Climatic Influence On The Distribution And Risk Of Ovine Haemonchosis In The UK

Bolajoko, M. and Morgan, E. R.

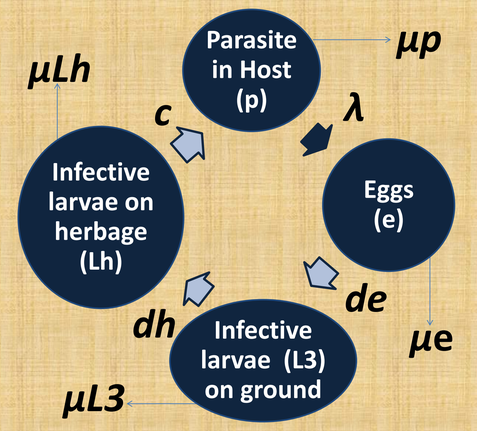
School of Biological Sciences, University of Bristol, Woodland Road. BS8 1UG

Haemonchosis in sheep

Haemonchosis is caused by the round worm, *Haemonchus contortus*. The adult is parasitic in the stomach and sucks blood. The occurrence of haemonchosis depends on the prevailing climate, which determines the availability of infective larvae. The disease poses a great threat to sheep production because of increasing resistance to available anthelmintic drugs. There is an urgent need for sustainable control strategies based on improved understanding of parasite epidemiology.

O'Connor, L.J., Walkden-Brown, S.W., Kahn, L.P., 2006. Ecology of the free-living stages of major trichostrongylid parasites of sheep. *Vet. Parasitol*. 142, 1-15.

Haemonchus contortus (H. contortus)



Lifecycle model of *H. contortus*

Key:*λ:* fecundity rate**, μp:**mortality rate of adult**, *μLh:*** mortality rate of *L3*, ***μe:***mortality rate of egg**, *μL3:*** moratlity rate of *L3*, ***dh:***migration rate of *L3*, ***de:***development rate of eggs**, c:**ingestion rate of herbage by host

The Model

The model is based on the basic reproduction rate (Q_0), derived from the vital rates in the parasite life cycle (above). Higher Q_0 implies stronger tendency towards parasite population growth in the absence of immunity, and higher infection pressure.

$$Q_0 = \lambda /2\mu p * d_e d_h / (\mu_e + d_e)(\mu L_3 + d_h) * cH/(bA\mu L_h + Ch) * pe$$

Fecundity rate of adult | **Probability of development to *L3*** | **Chance of *L3* ingestion** | **Chance of *L3* establishment**

Data on climate (MET) and observed cases of haemonchosis (VIDA) were used. In this study, the Q_0 model was used to determine the long term dynamics in the parasite population and parasite-host population.

Heesterbeek, J.A.P., Roberts, M.G., 1994. Threshold quantities for helminth infections. *J.* Math. *Biol.,* 33, 415-434

Preliminary Results and Conclusions

The Q_0 model successfully predicts the typical timing of the peak in cases of haemonchosis in the UK. Temperature was found to be the main determinant of Q_0 in the UK. Thus this model explains the seasonality of haemonchosis. Inability of the Q_0 model to account for hypobiosis explains observed cases when predicted Q_0 was zero.

http://sciencewatch.com/sciencewatch/dr/erf/images-erf/2008/08aprerfKap2XL.jpeg

Blood-sucking adult worms attached to the mucosa of the abomasum (stomach).

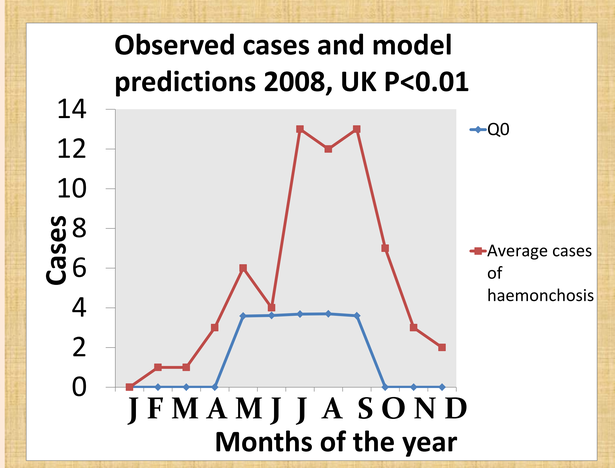
http://www.danekeclublambs.com/files/bottle20jaw.jpg

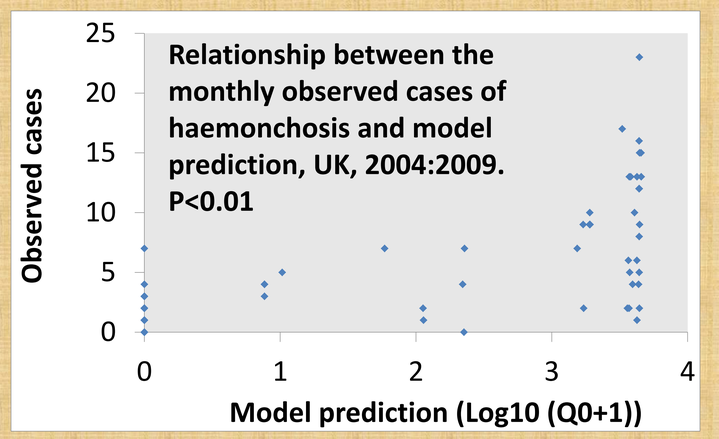
Severe intermandibular oedema resulting from protein loss caused by adult worms.

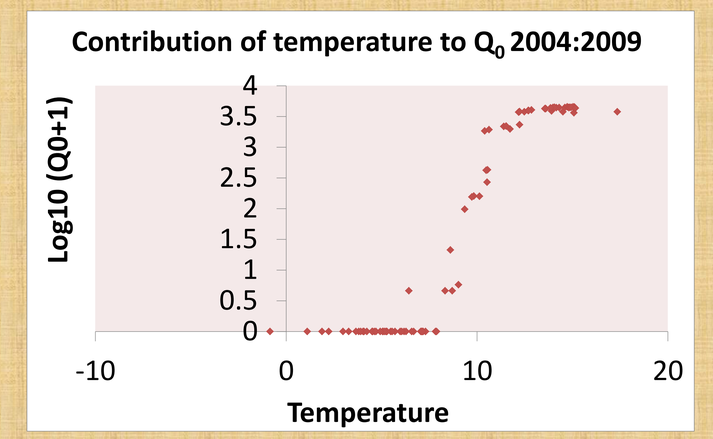
Aims

- Develop a simple model to predict occurrence of haemonchosis from climatic data.
- Apply the model to target treatments based on risk as part of a sustainable control plan on farms.

For comments and questions, please contact
Bolajoko, M: bzzmb@bristol.ac.uk







Further Work

- Sensitivity analysis of parameters and variables
- Integration of rainfall distribution into Q_0 model
- Replication and simulation of the model in different geographical regions