

***In vivo* studies of the effect of medicinal herbs on the pig nodular worm (*Oesophagostomum* spp.)**

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Summary

To study the effect of medicinal plants on pig nodular worm *Oesophagostomum* spp., a pilot study was conducted in an experimental unit of the Estonian Agricultural University in May – August 2004. Nematode-free piglets were infected with 5000 L₃ larvae of *Oesophagostomum* spp. to test antiparasitic effect of pumpkin (*Cucurbita pepo*) seeds, tansy (*Tanacetum vulgare*) herbs, sweet flag (*Acorus calamus*) rhizome and garlic (*Allium sativum*) bulbs. Herbal products were administered *per os* (5 g per 1 kg of body weight) three times at weekly intervals after start of patency. The worms were recovered at autopsy from large intestinal contents by agar-gel migration technique, counted and identified. All tested plants lowered abundance of pig nodular worm. Rhizome of sweet flag was found to be the most effective natural product. Further studies should verify the suitability of plant products as alternatives to synthetic anthelmintics.

Key words: pig nematodes; medicinal plants; *Oesophagostomum* spp.

Introduction

Herbal medicine as a branch of alternative medicine is reaffirming its validity and usefulness. According to ethnological folk knowledge several medicinal plants have been used against animal parasites long time ago before pharmaceutical preparations came into practice. As many drugs of synthetic origin may have a negative impact on the environment and parasite resistance to numerous chemical preparations can develop after repeated applications, there is an increasing wish to attain new means of control and the use of natural products have become more popular.

Many of the active ingredients in manufactured drugs were originally derived from plant compounds and used against

diseases. Use of medicinal plants with antiparasitic properties has become more important in organic farms, where preventive use of pharmaceutical drugs is not allowed by EU regulations. Control of internal parasites of livestock by non-chemical methods is an important focus of parasitological research in the Nordic countries (Thamsborg *et al.*, 1999; Waller *et al.*, 2001; Thamsborg & Roepstorff, 2003).

According to our own results of the previous *in vitro* tests with herbal preparations (Kaarma *et al.*, 2000) several plant products were able to lower ectoparasite abundance. Wormwood (*Artemisia absinthium*), hogweed (*Heracleum sosnowskyi*), tansy (*Tanacetum vulgare*) and mugwort (*Artemisia vulgaris*) showed the highest effect against swine ectoparasites tested in our laboratory. Herbal products have not been tested against intestinal parasites in domestic animals in Estonia.

The aim of the present study was to estimate the effect of local medicinal herbs in experimentally infected pigs.

Material and Methods

Plant Preparations

To study the influence of four local plants on common intestinal nematodes in pigs, a pilot experiment was conducted in an experimental unit of the Estonian Agricultural University in May – August 2004. Four herb products: pumpkin (*Cucurbita pepo*) seeds, tansy (*Tanacetum vulgare*) herb, sweet flag (*Acorus calamus*) rhizome and garlic (*Allium sativum*) bulb extract in capsules (Dansk Droge A/S) were tested on experimentally infected pigs.

According to Dr. Duke's Phytochemical and Ethnobotanical databases (1992) all tested plants contained insecticidal, repellent or nematocidal ingredients. Medicinal herbs were collected during their growing period, dried at room temperature, chopped with mixer and stored in darkness in glass containers. The dried plant dose administered to pig-

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lets was 5 g per 1 kg of body weight. Individual *per os* administration of all medicinal herbs was applied. For comparison one piglet group was treated with 1 % ivermectin.

Parasite Isolate

Pig nodular worm *Oesophagostomum* spp. as the most common large intestinal nematode in Estonian pig herds was chosen for experimentation. The original isolate was collected by H. Talvik from Estonian pig farms in 1997 and passaged through pigs during previous experiments. Faecal cultures containing *Oesophagostomum* spp. eggs were set up and cultivated at room temperature for 14 days. Infective larvae were collected and cleaned by the Baermann technique and stored in tap water at 10°C for 1 – 2 years prior to present experiment.

Experimental Animals

24 Landrace/Estonian Big White Pig crossbred piglets of both sexes with an average body weight of 13.3 kg at the age of 2 months were obtained from a reputable infection-free farm. Pigs were divided randomly between 6 experimental groups (4 pigs per group). The helminth-free status of piglets was confirmed by repeated faecal examinations prior to inoculation. Pigs were housed in isolated pens and strict measures were taken to avoid contamination or additional infection. The pigs were fed according to a standard feeding regimen and had free access to water.

All pigs were inoculated *per os* by syringe with 5000 L₃ larvae of *Oesophagostomum* spp. 10 days after transportation to the experimental unit. Faecal examinations were carried out once a week during the whole experiment and egg counts determined by the modified McMaster method. Plant treatments were carried out after start of patency three times at weekly intervals. The experiment was terminated with autopsy in August. The worms were recovered from large intestinal contents by the agar-gel migration technique (Slotved *et al.*, 1996). Collected worms were cleared in 85 % lactic acid and differentiated microscopically by sex and species according to Haupt (1966).

Results and Discussion

All tested plant products demonstrated nematicidal effect against pig nodular worm *Oesophagostomum* spp. (Table 1, Fig. 1). The number of excreted eggs in one gram of faeces (EPG) and the number of worms recovered from the

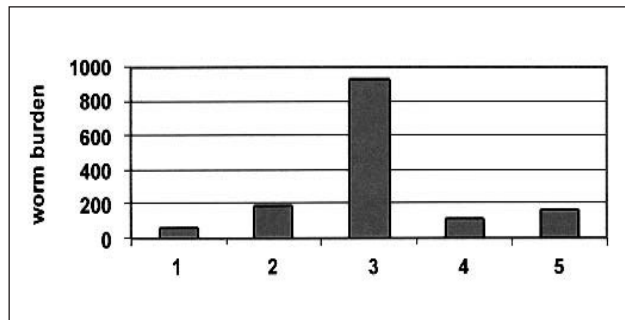


Fig. 1. Effectiveness of four herbal products on pig nodular worm (*Oesophagostomum* spp.): 1 – sweet flag *Acorus calamus* rhizome; 2 – tansy *Tanacetum vulgare* flowers and leaves; 3 – garlic *Allium sativum* bulb extract; 4 – pumpkin *Cucurbita pepo* seeds; 5 – ivermectin (1 %)

intestines (worm burden) was markedly lower (78 – 98 %) in treated pigs. The effectiveness of the tested herbal preparations was comparable with modern anthelmintics. The rhizome of sweet flag (*Acorus calamus*) had the highest effect against the pig nodular worm. After three treatments with dried rhizome only 54 parasites were found from the large intestine and EPG had dropped to zero. From these 54 worms found 38 were adult females. Apparently sweet flag treatment suppressed egg excretion in these female worms. The rhizome contains nematicidal compounds such as limonene and menthol. Their ovicidal or inhibitory effect on oviposition is not yet tested or proven. Tansy flowers and pumpkin seeds showed also high effect on worm abundance, lowering it 95 – 97 % in treated pigs. The main nematicidal compound in pumpkin seeds is called cucurbitin. The extracts of garlic bulbs diminished the number of parasites up to 78 % compared to the worm burden of the non-treated animal. Numerous studies performed in recent years indicate that the compound allicin, found in garlic bulbs, has antibiotic and antiparasitic properties (Mercola, 2001). The effectiveness of tested plant products was compared favourably with modern anthelmintics. Sweet flag and pumpkin treatments gave lower worm burdens. We did not evaluate the effect of tested herbs against the two different nodular worm species *O. dentatum* and *O. quadrispinulatum* present in the used isolate, as the initial species composition of the inoculum was not detectable. No alternations in appetite of treated pigs were registered. Despite the promising results of our pilot study, carried out

Table 1. Nematicidal effect of four different plants fed to pigs, experimentally infected with 5000 L₃ larvae of *Oesophagostomum* spp. Herbal products were administered *per os* (5 g of dry weight per kg) three times at weekly intervals after start of patency

Pig group no.	Treatment and dose	EPG (after treatments)	Worm burden at autopsy	Reduction %
1	Sweet flag rhizome 5 g/kg	0	54	98.0
2	Tansy flowers and leaves 5 g/kg	20	178	95.8
3	Garlic extract 10 mg/pig per day during 3 weeks	2800	920	78.5
4	Pumpkin seeds 5 g/kg	80	105	97.5
5	Ivermectin 1 % 1 ml/33 kg	200	166	96.1
6	Non-treated (control)	3720	4270 (100 %)	0

with experimentally infected pigs, given data are not sufficient to draw final conclusions about the effectiveness of these four plants against pig nodular worm. To determine optimal dosages and time schedule for herbal treatments of pigs further studies with more animals are needed.

We do suggest that on organic farms plant products may be used in future as alternatives to synthetic medicines against pig parasites.

The experiment was carried out in compliance with The Animal Protection Act of Estonia.

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