Borrelia burdorferi in the UK seroprevalence study in wild deer

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Background

The XXI century is being characterized by a rise in the incidence of zoonoses worldwide. The role of **wildlife** in the spread of pathogens has been documented in many cases.

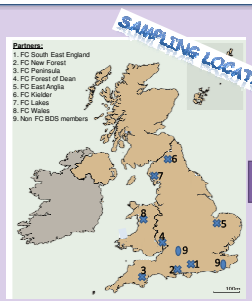
In the UK, as well as other European countries, Lyme disease is listed as the most important non foodborne zoonoses. Wild deer, although **incompetent reservoirs** for the pathogen, are involved in the epidemiology of this disease. They develop an antigenic response following contact with infected ticks.

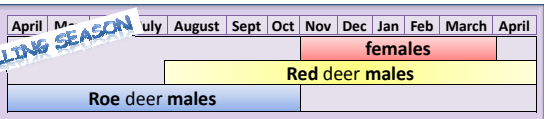
PROJECT AIM: To explore the presence and distribution of Borrelia burgdorferi in the UK via serological testing of wild deer

Methods

Sampling

Collection: **blood / ticks**
Sample size: **800 animals**
One year sampling – following culling season
Species: **Roe/Red deer** (UK native species)
Location: **7 locations in England and 1 in Wales**





Ticks (5/animal)

Blood samples

ELISA development

Controls (10+/40-)
Obtained from The Connecticut Agricultural Experiment Station, USA

Refining methodology
Adapted from:
Magnarelli et al. (USA)
Bhide et al. (Rep. of Slovakia)

Positive cut-off
Optical Density (OD) Value above which a test is considered positive

Intra-assay variability (CVi)
Measure of the variability of test results within one ELISA plate

Inter-assay variability (CVe)
Measure of the variability of test results across ELISA plates

Sensitivity & Specificity

Parameters	Formula	Result
Cut-off	mean (x^1) + 3*SD(x) [1]neg controls	(NEG) OD value<0.52 (POS) OD value>0.52
CVi	(SD/mean)*100	8 % (acceptance <10%)
CVe	(SD/mean)*100	13 % (acceptance <20%)
Sensitivity		90%
Specificity		97%

Data

Variables	Description
Deer TAG No.	Official Identification
Cost centre	Administrative centre
Location Name	Forestry Commission (FC)
Date culled	
Species	Roe deer / Red deer
Sex	
Age	<1 yr / 1-2 yrs / >2yrs
Gross Weight	Kg
Grid Ref	National Grid
Tick infestation	None/Low/medium

Future work

DEER SEROPREVALENCE

- Spatial **seroprevalence distribution** (England and Wales)
- Identify **areas** with **higher exposure** to infected ticks
- Identify **risk factors** for higher seroprevalence in deer
- Association with presence of **farm deer**

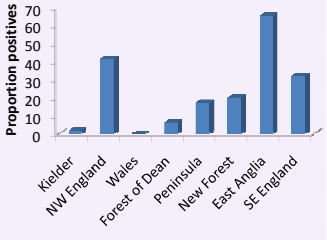
DISEASE SPREAD/DISTRIBUTION PATTERN

- Accounting for **deer density**
- Accounting for **ecology**
- Accounting for **social structure** of wild deer populations
- Accounting for **density of vector**

Results

1. **Discriminatory capacity of cut-off value**
   The cut-off value for positivity of the test was shown to be an appropriate point to distinguish between positive and negative samples. A ttest was used to evaluate the mean difference between positive and negative samples, which showed strong evidence of clear difference of OD values between positive and negative controls ($p<0.001$)

2. **Seroprevalence study (N=476)**
   Seroprevalence was found to be different among sampled areas (table), with South East England having higher prevalence.
   Moreover, there was an association between the presence of ticks in the animal as reported by the hunters and positive serology ($p<0.001$). No trend was observed in relation to degree of tick infestation in the single animal.



References
Bhide et al. Protein A/G dependent ELISA a promising diagnostic tool in lLyme disease seroprevalence in game animals and hunting dogs (2004). Comparative immunology, microbiology and Infec dis. 27, 191-199.
Magnarelli et al. Antibodies to *Borrelia burgdorferi* in deer and racoons (1991). Journal of Wildlife, 27(4), 562-568

Acknowledgments
We thank all hunters who have kindly agree to be involved in sample collection as well as members of the Deer Initiative for their support. We are grateful to the British Deer Society for funding the sampling activities. We also thank Norman Healy for his contribution to this poster and for sharing these nice pictures. Thank you to Laurianne Tavernier (Vet School Nantes) and Daphne Baulicault (Nuffield Bursary) for their input in the laboratory analysis of this project.

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