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Brucella melitensis shedding in Alpine ibex: age and sex heterogeneity

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► To cite this version:

Sébastien Lambert, Emmanuelle Gilot-Fromont, Pauline Freycon, Anne Thebault, Yvette Game, et al.. *Brucella melitensis* shedding in Alpine ibex: age and sex heterogeneity. 13th EWDA Conference, Aug 2018, Larissa, Greece. <hal-04688854>

HAL Id: hal-04688854

<https://vetagro-sup.hal.science/hal-04688854v1>

Submitted on 27 Feb 2025

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Context and issues

- *Brucella melitensis* infection in the Bargy Massif (French Alps)
 - ✓ France officially free of brucellosis since 2003
 - ✓ Two human cases in 2012 related to a dairy cattle herd
 - ✓ High seroprevalence in the ibex population¹, a protected species
 - ✓ Probable spill-back from Alpine ibex to cattle²
- 1st case of maintenance in wild ruminants in Europe
- Concerns in **public health**, in **veterinary health**, and in **wildlife conservation**
- Infection with *B. melitensis* unknown in ibex
 - **Issue #1**: possible transmission routes?
- Management in wildlife:
 - ✓ Better target infectious individuals³
 - ✓ Targeting individuals based on serology is not always accurate^{4,5}
 - **Issue #2**: seropositive = active infection?
 - If not:
 - **Issue #3**: characteristics of infectious individuals?

Material

- 2012-2017:
 - ✓ 339 ibex captured, euthanized if seropositive, marked and released if seronegative
 - ✓ 326 ibex culled, among which 33 analysed in serology
 - ✓ 127 ibex seropositive (113 captured, 14 culled)
 - ✓ 88 ibex seropositive analysed (56♀, 32♂) of known age, antibody titre, date and localisation of capture/culling



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#1: possible transmission routes?

- Method: *Brucella* cultures in potentially shedding tissues/samples
- Hypotheses:
 - ✓ Indirect transmission (genital shedding) → genital swabs/tracts
 - ✓ Congenital transmission (foetus) → bacterial culture of foetuses
 - ✓ Pseudo-vertical transmission (milk) → bacterial cultures of udders
 - ✓ Venereal transmission (semen) → bacterial cultures of testes
- Results :
 - ♀ 11/59 swabs +
 - ♀ 14/52 tracts +
 - ♀ 1/3 foetus +
 - ♀ 5/7 udders +
 - ♂ 12/32 testes +



→ 4 possible transmission routes

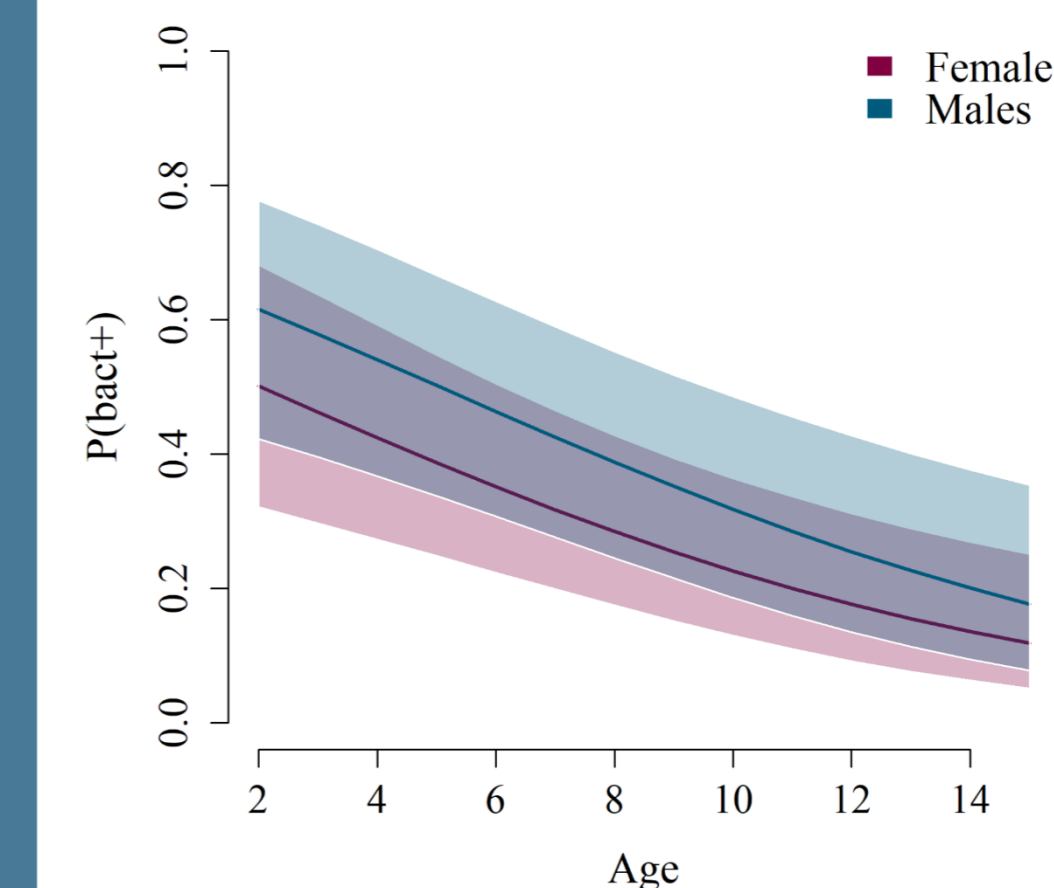
#2: seropositive = active infection?

- Method: proportion of seropositive individuals with positive bacterial cultures in tissues/samples
- Hypotheses :
 - ✓ Absence of active infection in a proportion of individuals
 - ✓ High proportion of active infection (maintenance in the population)
- Results: **active** / **inactive** infection
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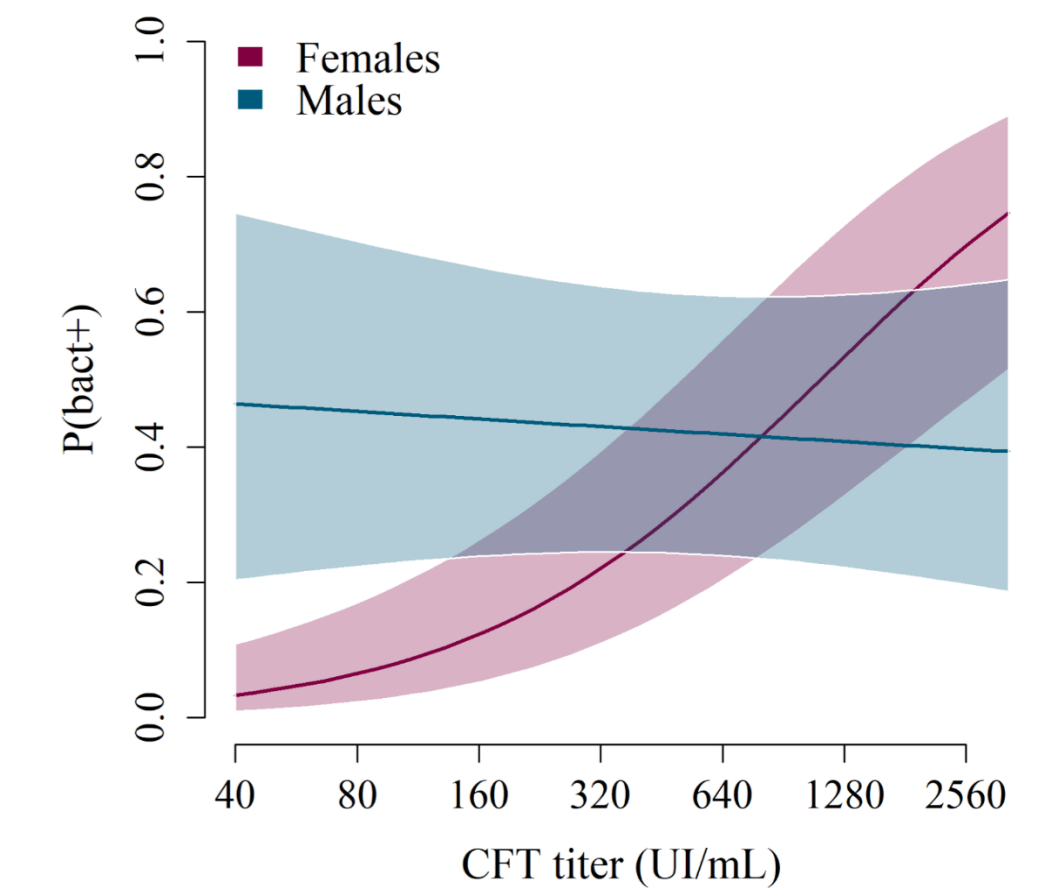
→ Seropositive ≠ active infection
 → High proportion of active infection

#3: characteristics of infectious individuals?

- Method: seeking explanatory variables for the probability of positive bacterial culture (generalised linear mixed models)
- Hypotheses :
 - ✓ Persistent shedding over time (goat) VS decrease with age (bison)⁵
 - ✓ Immune reaction level (antibody titres measured with Complement Fixation Test) correlated to active infection as in domestic sheep⁸
- Results :



→ Shedding decreases with age in both sexes



→ Active infection ⇔ high antibody titres in females
 → Not confirmed in males

Conclusion

- Consequences on management:
 - ✓ Target young seropositive females which are more at risk of shedding
 - ✓ Possible detection of infectious females with antibody titres
- Perspective: evaluation of management strategies with modelling

Acknowledgements:

The authors would like to thank the field technicians and researchers from the French Hunting and Wildlife Agency (ONCFS) who performed ibex captures, monitoring and management and provided transportation of dead animals to the laboratory. We also thank the local veterinary services, the local veterinarians and the Préfecture of Haute Savoie who supported the field work, and the departmental laboratory that performed all necropsies and bacterial examinations. We are grateful to the French Ministry of Research, the French Hunting and Wildlife Agency (ONCFS) and French Agency for Food, Environmental and Occupational Health and Safety (ANSES) for funding this work.

References: This work was published in Lambert *et al.* (2018) *Frontiers in Microbiology*, **9**(1065), 1-15. 10.3389/fmicb.2018.01065

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