

LOCUSTS SWARM – ENVIRONMENT

NEWS: Researchers have shown that it's possible to manipulate **pheromones released by locusts** to **prevent them from swarming** or engaging in group behaviour that leads to the **feeding frenzy**.

WHAT'S IN THE NEWS?

Locust Swarms and Their Impact

- Locust swarms have historically been one of the **most destructive agricultural pests**, capable of devastating crops and natural vegetation across continents.
- These insects **form large, fast-moving swarms** that can travel hundreds of kilometers and consume thousands of hectares of crops within just a few days.
- The **2019–2020 locust outbreak** in East Africa, Pakistan, and India was the **worst in 25 years**, posing a serious threat to regional food security.

Locust Biology and Species in India

- Locusts are **short-horned grasshoppers** with the ability to shift between solitary and gregarious (swarming) phases depending on environmental conditions.
- They undergo a **behavioral transformation** where solitary individuals become sociable and migrate in groups.
- In India, four main species are recorded:
 - **Desert locust (*Schistocerca gregaria*)** – the most dangerous and economically significant species.
 - **Migratory locust (*Locusta migratoria*)**
 - **Bombay locust (*Nomadacris succincta*)**
 - **Tree locust (*Anacridium* sp.)**



Why Desert Locusts Are a Major Concern

- Desert locusts are considered the **most devastating pest species**, both in India and globally.
- Their ability to form massive swarms and move rapidly across regions makes them **difficult to predict and control**.
- The damage they cause affects both **cultivated crops and natural vegetation**, potentially triggering food and fodder crises.

Traditional Control Methods and Environmental Impact

- Conventional locust control methods involve **wide-scale spraying of synthetic chemical pesticides**.
- These chemicals pose significant threats to:
 - **Soil health**
 - **Pollinators and beneficial insects**
 - **Water bodies and aquatic life**
 - **Human and animal health**
- There is increasing **research interest in eco-friendly alternatives** that minimize environmental and ecological damage.

Gregariousness: The Swarming Behaviour

- Locusts exhibit **gregarious behaviour**, a form of social organization where individuals **cooperate and move as a group**.
- Gregariousness is triggered when locusts sense the presence of others, leading to changes in behavior, color, and physiology.
- This social aggregation is **essential for swarm formation**.

Role of 4-Vinylanisole (4VA)

- In 2020, scientists identified a key **aggregation pheromone** called **4-vinylanisole (4VA)**.
- This compound is released by **locusts' hind legs after feeding** and acts as a signal to attract other locusts.
- The presence of 4VA **induces group formation**, which eventually leads to swarm development.
- The group rubbing of hind legs **triggers serotonin release**, further reinforcing swarming behaviour.

New Eco-Friendly Control Strategy (Based on 4VA Research)

Researchers proposed a **five-step integrated strategy** targeting the gregarious behaviour:

- **a. Trapping with Synthetic 4VA or Alternatives:**
 - Use synthetic 4VA to **attract locusts to specific areas**, where they can be **trapped and eliminated** using biopesticides or fungal pathogens.
- **b. Disruption through 4VA Spraying:**
 - Spray 4VA in a **controlled and misleading manner** to prevent the locusts from aggregating, breaking the swarm formation cycle.
- **c. Monitoring Locust Populations via 4VA Signatures:**
 - Track **airborne 4VA levels** using sensors to monitor locust population dynamics and predict swarming events in advance.
- **d. Release of Genetically Modified Non-Gregarious Locusts:**
 - Introduce **genetically altered locusts** that are resistant to gregarious transformation, reducing the chance of swarm formation in the wild population.
- **e. Combined Approach Using Biopesticides and Small Molecule Inhibitors:**
 - Employ **biological agents (e.g., fungi)** alongside **molecular inhibitors** to manage locust populations without harming the environment.

Significance of the Strategy

- This integrated approach offers a **sustainable, eco-friendly, and targeted solution** to locust outbreaks.
- It minimizes **reliance on chemical pesticides**, thus protecting biodiversity, human health, and food systems.
- It also opens new avenues for **precision pest management** through **chemical ecology and biotechnology**.

Source: <https://www.thehindu.com/sci-tech/science/scientists-identify-pheromone-that-triggers-locust-swarming-and-a-way-to-block-it/article69808158.ece>