Dynamics of Invasive Mosquitoes and Pathogen Transmission

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Overview & Significance

Invasive mosquitoes are species introduced outside their native range through human activities. Some species become established and spread, creating new risks for human, animal, and wildlife health. Global trade, travel, urbanization, and extreme weather conditions have accelerated the movement of mosquitoes and the pathogens they transmit. These mosquitoes can establish populations in new regions and alter native mosquito communities. They may introduce or amplify vector-borne pathogens, increasing risks to human, animal, and wildlife health.

Factors Affecting Establishment & Spread

Successful establishment of invasive mosquitoes depends on several ecological factors. Temperature affects survival and overwintering, whereas desiccation-resistant eggs enable some species to survive dry conditions during transport. Human-modified urban and suburban environments provide abundant habitats and interactions with native mosquitoes, predators, parasites, and vertebrate hosts. These interactions may either promote or limit invasion success.

Major Introduction Pathways

International Trade

- Used tires containing stagnant water and organic matter
- Lucky bamboo (*Dracaena* sp.) and other ornamental plants transported in water
- Commercial movement of goods

Transportation Networks

- Aircraft and airports
- Ground vehicles and highways
- Rail transportation

Natural Dispersal

- Local flight movement
- Wind-assisted dispersal
- Expansion into neighboring regions



Examples of Major Invasive Mosquitoes & Associated Diseases

Species	Native Region	Invaded Regions	Major Pathogens
Aedes aegypti	Africa	Americas, Asia, Europe, Oceania	dengue, Zika, yellow fever, chikungunya
Aedes albopictus	Asia	Europe, Americas, Africa, Oceania	dengue, chikungunya, Zika
Aedes japonicus	East Asia	North America, Europe	West Nile virus, Japanese encephalitis virus
Culex quinquefasciatus	Africa	Americas, Asia, New Zealand, Southern Europe	West Nile virus, lymphatic filariasis
Anopheles stephensi	Southern Asia	Horn of Africa, Ghana, Republic of Sudan, Sri Lanka	malaria

How Invasive Mosquitoes Alter Pathogen Transmission Cycles

Invasive mosquitoes can introduce new pathogens, acquire existing pathogens, act as bridge vectors between animals and humans, and change native mosquito communities—ultimately increasing disease risk.

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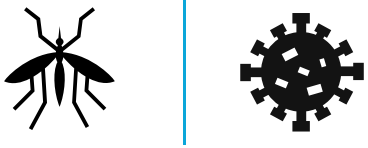
1 | Separate or Simultaneous Introduction

Pathogens and vectors may be introcuded separately or simultaneously.

A. Separate Introduction

Invasive mosquito introduced first

Pathogen is introduced later (via host or other pathway)



Time

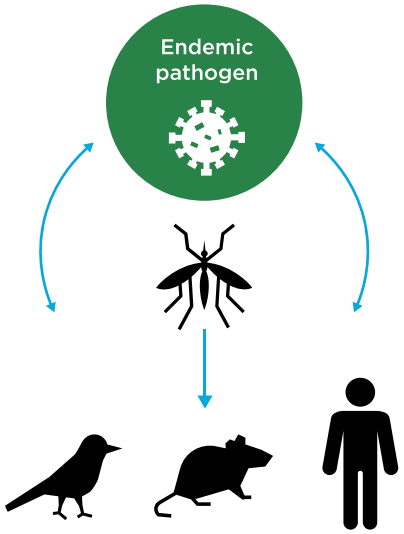
B. Simultaneous Introduction

Invasive mosquito and pathogen introduced together



2 | Acquisition of Existing Pathogens

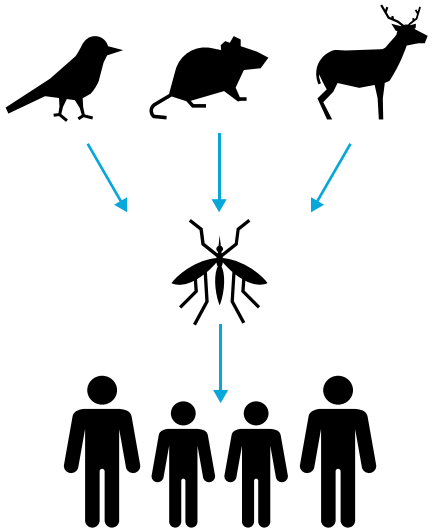
Introduced mosquitoes may acquire pathogens already present in the invaded region.



Mosquito feeds on local hosts and becomes infected

3 | Bridge Vector Role

Invasive mosquitoes may connect reservoirs to humans, creating new transmission pathways



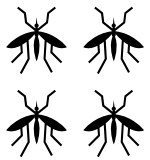
The invasive mosquito acts as a "bridge vector" between animals and humans

4 | Changes in Vector Community and Abundance

Invasive species can alter native mosquito abundance through competition, displacement, or resource use

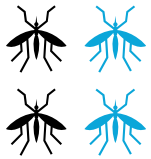
Before invasion

Native mosquitoes dominate



After invasion

Invasive species established



Potential Outcomes

- Increased transmission intensity
- Extended transmission season
- New host-vector interactions
- Higher disease risk to humans and animals

Overall Impact | Introduction + Pathogen acquisiton + Bridge vector role + Changes in vector community = **Altered transmission cycles and increased disease risk**