Epidemiology and pathogenesis of GI parasitism

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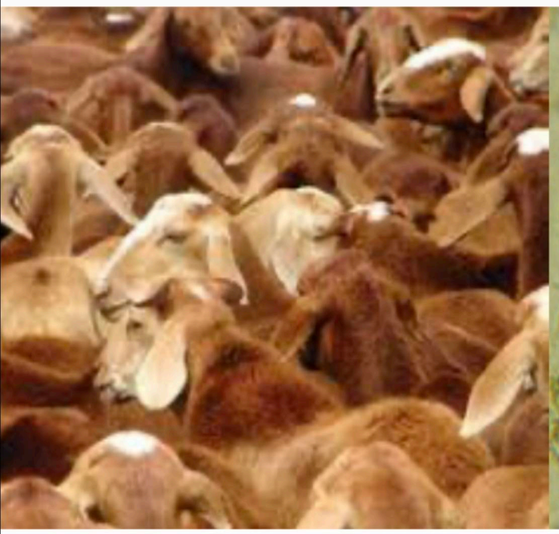
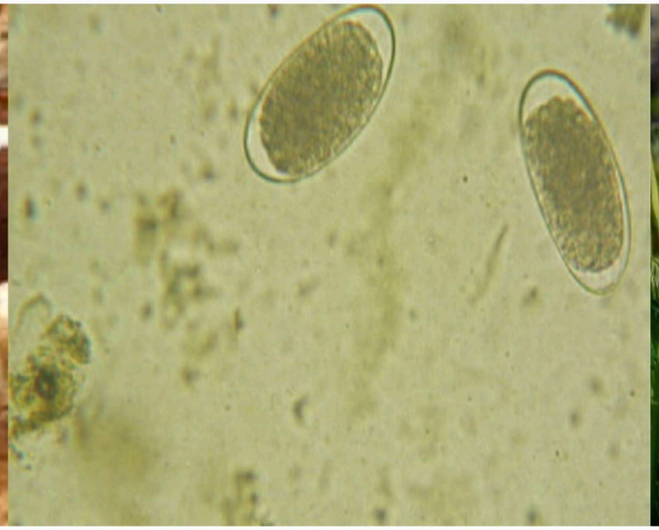
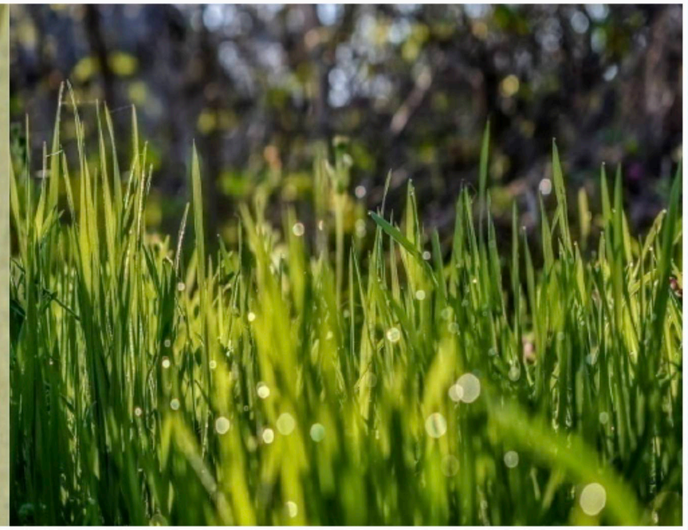
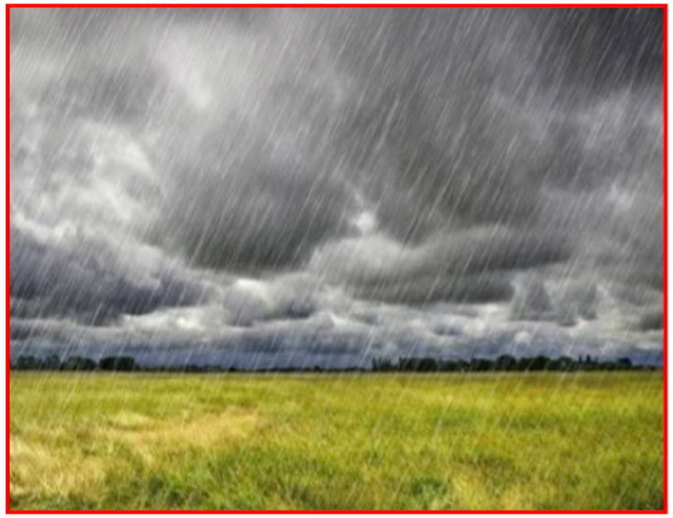
Epidemiology and pathogenesis of GI parasitism

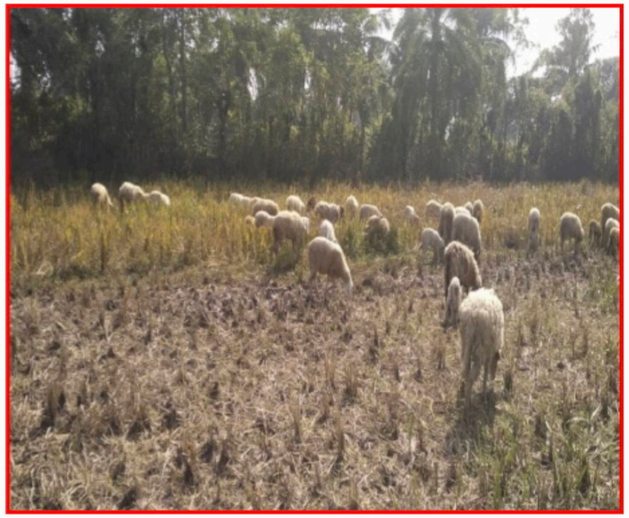
- 1. Factors governing PGE epidemiology
- 2. Pathogenesis of GI nematodes
- 3. Clinical signs in GI parasitism

Epidemiological intelligence on PGE

- Study of parasitic diseases and disease - causing agents at the population level.
- It predict to characterize the pattern of distribution, occurrence of disease and the factors responsible for these patterns.
- A good understanding on factors that drives parasite biology is essential to adopt effective control strategy





Factors governing PGE epidemiology

Host & Parasite

Worm species
Host factors/Age
Immune status
Genetics
Nutrition
PPR
Hypobiosis

Environment

Rainfall
Climate/Temperature
Moisture
Sunlight
Microclimate

Management

Type of management
Grazing pattern
Drug dosing

Host factors

- Goats do not develop age-related immunity
- Young animals more susceptible to GIN (< 6 months)
- Young adults (1-2 Y) develop varying degree of immunity
- Adults are generally immune to parasites, but stress can reduce immunity
- Lactating animals are more vulnerable & source of infection to young ones

Parasite factors

Worm species

- Knowledge on type of parasite species prevalent
- Mode of transmission and their economic
- importance is essential
- India - common GIN includes

Haemonchus contortus,
Trichostrongylus colubriformis,
Oesophagostomum columbianum
Strongyloides papillosus

Host defense mechanisms

Types of immunity

- Innate

  inherited (rare)

- Acquired

  Acquired during life results from exposure to infection

Self – cure phenomenon

- Self defense mechanism
- Adult worms are expelled spontaneously when there is continuous re infection over a short period
- IgE mediated hypersensitivity reaction
- noticed in Barder's bole worm infection

Nutritional status

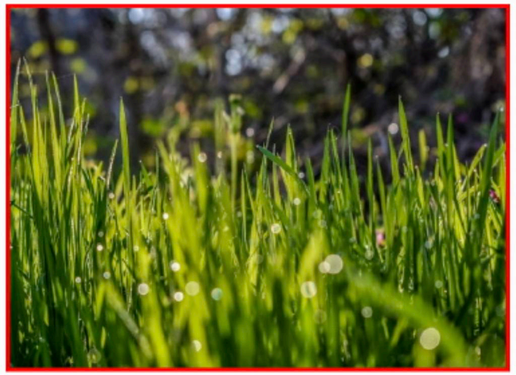
- Lack of grazing/ poor nutrition –more susceptible to GIN
- Deficiency in dietary protein – lowers the immune response to GIN
- Animals in good plan of nutrition showed

  Decreased FEC
  Good antibody level &
  Increased goblet cells in small intestine

- Thin animals are more susceptible

Hypobiosis

- Considered as an evolutionary adoption
- It has importance in GIN epidemiology because
  - Worms survive and maintain its population during harsh climatic extremes
  - Resume development in favourable conditions responsible for clinical disease
  - Major source of pasture contamination during monsoon

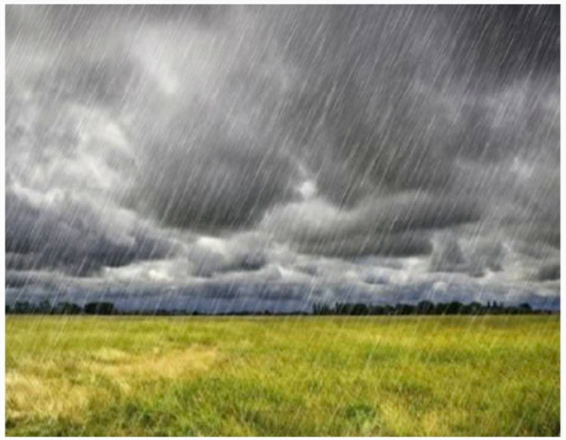


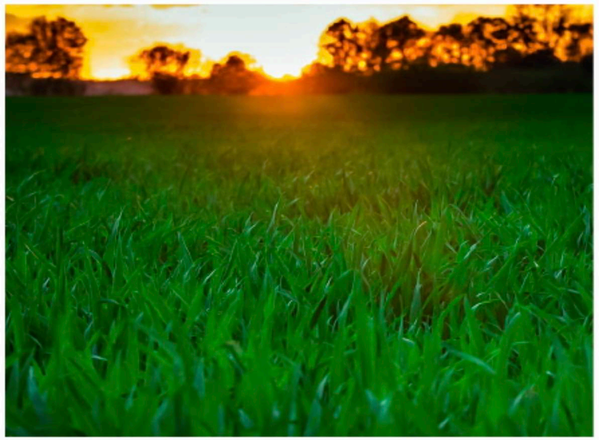
Peri Parturient Egg Rise (PPER)

- PPR is important in parasite survival
- Large numbers of eggs passed onto the pasture at the same time as the numbers of new susceptible hosts also increases
- Periparturient relaxation of immunity due to prolactin
- Exacerbation of PPER in
  - Inadequate/poor nutrition in animals in late pregnancy
  - Lack of vegetation in pasture
  - Deficiency of minerals

B. Environmental factors and Nematode survival

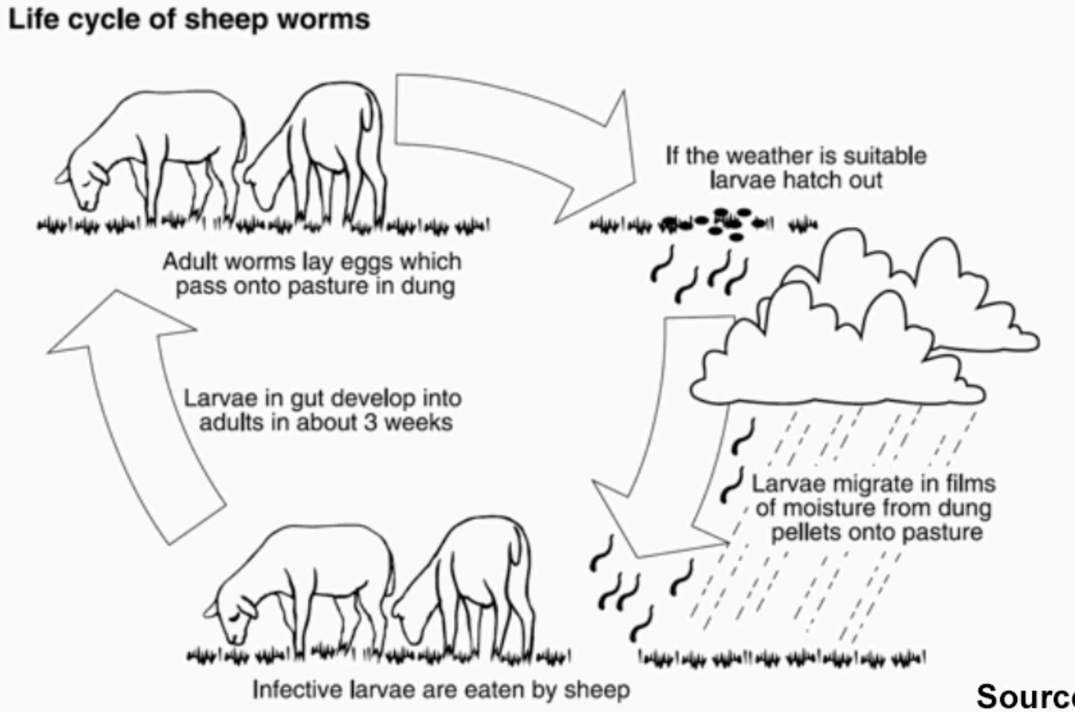
- Factors – Climate, seasons, temperature, humidity, rainfall etc.,
- Influences development and survival of larva on the pasture and migratory behaviour
- Bio climatograph – helps to predict the occurrence of disease





Free living stages are of 2 stages, largely dictated by climate

- The first stage is egg development to infective L3
- The second stage is L3 survival



Source : Jennifer Cotter, Agriculture and Food

Bionomics of infective larvae

Under Indian tropical conditions,

- Optimum temperature for egg to infective larvae

Haemonchus contortus - 25- 37°c,highly susceptible to *cold and desiccation*
Trichostrongylus colubriformis - 20-33°c, susceptible to sub freezing winter

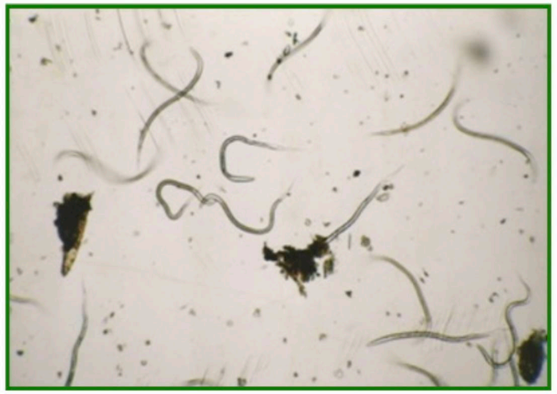
- Survival of infective larvae

H. contortus - warm, moist condition with adequate rainfall
T. colubriformis - warm/cool conditions with moist environment

- Survival period- 8 to 9 weeks in monsoon Up to 4 weeks in summer

Migration - horizontal - up to 50 cm
vertical - up to 10 cm

- Heavy morning dews or moisture will allow migration L3 up on the grass blades, enhancing infectivity of the pasture
- Hot, sunny days will drive the L_3 down to soil level, thus reducing infectivity
- Pasture larval burden(PLB) - higher in monsoon (July to November) period
- Over dispersion in FEC - >1000 EPG (August to November)
- Construction of bioclimatographs in a geographical area will explain pattern of GIN epidemiology
- In India, Rainy and Autumn seasons (June to December) are best suited for survival and migration of exogenous stages and higher GIN in small ruminants



C. Managemental practices vs GIN

Grazing system and pasture management

Factors enhances the risk of infections are :

- Lack of quality pasture (high risk pasture)
- Resting period –not adequate
- Non practice of rotational grazing

- Community grazing (pasture sharing by many animals)
- Grazing close to the ground and manure
- Early morning grazing in winter/rainy season
- Overstocking causes more egg deposits

System of management and deworming

Type of rearing –

- Extensive & semi intensive system -

  increases the risk of infection

- Intensive (stall fed) system –
  No source of infection

Anthelmintic dosing

- Periodical deworming
- Improper deworming
- Blanket treatment

↓

Drench failure

Anthelmintic resistance

Pathogenesis of Gastro Intestinal Nematodes

Haemonchus contortus (Haemonchosis)

- Abomasal nematode
- L_4 and adults - Blood feeders → Anaemia
- Apparent after 2 weeks of infection
- Diarrhoea is not a sign of pure infection
- Responsible for more production losses in tropics

- Type of infection depends on intensity of infection

- Hyper acute-
  Death within 1 wk of heavy infection without signs

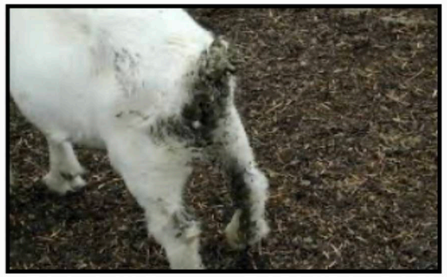
- Acute –
  haemorrhagic anaemia, dark coloured faeces, bottle jaw, weakness, death

- Decreased PCV level, from 33 to 22 %

- Chronic-
  Anaemia, weight loss & inappetance

Intestinal Trichostrongylosis (Black scour/Bankrupt worms)

- Major effects in lambs and weaners
- Migration of young adults and immature worms
- Extensive damage to intestinal villi and duodenal mucosa
- Generalised enteritis including haemorrhage, oedema
- Plasma protein loss- hypoproteinaemia, hypoalbuminaemia
- Heavy infection cause watery diarrhoea, stains the fleece of hind quarters (Black scours)



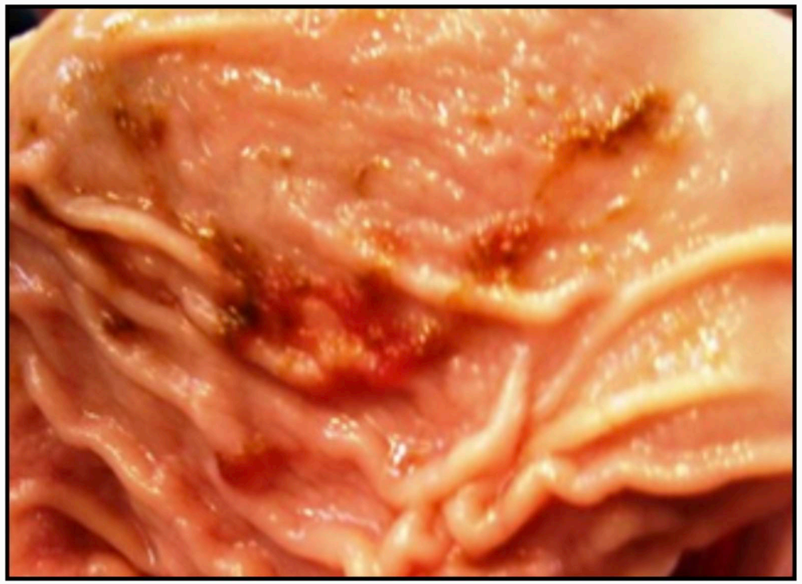
source : Tafere et al., (2022)

Ostertagiosis

- Less fecund worm- 200 eggs/worm/day
- Main pathogenic effects by its larval stages development
- Cause extensive damage to parietal cells and gastric glands of abomaum
- Decrease in HCL production - increase in abomasal $_{P}H$
- Failure of pepsinogen to convert pepsin (active form)
- Elevated plasma pepsinogen level & reduced protein digestion

Image from- farmhealthonline.com

- Moderate infections cause diarrhoea, hypoproteinaemia, poor weight gain and weight loss
- Type I &Type II type
- Nodular gastritis covered by mucus
- Abomasitis with ‘ostrich leather’ appearance and ulceration of the mucosa
- The brown stomach worms are so small that they are hardly visibly with the naked eye.



Courtesy: Dr. M.Hobson

Other GIN infections...

- *Oesophagostomum* sp.

  Persistent, foetid diarrhoea, weight loss
  Nodule formation (pimply gut)

- Hook worms (*Bunostomum* & *Gaigeria* sp.)

  Gaigeria pachyscelis – voracious blood sucker
  Anaemia, diarrhoea and hypoproteinemic edema

- Strongyloides sp

  Intermittent diarrhoea with mucus, loss of appetite and weight
  Foot rot – skin penetration

How can you identify PGE affected animals?

- Clinical signs, seasonal incidence and history are indicative

- History –

  Age, grazing history,
  Anthelmintic usage

- Clinical PGE – Young animals

- Mixed GI nematodes are common

How can you identify PGE affected animals?

- **Diarrhoea**
  Profuse and characteristic (Dark / greenish)

- Poor body condition/weight loss

- Rough hair coat

- Anorexia/inappetance

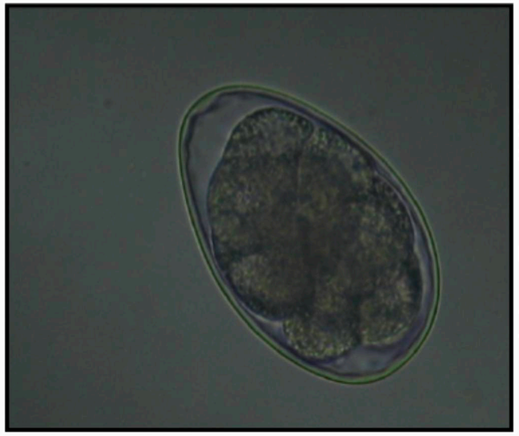
Signs of GI parasitism

- Haemonchosis
  Anaemia,
  Hypoproteinaemia
  (submandibular oedema- bottle jaw)

- Ostertagiosis, Trichostongylosis & others-
  Diarrhoea is the common feature

- Death in severe cases

- Confirmation by Faecal examination



Conclusion

- Epidemiology of GIN is mainly governed by host factors, weather conditions and adopted managemental practices.
- Haemonchosis causes more worm related fatalities in small ruminants in India
- Common signs of GI parasitism includes diarrhoea, hypoproteinaemia, decreased weight gain, anaemia and inappetance

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Thank you