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TON

Evidence of inter-species transmission between cattle and badger populations in Woodchester Park



Woodchester Park

Naturally infected badger population

Badgers trapped every season since late 1970s

Individual badger records of:

- Infection status
- Trapping locations
- Sex
- Age

High prevalence in badgers and surrounding cattle population

Delahay et al. - 2000 - The spatio-temporal distribution of Mycobacterium bovis (bovine tuberculosis) infection in a high-density badger population Delahay et al. - 2013 - Long-term temporal trends and estimated transmission rates for Mycobacterium bovis infection in an undisturbed high density badger population Rogers, Cheeseman, Mallinson - 1997 - The demography of a high-density badger (Meles meles) population in the west of England







84 Sampled Badgers 163 Whole Genome Sequenced *M. bovis isolates*



Delahay et al. - 2013 - Long-term temporal trends and estimated transmission rates for Mycobacterium bovis infection in an undisturbed high density badger population





81 Sampled Cattle 81 Whole Genome Sequenced *M. bovis isolates*

Locations of Cattle Reactors



Locations of Sequenced Isolates



DEFRA 2015 – Annual report Lawes et al. 2016 – Bovine TB surveillance in Great Britain in 2014 Abernethy et al. 2013 – Bovine tuberculosis trends in the UK and the Republic of Ireland





Phylogenetic Tree





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DUBLIN

<u>60</u>6









Cluster 2

- Infection detected in sampled cattle first
- Many test-positive in-contact cattle
- Cattle isolates closer to clade root
- Majority of 9 sampled herds connected
- 3 unconnected sampled badger social groups





Cluster 4

- Infection detected in sampled badgers first
- Sampled herds ~3km from Woodchester Park
- Many test-positive in-contact badgers
- Most of the 17 sampled badger social groups were connected
- Sampled badgers lived >15 years







Number of days between infection detection dates

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Number of animals recorded in both infected groups of sampled animals

Spatial distance (km) between infected groups

Spatial distance (km) between main groups

Number of days between sampling dates

Number of animals recorded in both main groups of sampled animals

Number of days overlap between recorded lifespans of the sampled animals

Number of animals recorded in both sampled groups of sampled animals

Mean number of animals dispersing along edges of shortest path between main groups

Spatial distance (km) between sampled groups

Mean number of animals dispersing along edges of shortest path between infected groups

Mean number of animals dispersing along edges of shortest path between sampled groups

Number of recorded animal movements between main groups of sampled animals

Liaw et al. 2002 – Classification and regression by randomForest

Proportion variation explained = 0.63

Spatial Temporal Network





Comparing Badger Isolates

Number of days between infection detection dates

Spatial distance (km) between infected groups Spatial distance (km) between main groups Number of days between sampling dates Number of animals recorded in both main groups of sampled animals Number of days overlap between recorded lifespans of the sampled animals Number of animals recorded in both sampled groups of sampled animals Mean number of animals dispersing along edges of shortest path between main groups **Proportion variation** Spatial distance (km) between sampled groups explained = 0.63Mean number of animals dispersing along edges of shortest path between infected groups Spatial Mean number of animals dispersing along edges of shortest path between sampled groups Temporal Number of recorded animal movements between main groups of sampled animals Network





Comparing Badger Isolates

Number of days between infection detection dates

Number of animals that lived in both sampled badger social groups

Spatial distance (km) between main groups

Number of days between sampling dates

Number of animals recorded in both main groups of sampled animals

Number of days overlap between recorded lifespans of the sampled animals

Number of animals recorded in both sampled groups of sampled animals

Mean number of animals dispersing along edges of shortest path between main groups

Spatial distance (km) between sampled groups

Mean number of animals dispersing along edges of shortest path between infected groups

Mean number of animals dispersing along edges of shortest path between sampled groups

Number of recorded animal movements between main groups of sampled animals

Proportion variation explained = 0.63

Spatial Temporal Network





Comparing Badger Isolates

Number of days between infection detection dates

Number of animals recorded in both infected groups of sampled animals

Spatial distance (km) between the sampled badger social groups







BASTA











BASTA





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Conclusions

Sampled badger population maintained infection independently

Evidence of inter-species transmission in both directions





THANKS!!!!!

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