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Restraining Mosquito Populations with CRISPR

 drishtias.com/printpdf/restraining-mosquito-populations-with-crispr

Why in News

Recently, researchers have created a system that **restrains populations of mosquitoes** by leveraging advancements in **Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR)**-based **genetic engineering**.

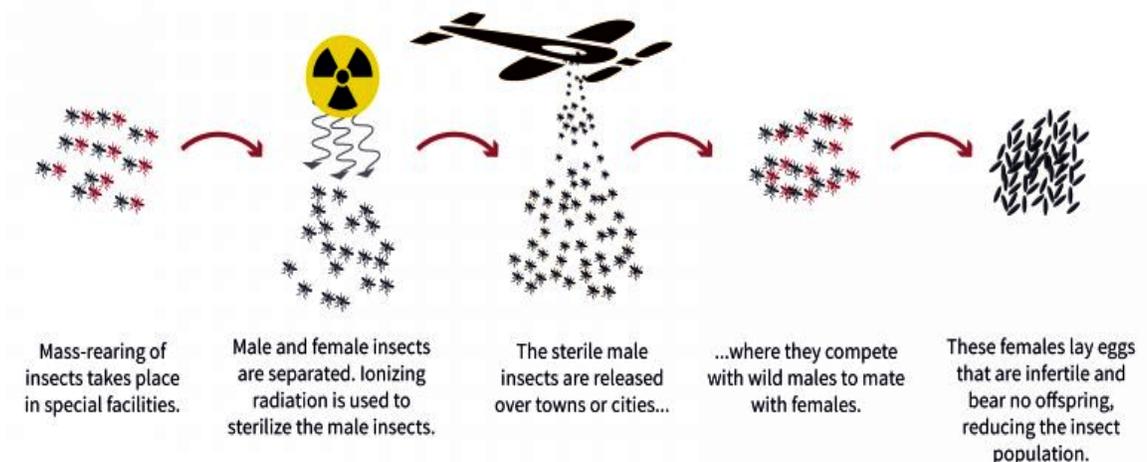
Mosquitoes infect millions each year with debilitating diseases such as **dengue** and **malaria**.

Key Points

- **Sterile Insect Technique:**
 - SIT is an **environmentally safe and proven technology** to suppress wild populations.

STERILE INSECT TECHNIQUE (SIT)

A method of biological insect control



- To further advance its utility, a novel **CRISPR-based technology**, termed **precision-guided Sterile Insect Technique (pgSIT)** is described.

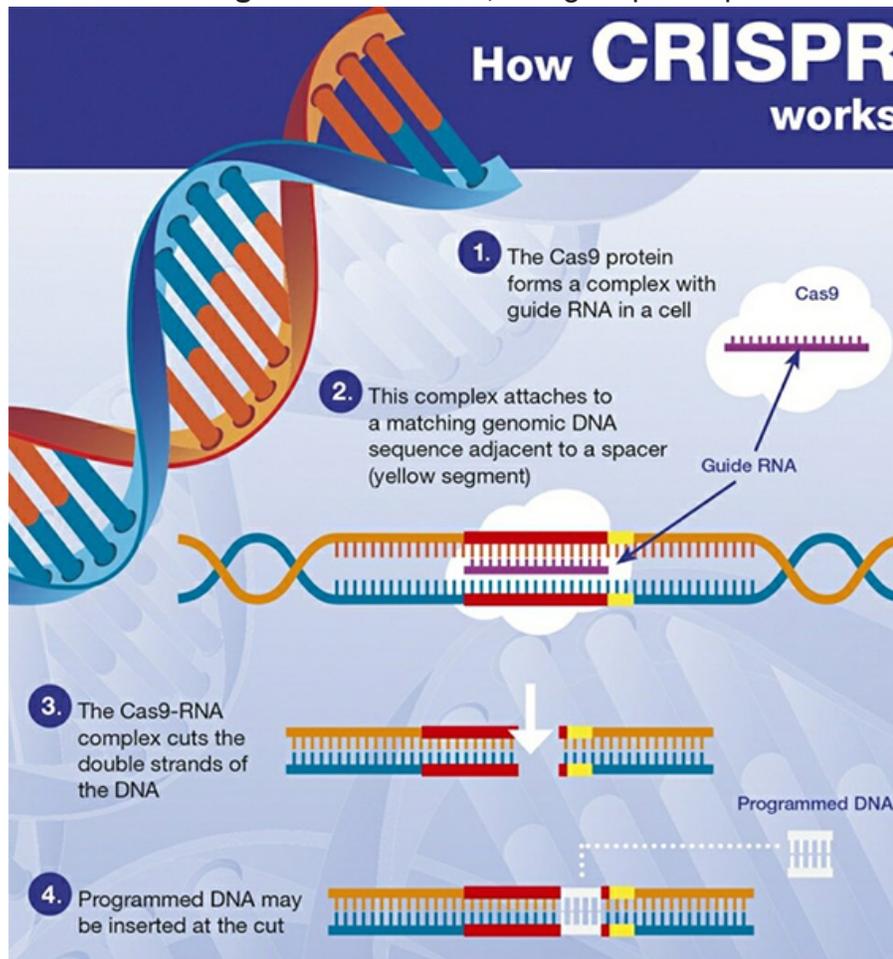
- **pgSIT:**

- It is a **new scalable genetic control system that uses a CRISPR-based approach** to engineer deployable mosquitoes that can suppress populations.
 - **Males don't transmit diseases** so the idea is to **release more and more sterile males**.
 - The population of mosquitos can be suppressed **without relying on harmful chemicals and insecticides**.
- It **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**.
- PgSIT mechanistically relies on a **dominant genetic technology that enables simultaneous sexing and sterilization**, facilitating the release of eggs into the environment ensuring only sterile adult males emerge.

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.
- 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.

- **CRISPR:**

- It is a **gene editing technology**, which **replicates natural defence mechanisms in bacteria to fight virus attacks**, using a special protein called Cas9.



- CRISPR-Cas9 technology **behaves like a cut-and-paste mechanism on DNA strands** that contain genetic information. The **specific location** of the genetic codes that need to be changed, or edited, is **identified on the DNA strand**, and then, using the **Cas9 protein, which acts like a pair of scissors**, that location is cut off from the strand.
- A DNA strand, when broken, has a natural tendency to repair itself. Scientists **intervene during this auto-repair process**, supplying the desired sequence of genetic codes that binds itself with the broken DNA strand.
- CRISPR-Cas9 is a simple, effective, and incredibly precise technology with potential to revolutionise human existence in future.
- **Emmanuelle Charpentier of France** and **Jennifer A Doudna of the USA** were awarded the **2020 Nobel Prize in Chemistry** for developing CRISPR/Cas9 genetic scissors.

Source: IE