New CRISPR-based technology to genetically control disease-spreading mosquitoes

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In news— Leveraging advancements in CRISPR-based genetic engineering, researchers at the University of California have created a new system that restrains populations of mosquitoes that infect millions each year with debilitating diseases.

What is CRISPR-based new technology?

The newly developed technology is called the "precision-guided sterile insect technique" (pgSIT).

How does it work?

- The pgSIT alters genes linked to male fertility, creating sterile offspring and female flight in Aedes aegypti, the mosquito species responsible for spreading diseases including dengue fever, chikungunya and Zika.
- The pgSIT uses CRISPR to sterilise male mosquitoes and render female mosquitoes (which spread disease) flightless.
- The system is self-limiting and is not predicted to persist or spread in the environment, two safety features that should enable acceptance for this technology.
- The pgSIT eggs can be shipped to a location threatened by mosquito-borne disease or developed at an on-site facility that could produce the eggs for nearby deployment.
- Once the pgSIT eggs are released in the wild, sterile pgSIT males will emerge and eventually mate with females, driving down the wild population as needed.
- Beyond Aedes aegypti, the researchers believe the pgSIT

technology could be directed to other species that spread disease.

How is it different from Gene Drive?

- The pgSIT differs from "gene drive" systems that could suppress disease vectors by passing desired genetic alterations indefinitely from one generation to the next.
- Instead, pgSIT uses CRISPR to sterilize male mosquitoes and render female mosquitoes, which spread disease, as flightless.

CRISPR technology-

- CRISPR stands for Clustered Regularly Interspaced Short Palindromic Repeats which are the hallmark of a bacterial defense system that forms the basis for CRISPR-Cas9 genome editing technology.
- CRISPR is a technology that can be used to edit genes.
- The term "CRISPR" or "CRISPR-Cas9" is often used loosely to refer to the various CRISPR-Cas9 and -CPF1, (and other) systems that can be programmed to target specific stretches of genetic code and to edit DNA at precise locations, as well as for other purposes, such as for new diagnostic tools.
- CRISPR "spacer" sequences are transcribed into short RNA sequences ("CRISPR RNAs" or "crRNAs") capable of guiding the system to matching sequences of DNA.
- When the target DNA is found, Cas9 one of the enzymes produced by the CRISPR system, binds to the DNA and cuts it, shutting the targeted gene off.
- Using modified versions of Cas9, researchers can activate gene expression instead of cutting the DNA. These techniques allow researchers to study the gene's function.