Leptospirosis reservoir animals

Cyrille GOARANT, Noellie GAY
Leptospirosis research and expertise Unit
Institut Pasteur in New Caledonia
"The world most widespread (bacterial) zoonosis"
Leptospirosis in animals

- Virtually any Mammal species

- Clinical presentations in animals very similar to human: Non-symptomatic to rapidly fatal, including forms regarded as rare in humans (e.g. abortions in cattle and pigs, uveitis in horses,...)

- Highly dependant on the host / strain association (co-evolution)

- Of outstanding importance for understanding and controlling human leptospirosis.
A few monographs - Rodents

- Rats reservoirs for SG Icterohaemorrhagiae (more rarely Ballum, in black rats)

- Mice reservoirs for SG Ballum

- Of worldwide significance, major contributors to both human and animal leptospirosis.
A few monographs - Cattle, deer and pig

- Rarely severe in adults
- Frequently sexually-transmitted
- Frequently a reservoir
- Fever, anorexia, milking loss in cattle
- Reproduction loss (abortions, stillbirths)

Financial loss poorly studied
A few monographs - Dogs

• Possible typical Weil’s syndrome if infected with Icterohaemorrhagiae:
  - Renal and hepatic failure, haemorrhages, pulmonary haemorrhages, digestive symptoms…

• As susceptible hosts, they reflect the environmental contamination

• Chronic asymptomatic reservoir if infected with Canicola (or others?)
  - No clinical signs in chronic carriers
  - Excrete virulent leptospires in urine
Leptospira phylogeny and taxonomies

A double, non-consistent taxonomy...

Serology:
- More than 230 serovars
- grouped into ~20 serogroups

Genetics:
- 9 pathogens
- 5 intermediates
- 6 saprophytes

⚠️ Most serovars put together strains belonging to different species
⚠️ All species have strains in several serogroups

“Pathogens” disease-causing
“Saprophytes” free-living
“Intermediates” low or uncertain virulence
### Complex taxonomies

<table>
<thead>
<tr>
<th>Serovar</th>
<th>Strain</th>
<th>Serogroup</th>
<th>DNA species</th>
<th>Country of origin</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>pomona</td>
<td>Johnson</td>
<td>Pomona</td>
<td>L. interrogans</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>pomona</td>
<td>24K</td>
<td>Pomona</td>
<td>L. noguchii</td>
<td>USSR</td>
<td>Bovine</td>
</tr>
<tr>
<td>pomona</td>
<td>164</td>
<td>Pomona</td>
<td>L. interrogans</td>
<td>USA</td>
<td>Bovine</td>
</tr>
<tr>
<td>pomona</td>
<td>Wickard</td>
<td>Pomona</td>
<td>L. interrogans</td>
<td>USA</td>
<td>Human</td>
</tr>
<tr>
<td>pomona</td>
<td>S91</td>
<td>Pomona</td>
<td>L. interrogans</td>
<td>Australia</td>
<td>Pig</td>
</tr>
</tbody>
</table>

**Example:** 1 serovar but 2 genomic species!

<table>
<thead>
<tr>
<th>Serovar</th>
<th>Strain</th>
<th>Serogroup</th>
<th>DNA species</th>
<th>Country of origin</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>hardjo</td>
<td>K-125</td>
<td>Sejroe</td>
<td>L. borgpeterseni</td>
<td>USA</td>
<td>Bovine</td>
</tr>
<tr>
<td>hardjo</td>
<td>T-20</td>
<td>Sejroe</td>
<td>L. borgpeterseni</td>
<td>USA</td>
<td>Bovine</td>
</tr>
<tr>
<td>hardjo</td>
<td>Hardjoprajitno</td>
<td>Sejroe</td>
<td>L. interrogans</td>
<td>Indonesia</td>
<td>Human</td>
</tr>
<tr>
<td>hardjo</td>
<td>Went 5</td>
<td>Sejroe</td>
<td>L. meyeri</td>
<td>Canada</td>
<td>?</td>
</tr>
</tbody>
</table>

**Example:** 1 serovar but 3 genomic species!

**Example:** *Leptospira interrogans* : ~100 serovars described!
Reconciling serology and genetics?

- Positive serology: proof of a former infectious contact with a leptospire

- Renal carriage and urinary shedding:
  - only some of the animals previously infected.
  - even after serology has turned back negative!

- Multiple positive serogroups in MAT:
  - multiple exposures to different leptospires?
  - co-agglutinins?
<table>
<thead>
<tr>
<th><em>Leptospira</em> species</th>
<th>Serogroup</th>
<th>Known reservoir</th>
<th>% human cases (2009-2013)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Leptospira</em> borgpetersenii</td>
<td>Hardjobovis</td>
<td>Cattle, deer</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>Ballum</td>
<td>Mice (+black rats)</td>
<td>5%</td>
</tr>
<tr>
<td><em>Icterohaemorrhagiae</em></td>
<td></td>
<td>Rats (3 species)</td>
<td>64%</td>
</tr>
<tr>
<td><em>Leptospira</em> interrogans</td>
<td>Australis</td>
<td>Pig</td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td>Pomona</td>
<td>Pig, deer (cattle?)</td>
<td>2%</td>
</tr>
<tr>
<td></td>
<td>Pyrogenes</td>
<td>unknown</td>
<td>19%</td>
</tr>
</tbody>
</table>

**Introduced invasive rodents contribute ~70%!**

**An unknown reservoir contributes ~20%!**

**Pigs might contribute up to > 10%!**
What remains to be explored?

- Animal reservoir of the local Pyrogenes?
- Dynamics of Lepto carriage in herds?
- Financial impact of animal leptospirosis?
- Role of feral invasive Mammals?
- Role of cats? Role of Chiropters?
- Direct / indirect transmission: how humans get infected?
- Animals as vectors in addition to reservoirs?
  → Role of non-severe forms in domestic and pet mammals?
- Geographical distribution in animals?
  → to better address prevention
Merci - Thank you