Heritability of lamb survival on tick infested pastures

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Ticks (*Ixodes ricinus*)...

Photo Lise Grøva

Photos Lise Grøva

...feed on sheep...

… and may transfer disease.

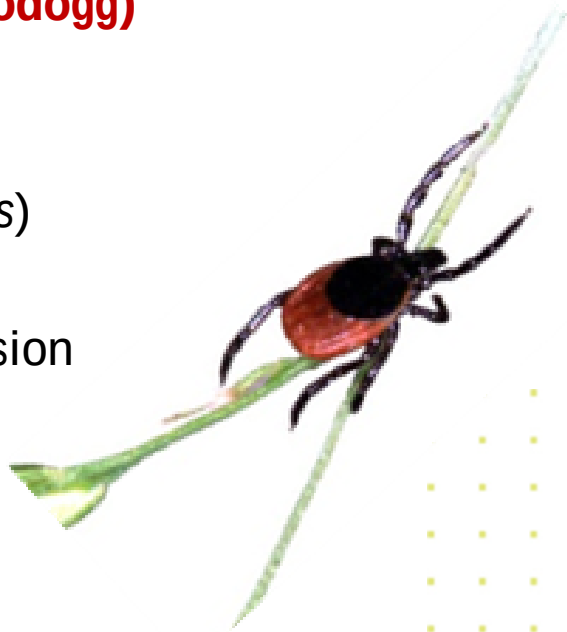
Photo Lise Grøva

General background I

- Losses and welfare challenges on range pastures in Norway:
  - **predators**
  - **blow-flies**
  - **alveld** (photosensitivity disease)
  - **tick-borne fever (TBF) (Norwegian: sjodogg)**

- TBF: - bacteria *Anaplasma phagocytophilum*
  - transmitted by the tick (*Ixodes ricinus*)

- Clinics: - high fever + immunosuppression
  - abortion and sterile rams
  - **secondary infections**



General background II

- Lower live weights: - 3,8 kg (Stuen et al., 2002) - 1,2 kg (Grøva et al., 2011)
- High losses of lambs: > 30%
- Estimated that **300 000 lambs** are infected every year in Norway

- The occurrence of ticks seems to increase and spread (Jore et al., 2011):
  - climate change
  - bush encroachment
  - increased number of deer

Jore et al. Parasites & Vectors 2011, 4:84
http://www.parasitesandvectors.com/content/4/1/84

Parasites &Vectors

RESEARCH Open Access

Multi-source analysis reveals latitudinal and altitudinal shifts in range of *Ixodes ricinus* at its northern distribution limit

Solveig Jore[1*], Hildegunn Viljugrein[1,4], Merete Hofshagen[1], Hege Brun-Hansen[2], Anja B Kristoffersen[1,5], Karin Nygård[3], Edgar Brun[1], Preben Ottesen[3], Bente K Sævik[2] and Bjørnar Ytrehus[1]

Abstract

Background: There is increasing evidence for a latitudinal and altitudinal shift in the distribution range of *Ixodes ricinus*. The reported incidence of tick-borne disease in humans is on the rise in many European countries and has

What to do?

- Preventive measures:
  - acaricides (pour-on)
    - last 4-5 years access to long-acting acaricides (e.g. Dysect sheep)
  - clearing bush and drain wet areas
  - remove hosts
  - early infection of lambs

- Risk of ticks becoming resistant to acaricides!?

- Breeding for robustness?
  - in line with aim of organic farming

Hypothesis

There is genetic variance in sheep's robustness to TBF / *Anaplasma phagocytophilum* infection

Objective and background

- **Objective:**

To identify possible genetic variation in lamb survival on tick-exposed pastures.

- **Background:**

Genetic variation in robustness is shown in many species to numerous diseases (Bishop et al., 2010).

Marked differences between individual animals with respect to clinical, serological and haematological reactions to *A. phagocytophilum* infection (Stuen, 2003; Stuen et al., 2011, Granquist et al., 2010).

M&M

- **Data from National Sheep Recording System**
  - Flocks in a breeding circle within the normal distribution area of ticks and registered with cases of TBF and/or using preventive treatment against ectoparasites are included.
- **Recordings from 2000 – 2008 with a 10 generation pedigree is used to estimate heritability of survival.**

- **Descriptive statistics**

Individuals (no)	126 732
Farms (no)	44
Lambs/farm (average, min and max)	2880 (362 - 5907)
Sires total (no)	5551
Lambs/sire (average, min and max)	23 (1 - 381)
Average survival (%) (min and max farm-year)	96.2 % (100 – 78)
Day of birth within year (mean (SD)	107 (10)

Results

Table 3
Estimates of variance components, heritability (h^2) and maternal variance as proportion of phenotypc variance (c^2) for survival on tick infested summer pasture with standard errors

Parameter	Estimate	s.e.
Direct additive variance	0.0075	0.00019
Maternal variance	0.00003	0.00001
Phenotypic variance	0.0342	0.00015
Residual variance	0.0266	0.00017
Heritability (h^2)	0.2200	0.00501
Maternal variance as proportion of phenotypic variance (c^2)	0.0007	0.00037

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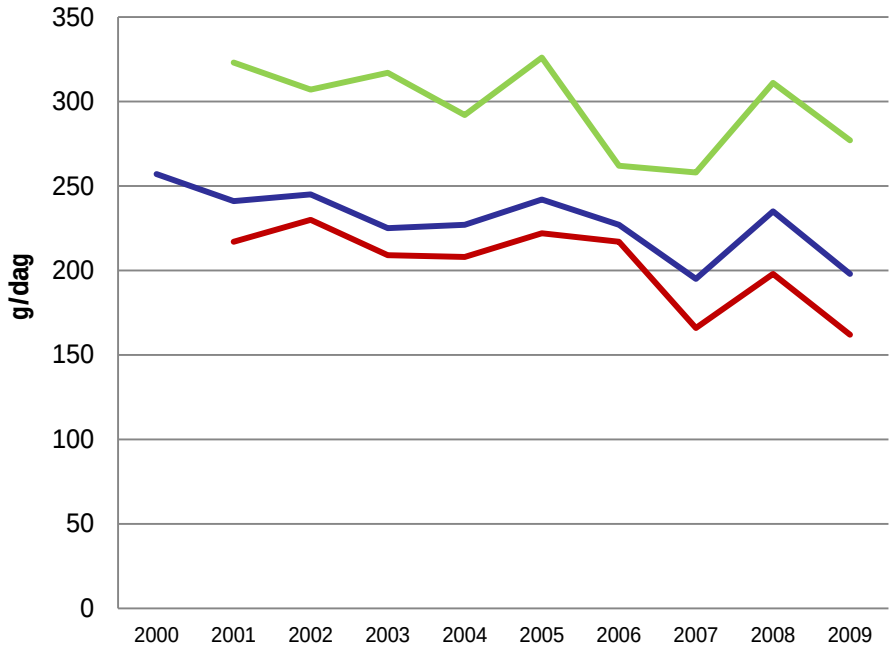
Conclusions

- There is genetic variation in lamb survival on tick-exposed pastures
- Heritability of 0.22 implies potential for improvement by selection
- This heritability cannot, however, be directly attributed to resistance to *A. phagocytophilum*

Thoughts for the future

- **How to identify geneticly robust sheep?**
  - Survival?
  - Tick-count?
  - Weight gain?

Weight gain lambs FARM X 2000 - 2009



- **150 ewes + 300 lambs**
- **35,7 % lamb loss**
- **High prevalence of *A.ph*.**

Ca 20% of lambs weight gain < 100 g/day

Ca 20% of lambs weight gain > 300 g/day

2009	Weight gain Birth - spring	Weight gain Spring - autumn	Weight gain Birth - autumn	Average weaning live weight
National average	332	262	283	44,2
County (M&R) average	338	260	277	44,8
FARM X	276*	154*	194*	33,5*

Thoughts for the future

- **How to identify geneticly robust sheep?**
  - Survival?
  - Tick-count?
  - Weight gain?
  - Challenge?:
    - extensive use of acaricide “Dysect sheep”
    - covers trait of interest(s)

Resources in the project

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Thank you!