MEDICAL AND VETERINARY ENTOMOLOGY

CERATOPOGONIDAE, SIMULIIDAE, BRACHYCERA

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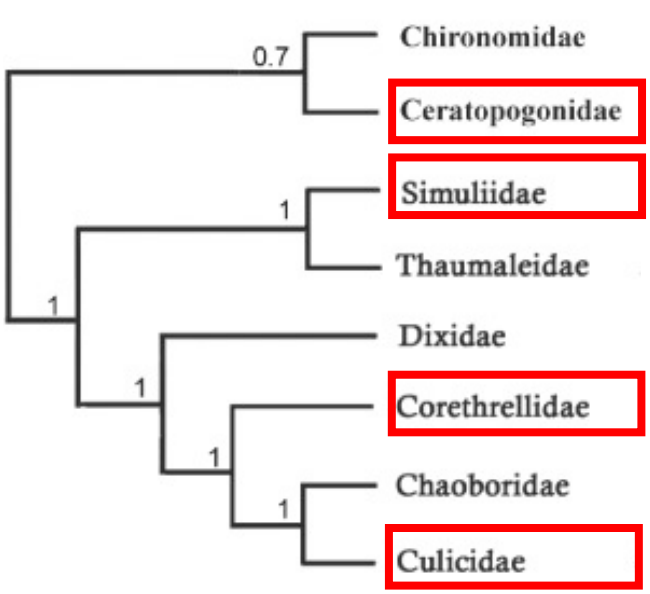
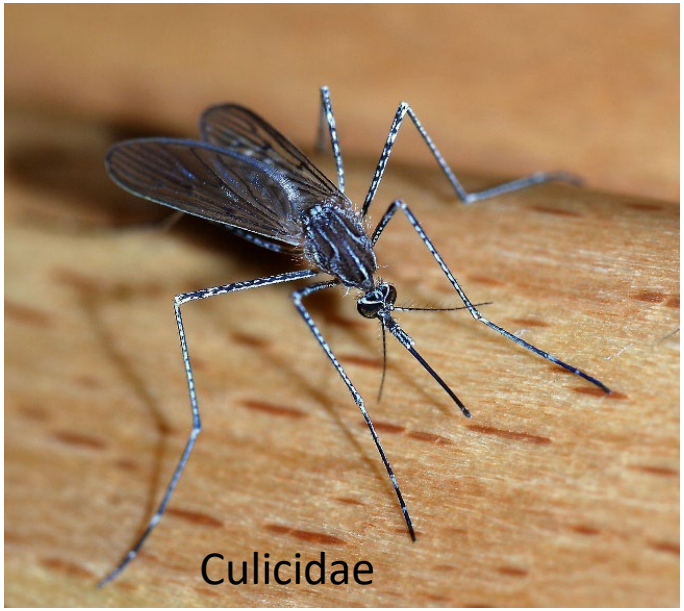
Medicinski značajni Arthropoda - Diptera




Ceratopogonidae


Culicidae


Simuliidae

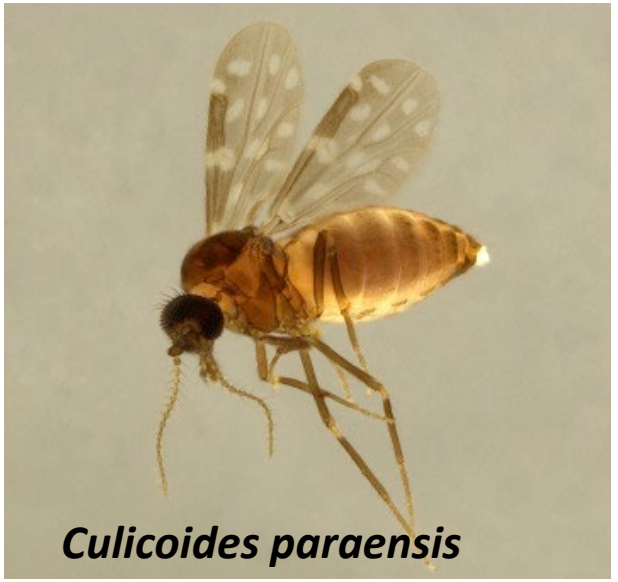
Medically significant Arthropoda – Ceratopogonidae

- Very small dipterans (1-2.5 mm) - "no-see-ums"
- In the world, about 6300 species in 4 subfamilies (3 medically and veterinary important Leptoconopinae, Forcipomyiinae and Ceratopogoninae)
- Larvae live in aquatic and semiaquatic habitats from the tropics to the arctic tundra
- The most important species that transmit diseases are from the genus *Culicoides*, but the genera *Leptoconops*, *Forcipomyia*,... also bite
- Bites burn and are felt strongly, especially in tropical species - TELMOPHAGIA
- Carriers of viruses and their forms to humans and animals

Culicoides spp.

Medically significant Arthropoda – Ceratopogonidae

- **Oropouche virus disease**
  - It is caused by a virus from the Peribunyaviridae family, isolated in Trinidad
  - The primary vector is *Culicoides paraensis*
  - The disease is not fatal - temperature, pain in muscles and joints, with some photophobia, headache, dizziness - duration from 2 to 5 days, only exceptionally up to 2 weeks
  - From 1961 to 1980, 165,000 patients in the Amazon region of Brazil
  - Many animals serve as a reservoir of the virus

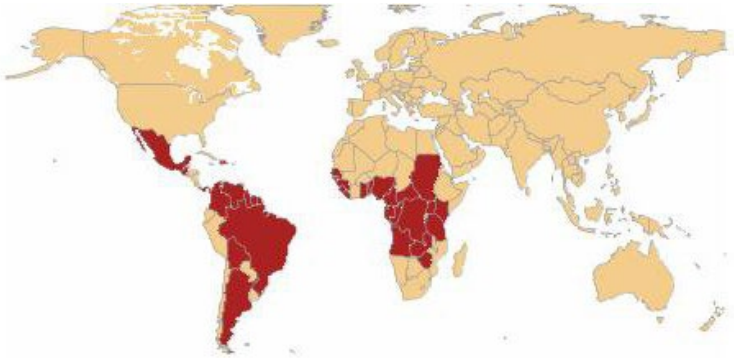


Culicoides paraensis

Medically significant Arthropoda – Ceratopogonidae

- **Mansonellosis**
- **3 types of filarial forms from the genus *Mansonella* (*Mansonella ozzardi* - America, *M. perstans* - Africa and America introduction and *M. streptocerca* - Africa limited) cause this disease**
- **In tropical and subtropical regions of the world**
- **Vectors of species from the genera *Culicoides*, *Forcipomyia* and *Leptoconops***

Mansonella ozzardi

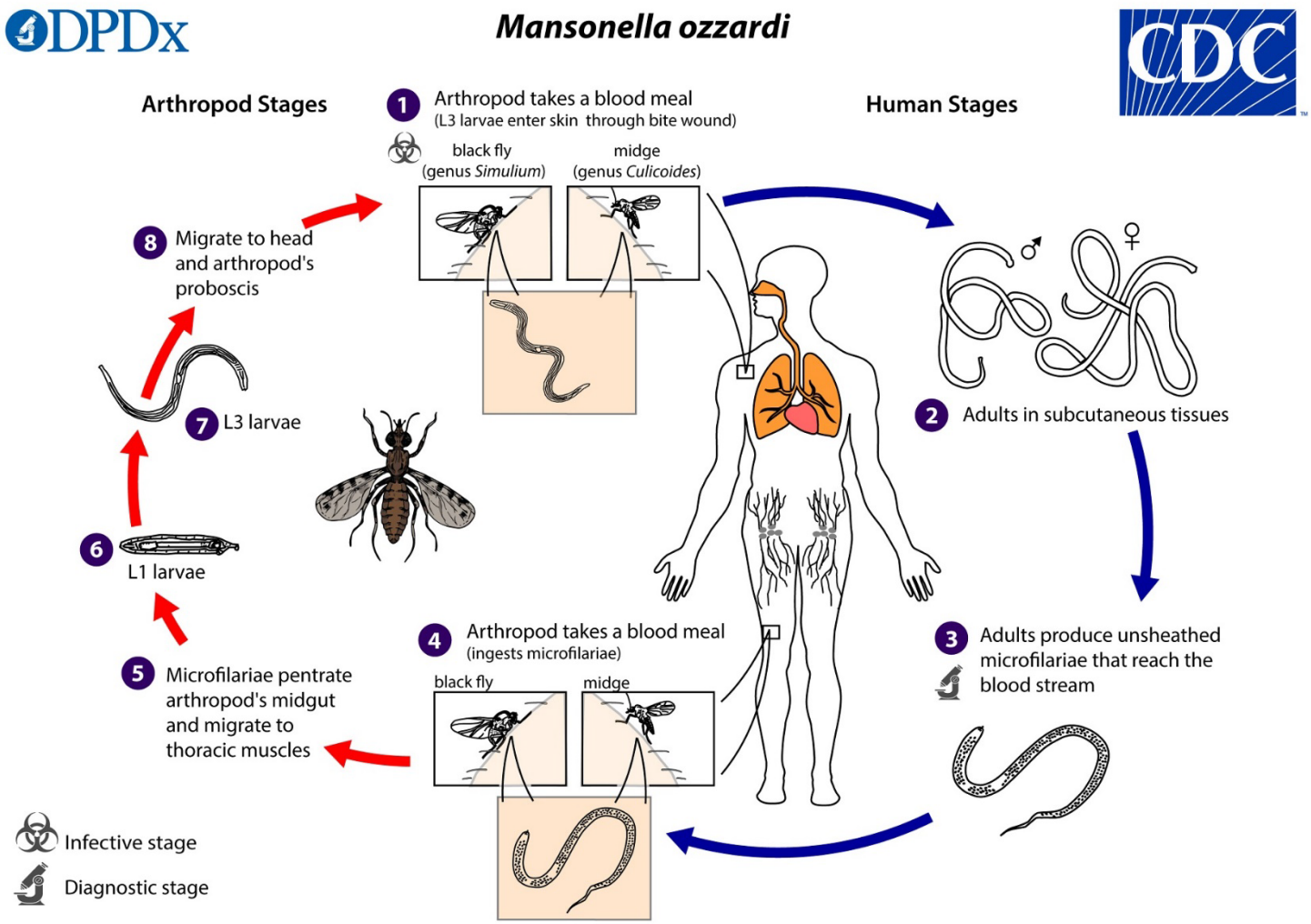


Forcipomyia squamipennis

Mullen & Murphree 2019

Medically significant Arthropoda – Ceratopogonidae

- **Mansonellosis**



Mullen & Murphree 2019

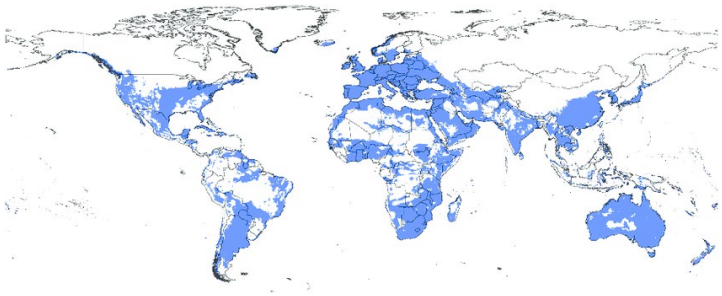
Medically significant Arthropoda – Ceratopogonidae

- **Mansonellosis**
  - Infection is more common in older people, due to chronic exposure to infection
  - It has no significant pathology, relatively little damage is done in the dermal tissue
  - Infection is established by biopsy of the skin and surrounding blood for microfilariae
  - Adults are most often found in the fatty tissue of the abdomen, body cavities, sometimes causing conjunctivitis and swelling of the eyes
  - Only in rare cases does it cause a disease such as Bancroftian filariasis
  - Ivermectin (*M. ozzardi*), mebendazole (*M. perstans*), diethylcarbamazine (*M. streptocerca*) is used for treatment
  - In addition to the Ceratopogonidae vector, Simuliidae can also be vectors

Medically significant Arthropoda – Ceratopogonidae

- **Blue tongue disease**
  - It is caused by the bluetongue virus of the genus Orbivirus (family Reoviridae) with 27 different serotypes
  - viral infectious disease of domestic (sheep, goats and cattle) and wild ruminants
  - The disease is not transmitted by contact between animals, but the virus is transmitted by species of the genus *Culicoides*
  - It affects sheep the most, there is a vaccine
  - It used to occur between 40 and 35 degrees north latitude, but today it is massively spreading to the north, this is attributed to the spread of the vector and climate change


Culicoides imicola



Mullen & Murphree 2019

Medically significant Arthropoda – Ceratopogonidae

- **Blue tongue disease**
  - **Mortality is up to 75% (mostly in sheep)**
  - **In severe cases, animals develop lesions around the mouth and on the udders, inflammation of the hooves and between the toes**
  - **respiratory difficulties caused by the accumulation of fluid in the lungs and internal bleeding (this usually leads to death)**
  - **The name Blue tongue disease comes from the bluish color of the tongue and surrounding mucous membranes caused by cyanosis (lack of oxygen in the blood)**
  - **Animals develop lameness and curvature of the back because they try to reduce the weight on painful hooves, it also affects reproduction**



Mullen & Murphree 2019

Medically significant Arthropoda – Ceratopogonidae

- **Epizotic hemorrhagic disease**
  - A very similar disease to Bluetongue, but primarily in wild ruminants (deer)
- **African horse disease**
  - It is also caused by the genus Orbivirus
  - 4 forms of the disease - pulmonary (peracute) - the most lethal (95%), cardiac (subacute), pulmonary-cardiac (acute) and horse fever
  - Once only associated with Africa, today it is present much more widely
  - Zebra are virus reservoirs

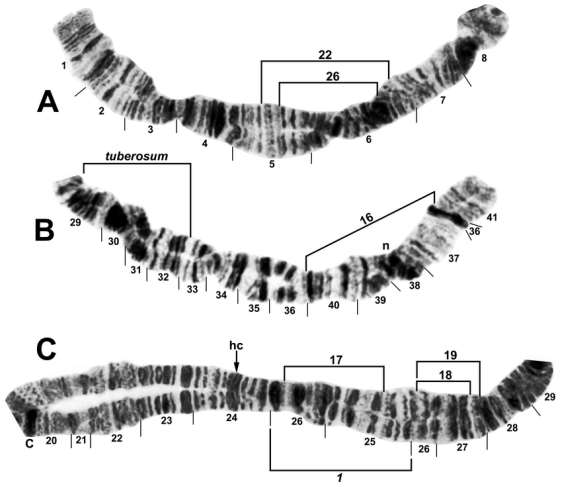
Medically significant Arthropoda – Simuliidae

- Small, dark flies, very good flying abilities (females can fly up to 500 km) with over 2400 described species
- All species are hematophagous (only 5 species of the genus *Parasimulium* are not), feeding on the blood of humans, domestic and wild animals - **TELMOPHAGIA**
- Ubiquitous (except Antarctica and some oceanic islands)
- Larvae are a very important component of freshwater ecosystems and one of the best adapted organisms for life in water

Adler & McCreadie 2019

Medically significant Arthropoda – Simuliidae

- The genus *Simulium* contains about 90% of all harmful and vector species
- A very demanding identification, but one of the best known groups
- They primarily transmit phagotrophic protists (animals), filarial forms (humans and animals) and viruses (animals, but rarely)



Medically significant Arthropoda – Simuliidae

TABLE 14.1 Species of Black Flies Regarded as Significant Biting and Nuisance Pests of Humans, Livestock, and Poultry

Species	Geographic Region
Humans	
Austrosimulium australense	New Zealand
Austrosimulium ungulatum	New Zealand
Prosimulium mixtum group	Eastern North America
Simulium amazonicum complex	South America (Amazon Basin)
Simulium arakawae	Japan
Simulium buissoni	Marquesas Islands
Simulium cholodkovskii	Russia
Simulium decimatum	Russia
Simulium jenningsi	Eastern North America
Simulium johannseni	Midwestern North America
Simulium jujuyense	Argentina
Simulium meridionale	Western North America
Simulium nigrogilvum	Thailand
Simulium ochraceum complex	Galapagos Islands
Simulium oyapokense complex	South America (Amazonian Region)
Simulium parnassum	Eastern North America
Simulium penobscotense	Northeastern North America
Simulium pertinax	Brazil
Simulium posticatum	England
Simulium quadrivittatum	Central America
Simulium sanguineum	Northwestern South America
Simulium tescorum	Southwestern United States
Simulium turgaicum	Western Asia
Simulium venustum complex	North America
Simulium vittatum complex	North America
Livestock	
Austrosimulium pestilens	Australia (Queensland)
Cnephia pecuarum	United States (Mississippi River Valley)
Simulium cholodkovskii	Russia
Simulium chutteri	South Africa
Simulium colombaschense	Europe (historical)
Simulium decimatum	Russia
Simulium equinum	Europe, Russia
Simulium erythrocephalum	Europe
Simulium incrustatum	Paraguay
Simulium jenningsi group	Eastern North America
Simulium kurense	Western Asia
Simulium lineatum	Europe
Simulium luggeri	Western Canada
Simulium maculatum	Russia
Simulium ochraceum complex	Galapagos Islands
Simulium ornatum complex	Europe, Russia
Simulium reptans	Europe, Russia
Simulium turgaicum	Russia, western Asia
Simulium vampirum	Western Canada
Simulium vittatum complex	North America
Poultry	
Cnephia ornithophilia	Eastern North America
Simulium meridionale	North America
Simulium rugglesi	North America
Simulium slossonae	Southeastern United States

- **Species that cause major nuisance and significant bites in humans and animals**
- **They cause blackfly fever (North America) - reaction to the components of the salivary glands - headache, fever, nausea, swelling of the lymph nodes in the neck**
- **Allergic reactions from bites/stings**
- **A major nuisance in certain parts of the world (*Simulium jenningsi* in North America)**

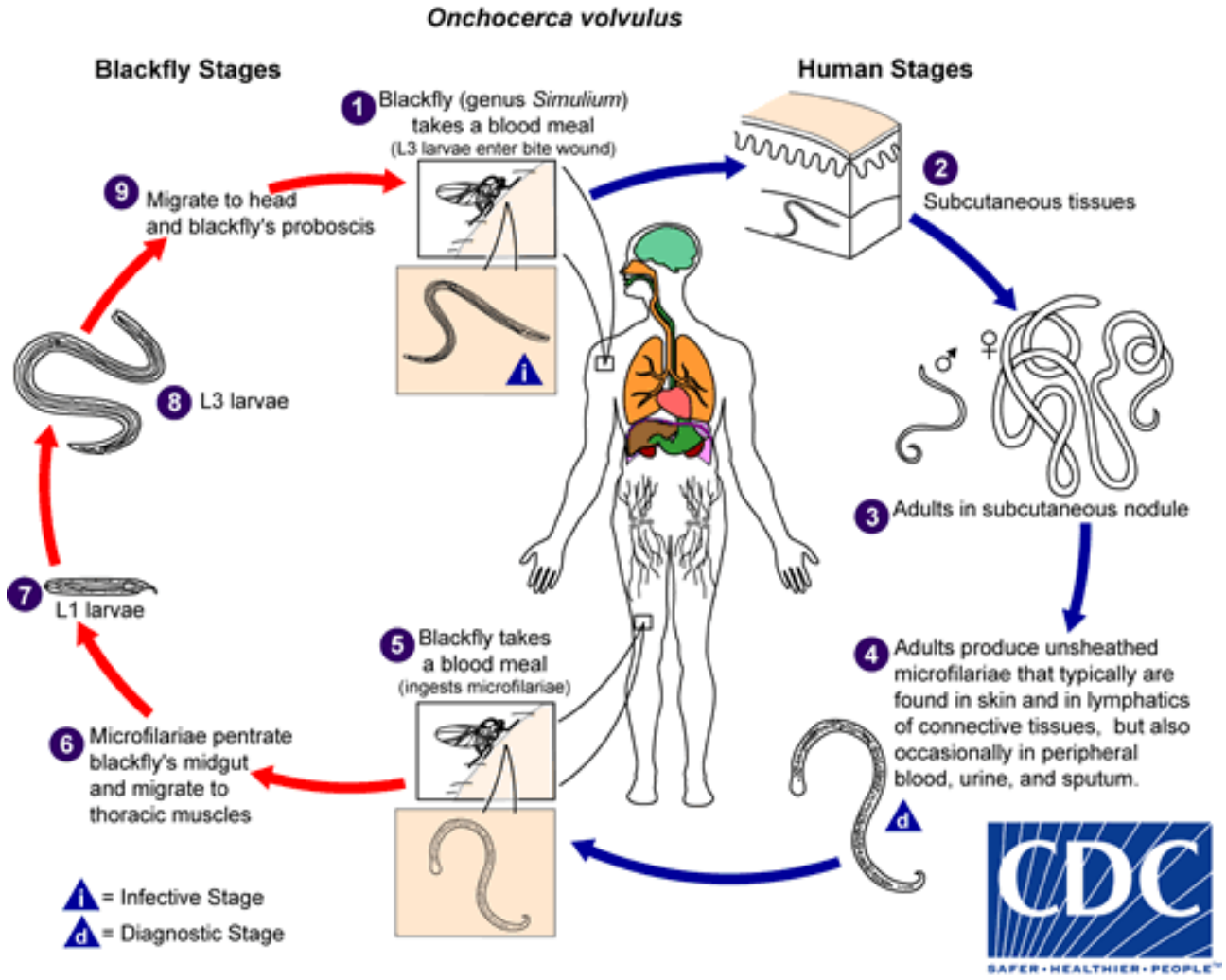
Adler & McCreadie 2019

Medically significant Arthropoda – Simuliidae

- **Human Onchocerciasis (River Blindness)**
- **A tropical disease caused by the worm *Onchocerca volvulus***
- **At least 26 disease vectors, most vectors within the *Simulium damnosum* species complex**
- **The second most important cause of blindness in humans (after cataracts)**
- **About 17.7 million people are infected in Africa and Yemen, 140,500 in tropical Central and South America – 270,000 blind and half a million with limited visibility**
- **120 million people at risk - 37 million possibly infected**

Medically significant Arthropoda – Simuliidae

- **Human Onchocerciasis (River Blindness)**



Medically significant Arthropoda – Simuliidae

- **Human Onchocerciasis (River Blindness)**
- **Adult females produce millions of microfilariae by the age of 14**
- **Microfilariae migrate into the skin and diagnosis of the disease is made from pieces of skin, which in case of disease are full of microfilariae.**
- **A large number of microfilariae causes terrible itching of the skin, which leads to secondary infections, and from the inability to sleep to suicides**
- **Different skin problems occur, they differ by geographical region**

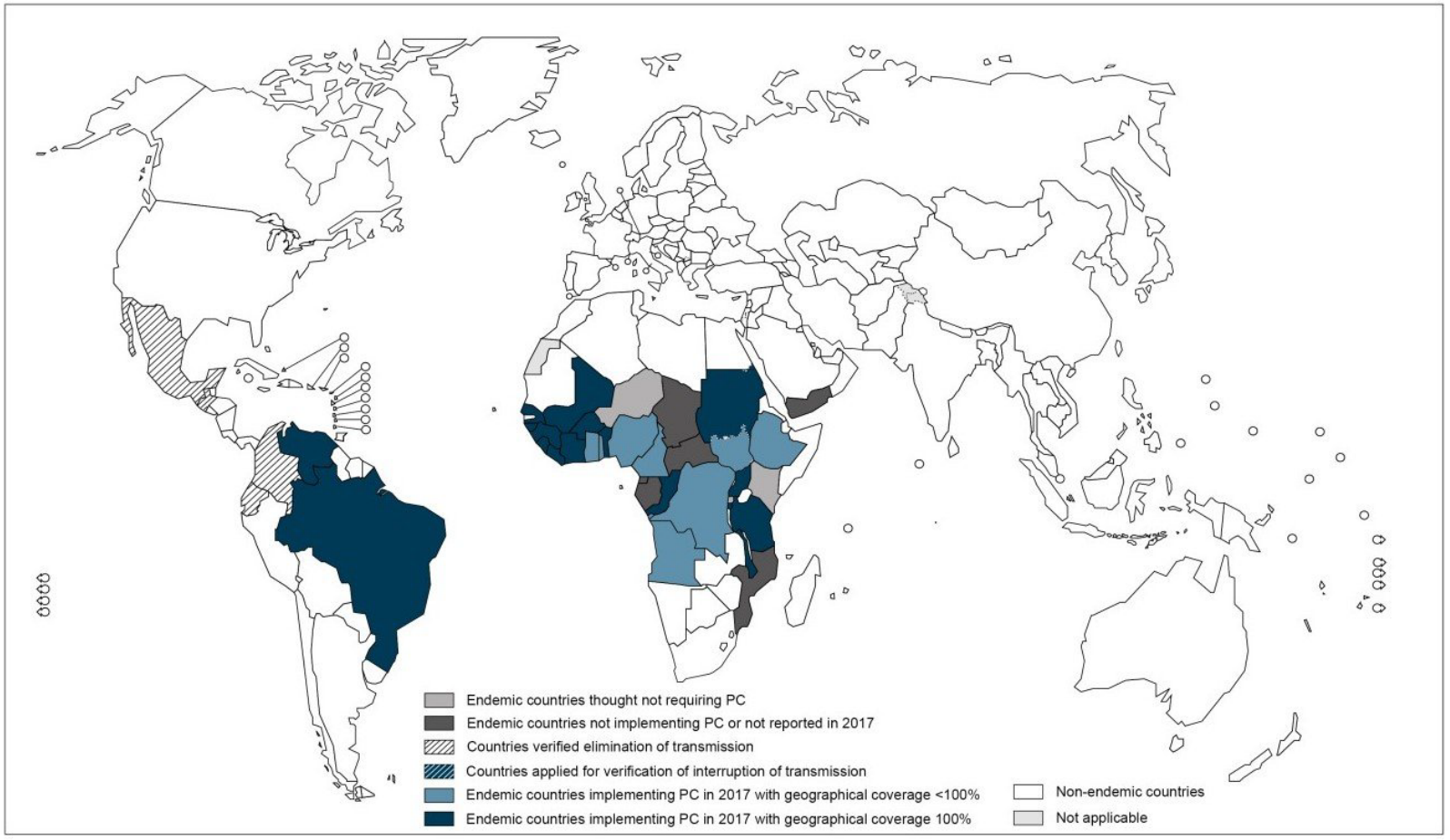
Medically significant Arthropoda – Simuliidae

- **Human Onchocerciasis (River Blindness)**
- **Migrating microfilariae enter the eye and cause severe pathologies such as cataracts, retinal hemorrhages, corneal clouding, secondary glaucoma, sclerosing keratitis and optic neuritis (inflammation of the optic nerve)**
- **The worst symptom is complete blindness**
- **The discovery of the symbiotic bacterium *Wolbachia* in the worm contributed to the treatment with antibiotics (doxycycline) and the reduction of ocular onchocerciasis**
- **Additional treatment with Ivermectin on an annual basis - prevention**

Taylor i sur. 2014; Adler & McCreadie 2019

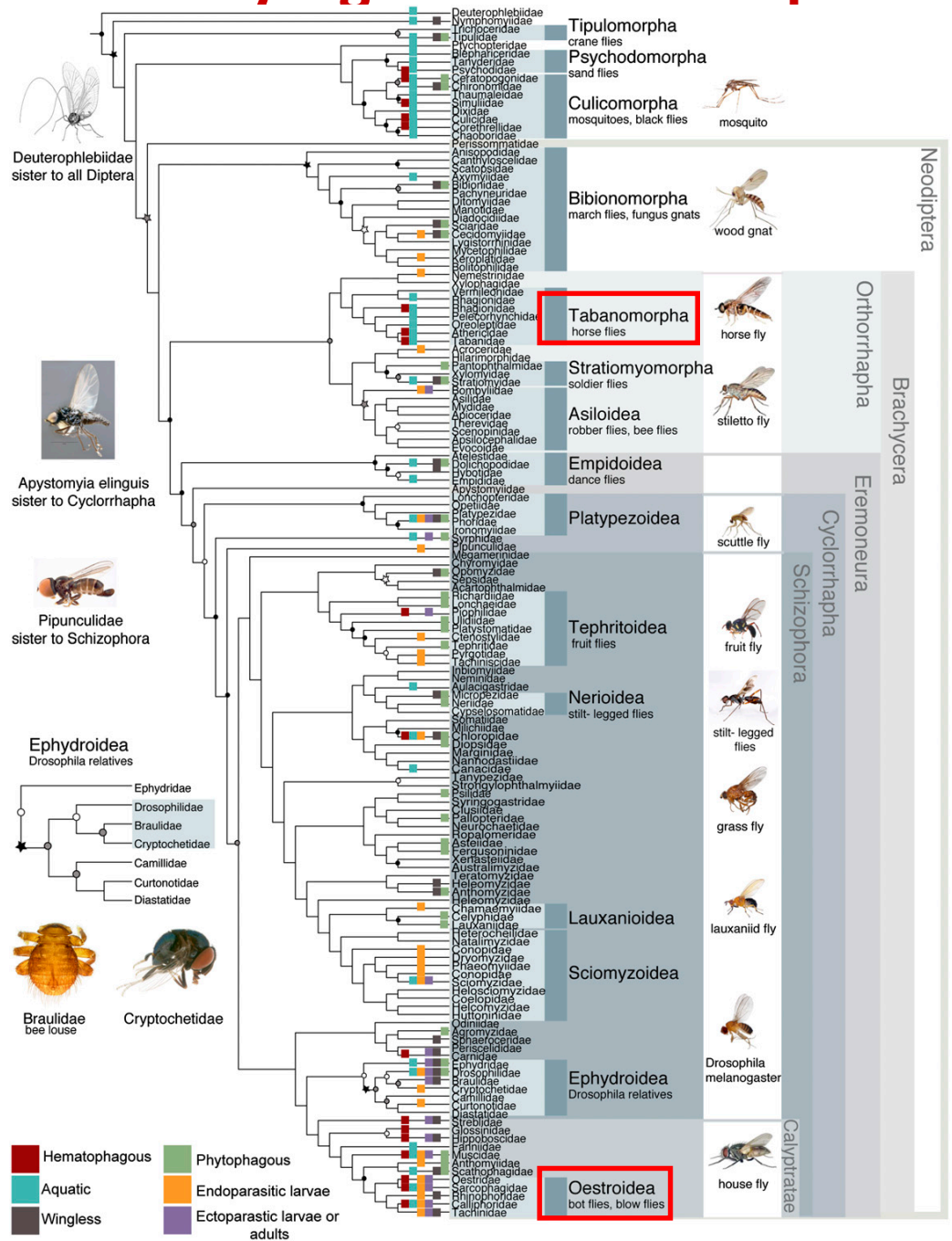
Medically significant Arthropoda – Simuliidae

- **Human Onchocerciasis (River Blindness)**
- **Prevention with mass prophylaxis with ivermectin since 1989 in West Africa**



Taylor i sur. 2014; Adler & McCreadie 2019

Medically significant Arthropoda – Diptera



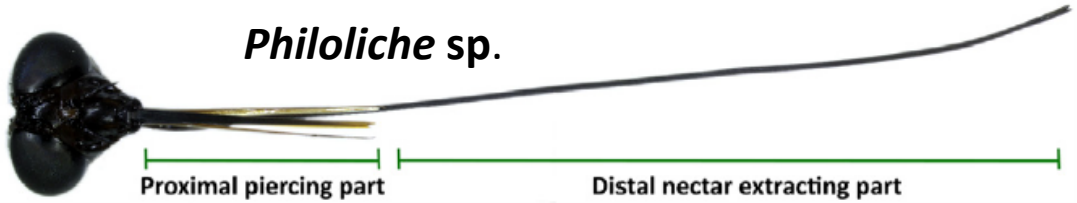
Mullens 2019

Medically significant Arthropoda – Tabanidae

- Relatively large dipterans, with large, colored eyes that only bite during the day
- They are very annoying in their attempts to bite their host
- The most described species of all blood-sucking insects, about 4,500 species, the greatest diversity in the Neotropis
- 3 subfamilies – Tabaninae, Pagoniinae and Chrysopsinae
- Larvae live in terrestrial, semiaquatic and aquatic habitats
- Carriers of filarial worms (humans and animals), phagotrophic protists (animals) and bacteria (humans and animals)

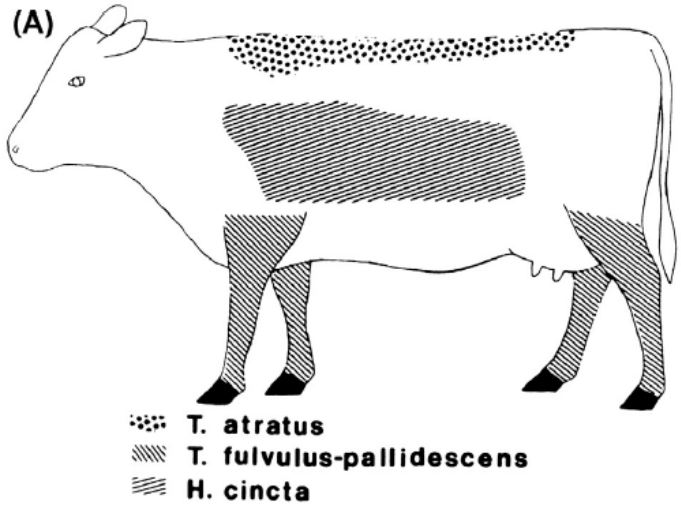
Medically significant Arthropoda – Tabanidae

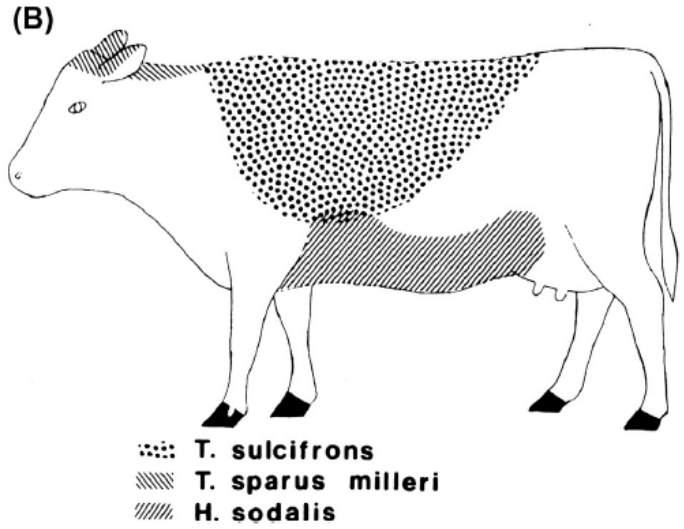
- The feeding method is called telmophagy or "pool feeding" as opposed to solenophagy where blood is taken directly from the capillary
- Both females and males feed on nectar, but females also feed on blood - adaptations of the oral organs
- Females are either anautogenous or autogenous in the gonadotropic cycle



Medically significant Arthropoda – Tabanidae

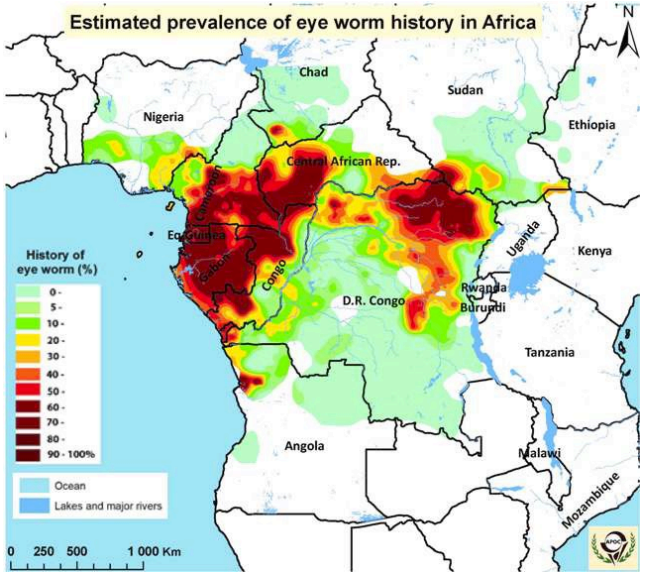
- Different feeding places, depending on the species
- Bites very painful and keep coming back to feed again as they are often interrupted in feeding - excellent mechanical vectors
- They are attracted by CO_2 (in all groups of insects that feed on blood) and some compounds in the urine of animals along with visual cues such as size, shape, color and movement of the host
- In addition to the painful bites of adults, even larvae in rice fields can cause problems by biting workers





Medically significant Arthropoda – Tabanidae

- **Loaoz**
- **The most important disease transmitted by Tabanids to humans, the causative agent is the Loa Loa filarial worm - it is also called the African eye worm**
- **In West and Central Africa**
- **Vectors from the genus *Chrysops* spp.**
- **Adults are found in the subcutaneous tissue, often in the eyes, causing inflammation by moving through the tissue**
- **If they stay in one place, there is an increase and swelling, which is called CALABAR'S SWELLING**

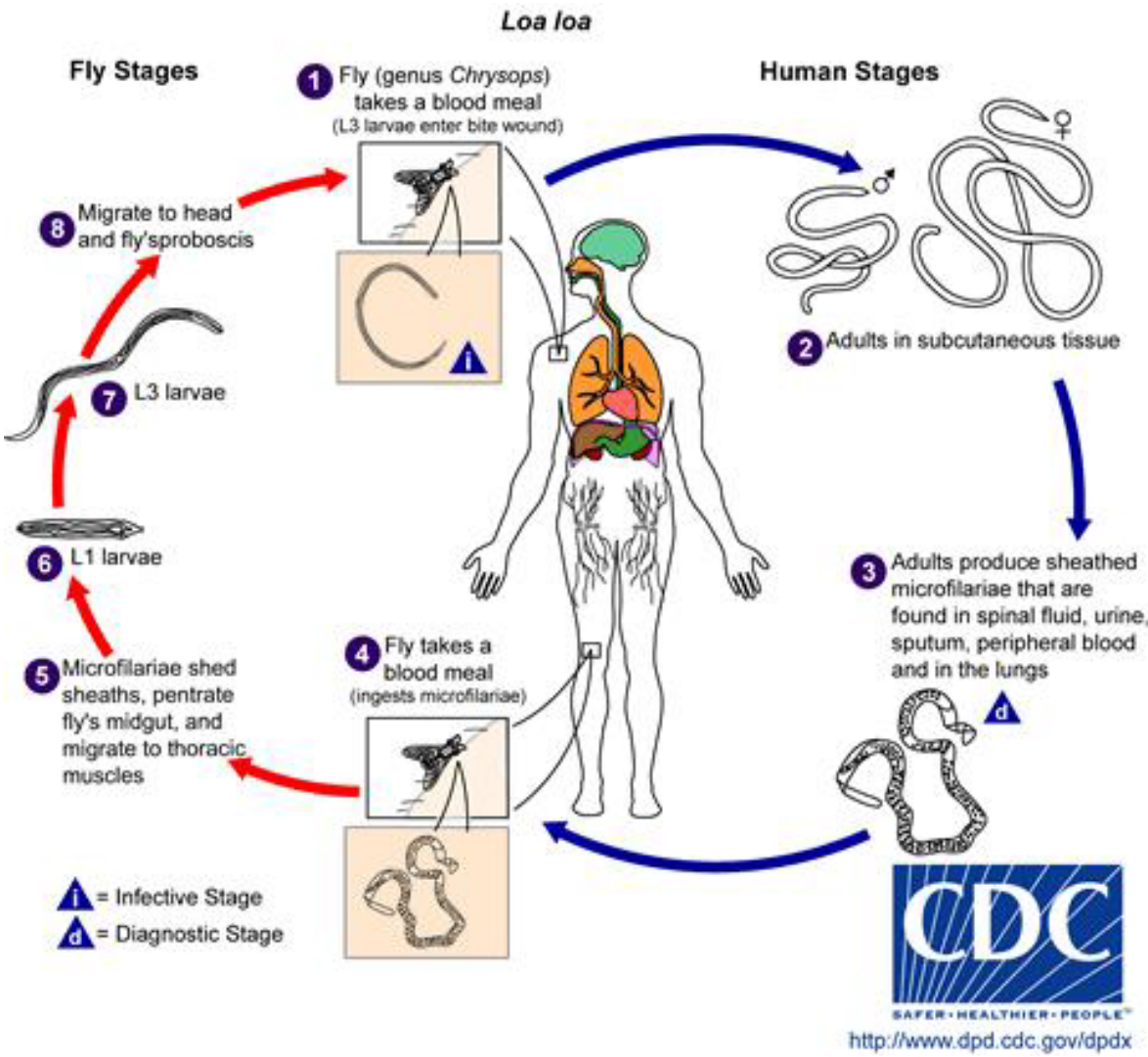


Medically significant Arthropoda – Tabanidae

- **Loaoz**
- **If they stay in one place, there is an increase and swelling, which is called CALABAR'S SWELLING**

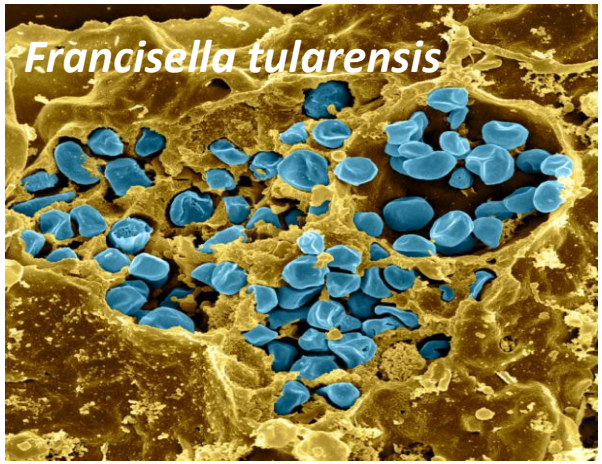
Medically significant Arthropoda – Tabanidae

- **Loaoz – Life cycle**
- **Diethylcarbamazine is used in treatment because it kills both microfilariae and adults**



Medically significant Arthropoda – Tabanidae

- **Tularemia (rabbit fever or deer fly fever)**
  - **Zoonosis caused by the bacterium *Francisella tularensis***
  - **The most common transmission is by ticks, and by ticks with the help of *Chrysops* spp. (in North America *Chrysops discalis*)**

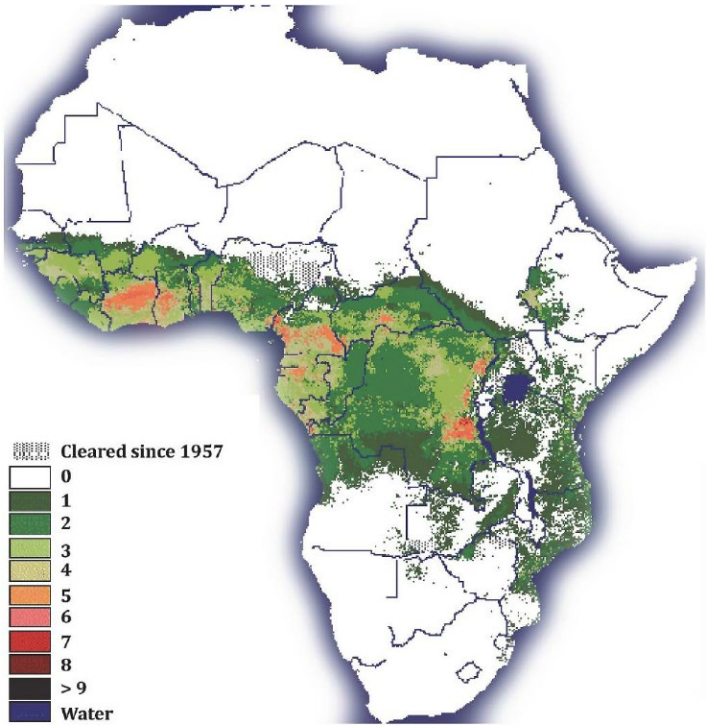


Medically significant Arthropoda – Tabanidae

- **Tularemia (rabbit fever or deer fly fever)**
  - **A distinct lesion at the site of bacterial entry**
  - **Regional lymphadenopathy, severe systemic symptoms and sometimes, atypical pneumonia**
  - **Possible death if not treated with antibiotics**
  - **Rabbits are the reservoir of pathogens**

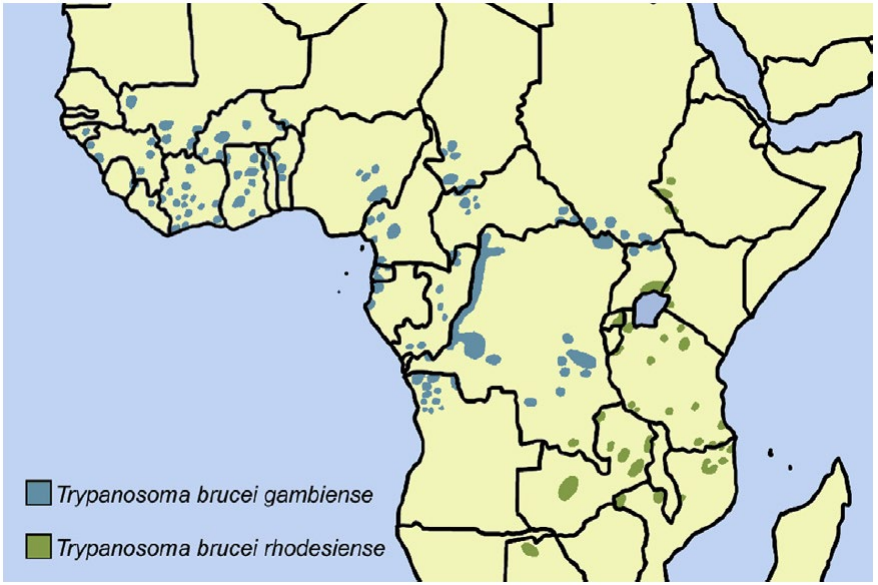
Medically significant Arthropoda – Glossinidae

- Flies that are exclusively present from 15˚S latitude to 26˚S latitude in Africa
- Only one genus with 31 species of flies
- Unlike most groups of flies and insects that drink blood in tsetse flies, both males and females drink blood and that is their only food, in order to become reproductively mature they need a blood meal (several times in males)
- They come exclusively in shaded, wooded areas
- *Trypanosoma* vectors in humans and animals



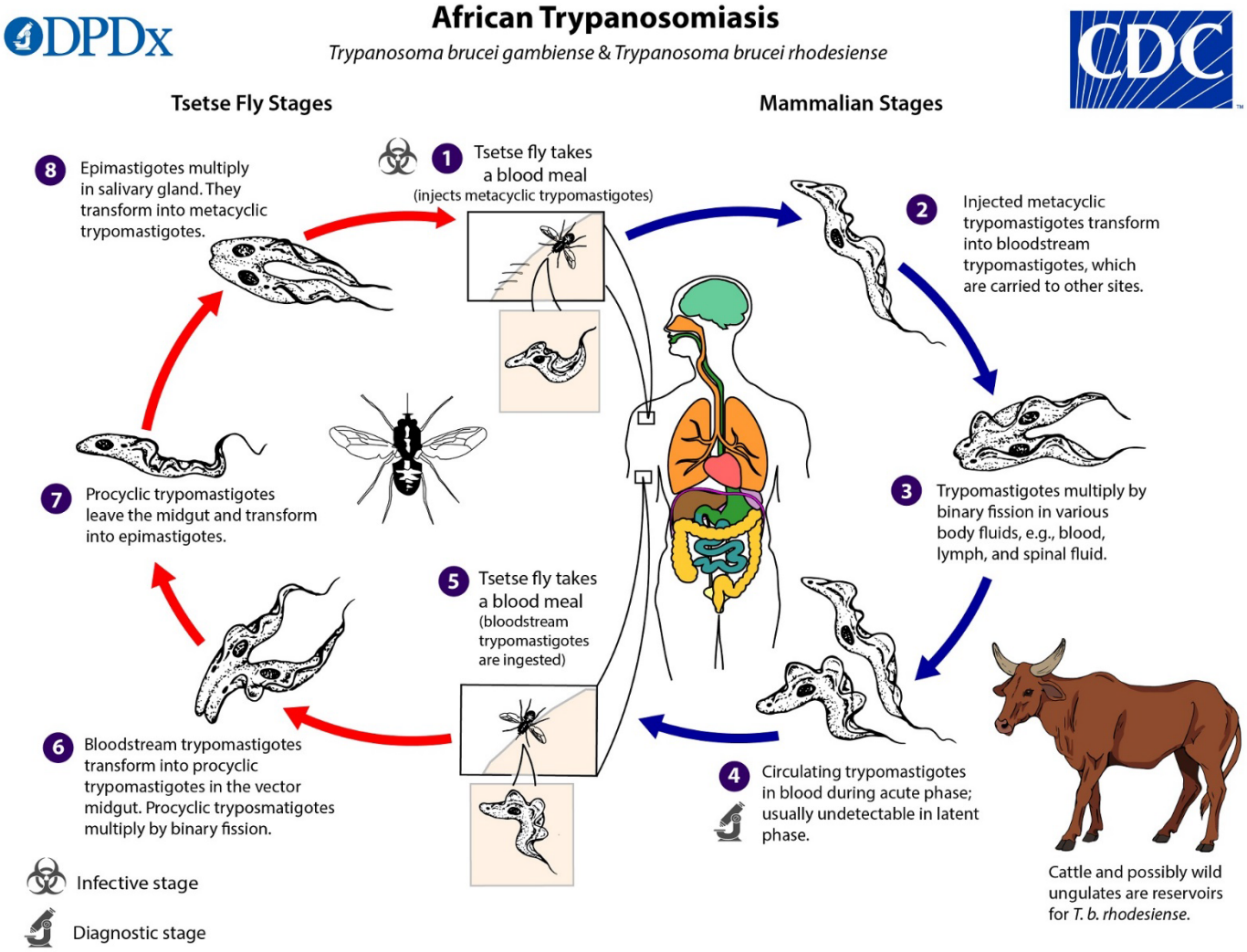
Medically significant Arthropoda – Glossinidae

- **African sleeping sickness**
- **The causative agent of *Trypanosoma brucei gambiense* (causes West African trypanosomiasis) and *T. brucei rhodesiense* (causes East African trypanosomiasis)**
- **The name comes from the sleepiness to comatoseness of those afflicted with the disease**
- **West African trypanosomiasis is a chronic disease that leads to mental detoriation and progressive weakness**
- **East African trypanosomiasis is an acute disease characterized by myocarditis and meningoencephalitis and ends in death**
- **Described in 1734 - John Atkins - "Negro lethargy"**



Medically significant Arthropoda – Glossinidae

- **African sleeping sickness – Life cycle**



Medically significant Arthropoda – Glossinidae

- African sleeping sickness
- About 750,000 people died of sleeping sickness between 1896 and 1906
- With the development of medicines, that number has decreased significantly
- Locally *Trypanosoma* produces painful nodules or TRIPANOME (Trypanosome chancre) where *Trypanosoma* reproduces locally
- Development of lymphadenopathy on the back of the patient's neck - Winterbott's sign, urticaria and rash also occur
- When parasites enter the nervous system, behavioral changes, hallucinations, delusions and drowsiness occur
- Everything is much faster in the Eastern than in the Western form of the disease