A new feed additive based on parasiticide spores for prevention of parasitoses in livestock

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Introduction

• Parasitoses: 30-90% of livestock infections (related to management regime)
Main parasites: gastrointestinal helminths: cestodes, trematodes, nematodes
• Problems:
  • Clinical effects: roughness of coat, anemia, edema, diarrhea, death
  • Losses in animal productivity (milk production, weight gain, conception rate, etc.)

  ▪ Parasites attributable economical losses in cattle: ↓ 154 Kg weight gain
  ▪ ↓ 45-544 L milk/lactation period
  ▪ Parasite free heifers reach puberty nearly four weeks earlier than parasitized ones
  ▪ Age at calving is delayed by 3.5 months in parasitized cows
  ▪ 20-40% abattoir condemned organs

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Major economic importance for producer
Introduction

• Methods of prevention
  Pasture practices:
  rotational grazing systems
  rotation of livestock species
  manual collection of manure

• Deworming procedures
  Antiparasitic drugs
  (several times/year)

  SOME PROBLEMS

  • Decreased productivity
  • Parasite resistant strains
  • Increased handling of animals
  • Drug residues in derived food (meat, milk)
  • Forbidden in organic farming
  • Ecotoxicity

Production costs
Our approach

- Fungi isolated from soil where animals graze and from faeces of animals: natural solution for controlling parasitic infections in animals
  
  1. Fungi able to colonize and disrupt the eggshell
  2. Fungi trap parasite larvae by means of specialized adhesive hyphal nets

- Technology aims
  - To prevent infection of grazing livestock by reducing the presence of parasitic infective stages in the soil
  - To minimize administration of antiparasitic pharmacological drugs
Our technology

- Most infections in livestock are mixed (> 1 type of parasite)
- **Spores from 2 different fungal species**: active against the parasitic stages found in the soil (**eggs, larvae**) + activity over trematodes + cestodes + nematodes: **broader spectrum**

**LARVICIDE**

- nematodes

**OVICIDE**

- trematodes + cestodes + nematodes

**UNIQUE PRODUCT WITH BROAD SPECTRUM ACTIVITY OVER GASTROINTESTINAL & LIVER PARASITES**
Our results:
Production of spores

• **Liquid culture medium** that allows production of spores from different fungal species at the same time

• Suitable for industry
• Suitable for scaling-up (big tanks)
• Suitable for addition to feed during manufacturing process (no agar)
• Culture can be done at room temperature
• No problem with fungal pathogens as mites
Our results: Spores added to faeces
Reduction of parasitic forms in cattle faeces by directly adding the fungal mixture

Cattle shedding 331 trematode epg and 142 strongyles epg

Days after treatment

% reduction

Strongyles
Trematodes
Our results: Spores directly spread onto the soil

FUNGAL SPORES

FIELD TRIALS

Farm “Gaioso-Castro” Autochthonous horses

RESULTS

- Innocuous for animals (constant admin. for > 3 months) (Natural soil fungi)
- Reduction of infection so that only 1 treatment per year is required
- Addition of spores (IVM+ Df) reduces the parasite egg output (50-150 epg) compared to when only ivermectin is applied (IVM: up to 400 epg) (Testigo: control)
- Important: 300-400 epg is considered the parasite egg output that starts to be pathogenic for the animals. Spore addition keeps it under 150 epg!!
Our results: Spores directly fed

**FUNGAL SPORES**

Directly fed 1 year - Low dose

**FIELD TRIALS**

Marcelle (Lugo) Wild animals in captivity

**RESULTS**

- Innocuous for animals (constant admin. for 1 year) (Natural soil fungi)
- **Reduction of infection** from 3 deworming /year (red arrows) to no required deworming treatment /year
- Parasite egg output is kept under 200 epg

Results shown for zebras, domestic and African donkey

Green arrows: spore administration (every 15 days)
Our results: Spores as feed additive

**Fungal spores**
Temperature resistance shown: 72ºC/ 5 min 4ºC/ 48

First equine feed (1.500kg) produced with spores from 2 fungi (larvicide, ovicide) (Nanta, NUTRECO) : **FEED ADDITIVE**

Spores viable and active after feed manufacturing process

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**Fungi Spores** | **Livestock Feed** | **Field Trials**

Horses fed with the feed additive:
spores from the 2 fungi found in faeces after 12 h feeding

Able to resist the pass through the gastrointestinal tract of horses

No parasite larvae and no egg-output after 3 months feeding concentrate +spores!!
Our results: Spores as feed additive

Our feed additive reduces the parasite burden in the faeces of the animals

After 3 months of feeding horses with the feed additive (spores), there is a significant reduction on the parasite burden in the faeces of the animals, which is dropped to levels under 200 epg (parasite eggs/gram of faeces), whereas it is over 600 epg in untreated animals. Please note that 300-400 epg is considered the parasite egg-output that starts to be pathogenic for the animals, and thus parasiticide treatment is required.
Comercial Opportunity

Feed additive for preventing parasitic infections in animals

- **Effective reduction of parasites and control of parasitic infections** already shown in field trials (horses, sylvatic animals).

- **Feed additive**: parasiticide spores already in the feed. This reduces:
  - the need to use antiparasitic products
  - the handling of the animals
  - the overall production costs of the farm

- **Broad spectrum of activity**: Combination of different fungal spores with larvicde and ovicide activity into a unique feed: broad range of activity over different helminth parasites (trematodes, cestodes and nematodes), highly prevalent in livestock.

- **Broad application**:
  - cattle, swine, ovine, caprine, equine livestock
  - sylvatic animals in zoological parks

- **Possibility of developing new products** based other individual strains already isolated or in combinations thereof
Current work

Proof of concept in cattle (in process)
- Spores of fungi with parasiticide activity will be added to cattle feed concentrates (3 different concentrations)
- Feeds will be tested in cattle

Project aim
To show whether our feed additive is able to:
- reduce the presence of parasitic forms in the faeces of cattle
- prevent parasitic infections in cattle
Two patent applications filed:

1. **Antiparasitic composition/feed additive** comprising spores of *Species 1* and additionally its combinations with other parasiticide fungi (*Species 2, Species 3, Species 4, Species 5*) in order to prevent parasitic infections in animals (strains deposited for patent purposes under the Budapest Treaty).

2. **Culture medium** with a novel composition that allows the culture of several species of parasiticide fungi simultaneously and in liquid medium, allowing their subsequent addition to the feeds and facilitating their scaling-up for industrial production.
Conclusion

- **We already have a product**: feed additive
- **Tested in different animals, and effective!!!**
- **Industrial scale-up shown**
- **Broad range of applications**: cattle, swine, ovine, caprine, equine livestock, sylvatic animals.
- **Cattle is the biggest market sector**: proof of concept will increase value
- **Broad activity spectrum** on parasites that are highly prevalent in livestock (adapted to real situation: mixed infections)
- **Only alternative to parasite control in organic farming**