Research Article

# Effect of Plant Extracts on the Gastrointstinal Nematodes of Ruminants in Uzbekistan

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**Abstract** | The objective was to study the effect of extracts from local plants of Uzbekistan on the gastrointestinal nematodes of domestic small ruminants. Plant extracts were obtained from the shoots and lower parts of plants, as *Ferula foetida, Acroptilan repens, Pepovskia angustifolia, Aptemisia leucoids, Tanacetum vulgare* and *Persica vulgaris* collected from the Fergana Valley, Tashkent and Jizzakh regions. The biological efficacy of this extracts of plants against gastrointestinal nematodes of small ruminants in the laboratory and in the field was determined. Test animals asked orally in a dose of 0,5 ml/kg. According to the results of experiments in field conditions, it was noted that the biological hight efficiency of *F. foetida* after 10 days in average was - 80%, *A. repens* intensive efficiency - 85%, *P. vulgaris* - 90%. The effeciency of other extracts was found to be low. Thus, plant extracts of *F. foetida, A. repens* and *P. vulgaris* can be recommended as an effective means of prevention of gastrointestinal nematodes of small ruminants.

**Keywords** | Nematodes, Ruminants, Plant extracts, Infection intensity, Intensive efficiency, Extensive efficiency

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## INTRODUCTION

Currently, because of the globalization process and deepening climate change in the world, the increase in the incidence of various parasitic diseases in farm animals, especially domestic ruminants, leads to a decrease in animal productivity and the death of young individuals. Accordingly, the detection of common parasitic nematodes in farm animals and the development of new drugs to combat them is one of the urgent problems. Parasite nematodes are round worms that is common among wild and domestic mammal ruminants in the world, and are also common among ruminants in Uzbekistan (Kuchboev et al., 2015, 2016). Gastrointestinal nematodes (GINs) is one of the main sanitary problems of ruminant herds, causing large economic losses to breeders. In particular, in the GINs of small ruminants of Uzbekistan there are more than 30 species of nematodes in the case of mixed invasion (Kuchboev et al., 2020).

To date, plant-derived anthelmintics have been widely used against parasites. At the same time, in the feeding of animals on livestock farms, the consumption of medicinal plants in pastures by animals has led to the disappearance of parasitic individuals in their bodies (Damirov et al., 1988). If small horned animals consume small amounts of a wormwood plant (*Artemisia*), which has bactericidal and antiparasitic properties, they get rid of parasites under the national conditions, but consuming large amounts of the plant can lead to negative consequences (Damirov et al., 1988). Margerramov (Magerramov, 2013) used a drug prepared from a mixture of wormwood and incense in different amounts to fight against the hemangiomas and strongylidoses, and it was found that these drugs

do not have a cumulative effect on the host organism. In addition, various amounts of extracts from *Artemisia absinthium*, *A. annua, Echinacea purpurea*, *Matricaria chamomilla*, *Tanacetum vulgare*, *Salvia sclarea*, *Levisticum officinale*, *Petroselinum crispum* were given to the larvae of *Strongyloides papillosus* (Nematoda, Strongyloididae) and their biological effectiveness was determined (Boyko et al., 2016). The obtainihg data of Gogo and Yadav (Gogo and Yadev, 2016) showing that leaf extract of *C. bonducella* (L.) possesses significant anthelmintic effects and supports its use as an anthelmintic in traditional medicine. This the first report of *in vivo* anthelmintic activity of *C. bonducella* against on *Hymenolepis diminuta* (Cestoda) and *Syphacia obvelata* (Nematoda) parasites. Thus, there is an urgent need for the discovery and development of new anthelmintic drugs, especially ones with novel mechanisms of action. Traditional medicinal plants hold great promise as a source of effective treatments, including anthelmintic therapy. They have been used traditionally for centuries and are mostly safe. However, in most medicinal plants the compounds active against nematodes have not been identified thus far (Liu et al., 2020).

The aim of the study was to study the effect of extracts from local plants used in traditional medicine and having anthelmintic properties on the gastrointestinal nematodes of small domestic ruminants.

In the research, the following plants were used, as *Ferula foetida, Acroptilan repens, Pepovskia angustifolia, Aptemisia leucoids, Tanacetum vulgare* and *Persica vulgaris*, which are widespread in Uzbekistan and grown in a wild and cultivated forms. They are collected from the Fergana Valley, Tashkent and Jizzakh regions in April-May and September-October, 2018-2019. These plant extracts were prepared by the staff of the Institute of Chemistry of plant substances of Uzbekistan on the basis of appropriate methods (Tashmatov et al., 2018) and submitted for testing. Initially, the effects of these plant extracts on GINs (*Ostertagia, Marshallagia, Telodorsagia*) were studied *in vitro* conditions, were found to be effective (Karimova et al., 2020). In the study, laboratory and field experiments were conducted to study the effect of six plant extracts on small ruminants, which had a good effect on GINs *in vitro* conditions.

Laboratory studies were conducted on 7-8 month-old sheep and goats reared in the temporary vivarium of the Institute of Zoology of Uzbekistan. Initially, the deworming of small horned animals was tested twice by generally accepted helminthological methods. The animals were then divided into 8 groups, containing 3 animals each (experiment and control). Animals of groups I (sheep, goat, goat), II (sheep, sheep, goat), III (sheep, goat, goat), IV (sheep, goat, goat), V (goat, sheep, goat), VI (goat, sheep, sheep), VII (goat, sheep, sheep) in the experiment were infested with larvae of GINs (800-1000 specimens). Group VIII was left as control (no parasites were given). All animals in the experimental and control groups were helminthologically examined between 33 and 35 days. In this case, to check that each animal is infected,the number of eggs and larvae of nematodes in 1 g of feces was counted using helminthocaprological methods (Kotelnikov, 1984). Sheep and goats infested with gastrointestinal nematodes were used for anthelmintic testing.

In the laboratory conditions, infected animals in the experimental group were given six plant extracts at a rate of 0,5 ml/kg per os. Oral administration (in latin per os) is the most common method of administration, where a substance is taken through the mouth. About 60% of all drugs are administered orally (Savchenko et al., 2008). Then, to determine the results of the plant extracts,the number of eggs and larvae of nematodesis 1 g of feces ofthe animals was counted in 5, 7, and 10 days, and the results were statistically analyzed.

Field research was conducted on 183 sheep at the Samsarak farm in Parkent district of Tashkent region (experience 1) and 148 goats on the Karakurgan farm in Chust district of Namangan region (experience 2). Fecal samples taken from animals were helminthologically examined under laboratory conditions. Animals that tested positive were given special digital earrings on their ears for the experiment. Animals were divided into 8 groups, and 6 different plant extracts, which gave good biological efficacy under laboratory conditions, were given to the animals in groups I-VI at a rate of 0,5 ml/kg *per os*. Group VII was given albendazole 10% (solution), VIII - served as a control group (extract was not given). The animals in the experimental and control group were examined helminthologically within 5, 7 and 10 days, afterthe plant extracts were given to them. The intensity of infection (II) in a group (farm) or the arithmetic mean of the number of parasites per infected animal was determined by dividing the total number of found parasites by the number of infected animals.

Laboratory experiments: Six different plant extracts against GINs of animals were given to sheep and goats under laboratory conditions. The results showed that the biological efficiency of plant extracts for animal GINs of groups I, III and VI ranged from 91,58% to 93,33%, and the biological efficiency ranged from 66,2% to 68,3% in the remaining groups II, IV and V (Table 1).

In order to confirm the results obtained, one animal from each group in the experiment (experimental and control group) was slaughtered. In this case, the presence of sexually mature nematodes in the abomasum and intestine was examined. No sexually mature nematodes were found

in animal abomasum of groups I, III, VI and several encapsulated nematodes were recorded in the abomasum of animals in the remaining groups.

Field experiments: Based on experiments conducted in laboratory animals, these plant extracts have been tested in field conditions in small horned animals naturally infested with nematodes.

According to the results of the first experience, the average number of eggs in 1 g of feces decreased from 27 to 66 copies on the third day of the trearment experiment, and the results were as follows: Intensive efficiency (IE) - 16,43 - 31,35%, extensive efficiency (EE) - 10,20% (Table 2). On the 7th day of the experiment, the number of eggs was 84-140 copies, and biologic efficiency was IE-50,81-69,10%, EE - 30, 60%, while on the 10th day the number of eggs in groups I, III and VI remained 6-21 copies and biologic efficieny was IE - 90,14-97,40%, EE-80,90%. The number of eggs in the control group VII decreased by 57 ± 3,1 in 3 days, with IE – 97,29%, EE - 90%, the number of eggs in group VIII animals did not change until the end of the experiment. Thus, according to the results of the first experiment, *F. foetida* showed biological efficiency of IE - 96 (47%), EE - 80%, *A.repens* IE - 90,14%, EE - 90% and *P. vulgaris* IE - 97,40%, EE - 90%.

**Table 1:** Determination of the effectiveness of plant extracts against GINs in the laboratory conditions, n-3.

| Number group of animals | Plant extracts | Dose, ml/each animals | Number of nematodes before treatment, pcs | After the treatment, days | | | EI*,% |
|---|---|---|---|---|---|---|---|
| | | | | 5 | 7 | 10 | |
| I | Ferula foetida | 50 | 40,6±4,1 | 19±3,1 | 11,9±0,8 | 3,1±0,7 | 92,3 |
| II | Tanacetum vulgare | 50 | 43,6±3,9 | 18±1,1 | 16,7±1,1 | 13,8±0,8 | 68,3 |
| III | Acroptilan repens | 50 | 48±4,6 | 25,1±2,1 | 8,2±1,2 | 3,2±0,4 | 93,33 |
| VI | Pepovskia angustifolia | 50 | 41,8±3,4 | 23,4±1,8 | 15,7 ±0,9 | 14,1±0,7 | 66,2 |
| V | Aptemisia leucoids | 50 | 46,4±4,2 | 17,4±1,7 | 16,1±1,3 | 14,9±0,9 | 67,8 |
| VI | Persica vulgaris | 50 | 41,6±3,2 | 19,1±2,5 | 12,3±1,5 | 3,5±0,8 | 91,58 |
| VII | Albendazole,10% | 50 | 49,8±5,1 | 23,6±1,9 | 19,4±1,6 | 7,2±0,6 | 85,54 |
| VIII | Control | - | 38±3,6 | 38,2±3,4 | 39,5±3,7 | 40,1±3,9 | - |

*EI: Extensity of infection.

**Table 2:** Comparative description of the effectiveness of plant extracts in GINs of small horned animals in the field conditions, n-3.

| No. group | Plant extracts | The number of animals | The average number of nematode eggs in 1 g of feces, before treatment , M±m | Efficiency, after the treatment, days | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 3 days | | | 7 days | | | 10 days | | |
| | | | | II M±m | IE (%) | EE (%) | II M± m | IE (%) | EE (%) | II M± m | IE (%) | EE (%) |
| Experience -1 (sheeps) Samsarak farm in the Parkent district of Tashkent region | | | | | | | | | | | | |
| I | Ferula foetida | 10 | 142±3,1 | 115±2,1 | 19,01 | 10 | 58±1,9 | 59,15 | 30 | 8±0,5 | 96,47 | 80 |
| II | Tanacetum vulgare | 10 | 185±4,7 | 127±2,8 | 31,35 | 10 | 91±2,3 | 50,81 | 30 | 67±1,7 | 63,7 | 50 |
| III | Acroptilan repens | 10 | 213±5,7 | 171±3,4 | 16,43 | 10 | 82±1,7 | 61,50 | 50 | 21±1,3 | 90,14 | 90 |
| VI | Pepovskia angustifolia | 10 | 179±2,9 | 134±3,2 | 25,13 | 10 | 78±1,8 | 56,42 | 30 | 71±1,4 | 60,33 | 50 |
| V | Aptemisia leucoids | 10 | 123±2,1 | 87±2,4 | 29,26 | 20 | 38±1,4 | 69,10 | 40 | 18±0,9 | 85,36 | 60 |
| VI | Persica vulgaris | 10 | 231±3,4 | 165±3,8 | 28,57 | 20 | 91±3,1 | 60,60 | 60 | 6±0,6 | 97,40 | 90 |
| VII | Albendazole 10% | 10 | 148±2,6 | 107±2,9 | 27,70 | 20 | 57±3,1 | 61,48 | 60 | 4±0,7 | 97,29 | 90 |
| VIII | Control | 7 | 148±2,6 | 149±2,7 | 100 | 0 | 151±3,9 | 100 | 0 | 154±3,4 | 100 | 0 |
| | Experience -2 (goats) Karakurgan farm in the Chust district of Namangan region | | | | | | | | | | | |
| I | Ferula foetida | 10 | 118±2,3 | 85±2,1 | 27,96 | 10 | 48±1,4 | 59,32 | 20 | 10±0,9 | 91,52 | 80 |
| II | Tanacetum vulgare | 10 | 152±3,9 | 101±3,2 | 33,55 | 10 | 85±3,1 | 55,26 | 30 | 52±1,5 | 34,2 | 50 |
| III | Acroptilan repens | 10 | 193±6,2 | 123±3,7 | 36,26 | 10 | 37,8±1,3 | 62,17 | 40 | 6±0,7 | 96,89 | 80 |
| VI | Pepovskia angustifolia | 10 | 231±6,9 | 168±4,1 | 27,27 | 10 | 98±1,7 | 57,57 | 20 | 83±1,6 | 35,93 | 60 |
| V | Aptemisia leucoids | 10 | 167±4,3 | 111±2,9 | 33,53 | 20 | 79±1,1 | 47,30 | 20 | 62±1,9 | 37,12 | 50 |
| VI | Persica vulgaris | 10 | 157±3,2 | 117±1,8 | 25,47 | 20 | 61±0,9 | 61,14 | 30 | 17±0,9 | 89,17 | 90 |
| VII | Альбендазол 10% | 10 | 121±3,3 | 78±2,3 | 35,53 | 20 | 35±0,8 | 71,07 | 50 | 6±0,6 | 95,04 | 90 |
| VIII | Control | 6 | 133±3,6 | 134±3,7 | 100 | 0 | 135±3,8 | 100 | 0 | 136±3,6 | 100 | 0 |

*Note: II: Infection intensity; IE: Intensive efficiency; EE: Extensive efficiency.

In the second experience of the average number of eggs per 1 g of faeces in 3 days decreased by 33-70, the efficiency was IE -25,47-36,26%, EE -10-20% (Table 2). On the 7th day of the experiment, the number of eggs decreased by 70-133 copies, with IE - 47,30-62,17%, EE - 20-40%. During the last 10 days of the experiment, 6-17 eggs were detected in groups I, III and VI, with IE- 89,17-96,89%, EE– 80-90. The number of eggs in the control group VII animals decreased by 6±0,6 in 10 days, with IE- 95,04%, EE- 90%, the number of eggs in group VIII animals did not change until the end of the experiment.

According to both field experiments, the average biological efficiency of plant extracts given to small horned animals of groups I, III and VI was 80 - 90% (Table 2). The biological efficiency of *F.foetida* in average was IE-94%, EE-80%, *A.repens* IE-93, 51%, EE-85%, *P.vulgaris* IE-93, 28%, EE - 90%.

Studies have shown that plant extracts of *F. foetida*, A. *repens* and *P. vulgaris* are highly effective and can be recommended as an effective means of prevention gastrointestinal nematodes of small domestic ruminants.

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## NOVELTY STATEMENT

To this article the local plant extracts of *F. foetida*, *A. repens* and *P. vulgaris* was tested first time and are highly effective for gastrointestinal nematodes of small domestic ruminants in Uzbekistan.

## AUTHOR'S CONTRIBUTION

All authors contributed equally to study design methodology, interpretation of results, and writing of the manuscript.

### Conflict of interest

The authors have declared no conflict of interest.

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