>Fasciola gigantica</i>	Upadhyay et al., 2009
	Ether and alcoholic extracts of seeds	<i>Ascaridia galli</i>	Shilaskar & Parashar, 1989
	Alcoholic extract	<i>Fasciola gigantica</i>	Kushwaha, 1998; Kushwaha et al., 2004
		<i>Gastrothylax crumenifer</i>	George, 2004

<i>Calotropis procera</i>	Leaf extract	<i>Setaria digitata</i>	Banu et al., 1992
<i>Carica papaya</i>	Alcoholic extract	<i>Ascaridia galli</i>	Shilaskar & Parashar, 1989
<i>Cedrus deodara</i>	Essential oil	<i>Gastrothylax crumenifer</i>	George, 2004
<i>Cymbopogon nardus</i>	Essential oil	<i>Ascaridia galli</i>	Kaushik et al., 1981
<i>Datura metal</i>	Aqueous extract	<i>Fasciola gigantica</i>	Jeyathilakan et al., 2010

<i>Datura quercifolia</i>	Aqueous extract of fruits	<i>Ascaridia galli</i>	Kaushik et al., 1981
<i>Embelia ribes</i>	Aqueous extract of seeds	<i>Paramphistomum cervi</i>	Lal et al., 1976
<i>Eucalyptus grandis</i>	Essential oil	<i>Gastrothylax crumenifer</i>	George, 2004
<i>Hedychium spicatum</i>	Alcoholic extract	<i>Fasciola gigantica</i>	Hajare, 2000
	Essential oil	<i>Gastrothylax crumenifer</i>	George, 2004

<i>Flemingia vestita</i>	Alcoholic extract of root-tuber peel	<i>Artefechinostomum surfrartyfex</i>	Roy & Tandon, 1996
		<i>Raillietina echinobothrida</i> , <i>Paramphistomum</i> sp.	Tandon et al., 1997
		<i>Raillietina echinobothrida</i>	Pal & Tandon, 1998; Das et al., 2004
		<i>Fasciolopsis buski</i>	Kar et al., 2002
	Genistein	<i>Raillietina echinobothrida</i>	Tandon et al., 1997
		<i>Fasciolopsis buski</i>	Kar et al., 2004

<i>Mallotus philippinensis</i>	Alcoholic extract	<i>Fasciola gigantica</i>	Hajare, 2000
		<i>Gastrothylax crumenifer</i>	George, 2004
<i>Melia azedarach</i>	Aqueous extract of seeds	<i>Haemonchus contortus</i>	Arora et al., 2010
<i>Mentha spicata</i>	Methanolic extract of leaves	<i>Haemonchus contortus</i>	Sharma & Varshneya, 2008
<i>Nigella sativa</i>	Essential oil from seeds	<i>Gastrothylax crumenifer</i>	George, 2004

<i>Peganum harmala</i>	Alcoholic extract	<i>Fasciola gigantica</i>	Hajare, 2000
<i>Piper longum</i>	Alcoholic extract of fruits	<i>Gigantocotyle explanatum</i>	Singh et al., 2008
<i>Pongamia glabra</i>	Ether extract of seeds	<i>Haemonchus contortus</i>	Arora et al., 2010
<i>Tagetes patula</i>	Methanolic extract of flowers	<i>Haemonchus contortus</i>	Bhardwaj et al., 2010
<i>Rhynchosia minima</i>	Leaf aqueous & ethanolic extracts of seeds	<i>Ascaridia galli</i>	Mali & Mahale, 2008

Active principles possessing anthelmintic activity

Active principle	Helminth parasite	Reference
Benzylisothiocyanate	<i>Raillietina</i> spp., <i>Ascaridia galli</i>	Kumar, 1988; Kumar et al.,1991
Bromelain	<i>Oesophagostomum columbianum</i> , <i>Bunostomum trigonocephalum</i>	Garg & Atal, 1963
Calotropain	<i>Oesophagostomum columbianum</i> , <i>Bunostomum trigonocephalum</i>	Garg & Atal, 1963

Embelin	<i>Paramphistomum cervi</i> , <i>Oesophagostomum columbianum</i> , <i>Trichuris ovis</i> , <i>Dipylidium caninum</i>	Gupta et al., 1976
Genistein	<i>Raillietina echinobothrida</i>	Tandon et al., 1997
Palasonin	<i>Setaria cervi</i> , <i>Fasciola hepatica</i>	Sabir et al., 1977
	<i>Ascaridia galli</i>	Kumar et al., 1983, 1995
	<i>Haemonchus contortus</i>	Sathianesan et al., 1984
	<i>Raillietina</i> spp.	Kumar, 1988

In vivo activity of plant preparations against helminth parasites of domestic animals

Plant species	Part/extract/active principle used	Helminth parasite	Reference
<i>Allium sativum</i>	Raw and aqueous extract	<i>Ascaridia galli</i>	Das and Thakuria, 1974
<i>Aristolochia bracheata</i>	Alcoholic extract	<i>Ascaridia galli</i> in chicks	Rao et al., 1982
<i>Azadirachta indica</i>	Methanolic extract of leaves	<i>Haemonchus contortus</i> in goats	Arora et al., 2010
<i>Butea frondosa</i>	Decoction of seeds	<i>Ascaridia galli</i> in poultry	Sharma and Sisodia, 1976
	Aqueous extract of seeds	Hookworms in dogs	Joshi, 1970
	Alcoholic extract	<i>Ascaridia galli</i> in chicks	Rao et al., 1982

<i>Carica papaya</i>	Aqueous extract of seeds	<i>Ascaridia galli</i> in chicks	Rao et al., 1982
<i>Cucurbita maxima</i>	Extract of seeds	Nematodes in calves	Pradhan et al., 1992
<i>Embelia ribes</i>	Extract of seeds	<i>Ascaridia galli</i> in fowls	Dama & Kirdak, 2002
		<i>Haemonchus contortus</i> in goats	Arora et al., 2010
	Leaf powder	<i>GI nematodes</i> in sheep & goats	Kumar et al., 2010
<i>Melia azedarach</i>	Extracts of seeds	<i>Haemonchus contortus</i> in goats	Misri et al., 2002
	Methanolic extract of seeds	<i>Haemonchus contortus</i> in goats	Arora et al., 2010

<i>Pongamia glabra</i>	Ether extract of seeds	<i>Haemonchus contortus</i> in goats	Arora et al., 2010
<i>Psoralea corylifolia</i>	Ether and alcoholic extracts	Avian <i>Ascaridia galli</i>	Shilaskar & Parashar, 1985
<i>Punica granatum</i>	Extract of rind	Nematodes in calves	Pradhan et al., 1992
<i>Swertia chirata</i>	Aqueous extract of seeds	Nematodes in goats	Jain & Sahni, 2009
<i>Vernonia anthelmintica</i>	Alcoholic extract	<i>Hymenolepis nana</i> , <i>Fasciolopsis buski</i>	Singh et al., 1985

***In vivo* activity of combination of plant preparations against helminth parasites of domestic animals**

Product name	Constituent	Helminth parasite	Reference
	<i>Azadirachta indica</i> , <i>Butea frondosa</i> , <i>Nigella sativa</i> and <i>Piper longum</i>	<i>Haemonchus contortus</i> , <i>Oesophagostomum columbianum</i> , <i>Paramphistomum cervi</i> in goats	Raje et al., 2004
	<i>Acacia auriculiformis</i> and <i>Centella asiatica</i>	<i>Dirofilaria immitis</i> in dogs	Sarkar et al., 1998
Helminta	Phenothiazine, Piperazine, Stannous oxide, <i>Vernonia anthelmintica</i> , Senna leaves and embelin	<i>Ascaridia galli</i> , <i>Railletina</i> spp. in poultry	Matta & Ahluwalia, 1979

Janata	<i>Artemisia maritima,</i> <i>Brassica nigra,</i> <i>Cassia lanceolata,</i> <i>Vernonia anthelmintica,</i> <i>Embelia ribes</i>	Helminth parasites in goats	Shirale & Maske, 2003
		<i>Haemonchus contortus,</i> <i>Strongylus,</i> <i>Trichstrongylus,</i> <i>Nematodirus</i> in crossbred cattle	Sharma, 1993
Krimos	Herbal preparation	<i>Ascaridia galli,</i> <i>Heterakis gallinae</i> in poultry	Mukherjee, 1996

Sonex	Nicotine sulphate, <i>Embelia ribes</i> and <i>Punica granatum</i>	<i>Ascaridia galli</i> , <i>Raillietina</i> spp. in poultry	Matta & Ahluwalia, 1979
Taenil	Male fern, <i>Mallotus philippinensis</i> , Barbrung, Senna, Ajwain and Saunf	<i>Taenia</i> , <i>Dipylidium</i> in dogs	John & Raghavan, 1987
		<i>Hymenolepis</i> spp. in ducks	Barua & Gogoi, 1988
		Poultry tapeworms	Tuli & Bali, 1991

Wopell	<i>Mallotus philippinensis</i> , <i>Butea frondosa</i> , <i>Embelia ribes</i> , <i>Acacia catechu</i> and <i>Droyptheris felix-mas</i>	<i>Ascaridia galli</i> in poultry	Hafeez & Venkatarata, 1989
	<i>Azadirachta indica</i> , <i>Nigella sativa</i> , <i>Butea frondosa</i> and <i>Piper longum</i>	GI helminths in goats	Ramteke et al., 2008

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Plant	Part	Active principle/extract	Activity against helminth parasite
<i>Prunus persica</i>	Leaves	Essential oil	<i>H. contortus</i>
<i>Butea frondosa</i>	Seeds	Palasonin	<i>S. cervi</i> , <i>A. galli</i> , <i>F. gigantea</i>
<i>Carica papaya</i>	Seeds	Benzylisothiocynate	<i>A. galli</i>
<i>Mallotus philippinensis</i>	Seeds	Alcoholic extract	<i>F. gigantea</i> , <i>G. crumenifer</i>
<i>Hedychium spicatum</i>	Root	Alcoholic extract/essential oil	<i>F. gigantea</i> , <i>G. crumenifer</i>

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Plant	Part	Active principle/extract	Activity against helminth parasite
<i>Peganum harmala</i>	Seeds	Alcoholic extract	<i>F. gigantica</i>
<i>Nigella sativa</i>	Seeds	Essential oil	<i>G. crumenifer</i>
<i>Eucalyptus grandis</i>	Leaves	Essential oil	<i>G. crumenifer</i>
<i>Cedrus deodara</i>	Wood	Essential oil	<i>G. crumenifer</i>

Veterinary Pharmaceuticals dealing with Herbal Drugs

1	Aamoda, Bangalore	11.	Cheerans, Thrissur
2	Alarsin, Mumbai	12	Concept, Mumbai
3	Alembic, Baroda	13	Dabur Ayurved, Delhi
4	AVR, Bangalore	14	Guybro, Mumbai
5	BE Animal Health	15	Herbal Medicaments, Bangalore
6	Cadila Pharma, Ahmedabad	16	Himalaya, Bangalore
7	Care Tech, Bangalore	17	Indian Herbs, Saharanpur
8	Cattle Remedies, N. Delhi	18	Indian Pet Products, Bangalore
9	Century, Baroda	19	Natural Remedies, Bangalore
10	Charak, Mumbai	20	Novartis, Mumbai

Veterinary Pharmaceuticals dealing with Herbal Drugs

21	Oriental, Mumbai	31	Sarabhai Zydus, Baroda
22	Pranav, Pune	32	Theodore, Mehsana
23	Premium, Mumbai	33	TTK, Chennai
24	Rakesh, Mehsana	34	VC, Ernakulam
25	Rallis, Mumbai	35	Venky's, Pune
26	Ranbaxy, New Delhi	36	Vesper, Bangalore
27	Redeem, Bangalore	37	Vetchem, Chennai
28	Respel Pharma, Bangalore	38	Vetguard
29	Sai Deep, Bangalore	39	Vets Farma, Jalandhar
30	Sam Browne	40	Wockhardt, Mumbai

HERBAL VETERINARY DRUGS MARKETED IN INDIA

Drug/ Disorder	Number
Antihaemorrhagic/haemostatic	1
Anxiolytic/behavioural modifier	1
Herbal ear drops	1
Herbal performance enhancer	1
Haematinic	1
Renal disorders	2
Drugs acting on female genital system-intrauterine formulations	22 2
Antifungal/antimange	3
Appetite stimulant	4
Anthelmintics	4
Toxin binders	4


HERBAL VETERINARY DRUGS MARKETED IN INDIA

Drug / Disorder	Number
Anti-inflammatory, antiarthritic, antiflogistic	5
Udder (topical preparations)	6
Expectorant/mucolytics	7
Tympany/bloat/indigestion/colic	8
Anti-stress	8
Ectoparasiticides	9
Pain, fever, inflammation	13
Acute or chronic diarrhoea/dysentery	16
Stomachics/rumenotonics	16
Galactogogues	20
Hepatobiliary drugs	32
Coat conditioner/topical antiseptics	46

PLANT-BASED ANTHELMINTICS

- **Narrow and broad spectrum anthelmintic activities**
- **Lower cost**
- **Easy accessibility**
- **No residues in faeces**
- **No environmental problems**

FUTURE NEEDS

- **Suitable dosage regimens**
- **Improved methods of preparation and uses**
- **Scientific trials in experimentally infected and naturally infected animals**
- **Strategies to enhance therapeutic effects of plant-based anthelmintics**
- **Identification/standardization of active principles** 
quality control
- **Biotechnological intervention to increase anthelmintic production by plants**



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