



European Honeybees as Biomonitoring Agents for AMR

For Prelims: European honeybees, Behaviour of Honeybee, IUCN Red List

For Mains: Antimicrobial Resistance and its Impacts

[Source: DTE](#)

Why in News?

A recent study has revealed an unconventional yet efficient method for **monitoring the proliferation of antimicrobial resistance (AMR) in urban areas:** the utilization of **European honeybees** as biomonitoring agents.

What are the Major Highlights of the Research?

- **European honeybees** serve as a unique **environmental proxy**, effectively "**crowdsourcing**" **data as they interact with contaminants** in various urban elements such as soil, dust, air, water, and pollen during their foraging activities.
 - **Their short lifespan, around 4 weeks**, allows them to provide real-time data on the state of the environment concerning antimicrobial resistance.
- Researchers have shed light on the significance of these bees in assessing pollution that may pose risks to human health. They analyzed the **gut bacteria of 144 bees and identified Class 1 integrons (int1)** as a universal marker for **tracking AMR**.
 - Surprisingly, around **52% of the bees carried int1 in urban areas**.
 - **Integron** is a mobile DNA element that can capture and carry genes, particularly those responsible for antibiotic resistance.
- Furthermore, the **researchers examined eight bees from each of the 18 hives** owned by citizen-scientist beekeepers in Greater Sydney, Australia.
 - 80% of these bees across all hives **tested positive for one or more AMR targets**.
 - Higher concentrations were observed near bodies of water like dams and lakes.

What are European Honeybees?

- **About:**
 - European honeybees (***Apis mellifera***) commonly referred to as the **Western honey bee**, possess two pairs of wings and usually display **black or brown coloring with distinctive yellow stripes on its abdomen**.
 - They prefer to **nest in a cavity such as a hollow tree or house wall**.
 - They are assessed as "**Data Deficient**" on the [IUCN Red List](#).
- **Distribution:**
 - The species lives predominantly in managed bee colonies **throughout Europe**, although there are potentially feral and **wild bee colonies found in a wide range of habitats**.
 - Generally, the species can be found to **inhabit temperate forests, grasslands and even semi-deserts**.

What is the Social Structure and Behaviour of Honeybee?

▪ Social Structure:

- Among them, **queen bees, the fertile females**, develop into the largest individuals.
- **Drones, which are the males**, have a medium build and notably larger eyes compared to females.
- **Worker bees, smaller sterile females**, are equipped with **barbed stingers and possess unique hind legs utilized as pollen baskets**.

▪ Behavior:

- **Communication:** They communicate through a complex system of dance called **“waggle dance”** to relay information about food sources and hive conditions.
- **Hive Construction:** Bees construct intricate **hexagonal honeycomb structures** made of beeswax to store honey, **pollen**, and raise brood.
- **Pollination:** While foraging for nectar and pollen, honeybees unintentionally **pollinate many plant species, aiding in plant reproduction**.

What is Antimicrobial Resistance?

ANTIMICROBIAL RESISTANCE

The ability of microorganisms to resist the effects of antimicrobial drugs

CAUSES OF ↑ AMR

- Poor infection control/sanitation
- Antibiotic overuse
- Genetic mutations of microbe
- Lack of investment in R&D of new antimicrobial drugs

Microbes that develop AMR are called 'Superbugs'

IMPACTS OF AMR

- ↑ Risk of spreading infections
- Makes infections harder to treat; prolonged illness
- ↑ Healthcare costs

EXAMPLE

- Carbapenem antibiotics stop responding due to AMR in *K. pneumoniae*
- AMR Mycobacterium tuberculosis causing Rifampicin-Resistant TB (RR-TB)
- Drug-resistant HIV (HIVDR) making antiretroviral (ARV) drugs ineffective

RECOGNITION BY WHO

- Identified AMR as **one of the top 10 threats** to global health
- Launched **GLASS** (Global Antimicrobial Resistance and Use Surveillance System) in 2015

INDIA'S INITIATIVES AGAINST AMR

- Surveillance of AMR in microbes causing **TB, Vector Borne diseases, AIDS etc.**
- **National Action Plan on AMR** (2017) with One Health approach
- **Antibiotic Stewardship Program** by ICMR

New Delhi metallo-β-lactamase-1 (NDM-1) is a bacterial enzyme, emerged from India, that renders all current β-lactam antibiotics inactive

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Note: A **United Nations Environment Programme** report in February 2023 warned that the unchecked rise of AMR could lead to up to **10 million deaths annually by 2050**.

UPSC Civil Services Examination, Previous Year Questions (PYQ)

Q. Which of the following organisms perform a waggle dance for others of their kin to indicate the direction and the distance to a source of their food? (2023)

- (a) Butterflies
- (b) Dragonflies
- (c) Honey Bees
- (d) Wasps

Ans: (c)

Q. Consider the following kinds of organisms: (2012)

1. Bat
2. Bee
3. Bird

Which of the above is/are pollinating agent/agents?

- (a) 1 and 2 only
- (b) 2 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

Ans: (d)

Q. Which of the following are the reasons for the occurrence of multi-drug resistance in microbial pathogens in India? (2019)

1. Genetic predisposition of some people
2. Taking incorrect doses of antibiotics to cure diseases
3. Using antibiotics in livestock farming
4. Multiple chronic diseases in some people

Select the correct answer using the code given below.

- (a) 1 and 2
- (b) 2 and 3 only
- (c) 1, 3 and 4
- (d) 2, 3 and 4

Ans: (b)

Mains

Q. Can overuse and free availability of antibiotics without Doctor's prescription, be contributors to the emergence of drug-resistant diseases in India? What are the available mechanisms for monitoring and control? Critically discuss the various issues involved. (2014)

