Brucellosis

An emerging disease with public health implications?

B. Garin-Bastuji, DVM, PhD, Research. Dir.
EU / OIE & FAO Reference Laboratory for Brucellosis
ANSES, Maisons-Alfort, France.

Symposium "Exotic livestock diseases – a Swedish issue?"
SLU / CGD–
Uppsala – Sweden - 12 November 2014

EU RL Brucellosis

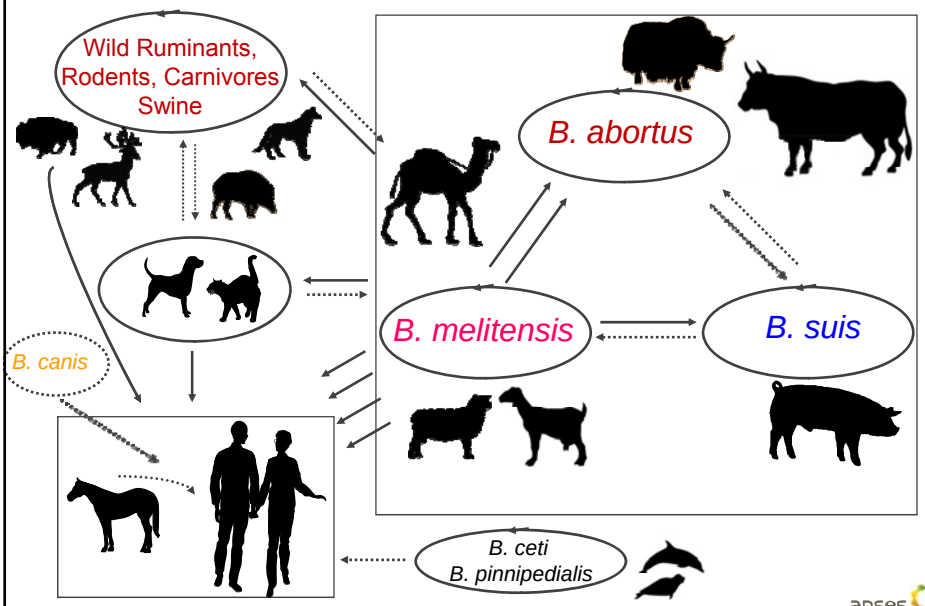
Brucellosis

- Infectious & contagious disease due to *Brucella* sp.
- Of major public health and worldwide importance (*annual human incidence: 500,000*)
- Causes significant economic losses to livestock production due to:
  - reproductive disorders (abortion, orchitis)
  - reduced productivity (milk, infertility)

Brucella : species & biovars

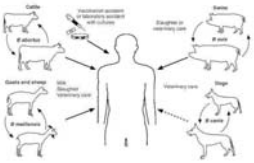
Species	Biovars	Preferred natural host	Main geographical area	Pathogenicity for man
B. melitensis	1, 2, 3	Sheep, Goats Wild ungulates	Mediterranean countries Middle & Near East	High
B. abortus	1, 2, 3, 4, 5, 6, (7), 9	Bovines Wild ungulates	Europe, Americas, Africa, Asia	Moderate
B. suis	1	Suids	Americas, Asia, Oceania	High
	2	Suids, Hares	Central & Western Europe	Very low
	3	Suids	USA, China	High
	4	Reindeer	USA, Canada, Russia	Moderate
	5	Wild rodents	Russia	High
B. neotomae		Desert wood rat *Neotoma lepida*	USA	Unknown
B. ovis		Sheep (males)	Mediterranean countries	No
B. canis		Dogs	USA, South America Central/Eastern Europe	Low
B. ceti		Cetaceans	-	High / Unknown
B. pinnipedialis		Pinnipeds	-	High / Unknown
B. microti		Common vole	Central Europe	Unknown
B. inopinata		Unknown	USA / Oceania	Unknown
B. papionis		Unknown	Unknown	Unknown

Brucellosis : the global cycle

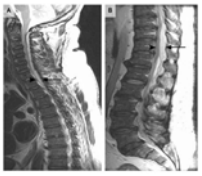


Brucellosis

- ***A zoonosis of worldwide importance***
  - *Sources:* animals infected by
    - *Brucella melitensis* (small ruminants)
    - *Brucella abortus* (large ruminants)
    - *Brucella suis* (pigs)
  - *Transmission route:*
    - occupational direct contact or exposure
    - unpasteurised dairy food consumption



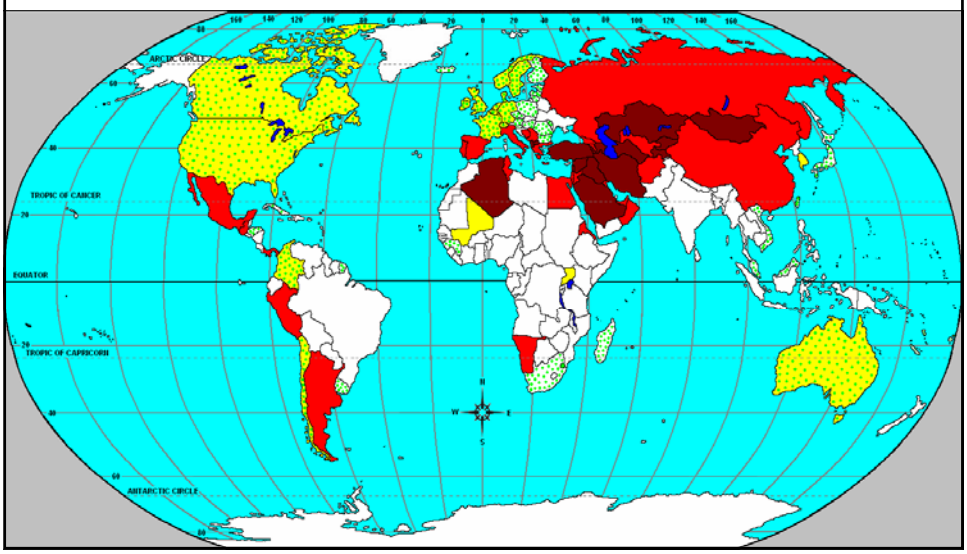
- ***A significant public health challenge***
  - *Of major economic & financial importance*
  - *Human brucellosis is:*
    - The commonest zoonosis worldwide: 500.000 cases/year (WHO)
    - Minimal mortality but,
    - Substantial residual disability if not treated promptly & effectively
    - Important cause of travel-associated morbidity
    - Endemic in the major part of the World



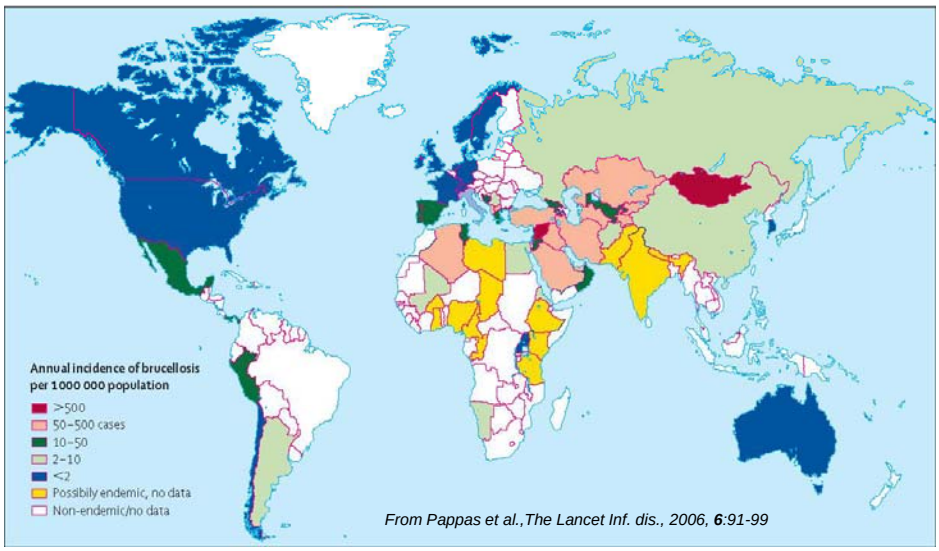
Human brucellosis: worldwide incidence

Incidence <2 / million ***B. melitensis* does not exist**

Incidence >2 / million **Incidence > 50 / million** **Data not available**

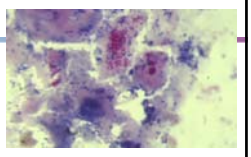


Human brucellosis: worldwide incidence



*From Pappas et al.,The Lancet Inf. dis., 2006, **6**:91-99*

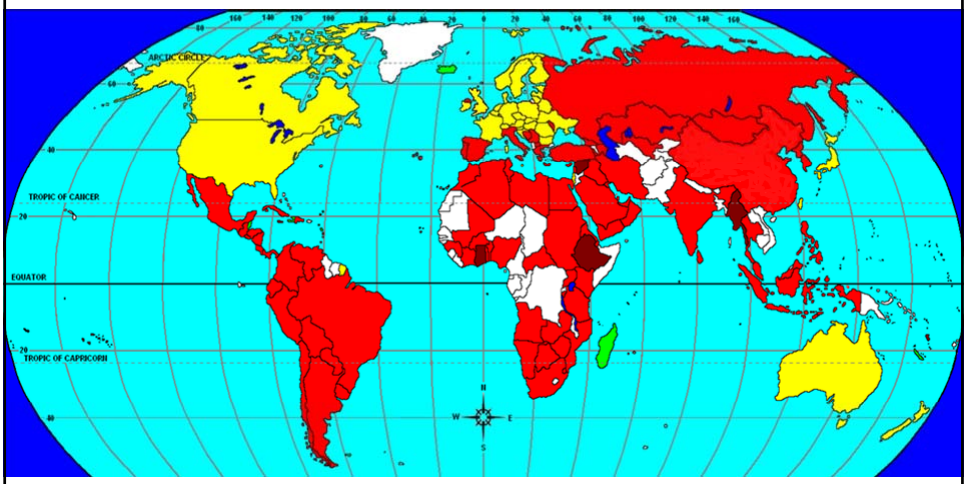
Animal brucellosis



- ***Significant economic losses***
  - *Decreased productivity:*
    - *Abortions, orchitis*
    - *weak offspring, infertility*
    - *decreased milk production*

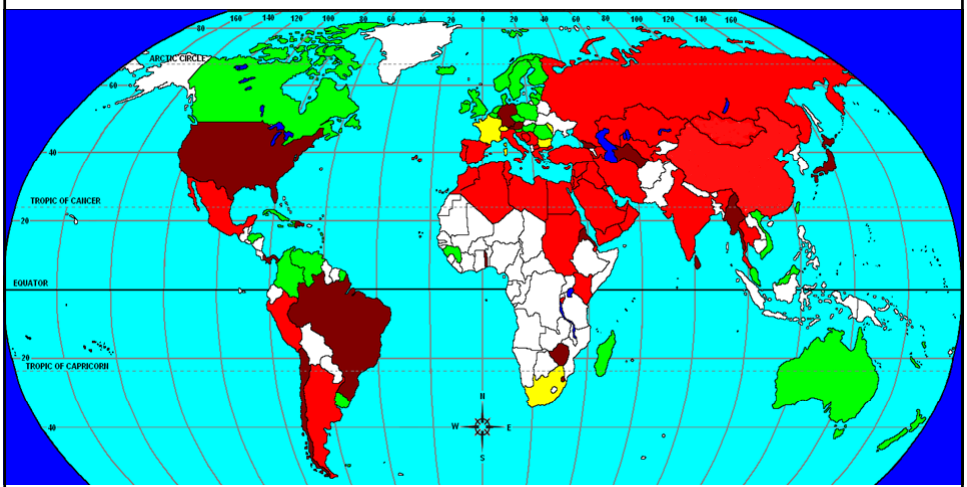
  - *Lost trade opportunities:* WTO/OIE/EU Trade rules
- ***A significant public health challenge***
  - Sheep and goats are the main reservoir of *B. melitensis*
  - However increasing evidence of emergence in cattle and camels

Bovine brucellosis global status



Never reported | Eradicated | Infected | Reported in past | Data not available

Sheep and goat brucellosis global status



Never reported | Eradicated | Infected | Reported in past | Data not available

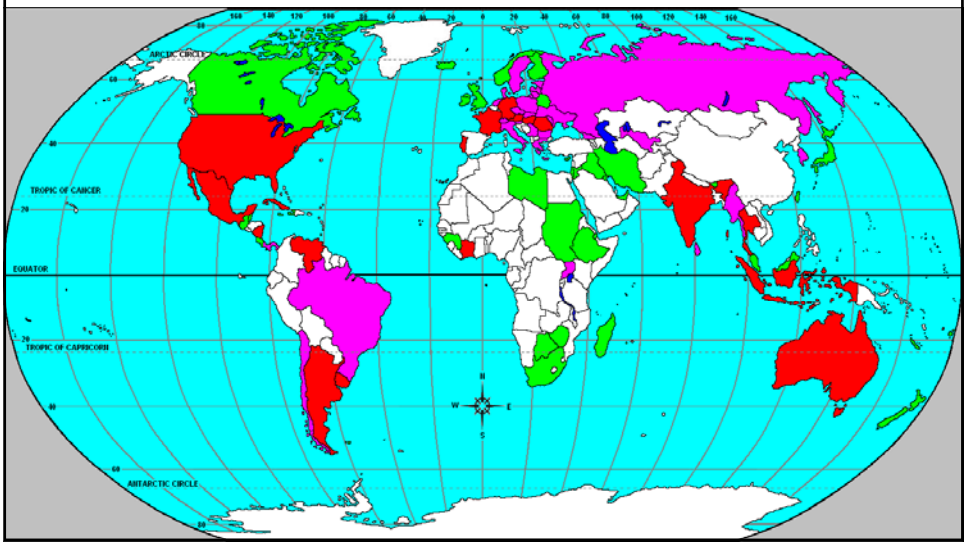
B. suis infection global status

***B. suis* never reported**

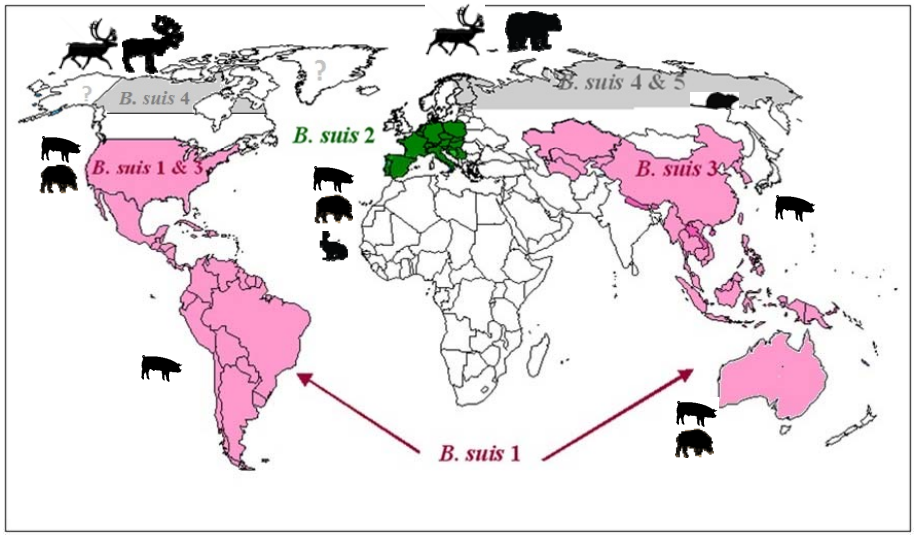
***B. suis* infection reported in the past**

***B. suis* infected countries**

Data not available

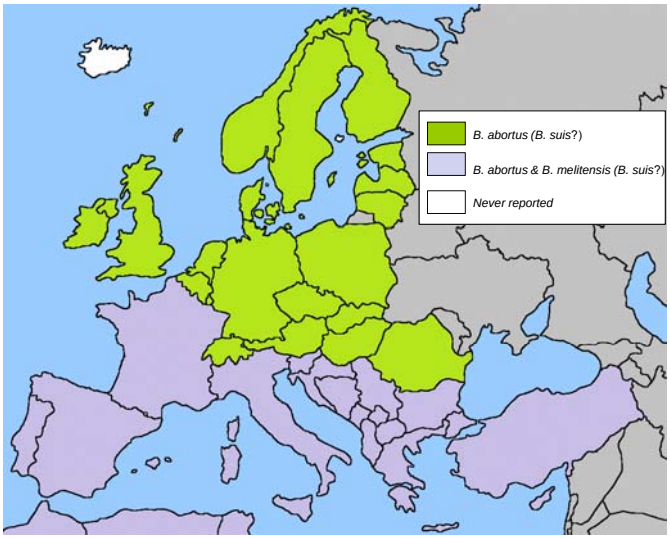


Porcine brucellosis – *Domestic / wild suids*



Brucellosis in the EU - *History*

Animal Brucellosis historically endemic all over Europe



Brucellosis in the EU – *The tools*

- Regulation on trade:
  - EC 64/432 (cattle and pigs)
  - EC 91/68 (sheep and goats)
  - Other regulations on animal products, AI, animal identification, etc.
- European agencies
  - EDQM: European Directorate for the quality of medicines
  - ECDC: European Centre for Disease Prevention & Control *(2005)*
  - EFSA: European Food Safety Authority *(2002)*
- Co-financed eradication programmes:
  - Task Force for Monitoring Diseases Eradication *(2000)*
  - Eradication programmes expert groups *(2012)*
- The EURL *(2006)*

EU RL
Brucellosis

Brucellosis in the EU – *Control & Eradication strategies*

- In low prevalence areas: Test-and-slaughter

  e.g: in Scandinavia, where the disease was eradicated in the fifties (but later in the UK - 1984)

- In mean prevalence areas:

  Test-and-slaughter

  +

  Vaccination of replacement females (at least in early stages)

  - S19 and Rev.1 in large and small ruminants mainly (*e.g*. France)
  - RB51 more recently in Spain, Portugal and Greece

- In some high prevalence areas: mass vaccination

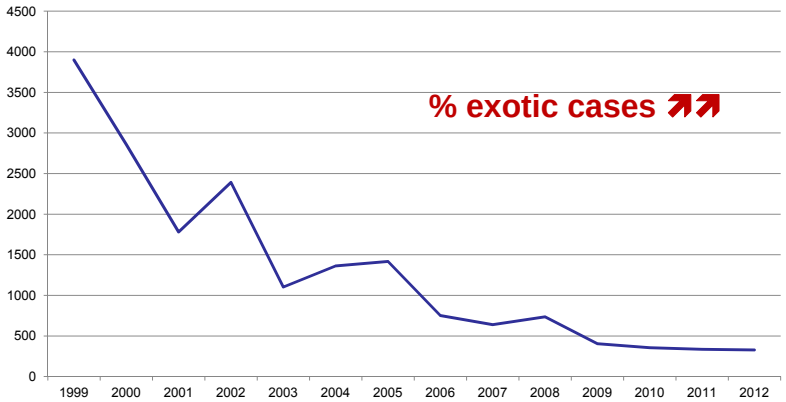
  e.g. Greece mainland, several counties in Spain and Portugal

☞ *Since 2000, the Task Force has progressively contributed to the harmonisation of strategies, in particular in enhancing the use of vaccination as an efficient tool for controlling the disease*

http://ec.europa.eu/food/animal/diseases/eradication/eradication_bovine_sheep_goats_brucellosis_en.pdf

Brucellosis in the EU – *Human cases*

- *Evolution of human cases reported in the EU*



Human cases of brucellosis in the EU (1999-2012)

Brucellosis in the EU - *Large & small ruminants (2012)*

Sheep and goats

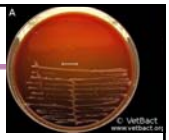
Cattle

From EFSA/ECDC, 2013

Brucellosis in the EU - *Swine*

- Sporadic or endemic occurrence in the 50s
- Cases never reported:
  - Finland, Sweden, Norway and UK
- Sporadic cases reported, mainly in outdoor ranged pig farms:
  Austria, Czech Rep., Croatia, Denmark, France, Germany, Montenegro, Portugal, Romania, Serbia, Spain, Switzerland
- Low to high prevalence in many EU countries in wild-boars (+hares)
- *B. suis* biovar 2 the most frequent
- Few cases in humans, cattle and sheep
- However biovars 1 and 3 reported in Croatia.
- No systematic surveillance
- Depopulation in place in outbreaks in many countries

Brucellosis in the EU – *Dogs (B. canis)*



- Sporadic cases recently reported in:

  Austria, Finland, France, Italy, Hungary, Poland, Sweden, Turkey

  &

  Canada, USA, Central and South-America, South-Africa, Eastern-Asia, Oceania (French Polynesia)

- Real prevalence / Real risk of introduction?

- No trade control for *B. canis* infection

Brucellosis in the EU

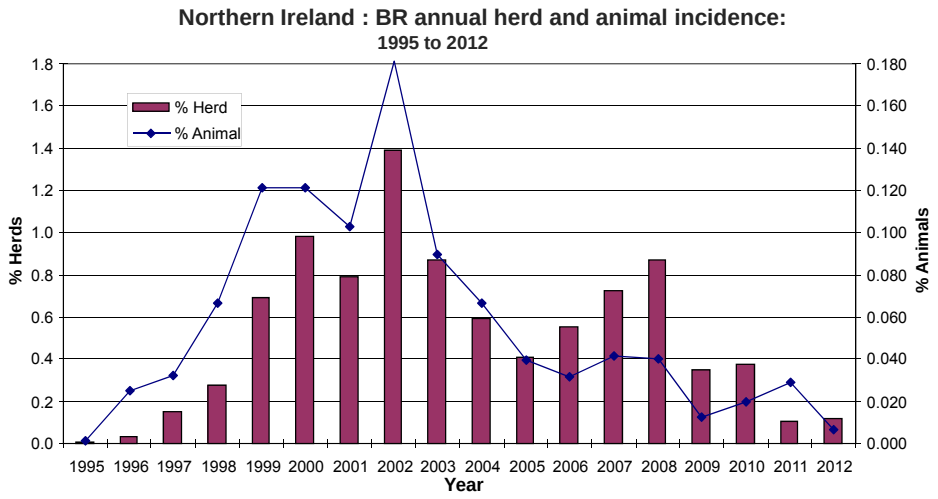
Brucellosis in the EU

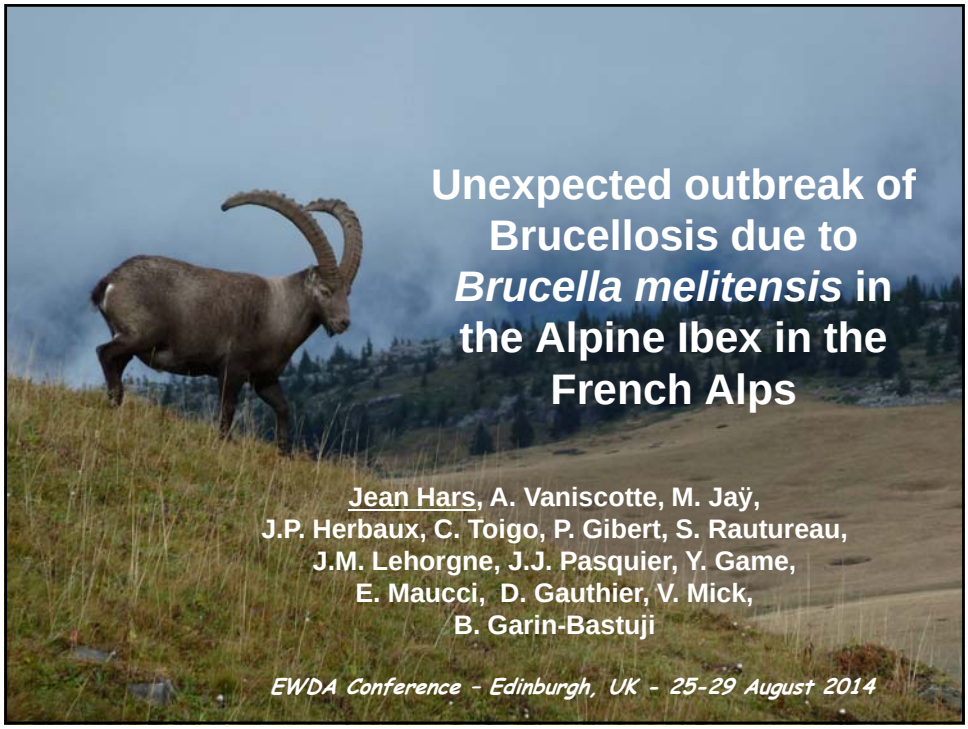
Possible dangers

Animal brucellosis in the EU – Possible risks

- Underestimation of the prevalence
  - Northern Ireland (cattle): surveillance lightened
  - Greece (sheep & goats): vaccination stopped
- Unknown source
  - Belgium 2010 (1 outbreak) & 2012-13 (6+1)
- Introduction
  - From infected neighbouring countries: UK 2004 (←Ireland or NI)
  - From OBF neighbouring countries: France 2012 (← Belgium)
- Wildlife reservoir (*B. abortus*/*B. melitensis*)
  - Up to recently: no wild reservoir identified n the EU
  - Few sporadic cases of *B. abortus* & *melitensis* is wild ruminants: considered as dead-end hosts
  - However: primary reservoir identified in Alpine Ibex in France in 2012 *(transmission to dairy cattle with human cases)*

Animal brucellosis in the EU – Possible risks



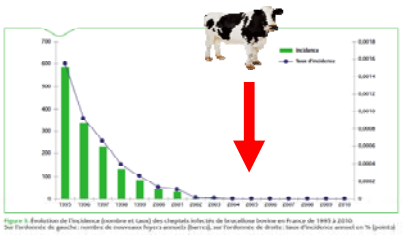


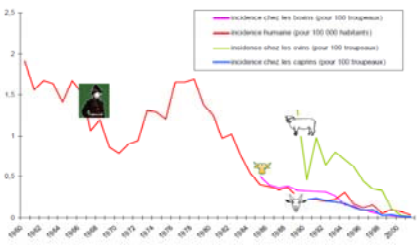
Brucellosis in French ruminants & humans

- No cases of brucellosis in cattle, sheep and goats since 2003
- France officially free of Bovine brucellosis since 2005
- Consequently, incidence decreased in humans:

☞ only 32 human cases, mostly imported, in 2012

(29 in 2013)





The 2012 outbreak in the French Alps

- January 2012: one human case in Grand-Bornand* village (**Bargy** massif, Haute-Savoie, France) followed by a second case later *(2013 - focalised form)*

An area famous for its well-known raw-milk "Reblochon" cheese

April 2012: confirmation of one case in an aborted cow in the same village due to *Brucella melitensis* biovar 3

☞ *2 human cases due to fresh cheese consumption*

- May 2012: serological control of livestock (> 12,000 animals tested)
  ➔ all results negative

Last ovine/bovine breakdown in the massif in 1999

➔ *What about wildlife????*

An extensive survey in wildlife in 2012-2013...2014....

Office National de la Chasse et de la Faune Sauvage

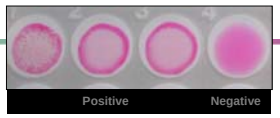
- **In hunted species:**
  blood, lung, spleen, testes and uterus sampled by hunters for serological and bacteriological analyses

- **In Alpine Ibex (protected species)**
  - **Detection of clinical signs (arthritis and orchitis) in the field**

  - **Random captures by dart-gun anaesthesia in the Bargy and neighbouring massifs**

anses

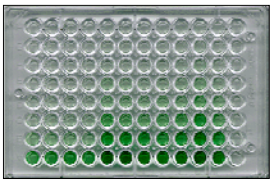
Test protocol



- Serology
  - Rose Bengal (RBT)
  - Complement fixation (CFT)
  - iELISA *(IDEXX, France)*
  - cELISA *(Ingenasa, Spain)*

LiDAL

anses



☞ *if blood unavailable, lung extracts tested*

➔ in 2014, whole-blood rapid test:
Anigen Rapid GS Brucella Ab Test (Bionote, South Korea)

- Bacteriology

➔ Culture

➔ Real-time-PCR

SAVOIE CONSEIL GENERAL

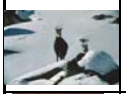
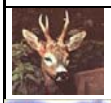
anses

Office National de la Chasse et de la Faune Sauvage

Results

Hunted species

Two hunting seasons (2012-2013 and 2013-2014)

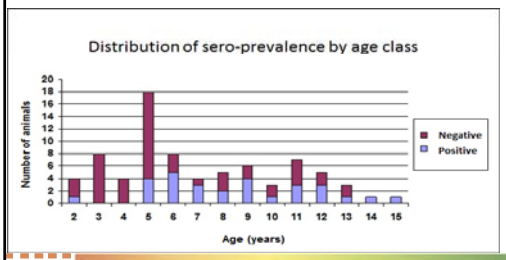
	Bargy / Borne	Aravis	Total	Results
	115	39	**154**	**2 positive**
	61	4	**65**	All negative
	55	1	**56**	All negative

2 chamois females (6 and 7 years old) killed in Sept. 2012 and Oct. 2013 in the same municipality

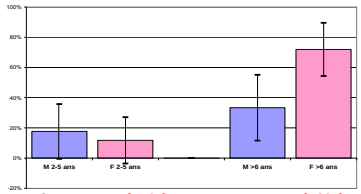
Arthritis due to *Brucella* on the 1st chamois found infected

Serological results
in Alpine Ibex
2012-2013

Massif	Killed clinical suspects	No. tested	No. positive	Seroprevalence
Bargy	8	77	29	**38%** [28 -48]
Aravis	0	60	0	0% [0 -5]
Sous-Dine	0	30	0	0% [0 -8]



Distribution by sex and age (%)



2 – 5 years (15%) **> 5 years (56%)**

Population studies

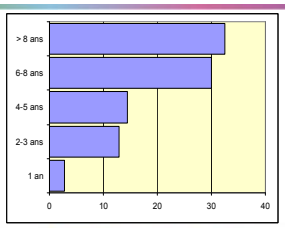
to monitor movements, spatial behaviour and habitat selection

- Aerial counts (helicopter)
- Pedestrian counts twice a month

➔ 20 ibex equipped with GPS collars
➔ 53 ibex equipped with VHF collars
(Capture-Mark-Recapture – CMR)

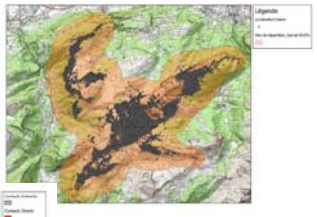
➔ Visual surveillance of 10 farms to evaluate contacts between domestic and wild animals

Population studies: results

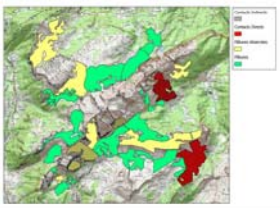


- Population size - CMR estimation**: 500 ibex**
- Reproduction index very low: 0.23
- Inverted population pyramid: 68% > 6 years

➔ **Ageing population**



- GPS and VHF collars: movements on short distances only between the Bargy and neighbouring massifs (Aravis and Sous-Dine)
- Contacts between wild/and domestic ruminants: **do exist but occur rarely**



Conclusions

- A Brucellosis reservoir has been identified in Alpine Ibex, with a very high prevalence, particularly in the over 5 year-old ibex.
- This reservoir has probably been present for a long time (≤1999?)
- Transmission to other species seems to be difficult and/or very rare (only two chamois and one cow)

➔ *Mainly venereal transmission within Ibex ?….*

- Ibex population dynamics seem disrupted
- Direct and indirect contacts between ibex and domestic ruminants are rare but do exist and are unpredictable.

☞ **The challenge:**

How to manage a spread of Brucellosis, a major contagious and zoonotic disease, with a wild reservoir in a protected species living in the main production area of the famous raw-milk cheese "Reblochon"??

Management….

- *Stamping out of the ibex population: technically difficult and socially unacceptable*
- *Capture-test-and-kill: technically impossible*
- *Vaccination ?? Impossible at short term*
  (innocuousness, efficacy, route, side-effects, how long...?)

☞ ***October 2013, the French authorities decided to cull all over 5-year old ibex***

➔ *233 ibex killed*

First results of 2014 investigations

Office National de la Chasse et de la Faune Sauvage

- **78 ibex (40 young, 38 old) captured and tested in the remaining population (*ca*. 300 animals)**
  - ➔Global seroprevalence = 45 % (38% in 2013)
  - ➔Prevalence in young ibex = 50% (15% in 2013)

The general situation has not improved
Moreover, it has worsened in young ibex..!!

….what would happen in the future….?????

Photos: J. Hars

October 2012

Brucellosis in the EU: a re-emerging disease?

- Present situation:
  - Huge improvement in the last decade
    - Improvement of control strategies (identification/movements/regular checks)
    - Re-introduction of the vaccine tool for controlling the disease
  - Eradication reached in France and Cyprus
  - Eradication almost reached in Northern Ireland
  - Excellent results in Spain
  - Slower eradication in Portugal and Italy
  - No good information from Greece
- Possible dangers:
  - Introduction: always possible even from free countries
  - Wild reservoir: may be identified after years of absence in the domestic population
  - *B. canis* ? Marine *Brucella*?

☞ Adequate strategies proved to be efficient

☞ Maintaining a good surveillance is essential in free areas *(Human strains)*

Brucellosis: a re-emerging disease?

- No in developed countries
- Yes in the third world
  - Pure or crossed breeds with increased sensitivity
  - Increase in herd size and animal density
  - Increase in world animal/animal products trade and human movements

☞ Increased risks from an enlarged reservoir of the disease and multiple routes of introduction in free areas

☞ A rapid and accurate diagnosis is therefore essential for:

- ➢ *Identifying the disease introduction as rapidly as possible*
- ➢ *Identifying the source of the disease and its spread*
- ➢ *Implementing the appropriate diagnostic tools and epidemiological studies*

☞ *This does not mean necessarily to maintain a high level of specific research*

☞ *But to maintain a high and up-to-date level of skills/knowledge*

- ➢ *Active commitment in the EU Brucellosis network*






Merci de votre attention

Thank you for your attention

Jag tackar för er uppmärksamhet.