Domestication of transmission cycles of Cutaneous Leishmaniasis in Latin America

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Antwerp, November 2007
Leishmaniasis in the Americas

- Distributed throughout the Central and Southern America; some foci in Mexico and U.S.A.
- Range of clinical manifestation, i.e. CL, DCL, and ML
- ML leads to destruction of mucosa and cartilage and can cause significant scarring, disfigurement, can be fatal
- Most Leishmaniasis cases are reported in Brazil, but Bolivia has the highest reported ML:CL case ratio 1:4.
- Unlike some endemic settings in the Old World, most Leishmaniasis transmission in the Americas appears to be zoonotic
Anthroponotic vs zoonotic transmission cycles

- **Anthroponosis**: direct human-to-human transmission by vector without an animal reservoir
- **Sylvatic zoonosis**: infection occurs via a sylvatic animal, e.g. edentates or rodents.
- **Domestic zoonosis**: infection occurs via a domestic animal, e.g. dog.
Leishmaniasis in the Americas: Established Dogma
Challenging the Dogma: Sites with Evidence for Peridomestic Transmission
Domestication of Leishmaniasis in the Americas – Challenging the Dogma

Evidence for domestic transmission due to:

- **Entomological surveys**: increased vector activity in peridomestic, domestic, and urban environment
- **Epidemiological reservoir surveys**: increase reports of peridomestic and domestic animals
- **Epidemiological surveys and retrospective analysis of case reports**: increase reports and detection of autochthonous cases, mainly children and women, in domestic environment and urban areas
Domestication of leishmaniasis in the Americas – Entomological surveys

<table>
<thead>
<tr>
<th>Lu. species</th>
<th>Geographical distribution</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Lu. intermedia</em></td>
<td>Brazil</td>
<td>Falqueto, 1995</td>
</tr>
<tr>
<td><em>Lu. withmani</em></td>
<td>Brazil</td>
<td>Gutierrez, 2003</td>
</tr>
<tr>
<td><em>Lu. neivai</em></td>
<td>Argentina</td>
<td>Acevedo, 1997</td>
</tr>
<tr>
<td><em>Lu. trapidoi</em></td>
<td>Colombia</td>
<td>Ximenes, 2002</td>
</tr>
<tr>
<td><em>Lu. ovallesi</em></td>
<td>Venezuela</td>
<td>Salomon, 2003</td>
</tr>
<tr>
<td><em>Lu. peruensis</em></td>
<td>Perú</td>
<td>Travi, 1998</td>
</tr>
<tr>
<td><em>Lu. verrucarum</em></td>
<td>Bolivia</td>
<td>Feliciangeli, 1998</td>
</tr>
<tr>
<td><em>Lu. (n) anglesi</em></td>
<td>Bolivia</td>
<td>Perez, 1999</td>
</tr>
<tr>
<td><em>Lu. shawi</em></td>
<td>Brazil / Colombia</td>
<td>Martinez, 1999</td>
</tr>
<tr>
<td><em>Lu. longipalpis</em></td>
<td>Columbia</td>
<td>Garcia., 2007</td>
</tr>
<tr>
<td><em>Lu. gomezi</em></td>
<td></td>
<td>Almeida, 2002</td>
</tr>
<tr>
<td><em>Lu. ayacuchensis</em></td>
<td>Ecuador</td>
<td>Andrade, 2004</td>
</tr>
<tr>
<td><em>Lu. peruensis</em></td>
<td></td>
<td>Duque, 2004</td>
</tr>
<tr>
<td><em>Lu. verrucarum</em></td>
<td></td>
<td>Armijos, 1990</td>
</tr>
</tbody>
</table>

Reference:

- Falqueto, 1995
- Gutierrez, 2003
- Acevedo, 1997
- Ximenes, 2002
- Salomon, 2003
- Travi, 1998
- Feliciangeli, 1998
- Perez, 1999
- Martinez, 1999
- Garcia., 2007
- Almeida, 2002
- Andrade, 2004
- Duque, 2004
- Armijos, 1990
# Domestication of Leishmaniasis in the Americas – Epidemiological Reservoir Surveys

**Synantropic Animal** | **Geographic Localization** | **Reference**
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Domestic equines | Brazil, Argentina, Venezuela |

*Unusual animal host:* cats, pigs,
Domestication of Leishmaniasis in the Americas – Epidemiological or Retrospective Human Surveys

<table>
<thead>
<tr>
<th>Epidemiological Data</th>
<th>References</th>
</tr>
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<tbody>
<tr>
<td>➢ Age</td>
<td>Armijos, 2001</td>
</tr>
<tr>
<td>Children</td>
<td>Rodriguez 2007; Ampuero 2005, Munoz. 2006</td>
</tr>
<tr>
<td>No gender differences</td>
<td>De Castro, 2005</td>
</tr>
<tr>
<td>➢ Clinical characteristics</td>
<td></td>
</tr>
<tr>
<td>Children face 92%</td>
<td></td>
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</table>
Domestication of leishmaniasis in the Americas – Causes and Effects

**Causes**
- Increased urbanization
- Deforestation and development of new settlements
- Increased agricultural activity in sylvatic fringe areas (e.g. coffee, sugar cane)
- Intense migration of populations from urban to sylvatic and back to urban areas

**Effects**
- Adaptation of sand flies to new environments (i.e. in terms of abundance, distribution, anthropophily) leading to increase man / domestic animal – vector contact
- Adaptation of sylvatic (reservoir) animals to peridomestic or urban environment, e.g. marsupials
Conclusions

- The domestication cycles of Leishmaniasis is reflected in a global increase of cases, a wider age distribution and frequent family cases including children.
- Sandflies are adapting to anthropogenic changes (e.g. settlements, agricultural practice), and possible adopting new behavior, e.g. increased anthropophily.
- Increased number of domestic animals (e.g. dogs) are infected and potentially being infectious (i.e. a reservoir) due to a sandfly exposure.
- Anthropogenic changes (e.g. settlements) are making access to domestic areas sylvatic reservoirs of the diseases (e.g. opposums, rats, etc).
Conclusions

- Domestication or urbanization of leishmaniasis transmission cycles also represents an opportunity: methods for vector (e.g. insecticide-treated bednets or indoor residual spraying) or reservoir (e.g. insecticide-treated dog collars) could be effective to prevent and control transmission.
Acknowledgements

• Organizers of LeishRisk meeting
• Prof Jean-Claude Dujardin
• Colleagues from University of San Simon