Restraining Mosquito Populations with CRISPR

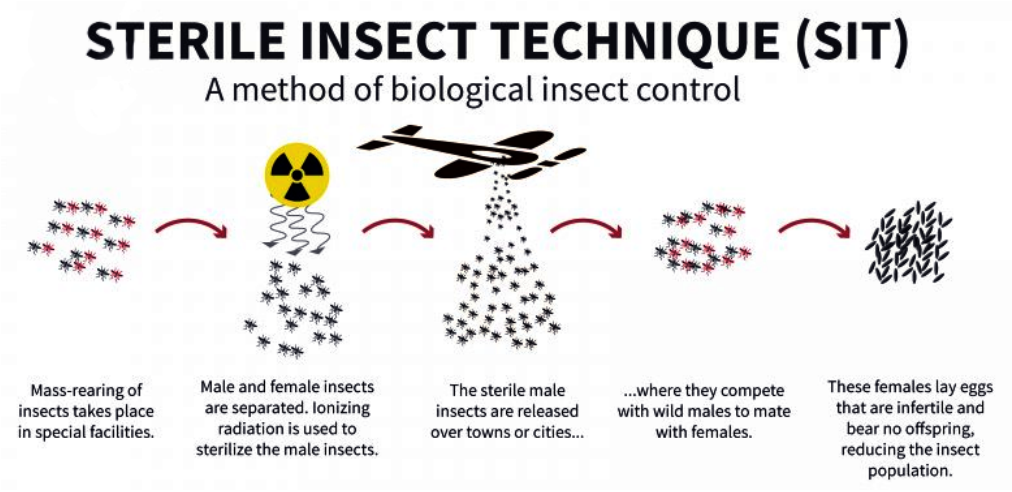
Why in News

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.**

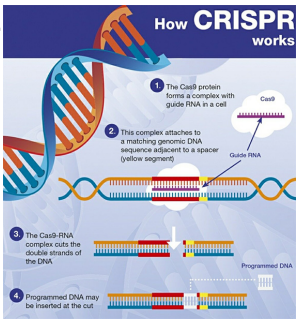
Key Points

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



  - 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