



REDUCING DEATHS AND SUFFERING
FROM **TROPICAL DISEASES**



Vector Biology and Transmission

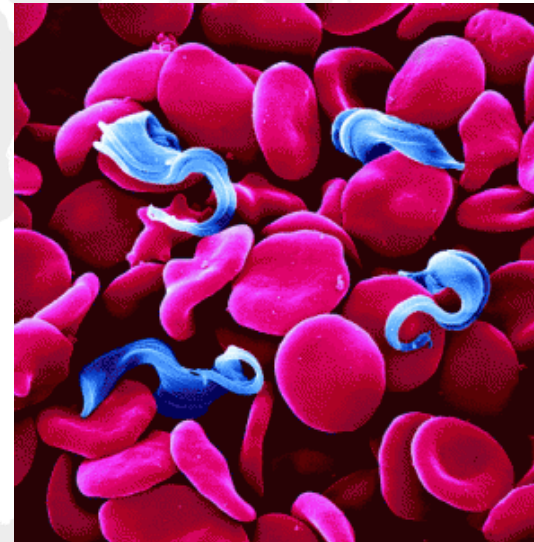
Vulnerability for Control



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Human African Trypanosomiasis (Sleeping Sickness)



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Vector Biology: African Tryp

- The vector for HAT is the **tsetse fly**
- Biological Vector
- Inhabits rural areas
- Bites during daytime hours
- Both males and females are capable of carrying and transmitting the disease.



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Vector Biology: African Tryp. (Cont.)

- Tsetse flies belong to the genus *Glossina*
- *Glossina* contains 3 subgroups
 - *Glossina* (includes *G. morsitans* group)
 - *Nemorhina* (includes *G. palpalis* group)
 - *Austenina* (includes *G. fusca* group)



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Vector Biology Cont'd

- *T.b. gambiense*:
transmitted by:
- *G. palpalis* & *G. tachinoides*
groups

- *T.b. rhodesiense*:
transmitted by:
- G. morsitans*, *G. swynnertoni*, &
G. pallidipes groups



Tsetse fly is capable of producing a larva every 7-9 days



Vectors of African Trypanosomiasis

- Both male and female *Glossina* feed on mammalian blood
- Infection occurs if enough organisms are injected
- <1% of flies in endemic areas are infected
- >5% of flies are infected during epidemic periods



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D. Scott Smith



Reservoirs

T.b. gambiense



T.b. rhodesiense



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Fly Behaviour

- Bite only in the day time when they can detect their host
- Attracted by odour, CO₂ and colours.



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Fly Behaviour

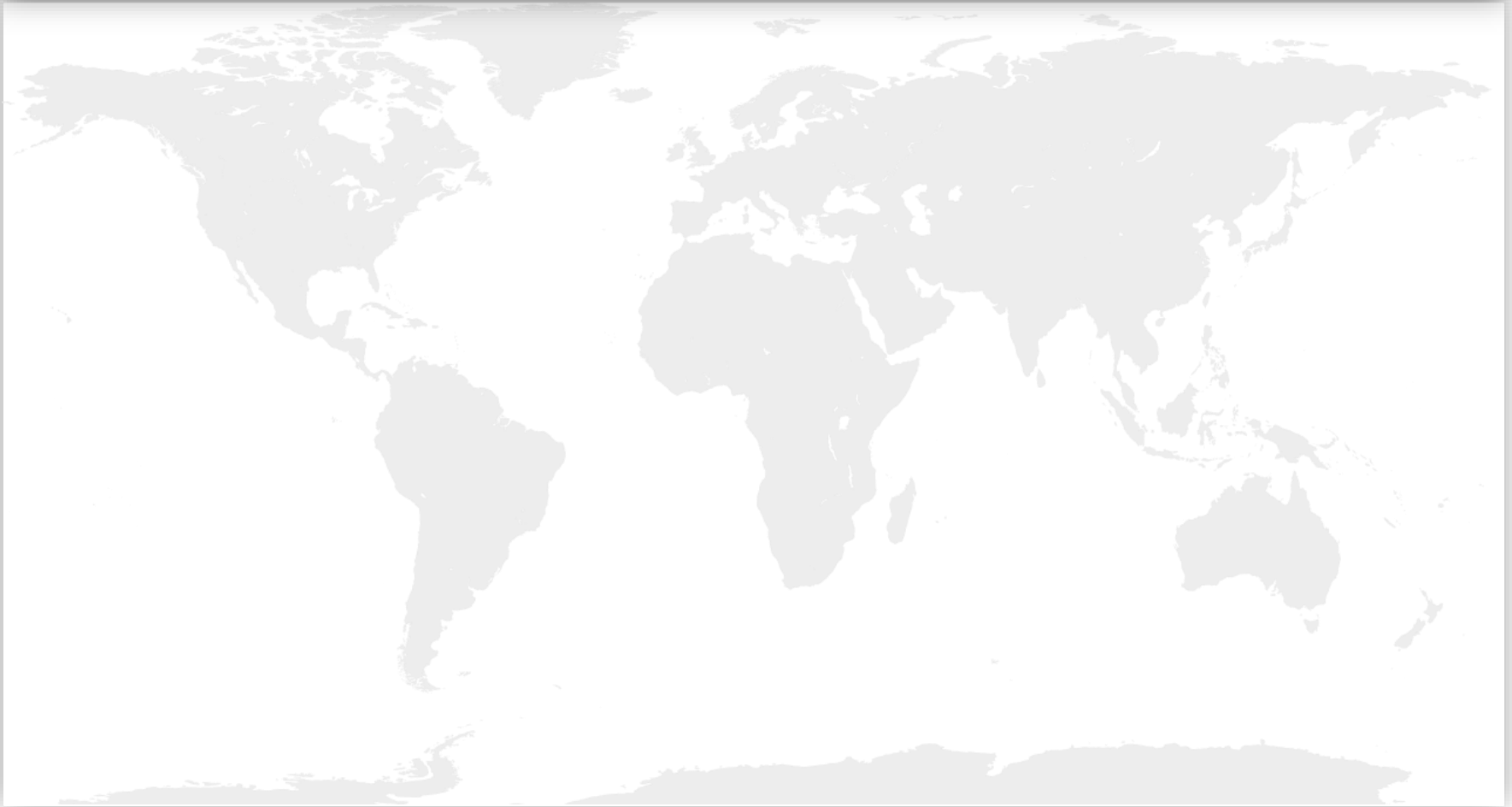
- Flies are attracted to the colour blue
- UNHCR plastic sheeting attracts the flies like a trap (human baited), and may draw them into camps



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Issues for Control



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Vector Control of Tsetse Flies

- No vaccine
- Case-finding and treatment
- Control and surveillance
- Vector control of the tsetse flies
- Fly traps
- Sequential aerosol spraying
- Spraying animals
- Sterile insect technique (SIT)



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Fly traps



Roberts J, <http://ibol.org/tracking-the-tsetse-with-barcodes/>



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Issue for Control



Traps are effective control tools for tsetse fly because:

1. Tsetse reproduction is very inefficient
2. They normally bite people at water collection sites in the day
3. They are easily attracted by blue and black
4. Cow odour on traps increases the attraction



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Fly Traps



Traps are effective control of tsetse flies in sleeping sickness areas:

1. Hung on the banks of rivers, lakes + ponds where ever people collect water or wash.
2. The flies, guided by colour and odour enter the trap and cannot exit. They die of heat.



Sequential aerosol spraying



African Studies Center,
<http://exploringafrica.matrix.msu.edu/teachers/curriculum/m18/activity4.php>



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Reservoir Control



Macmillan S, <http://www.ilri.org/ilrinews/index.php/archives/tag/trypanosomosis>



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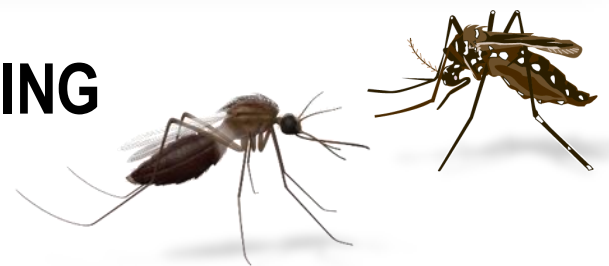


A sample of collaborations

- Programme to Eliminate Sleeping Sickness
- Initiative for Central Africa
- Programme Against African Trypanosomiasis (PAAT)
- Pan-African Tsetse and Trypanosomiasis Eradication Campaign (PATTEC)
- Drugs for Neglected Diseases Initiative (DNDi)



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**What are the key IEC messages
you need to include in your
prevention programme?
5 minutes**



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Leishmaniasis

- Transmitted by the bite of an infected female Phlebotomine sandfly
- 500 fly species, 30 carry Leishmaniasis. Small (2-3 mm long)
- Most forms of disease transmissible only from animals (zoonosis), but some can be spread between humans.
- Infection caused by about 21 of 30 species of *Leishmania* - obligate intracellular protozoan parasite that infect mammals. These include:
 - *L. donovani* complex: *L. donovani*, *L. infantum*, and *L. chagasi*
 - *L. mexicana* complex: *L. mexicana*,
 - *L. amazonensis*, and *L. Venezuelensis*
 - *L. tropica*; *L. major*; *L. aethiopica*;



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Leishmania-Vector Biology



Phlebotomine sandfly

500 species, 30 carry Leishmaniasis

Small (2-3 mm long)



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Leishmaniasis- Vector Biology

- Family Psychodidae, genera *Lutzomyia* (New world) *Phlebotomus* (Old world)
- Sandflies live in inter-tropical and temperate regions.
- Female Sandflies feed on blood to mature eggs
- Eggs are laid in the burrows of specific rodents, in bark of old trees, in cracks in walls, in animal shelters and in rubbish, where larvae will find the organic matter, heat and humidity which are necessary for development.



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Leishmania-Vector Biology

- Resting sites are often similar or near to the larval breeding sites and are usually places that are cool, humid and dark. Sand flies are able to survive in dry environments by withdrawing to cool, humid resting sites during the day and then becoming active at night when ambient temperatures drop and humidity increases.
- The female sandfly covers a radius of several hundred meters.



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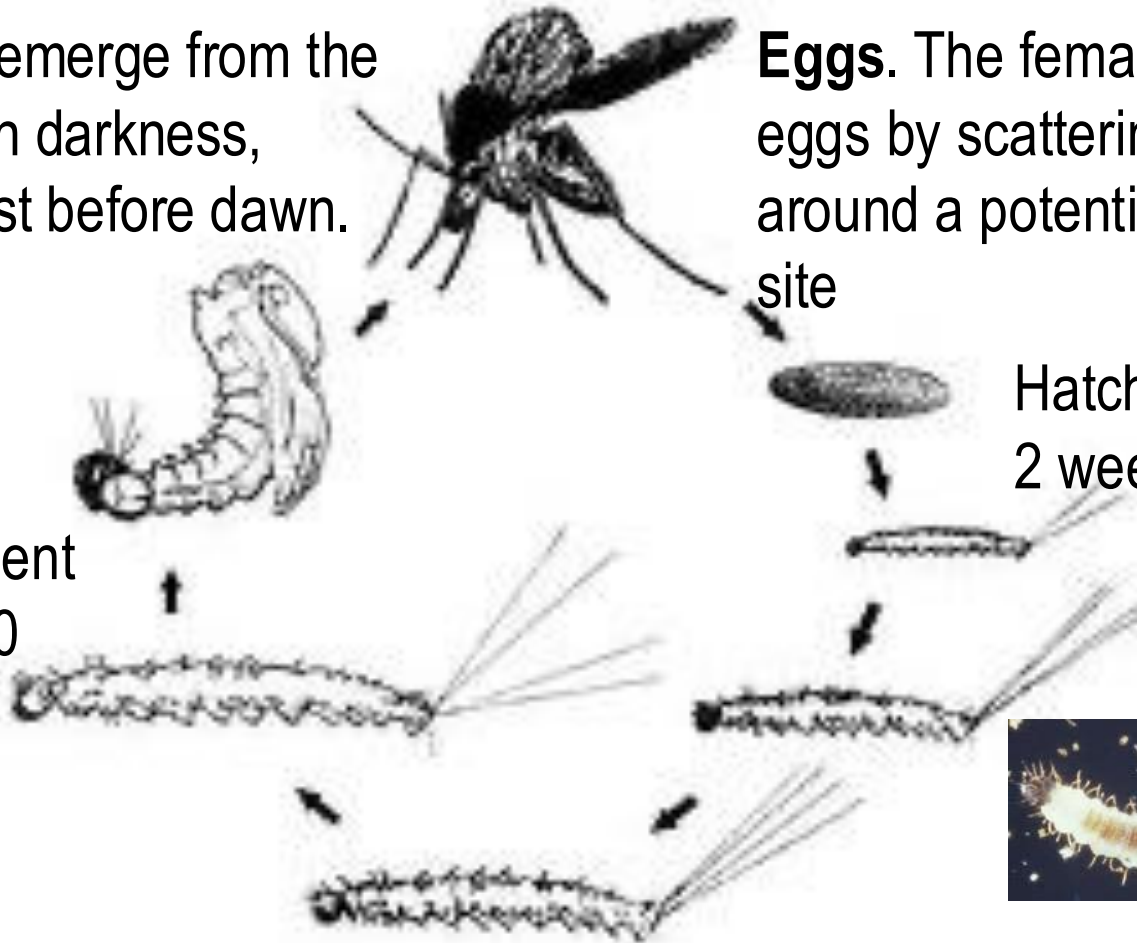
Vector- Life Cycle

Adults: emerge from the pupae in darkness, often just before dawn.

Eggs. The female lays 30-70 eggs by scattering them around a potential breeding site

Pupal development takes 5-10 days

Hatch within 1-2 weeks



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Leishmaniasis-Prevention

Personal/Community-prevent infection is to protect themselves from sand fly bites.

- **When outdoors (or in unprotected quarters):**
- Minimize the amount of exposed skin, long-sleeved shirts, long pants, and socks; and tuck your shirt into your pants.
- Apply insect repellent (DEET (N,N-diethylmetatoluamide) to exposed (uncovered) skin and under the ends of sleeves and pant legs.



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Leishmaniasis-Prevention

Public Health

- **LLINs** - smaller mesh size
- **IRS**
- **Spatial Repellents**
- **Killing of reservoir species.** Certain species of mammals can act as important reservoirs of *Leishmania* and by killing the reservoir species that are living near human habitation, Culling infected dogs
- **Insecticide spraying of larval habitat.** This is usually not possible because, usually, so little is known about where the larvae occur.



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Reservoir control



- Culling of reservoirs,

Control programme in Brazil, cull seropositive dogs (20000 each year since '80) and 200,000 houses sprayed each year, \$8 m/yr, no reduction in incidence!

- Treat dogs with insecticide and dog collars

Studies in middle east using treated dog collares incidence of disease in dogs down by 3 % (from 5.6 to 2.3) more than 50% reduction in children.



Applying insecticide directly to dogs- Permethrin and deltamethrin results in a high reduction in insect feeding and mortality for 5 -13 weeks, down to half by week 5 (*P. papatsi*, *L. whitmani*, *intermedia*). But deltamethrin collars remain effective for longer.



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Leishmaniasis Control-Key Points

Treatment

Expensive regime, **severe side effects**

Vector Control

- LLINs between dusk and dawn
 - Protection from infectious bites, breaks transmission
 - Complete coverage and correct use of nets necessary
 - High start up costs - big initial investment
 - Logistically challenging to deliver to household
 - They do not always fit the shelter



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Leishmaniasis Control-Key Points

Vector Control

- IRS/surface spraying
 - Kills sand fly vector of disease, reduces/interrupts transmission
 - Time (although much faster than LLIN distribution)
 - People absent from homes during spraying reduces coverage
 - Dependent on relatively skilled teams
 - Safety for sprayers, requires special equipment, expensive insecticides



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Leishmaniasis Control-Key Points

Animal reservoir control

- Culling- reduce disease reservoir, shown to not be effective and sustainable, not accepted by animal owners
- Insecticide spraying/collars- shown to be effective, acceptable, loss of collars, requires effective monitoring and coverage

Community

- Dusk: wear long sleeves and trousers-protection from sand fly bites
- Use insect repellent such as DEET on exposed skin.



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