



﴿إِنَّ اللَّهَ لَا يَسْتَحْيِي أَنْ يَضْرِبَ مَثَلًا مَا بَعُوضَةٌ فَمَا فَوْقَهَا ۚ فَأَمَّا الَّذِينَ آمَنُوا فَيَعْلَمُونَ أَنَّهُ الْحَقُّ مِنْ رَبِّهِمْ ۖ وَأَمَّا الَّذِينَ كَفَرُوا فَيَقُولُونَ مَاذَا أَرَادَ اللَّهُ بِهَذَا مَثَلًا ۚ يُضِلُّ بِهِ كَثِيرًا وَيَهْدِي بِهِ كَثِيرًا ۚ وَمَا يُضِلُّ بِهِ إِلَّا الْفَاسِقِينَ﴾

خدا ابایی ندارد که به پشه و کمتر از آن مثل بزند. آنان که ایمان آورده‌اند می‌دانند که آن مثل درست و از جانب پروردگار آنهاست. و اما کافران می‌گویند که خدا از این مثل چه می‌خواسته است؟ بسیاری را بدان گمراه می‌کند و بسیاری را هدایت. اما تنها فاسقان را گمراه می‌کند.

"آیه ۲۶ سوره بقره"



B.S. Biology/Zoology



M.S. Medical Entomology



Ph.D. Entomology
“Cytogenetics”



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***Aedes*: What Do We Know about Them?**



Maryam Kamali, Ph.D.

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Tarbiat Modares University**

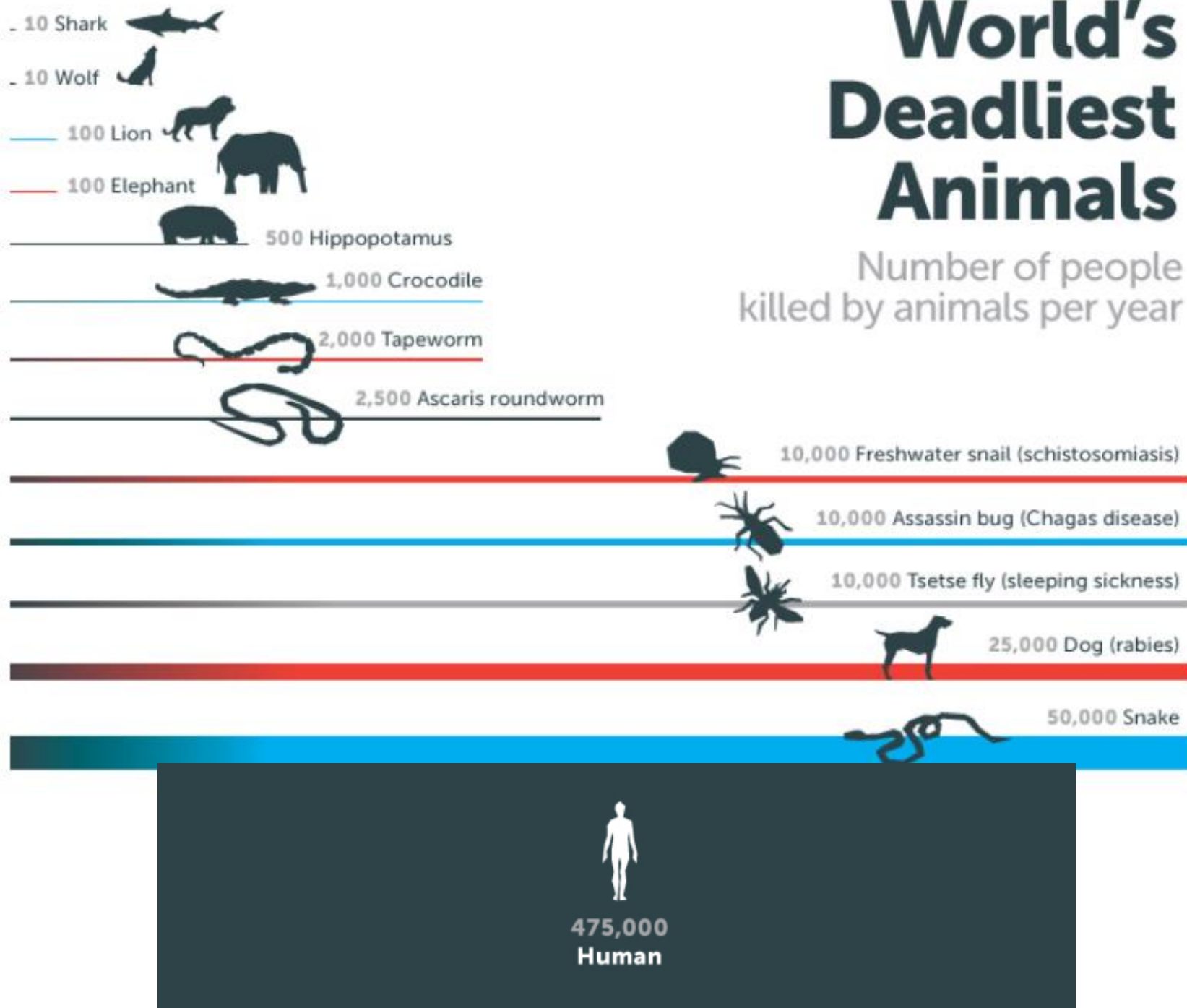
- What would you say is the most dangerous animal on Earth?
- Sharks?
- Snakes?

THE MOST DANGEROUS ANIMALS ON EARTH



World's Deadliest Animals

Number of people killed by animals per year

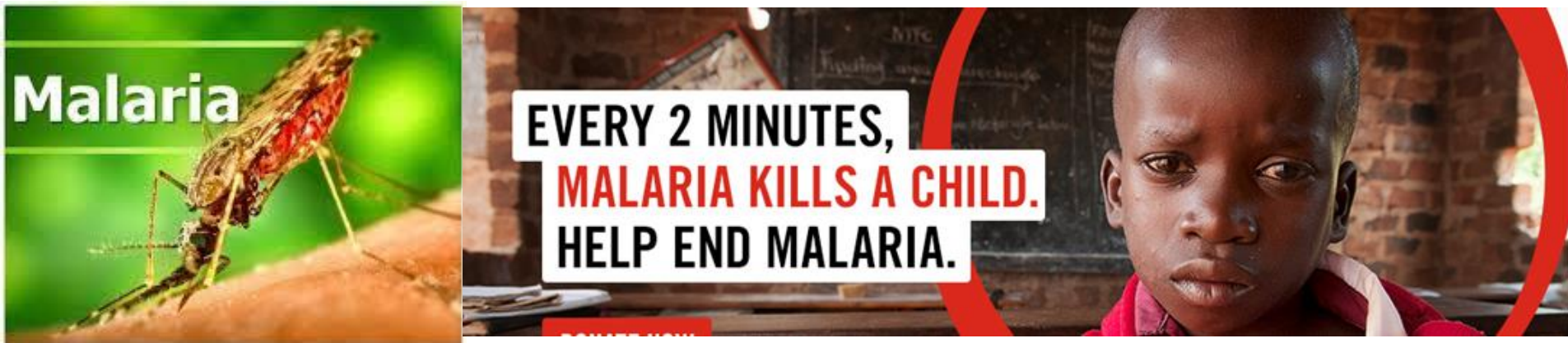


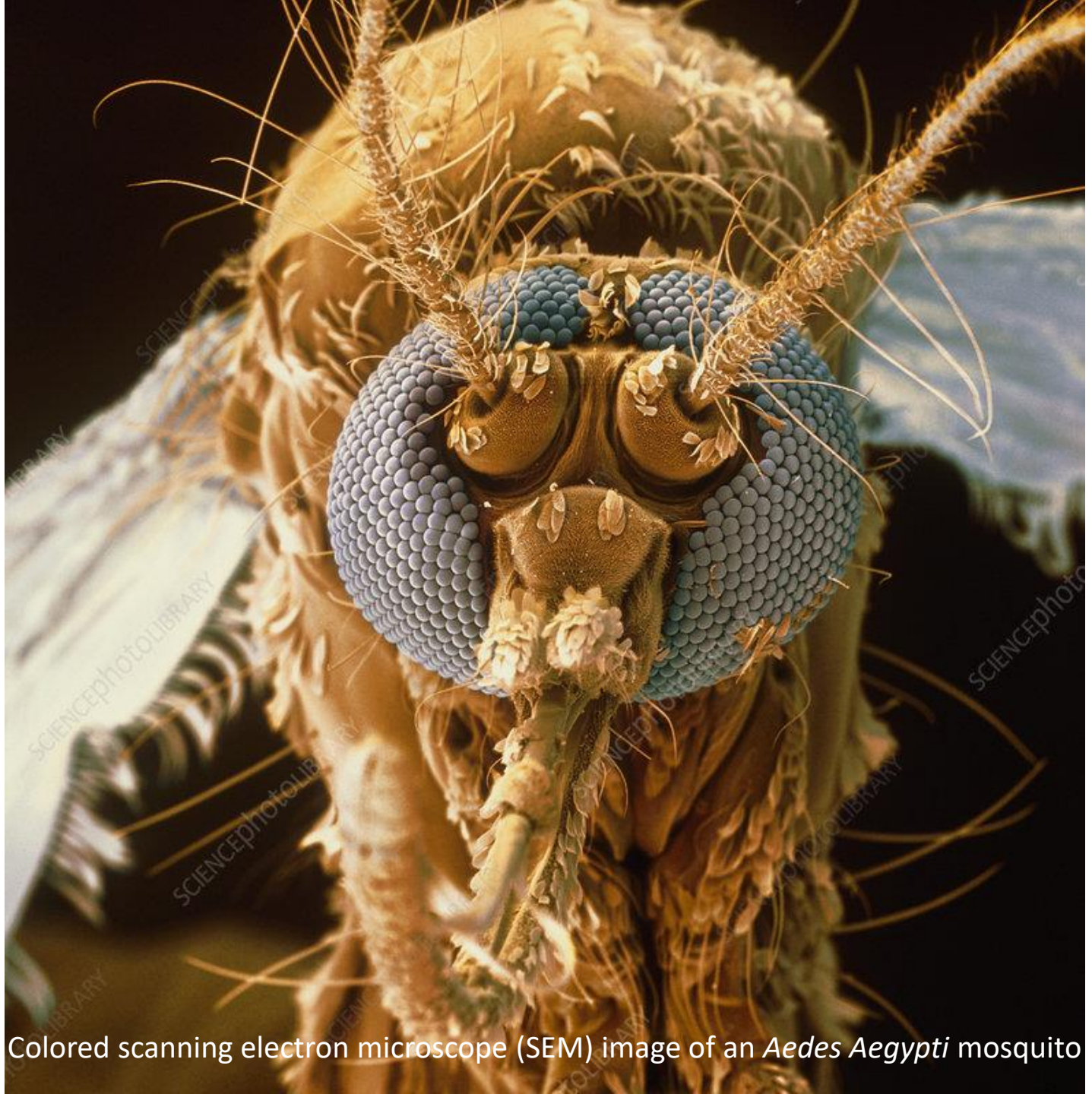


725,000
Mosquito

Vector-borne diseases

- Vector-borne diseases: more than 17% of all infectious diseases.
- More than 700 000 deaths annually (such as Malaria, Dengue, Yellow fever, Leishmaniasis).
- According to the latest World malaria report, there were 241 million cases of malaria in 2020 compared to 227 million cases in 2019.





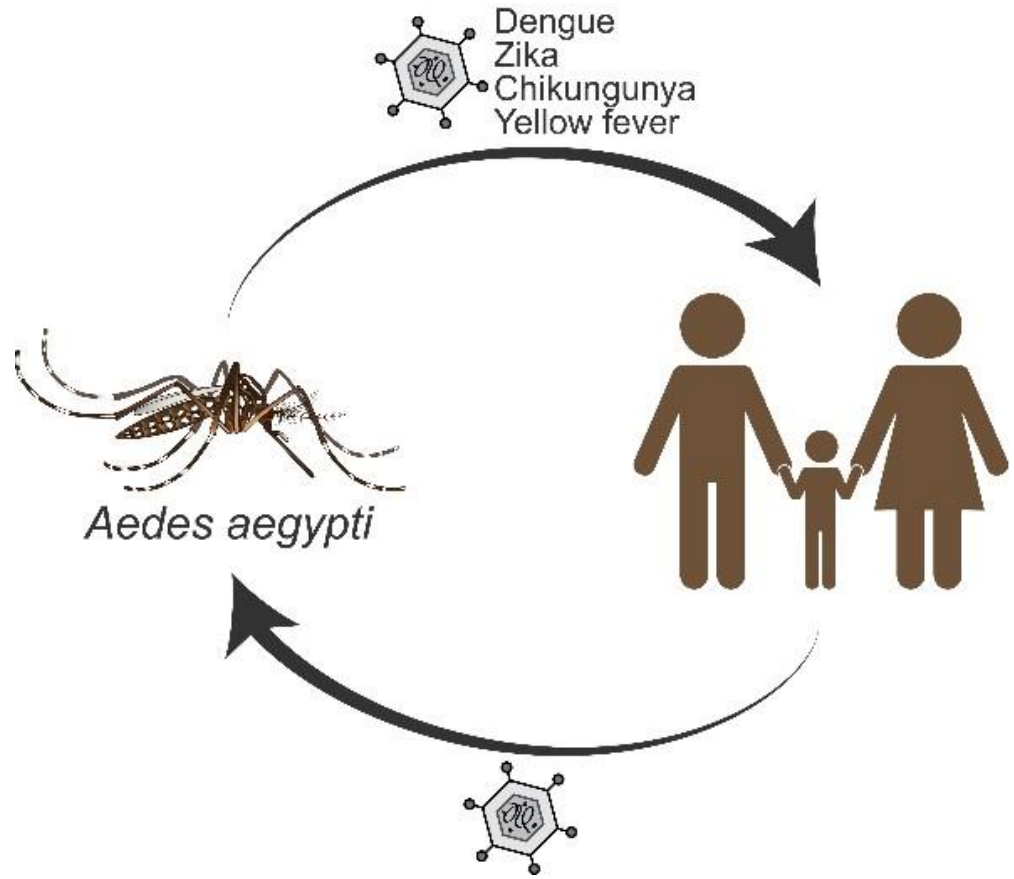
Colored scanning electron microscope (SEM) image of an *Aedes Aegypti* mosquito



Species name: *Aedes aegypti*

Diseases transmitted by *Aedes*

- Dengue fever
- Yellow fever
- Chikungunya
- Zika



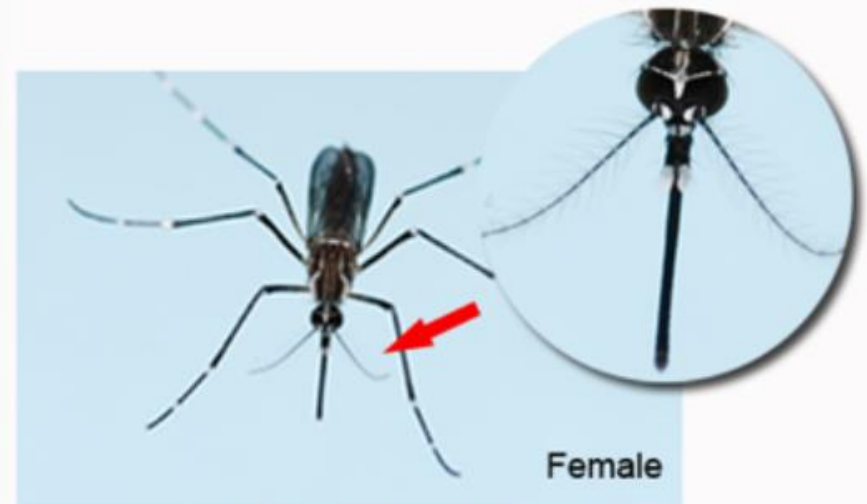
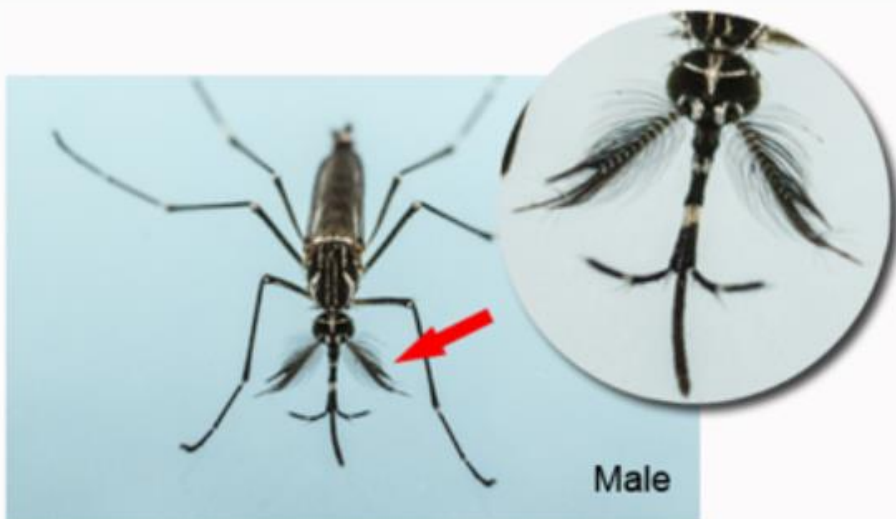
Morphological characters

- Adults of *Aedes aegypti* are relatively small.
- Black and white pattern.
- The prevailing diagnostic character: presence of silver scales in a shape of a lyre on a black background on the scutum (dorsal part of the thorax).



Only Female Mosquitoes Bite and Transmit Disease

- Female mosquito needs the protein in blood for its eggs to develop.
- Male mosquitoes feed only on plant juices, such as nectar.
- Males have bushy, hairy antennae, while the antennae of females are a lot less hairy.



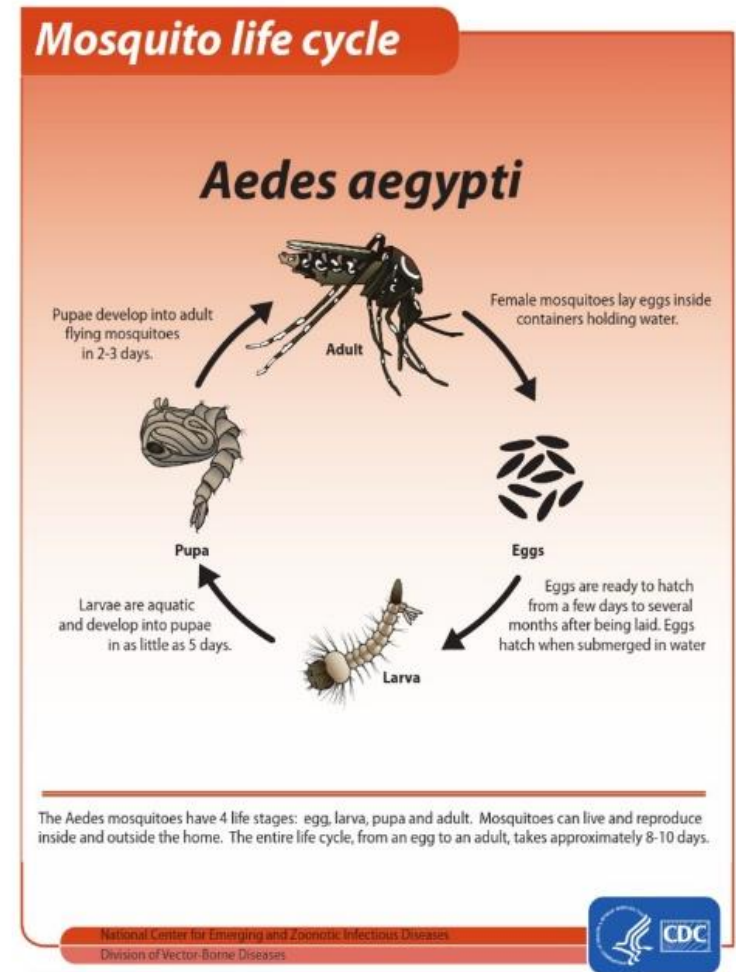
Where are these mosquitoes found?

- *Aedes aegypti* dwell in tropical and subtropical regions all over the world
- They are unable to survive cold winters.
- These mosquitoes are associated with the living spaces of humans. They generally spend their entire lives in and around the houses where their eggs hatched.



Aedes aegypti Life Cycle

- The *Aedes* mosquitoes have 4 life stages:
- egg, larvae, pupae and adult.
- Mosquitoes can live and reproduce inside and outside the home.
- The entire life cycle, from an egg to an adult, can occur in as little as 7-8 days.
- The life span for adult mosquitoes is around three weeks.



Habitat

- *Aedes aegypti* depend greatly on water storage containers to lay their eggs.
- They can use natural locations or habitats (tree holes and plant axils) and artificial containers with water to lay their eggs.



Habitat

- Underground collections of water: open or unsealed septic tanks, storm drains, wells, and water meters.



Eggs

- Adult female mosquitoes generally lay their eggs above the water line, and inside the inner wet walls of containers with water.
- Mosquitoes generally lay 100 eggs at a time.
- Eggs are very hardy; they stick to the walls of a container like glue.
- Larvae hatch from the eggs when the containers fill with water, after a rainfall.



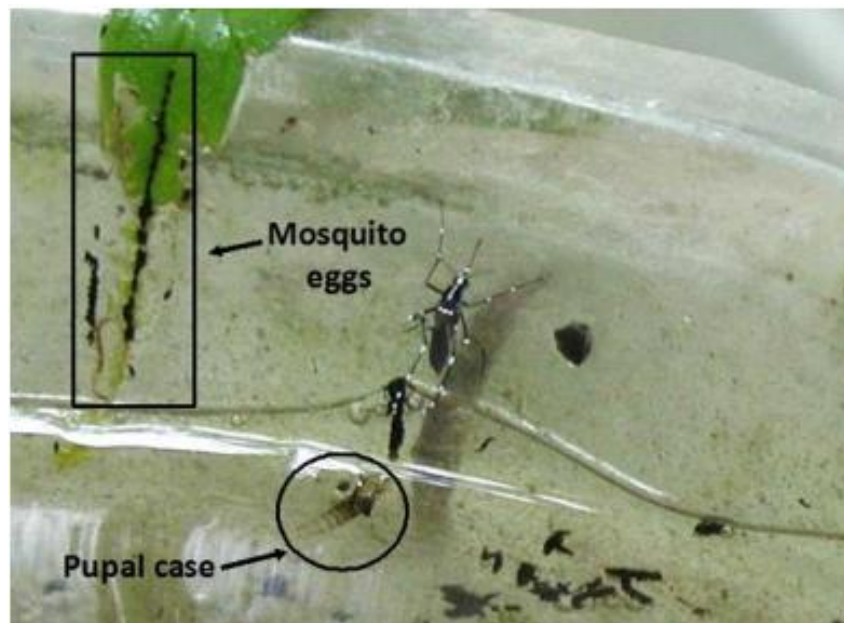
Desiccation resistant eggs

- *Aedes aegypti* mosquitoes have adapted so that their eggs can survive dry conditions for several months (up to 8 months).
- If eggs are laid in a dry container, new mosquitoes only develop when the container is filled with water.
- This adaptation has made it very difficult to eliminate mosquito populations completely.



Vertical Transmission

- Transovarial transmission/ vertical transmission through the eggs to the larval stage.
- Dengue, Zika, Chikungunya, Yellow fever.



Aedes laying eggs in breeding site

Larvae

- Larvae emerge from mosquito eggs, but only after the water level rises to cover the eggs.
- Rainwater or humans adding water to containers with eggs will trigger the larvae to emerge.
- Larvae feed on microorganisms in the water.
- After molting three times, the larvae becomes a pupae.



Pupae

- Pupae will develop until the body of the newly formed adult flying mosquito emerges from the pupal skin and leaves the water.



Host preferences

- *Aedes aegypti* is highly anthropophilic.
- Preferentially feed on humans, even in the presence of alternative hosts .
- They feed multiple times during one gonotrophic cycle- which has implications for disease transmission.



Biting Behavior

- *Aedes aegypti* bites primarily during the day.
- Most active:
- Two hours after sunrise
- Several hours before sunset.



Dispersal

- The flight range of *Ae. aegypti* is narrow (usually less than 200m, rarely up to 500m).
- Travel long distances by taking advantage of human (land, sea or air) vehicles
- There are reports of *Ae. aegypti* collected from ships right after docking.
- Trade of used tires is suspected to be one of the main contributions to the passive dispersal of *Ae. aegypti* immatures, both by land and sea.



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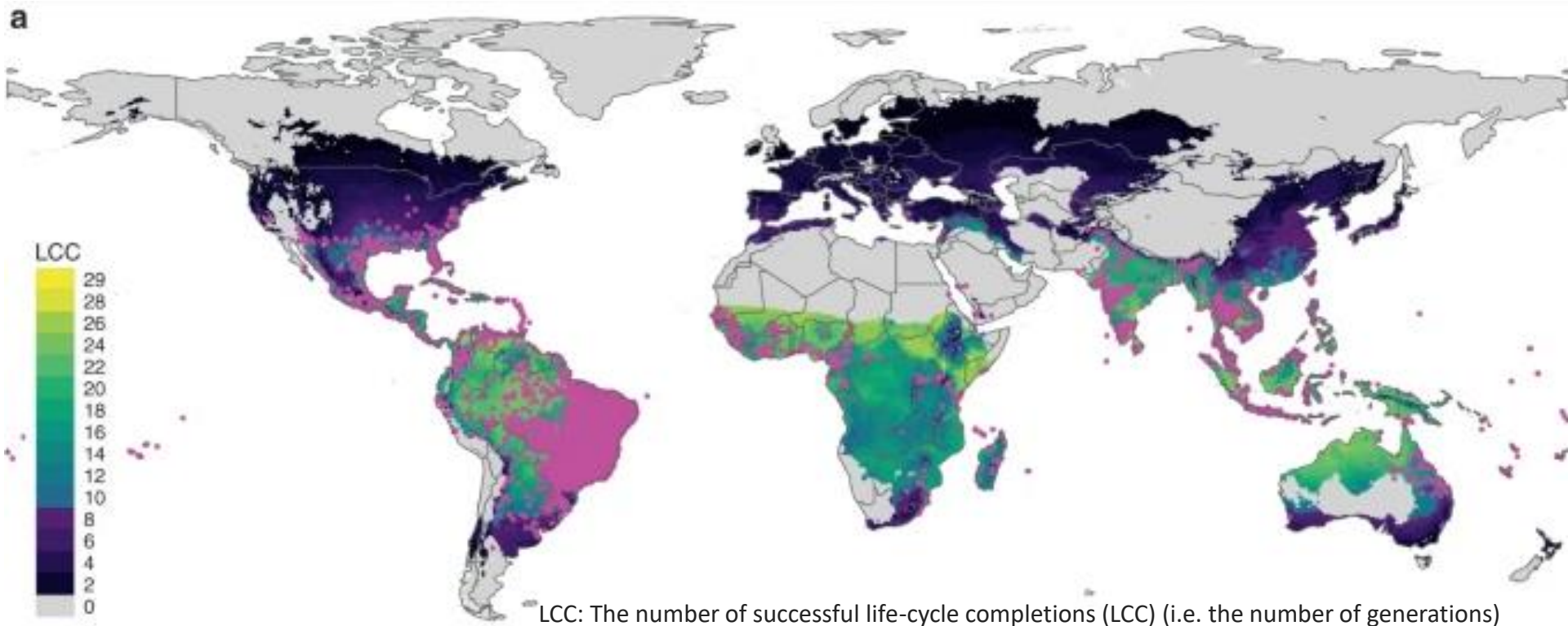
Accelerating invasion potential of disease vector *Aedes aegypti* under climate change

[Takuya Iwamura](#) , [Adriana Guzman-Holst](#) & [Kris A. Murray](#) 

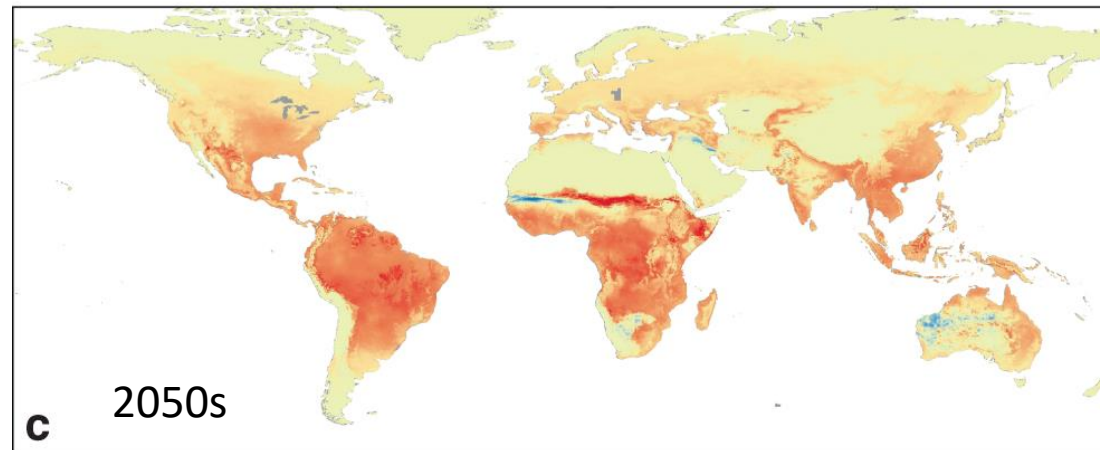
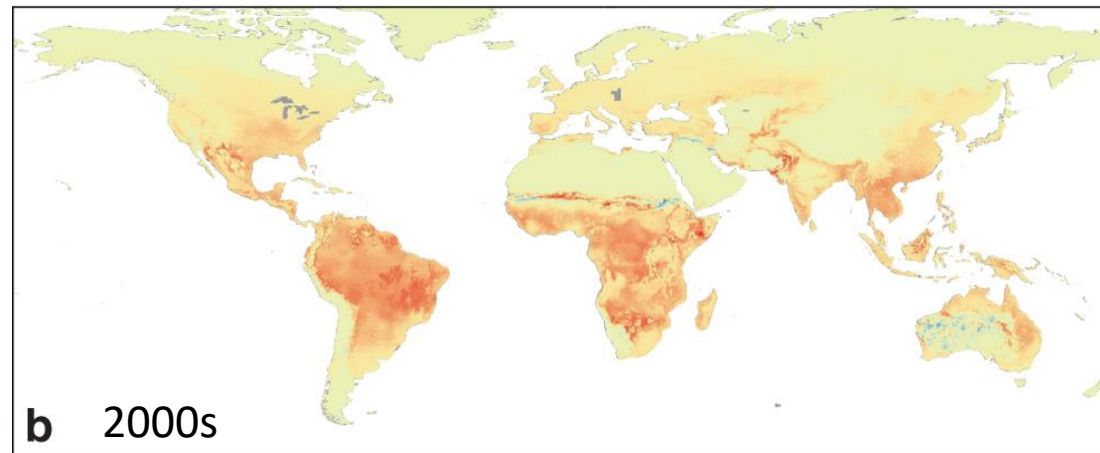
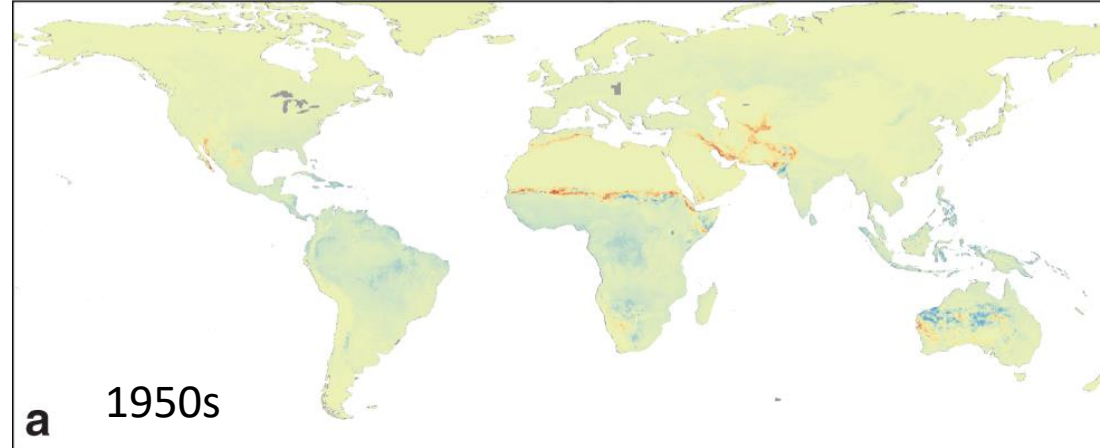
[Nature Communications](#) **11**, Article number: 2130 (2020) | [Cite this article](#)

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- The world became ~1.5% more suitable per decade for the development of *Ae. aegypti* during 1950–2000.
- This trend is predicted to accelerate to 3.2–4.4% per decade by 2050.



- This acceleration appears primarily linked to the climatic zones.
- Tropical areas showing particularly high suitability and strong increases.
- Temperate areas showing marked gains.
- Arid, polar and boreal climatic zones show low suitability.



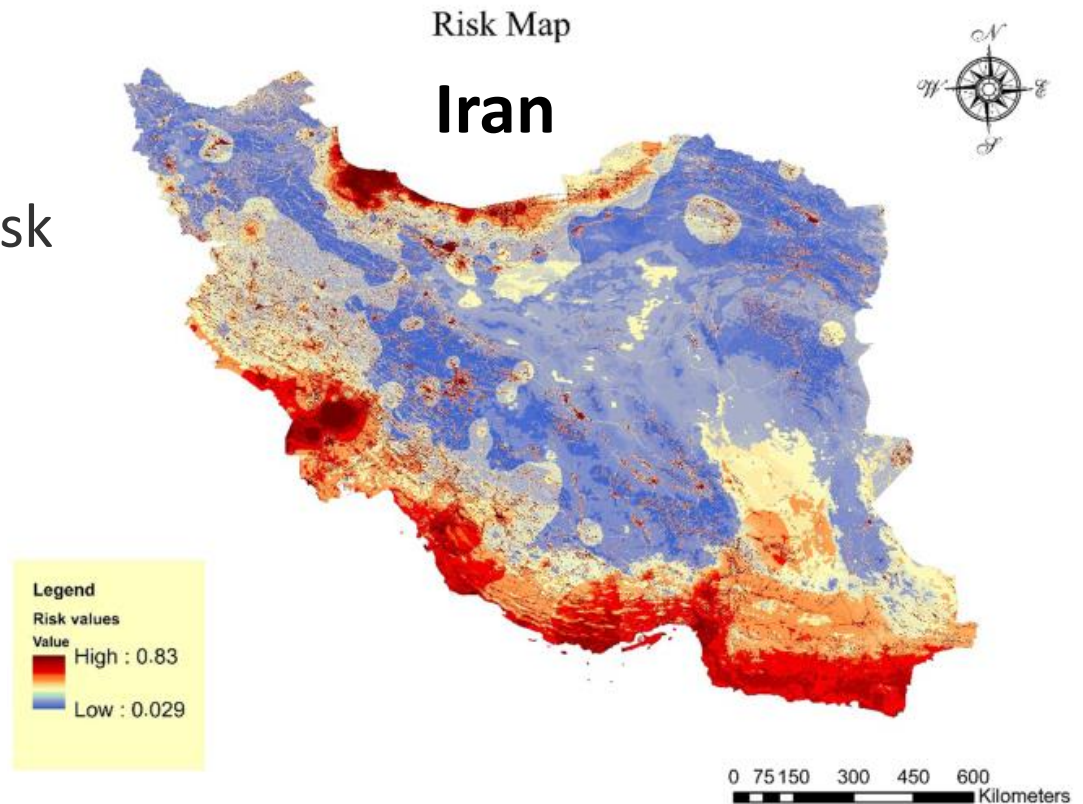
Original Paper | [Published: 26 June 2021](#)

Aedes albopictus: a spatial risk mapping of the mosquito using geographic information system in Iran

[Reza Shirzad](#), [Ali Asghar Alesheikh](#), [Mohsen Ahmadkhani](#)  & [Saied Reza Naddaf](#)

[Applied Geomatics](#) **13**, 691–700 (2021) | [Cite this article](#)

- Guilan and Khuzestan provinces have highest risk probability of the mosquito's presence, due to the semi-tropical climate.



Vector control strategy

- **Environmental management - Source control**
- Environmental modification
- Environmental manipulation
- Changes to human habitation or behavior.



Vector control strategy

- **Environmental management - Personal protection**
- Clothing
- Repellent applied to skin
- Repellent applied to clothing
- Long Lasting Insecticidal Nets (LLIN)
- Aerosol products
- Household fixtures



Vector control strategy

- **Community Engagement**
- Direct involvement in surveillance, education and vector control strategy.
- Interact with, and educate the public.



Aedes aegypti
yellow fever mosquito



Photo by James Gathany, CDC

World without insects?

- If **ants, bees, and termites** alone were removed from the earth, terrestrial life would probably collapse.
- Forests of the Amazon, Orinoco and Congo forests and other river basins would die off.
- The earth's atmosphere and oceans would become toxic.



Amazon Rainforest



Bee



Ant



Termite

Always keep in mind:

- There are many beneficial insect species.



And insects make our world much more interesting!



Thank you for your attention!

