

Arthropod-borne Viruses

An Overview

Arthropod-borne Viruses

Arthropod-borne viruses (arboviruses) are viruses that can be transmitted to man by arthropod vectors. The WHO definition is as follows

“Viruses maintained in nature principally, or to an important extent, through biological transmission between susceptible vertebrate hosts by haematophagous arthropods or through transovarian and possibly venereal transmission in arthropods.”

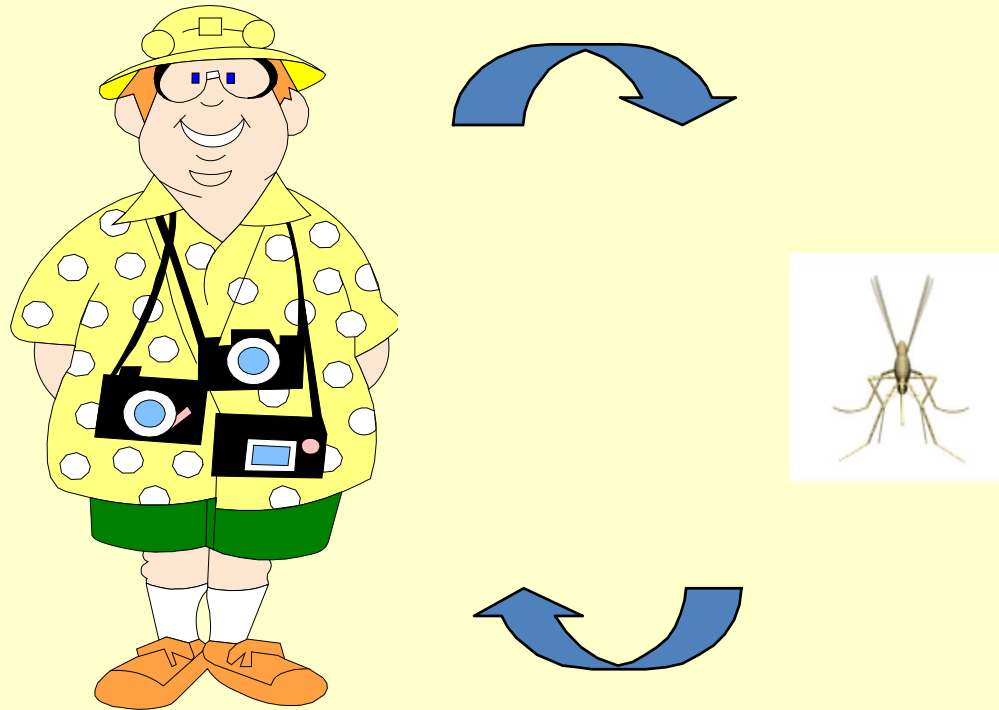
Arboviruses belong to three families

1. Togaviruses e.g. EEE, WEE, and VEE
2. Bunyaviruses e.g. Sandfly Fever, Rift Valley Fever, Crimean-Congo Haemorrhagic Fever
3. Flaviviruses e.g. Yellow Fever, dengue, Japanese Encephalitis

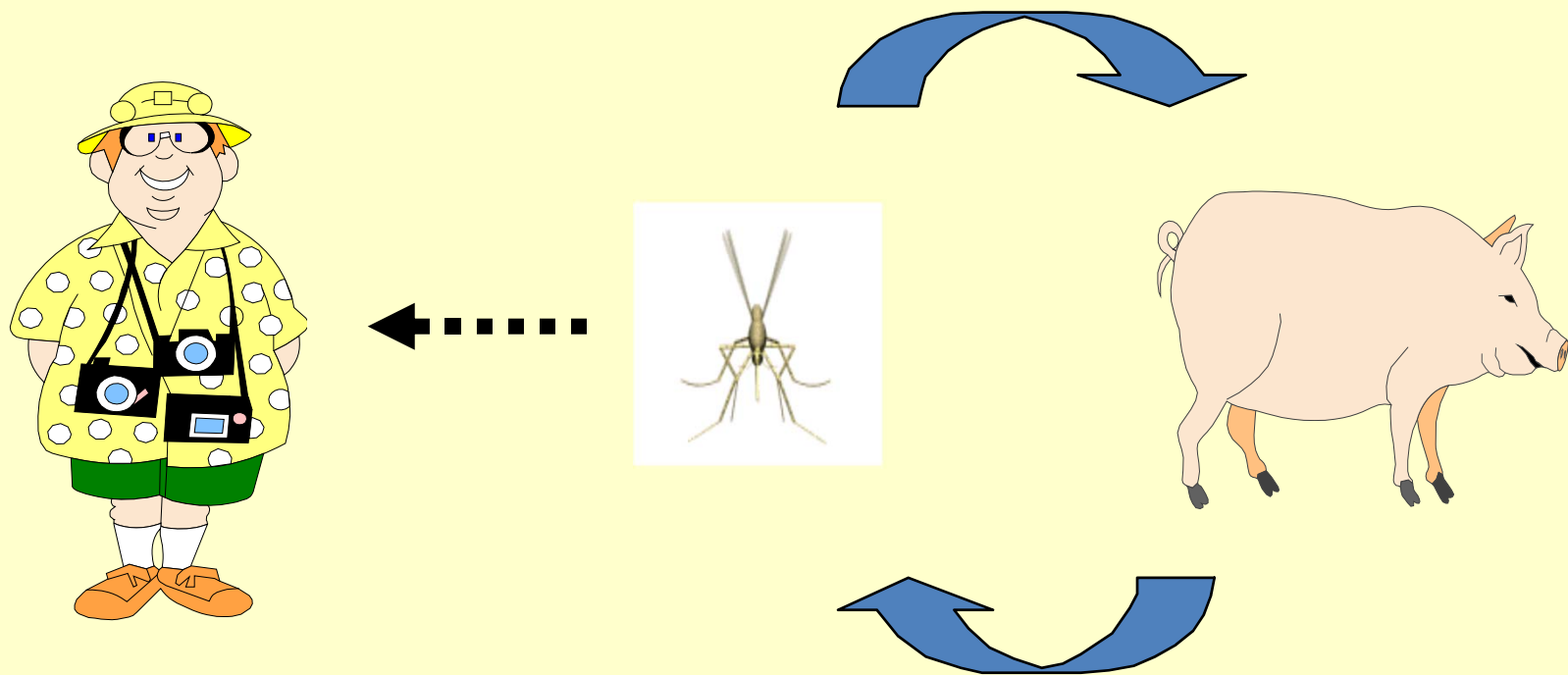
Transmission Cycles

- Man - arthropod -man
 - e.g. dengue, urban yellow fever.
 - Reservoir may be in either man or arthropod vector.
 - In the latter transovarial transmission may take place.
- Animal - arthropod vector - man
 - e.g. Japanese encephalitis, EEE, WEE, jungle yellow fever.
 - The reservoir is in an animal.
 - The virus is maintained in nature in a transmission cycle involving the arthropod vector and animal. Man becomes infected incidentally.
- Both cycles may be seen with some arboviruses such as yellow fever.

Man-Arthropod-Man Cycle



Animal-Arthropod-Man Cycle



Arthropod Vectors

Mosquitoes

Japanese encephalitis, dengue, yellow fever, St. Louis encephalitis, EEE, WEE, VEE etc.

Ticks

Crimean-Congo haemorrhagic fever, various tick-borne encephalitides etc.

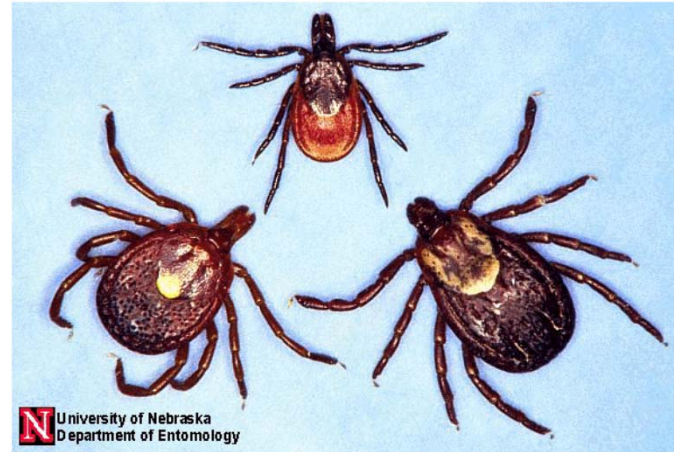
Sandflies

Sicilian sandfly fever, Rift valley fever.

Examples of Arthropod Vectors



Aedes Aegypti



Assorted Ticks



Culex Mosquito



Phlebotmine Sandfly

Animal Reservoirs

In many cases, the actual reservoir is not known. The following animals are implicated as reservoirs

Birds	Japanese encephalitis, St Louis encephalitis, EEE, WEE
Pigs	Japanese encephalitis
Monkeys	Yellow Fever
Rodents	VEE, Russian Spring-Summer encephalitis

Diseases Caused

- **Fever and rash** - this is usually a non-specific illness resembling a number of other viral illnesses such as influenza, rubella, and enterovirus infections. The patients may go on to develop encephalitis or haemorrhagic fever.
- **Encephalitis** - e.g. EEE, WEE, St Louis encephalitis, Japanese encephalitis.
- **Haemorrhagic fever** - e.g. yellow fever, dengue, Crimean-Congo haemorrhagic fever.

Diagnosis

- **Serology** - usually used to make a diagnosis of arbovirus infections.
- **Culture** - a number of cell lines may be used, including mosquito cell lines. However, it is rarely carried out since many of the pathogens are group 3 or 4 pathogens.
- **Direct detection tests** - e.g detection of antigen and nucleic acids are available but again there are safety issues.

Prevention

- **Surveillance** - of disease and vector populations
- **Control of vector** - pesticides, elimination of breeding grounds
- **Personal protection** - screening of houses, bed nets, insect repellants
- **Vaccination** - available for a number of arboviral infections e.g. Yellow fever, Japanese encephalitis, Russian tick-borne encephalitis

Japanese Encephalitis

- First discovered and originally restricted to Japan. Now large scale epidemics occur in China, India and other parts of Asia.
- Flavivirus, transmitted by culex mosquitoes.
- The virus is maintained in nature in a transmission cycle involving mosquitoes, birds and pigs.
- Most human infections are subclinical: the inapparent to clinical cases is 300:1
- In clinical cases, a life-threatening encephalitis occurs.
- The disease is usually diagnosed by serology. No specific therapy is available.
- Since Culex has a flight range of 20km, all local control measures will fail. An effective vaccine is available.

RISK OF JAPANESE ENCEPHALITIS WORLDWIDE, 1996

TM+VC
1300 65 88 44
Local Call Within Australia



Information based on CDC data for international travel, 1996

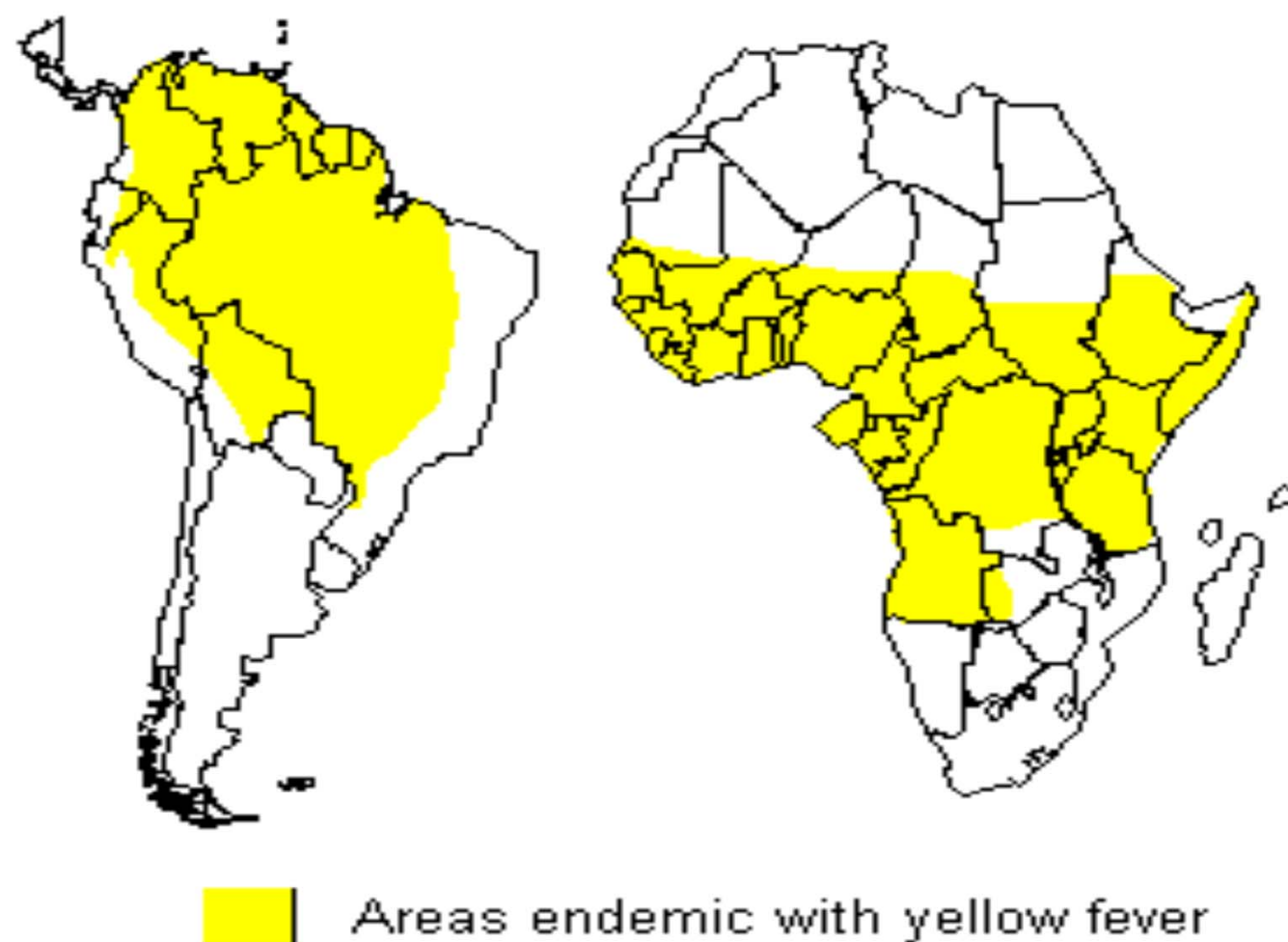
Yellow Fever (1)

- Flavivirus, mainly found in West Africa and S America
- Yellow fever occurs in 2 major forms: urban and jungle (sylvatic) yellow fever. Jungle YF is the natural reservoir of the disease in a cycle involving nonhuman primates and forest mosquitoes. Man may become incidentally infected on venturing into jungle areas.
- The urban form is transmitted between humans by the *Aedes aegypti* mosquito
- Classically Yellow Fever presents with chills, fever, and headache. Generalized myalgias and GI complaints (N+V).
- Some patients may experience an asymptomatic infection or a mild undifferentiated febrile illness.

Yellow Fever (2)

- After a period of 3 to 4 days, the more severely ill patients with a classical YF course will develop bradycardia (Faget's sign), jaundice, and haemorrhagic manifestations.
- 50% of patients with frank YF will develop fatal disease characterized by severe haemorrhagic manifestations, oliguria and hypotension.
- Diagnosis is usually made by serology
- There is no specific antiviral treatment
- An effective live attenuated vaccine is available against yellow fever and is used for persons living in or traveling to endemic areas.

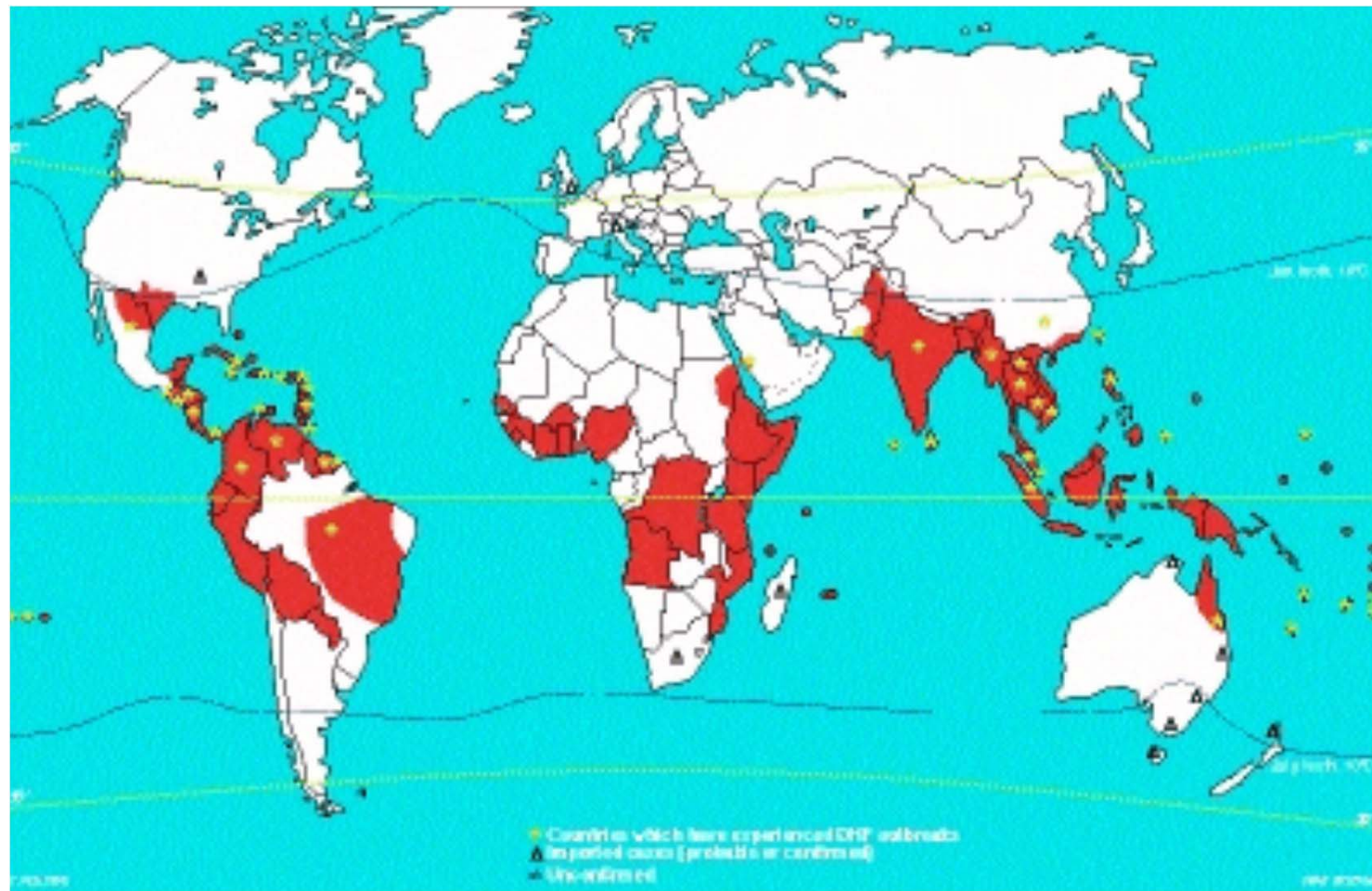
Global Distribution of Yellow Fever, 1996



Dengue (1)

- Dengue is the biggest arbovirus problem in the world today with over 2 million cases per year. Dengue is found in SE Asia, Africa and the Caribbean and S America.
- Flavivirus, 4 serotypes, transmitted by Aedes mosquitoes which reside in water-filled containers.
- Human infections arise from a human-mosquito-human cycle
- Classically, dengue presents with a high fever, lymphadenopathy, myalgia, bone and joint pains, headache, and a maculopapular rash.
- Severe cases may present with haemorrhagic fever and shock with a mortality of 5-10%. (Dengue haemorrhagic fever or Dengue shock syndrome.)

Distribution of Dengue



Dengue (2)

- Dengue haemorrhagic fever and shock syndrome appear most often in patients previously infected by a different serotype of dengue, thus suggesting an immunopathological mechanism.
- Diagnosis is made by serology.
- No specific antiviral therapy is available.
- Prevention of dengue in endemic areas depends on mosquito eradication. The population should remove all containers from their premises which may serve as vessels for egg deposition.
- A live attenuated vaccine is being tried in Thailand with encouraging results.