

Herbal Treatment for Intestinal Parasites

BY KERRY BONE AND MICHELLE MORGAN

Spring is traditionally a time for cleaning. This was well recognised by European herbalists who used a number of herbs as “spring tonics” or “spring cleansers”. Many of these spring tonics provided much needed vitamins after a lengthy period of consuming stored foods. But they also included the depurative herbs (which cleanse the blood by yet unknown mechanisms) and herbs for promoting digestion, including the bitter herbs wormwood and gentian. Wormwood, as the name implies, was also traditionally used to treat gastrointestinal worm infestation. We may conclude that this aspect was also part of the use of spring tonics.

Whether this is the case or not, it is true to say that the plant world has long provided options to assist in the control of intestinal parasites. A few of the more popular of these herbs are reviewed below, together with a significant and highly active anthelmintic herb from traditional Chinese medicine (TCM). But the main thrust of this review is to suggest that synergistic activity via a combination of these key herbs (with other herbal treatments as well to support digestion and immunity for example) will yield the best results.

Stemona

Stemona radix, the tuberous root of *Stemona sessilifolia*, *Stemona tuberosa* or *Stemona japonica*, is used in TCM mainly for the treatment of acute and chronic cough. Externally it is used for the treatment of fungal infections, lice infestation and as an enema for pinworm infestation.^{1,2,3} In addition to its primary use for the treatment of cough, in Vietnam *Stemona japonica* root is prescribed for *Ascaris* infestation and is used externally to treat scabies (mite infestation).⁴ Plant extracts from the Stemonaceae have also been used in Japanese traditional medicine in the treatment of respiratory diseases and as anthelmintics.⁵

Key Constituents

A series of complex alkaloids have been isolated from the root of these *Stemona* species.⁶ The unusual and complex alkaloids exist only in *Stemona* plants and in a few related species and include tuberostemonine and stemonine.⁷

Anthelmintic Activity

The experimental anthelmintic activity of crude extract

of *Stemona* may be due to the action of its alkaloids. Tuberostemonine, an alkaloid isolated from *Stemona sessilifolia*, *S. tuberosa* and *S. japonica* root,⁶ paralysed the motility of *Angiostrongylus cantonensis in vitro* and showed contractive effects on the motility of *Dipylidium caninum* and *Fasciola hepatica*.⁸ Tuberostemonine was inactive *in vitro* as an anthelmintic against a species of tapeworm.⁹

One hundred and forty cases of ancylostomiasis (hook worm infestation) were treated with the herb. After 3 months, follow-up examination of 110 cases revealed a negative rate of 94.5%. Another group of 48 cases was effectively treated with the herb decoction; 116 worms, all from the duodenum, were expelled. However, the same method did not show any anthelmintic effects in later trials.² Alcoholic extracts may have greater efficacy than decoction.

A suppository prepared from *Stemona* root tuber was used to treat 40 children with oxyuriasis (infestation with a type of nematode); 16 of them were cured. Twenty-seven out of 63 cases were cured by the herb powder.²

Dosage:

- Suppository (12.5 g each), one suppository was inserted into the rectum at 8 pm, another at 10 pm every night for one week, then every other night for another week.
- Powder: 1.5 g, 3 times daily for 3 days.

Wormwood

Artemisia absinthium is well known to herbalists with particular application to treating nematode infestation, especially infestation with *Enterobius* or *Ascaris*.^{10,11} Wormwood has been used as an anthelmintic since ancient times and is currently utilised in many countries throughout the world for this purpose. Wormwood tincture is employed in the West Indies as a worm preventative.¹² Wormwood has also been used for the de-worming of horses, cows and sheep.^{13,14}

Key Constituents

Constituents of the aerial parts of wormwood include bitter substances (sesquiterpene lactones, mainly absinthin) and an essential oil containing mainly

terpenes. The essential oil contains the potentially toxic monoterpene thujone and for this reason the recommended therapeutic doses of wormwood should not be exceeded.¹⁵

Anthelmintic Activity

In vitro wormwood aqueous extract demonstrated anthelmintic activity towards the nematode *Trichostrongylus colubriformis*,¹⁶ and wormwood oil was active in the *Toxocara* assay (defined below).¹⁷ Thujone is also implicated in the anthelmintic activity of wormwood. Experiments carried out in Edinburgh in 1955 indicated the efficacy of thujone in eliminating *Ascaris lumbricoides*.¹⁸

Other Related Activity

Wormwood aqueous extract and alcohol extract strongly inhibited the *in vitro* growth of the parasitic protozoa *Naegleria fowleri*. The sesquiterpene lactone fraction isolated from the alcohol extract was also active.¹⁹

Wormwood powder (1.5 g/day) provided effective treatment for acute intestinal amoebiasis in an uncontrolled trial of 20 patients. Symptoms were relieved and 70% of cases were cleared of the protozoa *Entamoeba histolytica* according to stool analysis.²⁰

Wormwood is also used to treat other gastrointestinal conditions such as appetite loss, disturbed digestion, flatulence¹¹ and disordered bile flow.²¹ Clinical trials have demonstrated the ability of wormwood to increase the flow of gastric enzymes, pancreatic enzymes and bile.^{22,23}

Black Walnut Hulls

A globular fruit is produced from the black walnut tree which contains a corrugated nut in its yellowish-green hull (also called husk or fruit wall). Upon ripening the hull softens and turns dark brown to black due to chemical oxidation. A decoction of the hull of *Juglans nigra* fruit has been used traditionally to expel worms.¹¹

Key Constituents

The unripe, green hulls of *Juglans nigra* contain 1,4-naphthoquinones including juglone and plumbagin.²⁴ The juglone content in green hulls varies with different cultivars and different months of growth.²⁵

Anthelmintic Activity

In vitro studies indicate that plumbagin inhibited the motility of and hatching of *Haemonchus contortus* first

stage larvae. Plumbagin was larvicidal towards *Ascaris suum* at the highest test concentration (100 mM). Partial inhibition of embryonic development of *A. suum* occurred with plumbagin.²⁶ The authors suggested that because of the relatively high doses required for the maximal effect on inhibiting the development of larval stages, plumbagin may not find practical application. The combination with other anthelmintic herbs would however, boost the activity of plumbagin.

Clove Bud Essential Oil

The dried, unopened flower bud of *Syzygium aromaticum* (*Eugenia caryophyllus*) has been used in Ayurveda and Western herbal medicine as a carminative and aromatic.^{11,27} It has recently been popularised as a worm treatment. Therapeutic indications for clove bud include nausea, flatulence, dyspepsia and to assist the action of other herbal remedies.^{11,27,28}

In traditional Thai medicine the essential oil is used as a carminative and to treat stomach ache, in addition to the well-known topical application of toothache.²⁹ In Indonesian traditional medicine clove oil is taken with beer to protect against abdominal pain! Clove bud is also used in this traditional system to alleviate flatulence.³⁰

Key Constituents

Key constituents of clove bud include an essential oil (15–20%, consisting mainly of eugenol, eugenol acetate, beta-caryophyllene), flavonoids, tannins and phenolic acids.³¹ Eugenol is a major constituent of clove bud essential oil (80–85%).³²

Anthelmintic Activity

Clove powder demonstrated potent anthelmintic activity *in vitro* towards *Pheretima* spp. (earthworms). At the time of the study, earthworms were used as a model to investigate anthelmintic activity. Suspension of clove powder was more than 5 times more potent than a water extract of cloves, and clove powder was 4.5 times more potent than powdered fresh garlic. Suspension of clove powder was 7.3 times more active than the anthelmintic drug piperazine, whereas the water extract of clove was of similar potency.³³ Piperazine is an anthelmintic drug which has been used to treat pinworm and roundworm infections in humans for decades.

Both water extract and methanol extract of clove bud were strongly active in a nematocidal assay.³⁴ The assay used the second-stage larva of the roundworm *Toxocara canis*, which at the time of the study was highly resistant

to anthelmintic drugs. The relative movability (RM) value compares the extent of movement of the test population which has been exposed to the anthelmintic agent with the movability of the control sample. Strong activity was defined as a RM value of 0 (at which all larvae are dead). A value of 100 indicates no activity (no disabling effect on the larvae), and increasingly lower RM values approaching 0 indicate stronger activity of the extracts against the larvae.

A value of 0 was obtained for clove methanolic extract tested at both concentrations (1 mg/mL, 10 mg/mL) and at both time frames (6 h, 24 h) and for water extract (10 mg/mL) at 24 hours. Piperazine produced a RM value of 32 for 1 mg/mL after 24 hours of incubation in the same assay and other anthelmintic drugs such as phenothiazine produced a RM value of 0 under the same conditions. Eugenol produced a RM value of 0 at 1 mg/mL at 24 h, and a value of 50 at the lower concentration of 0.1 mg/mL after the same time period.³⁴ In another study using the same assay a RM value of 0 was obtained for clove bud oil at 1 mg/mL for both time frames (6 h, 24 h), and for eugenol at the same concentration at 24 h.¹⁷

Clove oil killed *Anisakis* spp. larva *in vitro*.³⁵ Eugenol also demonstrated potent anthelmintic activity towards

*Caenorhabditis elegans in vitro*³⁶ and *Rhabditis macrocerca* and *Ascaris suum in vitro* and *in vivo* in mice (route unknown).³⁷

Potential for Synergistic Anthelmintic Activity

The phenomenon known as bursting of worm larvae occurs when the outer covering of the larva is torn, resulting in protrusion of its intestine. Nematocidal assays can discover active principles that cause the killing and/or bursting of worm larvae. A constituent that has no nematocidal activity may produce bursting when combined with a nematocidal agent.

Eugenol caused bursting of worm larvae in the *Toxocara* assay described above. The activity of eugenol on its own was relatively weak (11%) but it caused marked bursting of worms (90–91%) when combined with tannins (hydrolysable tannin and condensed tannins respectively).³⁴ Tannins are not larvicidal by themselves, but they cause bursting when combined with a larvicidal compound, as has been demonstrated in the same assay previously.³⁸ This is visually represented in the following table.

Substance	Nematocidal Activity §	Bursting Activity §
clove bud methanol extract	√ (strong)	x
eugenol	√ (strong)	√ (weak, 11%)
tannins*	x	x
eugenol + tannins*	√ (strong)	√ (strong, 90–91%)†

Table 1. The presence of an inactive substance increases the bursting activity of weakly active substances.^{34,38}

Note: All substances tested at 1 mg/mL and 24 h incubation, except the tannins when tested alone (0.2–10 mg/mL). For the constituent-tannin combination eugenol = 1 mg/mL, tannins = 0.1 mg/mL.

§ Strong nematocidal activity is defined as RM = 0 at 1 mg/mL, 24 h; strong bursting activity: 50–100%.

* Two sets of tannins tested: a hydrolysable tannin (tannic acid) and condensed tannins (mixture from *Areca catechu* (betel nut)).

† Range expresses hydrolysable tannin and condensed tannin mixture respectively.

In order to cause bursting, coexistence of both the anthelmintic compound and the bursting factor is necessary. The bursting activity of tannins (when combined with the suitable larvicidal substance) increased with increasing degree of condensation for condensed tannins and with increasing proportion of phenolic groups for hydrolysable tannins.³⁸ The types

of tannins found in green tea extract were not tested but could be expected to be active based on the significant activity seen for complex hydrolysable tannins. Grape seed extract could also be expected to be active but this activity would only be due to the tannins with a higher degree of condensation (tetramers or more) found in these extracts.

Eugenol in combination with tannins can cause, even at lower concentration than its minimum lethal concentration (MLC), the bursting of worms if a large amount of (another) nematocidal constituent is

present. (MLC was defined as the lowest concentration producing a RM value of 0 after 24 hours incubation, determined for eugenol as 0.33 mg/mL.)³⁴ This is highlighted in the following table.

Eugenol	Methyleugenol	+ Tannins	Bursting Activity
1 mg/mL		–	weak, 11%
	1 mg/mL	–	weak, 13%
1 mg/mL		0.1 mg/mL	strong, 90–91%
	1 mg/mL	0.1 mg/mL	inactive, 0–4%
0.1 mg/mL	0.9 mg/mL	0.1 mg/mL	strong, 55–92%

Note: Experimental conditions as per Table 1 (previous page).

Conclusions from these and further studies using the *Toxocara* assay indicate:

- a balance between the hydrophilicity (water-soluble) and hydrophobicity (fat-soluble) of the constituents is important for the larvicidal activity;³⁹
- the bursting activity may be caused not only by tannins but also by other nonvolatile³⁴ and volatile constituents;¹⁷
- that a different bursting feature was observed for the tannin-nematocide mixture compared to the bursting caused by essential oil alone¹⁷ suggesting a different mechanism of action;
- the synergistic action of tannins and an anthelmintic not only damages the worms irreversibly, but also, in some instances markedly reduced the required amount of the anthelmintic.³⁸

Methanol extract of turmeric rhizome (*Curcuma longa*) demonstrated anthelmintic activity in the *Toxocara* assay described above. RM values of 0 were obtained at 24 h for concentrations of 0.1–10 mg/mL.^{34,40} The curcuminoids curcumin, demethoxycurcumin and bisdemethoxycurcumin were ineffective when tested individually. When they were mixed in equal proportions (1:1:1), a strong nematocidal activity was demonstrated.⁴⁰

This research suggests the value of combining various herbal agents for a synergistic anthelmintic activity. It also implies that combination of anthelmintic herbs with tannin-containing herbs such as green tea and particularly herbs containing condensed tannins such as grape seed extract will enhance their activity. As seen in

the turmeric research the activity of an individual herb depends on several of its constituents working in synergy.

Recent Anthelmintic Research

In vitro tests conducted at a government laboratory in Brisbane in 2002 using a number of herbal extracts and essential oils have indicated that clove bud and *Stemona* have definite positive anthelmintic activity towards a sheep intestinal nematode prevalent in this locality.⁴¹ The testing included egg hatch assay, larval development assay and infective larvae assay. At the tested dosage, clove bud gave a convincing kill of the larvae population, rather than just immobilisation. A field trial testing a number of herbs and essential oils for the treatment of worm infestation in sheep is pending.

Suggested Combinations for Increased Activity

The following treatments would combine well and provide synergistic anthelmintic activity with the wormwood, black walnut hulls, *Stemona* and clove bud essential oil mentioned above. These treatments should be taken together (i.e. at the same time). The list includes:

- holy basil (*Ocimum sanctum*) essential oil, since the leaf has been used in traditional Ayurvedic medicine as an anthelmintic and the essential oil has demonstrated potent anthelmintic activity *in vitro* towards *Caenorhabditis elegans*.³⁶ In the worm bursting assay outlined above³⁴ methyleugenol demonstrated nematocidal activity but was devoid of worm bursting activity. The presence of even a

small amount of eugenol (5–10%) in the methyleugenol-tannin mixture caused the bursting of the worms, particularly when the tannin was of the condensed type.³⁴ Both eugenol and methyleugenol occur in holy basil essential oil; the amount of each varies depending upon the chemotype.⁴²

- tannin-containing herbs especially preparations containing green tea (*Camellia sinensis*) and grape seed (*Vitis vinifera*) extract. These herbs should be taken concomitantly with the anthelmintic herbs.
- turmeric (*Curcuma longa*), because the rhizome has been used as an anthelmintic in Thai traditional medicine⁴³ and has demonstrated *in vitro* anthelmintic activity (outlined above).^{34,40}
- immune enhancing herbs such as Echinacea, and also preparations containing *Andrographis paniculata* and holy basil essential oil, to enhance the body's natural immune function and assist in the immune response to worm infestation. (Eosinophilia (increased number of eosinophils in the blood) and elevated serum IgE (gamma-E globulin) levels are features of many helminthic infections.)
- garlic (*Allium sativum*) which has been used as an anthelmintic in Western herbal medicine,¹⁰ for example, as a decoction or freshly mashed and administered to children on an empty stomach.⁴⁴ Garlic extract containing alliin/allicin was effective against *Rhabditis* spp. and the eggs of *Ascaris suum* *in vitro*.⁴⁵
- laxative herbs to promote elimination of the worm infestation (or worm debris) via the bowel including preparations containing cascara (*Rhamnus purshiana*) and yellow dock (*Rumex crispus*).
- bitter herbs to promote the gastric acid barrier to resist reinfestation. Gentian (*Gentiana lutea*) liquid extract is recommended.
- digestive enzyme preparations, such as the latex of *Ficus* spp. which contains ficin has been used traditionally in neotropical areas such as the Amazon as an anthelmintic.⁴⁶ However, concomitant intake of digestive enzymes with tannins may result in the inactivation of the enzymes.

Example Treatments

Herbal Liquid Formula

<i>Echinacea purpurea</i> root and <i>E. angustifolia</i> root blend	1:2	30 mL
Wormwood (<i>Artemisia absinthium</i>)	1:5	15 mL
Black walnut hulls (<i>Juglans nigra</i>)	1:10	20 mL
Cranesbill root (<i>Geranium maculatum</i>)	1:2	20 mL
Thyme (<i>Thymus vulgaris</i>)	1:2	25 mL
		110 mL

Dose: 5 mL with water 4 to 6 times a day for 10 days. After a 10-day break, repeat treatment for 10 days. The second treatment is to kill any larvae which may have hatched after treatment, since herbal anthelmintics are not very effective at killing eggs.

Note: These are adult doses. Use appropriate calculations based on body weight for children's doses.

Tablet or Combined Protocols

Note that the doses for products given below represent adult doses. Use appropriate calculations based on body weight for children's doses.

Core Treatment

Herbal tablets containing *Andrographis*, *Echinacea angustifolia* root and holy basil leaf plus essential oil. Dose: 4 tablets per day as a continuous treatment for immune support.

AND

Herbal tablets containing *Stemona* spp., wormwood, black walnut hulls, and clove oil.

Dose: 4 to 6 tablets per day for 10 days. After a 10-day break, repeat treatment for 10 days.

Additional Treatments (as required)

- Garlic tablets (3 per day on the same days as the wormwood tablets) for stubborn parasites.
- A herbal formulation to promote digestion containing chamomile (*Matricaria recutita*), dandelion (*Taraxacum officinale*), *Echinacea angustifolia* root, milk thistle (*Silybum marianum*) and gentian (4 mL with water before meals) if a low gastric acid barrier and poor digestion are thought to contribute to reinfestation.

- Herbal tablets containing rosemary (*Rosmarinus officinalis*), green tea, turmeric and grape seed (2 tablets per day on the same days as the wormwood tablets but at different times) to provide synergistic worm-killing activity.
- Laxative herbs, such as herbal tablets containing cascara, dandelion root, yellow dock, dill (*Anethum graveolens*) seed and chamomile (2–6 tablets before bed twice a week during treatment with the wormwood tablets) to assist the expulsion of worms. The dose should be sufficient to create a very loose stool.

See the following article for clinical anecdotes on the treatment of worm infestation.

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Glossary

Angiostrongylus cantonensis

Species of parasitic nematode. Human infection, caused by consumption of raw slugs and land snails, results in eosinophilic meningitis.

Anisakis

Genus of roundworm. Human infection results from the consumption of fish harbouring roundworm larvae.

Anthelmintic/antihelmintic/nematocidal

Causing the death and/or elimination of worms.

Ascaris spp.

Ascaris lumbricoides is the largest nematode found in the human intestine. *Ascaris suum* is a species of parasitic nematode usually found in domestic pigs and a few other animals. Human infection can also occur from handling pig manure.

Caenorhabditis elegans

Species of nematode that is widely used in biological, biochemical, and genetic studies.

Dipylidium caninum

Species of tapeworm of which the dog and cat are definitive hosts, and humans are an occasional host.

Entamoeba histolytica

Species of parasitic protozoa causing amoebiasis and amoebic dysentery.

Enterobius

Genus of intestinal nematode including the pinworm or threadworm *Enterobius vermicularis*.

Fasciola hepatica

Species of helminth commonly called the sheep liver fluke. Occasionally seen in humans, it is most common in sheep and cattle.

***Haemonchus* spp.**

Haemonchus is a genus of parasitic nematode which infests herbivores e.g. sheep, which ingest it with the grasses they eat. Infestation of man is accidental.

Helminths

Parasitic worms, and includes the Acanthocephala, Nematoda and Platyhelminths (which includes tapeworms (Cestoda)).

Larva

Immature, grublike stage, following the egg in the life cycle of insects, worms, and other metamorphosing animals.

Nematode

Any worm of the phylum Nematoda (smooth-skinned, unsegmented worms with a long cylindrical body shape tapered at the ends).

Naegleria fowleri

Species of parasitic protozoa. Infection with this pathogen produces primary amoebic meningoencephalitis.

Rhabditis

Genus of nematode, a few species of which are parasitic in humans.

Toxocara canis

Species of parasitic nematode found in the intestine of dogs. Infection in humans has consequences to tissues beyond the intestines.

Trichostrongylus colubriformis

Nematode which is parasitic in the digestive tract of herbivorous animals and occurs only as incidental infections in humans.

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Kerry Bone was an experienced research and industrial chemist before studying herbal medicine full-time in the UK where he graduated and joined the National Institute of Medical Herbalists. Kerry is the founder of, and Director of Research and Development at MediHerb and from 1990–1997 was appointed to the Traditional Medicines Evaluation Committee of the Therapeutic Goods Administration. He is a prolific writer and presenter in Australia, New Zealand and the USA. He has written and co-authored several authoritative herbal medicine textbooks. Kerry is also a practising herbalist with 18 years' experience.

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Michelle Morgan has a Bachelor of Science degree majoring in Chemistry from the University of Queensland (1987) and worked in the scientific field as a laboratory technician for many years. She has expertise in Quality Assurance, working for over 3 years as a Quality Assurance Chemist in building products manufacture. Michelle has worked for 8 years at MediHerb as Technical Writer where she is responsible for information gathering, technical writing and organising technical publications. Michelle has also completed studies in herbal medicine.