

Detailed Genome Map of the Malaria Mosquito Vector

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In news: Recently the Scientists have unveiled the detailed genome of the malaria mosquito vector, revealing thousands of new genes vital for the development of genetic control strategies of disease transmission

Key highlights

- According to the researchers, including those from Tata Institute for Genetics and Society, and Institute of Bioinformatics and Applied Biotechnology, both in Bengaluru, noted that mosquito-transmitted malaria is the leading global killer among vector-borne diseases, claiming over 400,000 human lives in 2019.
- In order to engineer advanced forms of defence against malaria transmission, including targeted CRISPR and gene drive-based strategies, scientists require intricate knowledge of the genomes of vector mosquitoes.
- CRISPR technology is a gene-editing tool which allows researchers to easily alter DNA sequences and modify gene function.
- A scientist from the University of California, Irvine (UCI) in the US and his colleagues produced a new reference genome for the Asian malaria vector mosquito *Anopheles stephensi*.
- As per researchers, *Anopheles stephensi* is a major malaria vector mosquito in urban areas of South Asia and has recently invaded the horn of Africa. It is predicted to become a major urban malaria vector in Africa, putting 126 million urban Africans at risk
- According to the researchers, the new genome assembly is a comprehensive and accurate map of genomic functional elements and will serve as a foundation for the new age

of active genetics in *An. stephensi*

- With the newly upgraded *Anopheles stephensi* genome, the team unearthed more than 3,000 genes that previously evaded scrutiny.
- The newly revealed genes, which offer fresh gene-drive targets, play key roles in blood feeding and the metabolism of ingested blood meal, reproduction and immunity against microbial parasites.
- The discoveries include 29 formerly undetected genes that play crucial roles in resistance to chemical insecticides, a development that can help address the growing Asian and African *An. stephensi* populations with insecticide-resistant mutations
- The recent findings also offer clues suggesting that the molecular basis of insecticide resistance may differ between sexes

Significance of the recent findings

As per the researchers, this reference genome and its excellent quality should help malaria biologists in India and the rest of the world, particularly in view of the national goal of malaria elimination in India by 2030

This work will aid in basic studies of genome evolution and inform strategies aimed at eliminating one of the world's long-time disease scourges

Collectively, these results and resources underscore the significance of previously hidden genomic elements in the biology of malaria mosquitoes and will accelerate development of genetic control strategies of malaria transmission

Malaria

It is a disease caused by a plasmodium parasite, transmitted by the bite of infected mosquitoes. The parasites are spread to people through the bites of infected female *Anopheles* mosquitoes, called "malaria vectors." There are 5 parasite

species that cause malaria in humans, and 2 of these species – *P. falciparum* and *P.*

Disease Burden

- According to the latest World malaria report, released on 30 November 2020, there were 229 million cases of malaria in 2019 compared to 228 million cases in 2018. The estimated number of malaria deaths stood at 409 000 in 2019, compared with 411 000 deaths in 2018.
- The WHO African Region continues to carry a disproportionately high share of the global malaria burden. In 2019, the region was home to 94% of all malaria cases and deaths.
- In 2019, 6 countries accounted for approximately half of all malaria deaths worldwide: Nigeria (23%), the Democratic Republic of the Congo (11%), United Republic of Tanzania (5%), Burkina Faso (4%), Mozambique (4%) and Niger (4% each).
- Children under 5 years of age are the most vulnerable group affected by malaria; in 2019 they accounted for 67% (274 000) of all malaria deaths worldwide.

Different diseases and their vectors:

- Mosquitoes – (*Aedes*) cause Chikungunya, Dengue fever, Lymphatic filariasis, Rift Valley fever, Yellow fever, Zika.
- Mosquitoes – (*Anopheles*) cause Malaria, Lymphatic filariasis.
- Mosquitoes- (*Culex*) cause Japanese encephalitis, Lymphatic filariasis, West Nile fever.
- Sandflies cause Leishmaniasis, Sandfly fever.
- Triatomine bugs cause Chagas disease (American trypanosomiasis).
- Tsetse flies cause Sleeping sickness (African trypanosomiasis).
- Fleas cause Plague (transmitted by fleas from rats to

humans) and Rickettsiosis.