Restraining Mosquito Populations with CRISPR

**Why in News**

Recently, researchers have created a system that restraints 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

  ![Sterile Insect Technique (SIT)](image)

  - 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 mosquitoes 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**

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