

EPIC Topic 4 – Sheep scab (*Psoroptes ovis*)

Sheep scab

- Sheep scab is one of the top 5 sheep diseases in Scotland (financial and welfare perspectives)
- Endemic in UK – costs ~£9 million/year for control alone
- ~10 – 15% of Scottish sheep farms experience sheep scab in any one year



Psoroptes ovis

- Notifiable in Scotland since 2010 (Sheep Scab Order (Scotland))



- Current understanding of within-flock transmission of sheep scab is limited, hindering effective control planning.

Moredun penned trials

- Data on sheep scab transmission is currently being collected.
- Naïve animals are co-housed on a 1:1 basis with infested animals (pens (~2x3m))
- Weekly serological analysis (MRI sheep scab ELISA)
- Assessment of time required for naïve animals to exhibit clinical disease

Diagnostic test

- Researchers at Moredun have developed new methods of diagnosis and control for sheep scab.
- They established a diagnostic test which successfully identifies infection at the subclinical stage and are currently developing vaccines.
- Deploying a vaccine most effectively requires an understanding of the transmission dynamics of sheep scab.
- In EPIC Topic 4 we use outbreak data currently held at Moredun to develop and parameterise models of sheep scab spread, which will help to inform the delivery of interventions.

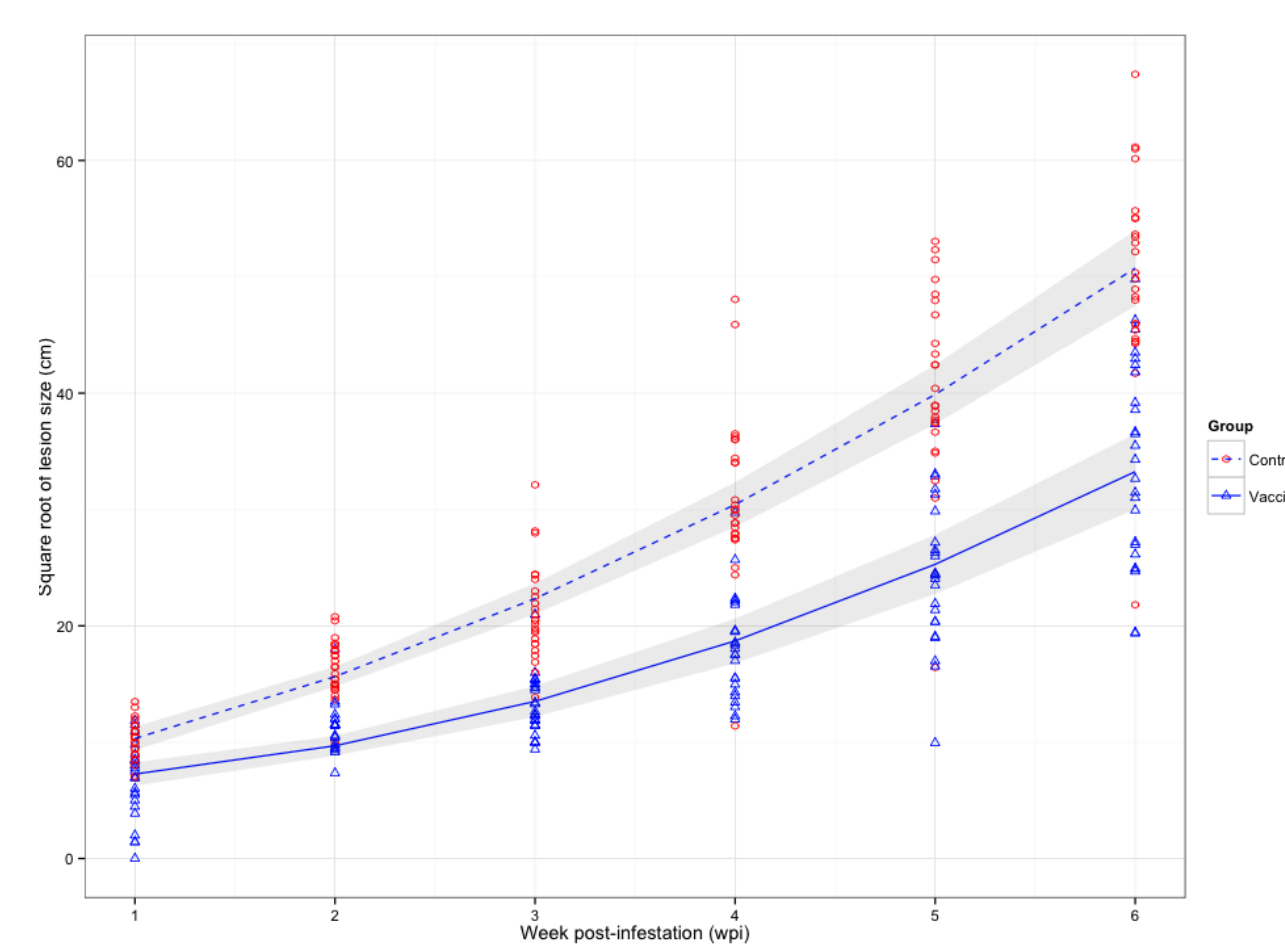
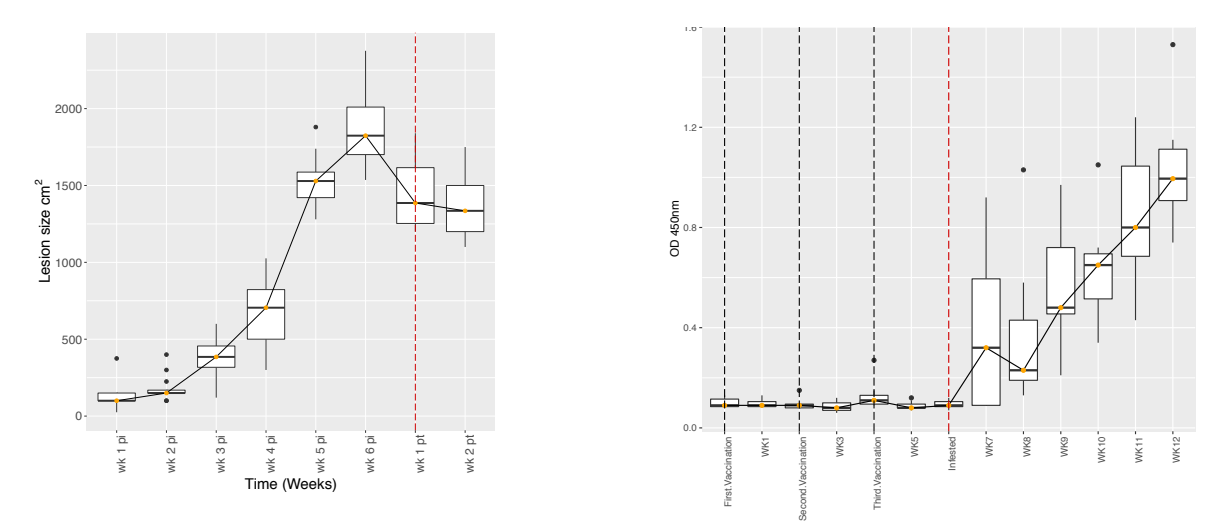


Fig.: Vaccination against sheep scab ($p < 0.0001$); reduction in lesion size in vaccinates (up to 63%); ~56% reduction ($p < 0.05$) in mite numbers at LE of lesion;

Mathematical modelling

- We aim to achieve an improved understanding of the transmission dynamics of sheep scab.
- We are developing a stochastic transmission model for the spread of sheep scab relating
 - ✓ Multiple key biomarkers
 - immune response
 - acute phase proteins
 - ✓ Lesion size
 - ✓ Infectivity of infested animals



- The transmission model captures the dynamics of infestation within a flock.

Current work

- We are developing transmission models using data from transmission experiments in penned trials.
- Pinned trial data will be build into the sheep scab model.
- The model will be validated against the natural outbreak.
- The final model will be validated with data from penned trials and used to determine the vaccine efficacy required to have a significant impact on disease control.

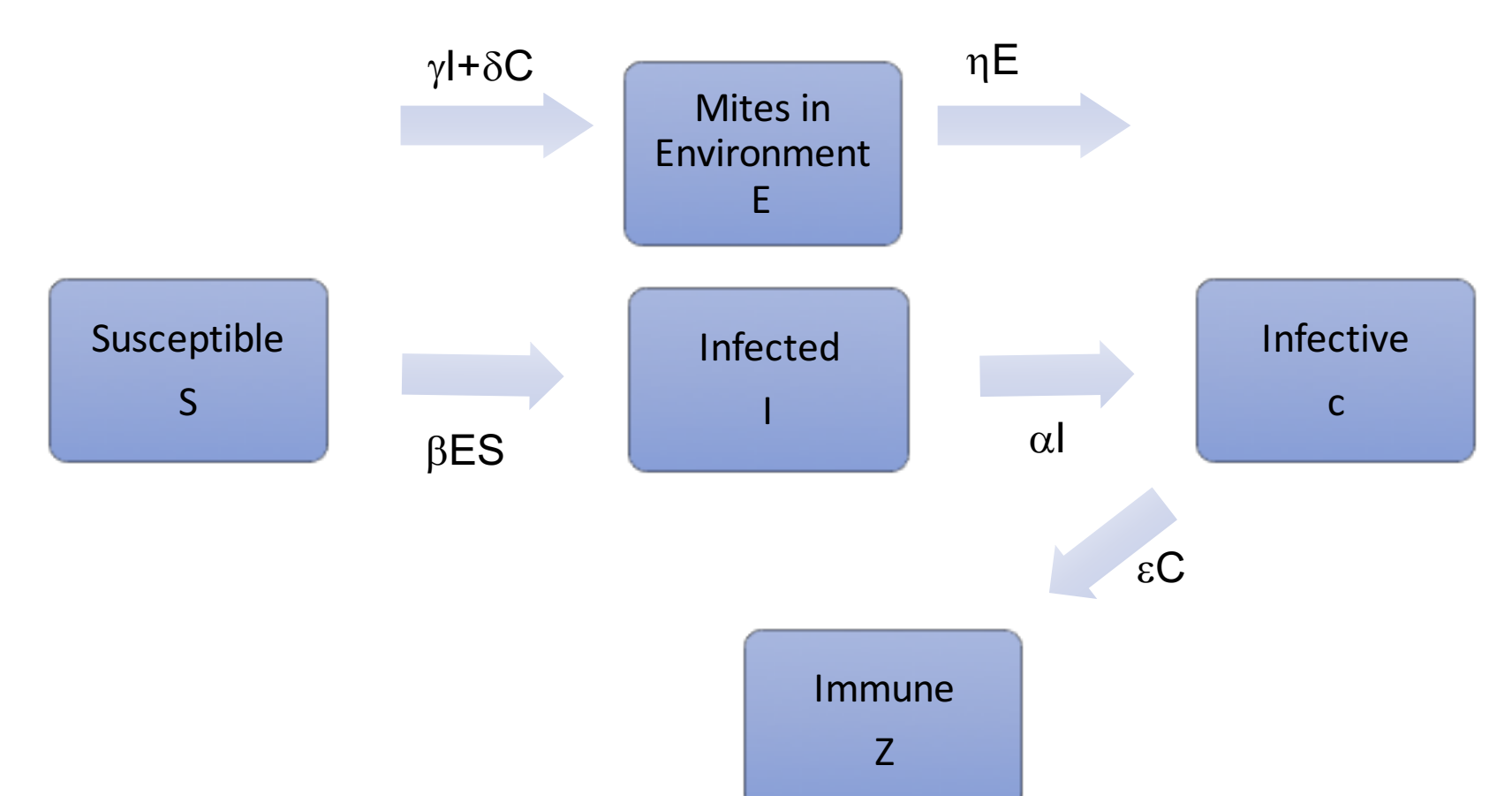
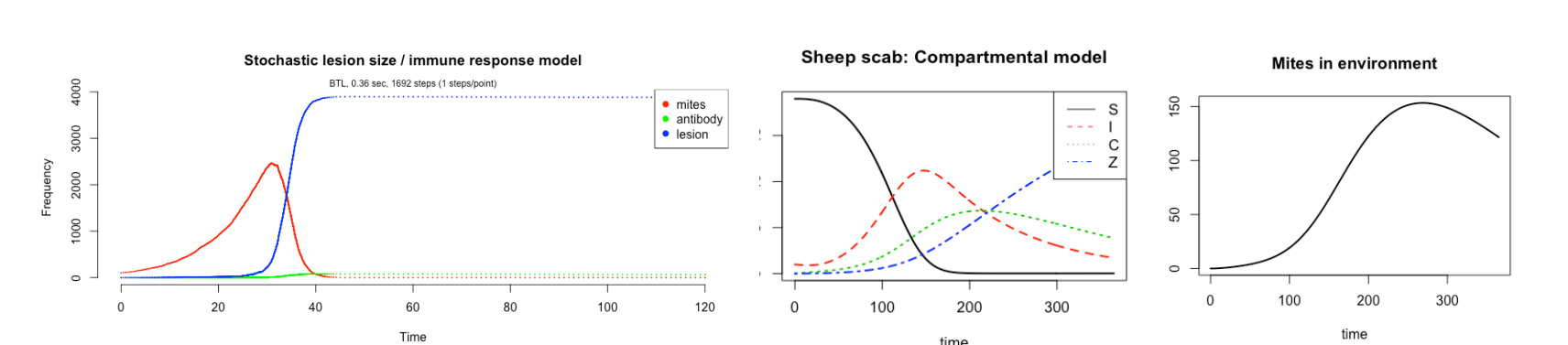


Fig.: Compartmental model of *Psoroptes ovis* infection ($\alpha = 1 / \text{time spent in infected class (I)}$), β = rate of transmission from environment to sheep, d = rate of transfer of mites from infectives (C) to environment, $\epsilon = 1 / \text{time spent in infective class (C)}$, γ = rate of transfer of mites from infected (I) to environment, $\eta = 1 / \text{survival time of mites in environment}$, $\mu = \text{birth / death rates}$).



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