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THE VITAL ROLE OF BEES IN ENSURING FOOD SECURITY AND NUTRITION

This year's celebration of World Bee Day on 20 May highlights the vital roles of bees and other pollinators in ensuring global food security and nutrition. In this blog, Amritha V.S. highlights the importance of bees as pollinators and the need to raise awareness about conserving them to ensure food and nutritional security.

CONTEXT: WHY DO BEES MATTER?

Flowering plants, or angiosperms, account for 75–80% of all known plant species. Insects—particularly bees—pollinate more than 75% of all flowering plants! Bees alone pollinate around 1,500 crops globally, accounting for 15 to 30% of global food production. The economic value of the pollination services provided by insects, mostly bees, is estimated to be between USD 235 and 577 billion annually. Their characteristics—such as flower fidelity, thoroughness in handling flowers, long working hours, large population sizes, social organization, communication methods, and morphological adaptations—make them the most efficient and reliable pollinators worldwide.

Box 1: Bee Pollinators

Pollinating bees come in all sizes and shapes. They can be highly social, like the well-known Indian honey bee (Apis cerana) and the Italian bee (A. mellifera), which are domesticated. The related rock bee (A. dorsata) and little bee (A. florea) also belong to the genus Apis but are not domesticated.

Eusocial (partly social) stingless bees form another highly diverse and abundant group of pollinators inhabiting tropical and subtropical regions. About 500 species belong to the tribe Meliponini. Stingless bees play an important ecological role as pollinators of many wild plant species and are considered promising candidates for managed pollination. Eleven stingless bee species across six genera have been found to forage effectively under enclosed conditions, indicating their potential in greenhouse crop pollination.

Indian Bee (Apis cerana)

Wild, non-social bees—such as the carpenter bee (Xylocopa spp.), alkali bee (Nomia spp.), halictids (Halictus spp.), and colletids (Colletes spp.)—also play crucial roles in pollinating crops and wild plants.

Sadly, bee populations are declining globally despite their importance for food and nutritional security, largely due to climate change, unscientific farming practices, and habitat destruction. However, much of this decline can be reversed through awareness and strategies that make agricultural landscapes more pollinator-friendly.

A honey bee pollinating a cucurbit plant

AUGMENTING BEE POLLINATION

Farm Management

Practices such as tillage, irrigation, nutrient, and pest management significantly affect bee pollinator health. When suitably modified, these practices can support, augment, and conserve bee populations. For instance, tillage affects ground-nesting bees by disturbing their habitat. Shuler et al. (2005) reported a threefold increase in squash bee (*Peponapis pruinosa*) density in no-tillage plots compared to tilled ones. Similarly, irrigation enhances bee populations by facilitating nesting, with Julier & Roulston (2009) reporting a 16% increase in irrigated plots.

Habitat Management

Habitat loss has the most severe impact on wild pollinators in agricultural landscapes. A reduction in foraging and nesting resources diminishes pollination services. Krishnan et al. (2012) found that larger adjoining forest fragments (0.3–20 ha), which serve as nesting sites for wild pollinators like the rock bee, significantly improved pollinator visitation and increased coffee fruit production by 50%. The habitat management can be organised as follows:

a) Provision of Foraging Sites

Flowering borders that bloom before and after the main crop help sustain bee populations. Floral strips and mass flowering crops serve as excellent foraging sites.

b) Provision of Nesting Sites

Wild bees can be supported with suitable nesting resources near cropped areas. About 30% of native bee species are solitary wood-nesters and can be attracted using drilled wooden

blocks, bundles of paper straws, or hollow stems. Over 70% of native bees are ground-nesters and prefer bare patches or stable soil piles with at least 35% sand.

PESTICIDE USE AND ITS IMPACT ON BEE POPULATIONS

Crop protection in developing countries is often pesticide-centric. Insecticides dominate and are the single most harmful factor to bee populations, sometimes wiping out entire colonies. Bees are poisoned through:

- Direct contact with sprayed flowers
- Drift to non-target sites
- Ingestion of contaminated nectar or pollen
- Contaminated water or nesting materials

To reduce harm, pesticide use must be limited and applied with care:

- Use sprays instead of dusts
- Prefer granules
- Spray during evening hours
- Avoid spraying near apiaries
- Relocate hives before spraying
- Choose bee-safe insecticides

BEEKEEPING – TWO BIRDS WITH ONE STONE

Beekeeping offers a low-investment income source while supporting pollination. Apiaries yield honey and wax, along with marketable by-products like pollen, propolis, royal jelly, and bee venom. Honey, long valued for its health benefits, is increasingly recognized for its therapeutic effects.

Box 2: Medicinal Properties of Honey

Used since ancient times by Chinese, Egyptians, Greeks, and Romans, honey treats wounds and gastrointestinal issues. Its components offer antimicrobial, anti-inflammatory, antioxidant, antitumor, anticancer, and gastroprotective benefits.

Honey prevents cancer by inhibiting carcinogenesis phases (initiation, promotion, progression). Its flavonoids and phenolics are responsible for these effects.

A recent study found that Stingless Bee Honey (SBH) contains unique phenolic compounds—2-hydroxy cinnamic acid, methyl syringate, and fumaric acid—not found in Indian Bee Honey (IBH). SBH also showed superior antioxidant and anti-proliferative activity against breast and cervical cancer cell lines.

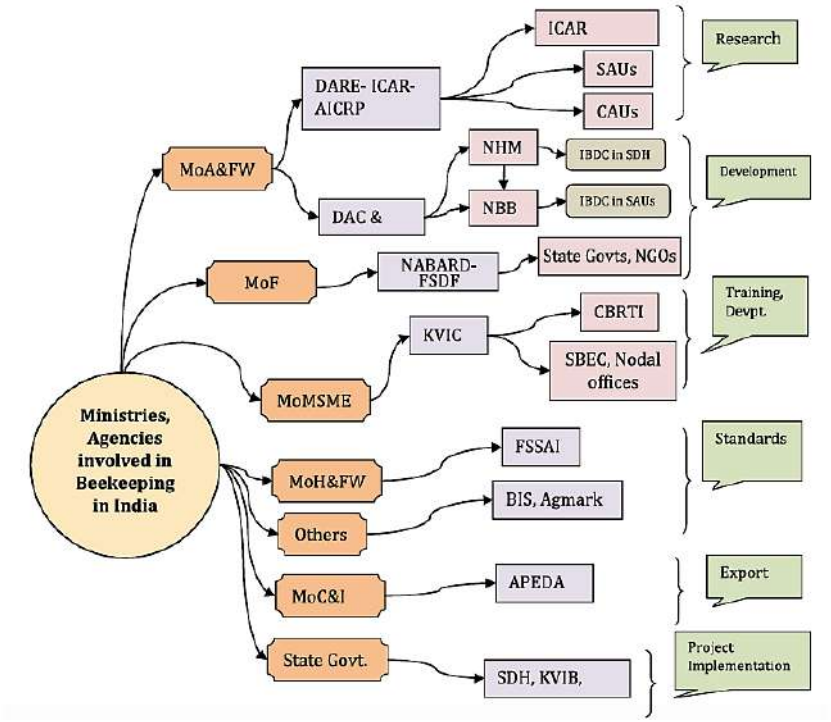
SUPPORT FOR BEEKEEPING IN INDIA

Beekeeping is supported by several agencies (see Figure and Table below). Assistance includes subsidies, loans, working capital, and grants.

Bee keeping is an auxiliary income generating activity in rubber plantations

Table 1: Agencies Supporting Apiculture

Sl No	Organization/Scheme	Nature of Support
1	National Beekeeping and Honey Mission (NBHM)	Scientific beekeeping, pollination, post-harvest, research
2	Mission on Integrated Development of Horticulture (MIDH)	Subsidies for colonies, hives, equipment
3	Scheme of Fund for Regeneration of Traditional Industries (SFURTI)	Financial aid, training, cluster formation
4	NABARD	Loans, working capital for beekeeping groups
5	Gramodyog Vikas Yojana (GVY)	Financial aid, subsidies, loans



Agencies involved in beekeeping in India

THE WAY AHEAD

Pollination services provided by bees are among the most critical ecosystem services that sustain food production and biodiversity. Despite their immense value, public understanding, particularly among the farming community, remains limited.

Training programme on Bee keeping at ICAR-Krishi Vigyan Kendra, Wayanad

While addressing existing knowledge gaps through research is important, the more immediate need is to raise awareness and build the capacity of farmers to conserve and enhance pollinator populations in agricultural landscapes. Farmers should be educated to identify key pollinators within different cropping systems and adopt agronomic practices that support their presence, such as minimal tillage, appropriate irrigation, provision of floral resources along field borders, refuges, and nesting sites.

Equally crucial is the promotion of safe pesticide use to reduce the harmful impact on bees. Beyond conservation, beekeeping should be actively promoted as a sustainable livelihood option that not only supplements income for rural communities but also boosts pollination services.

In addition, bee-assisted pollination, particularly within protected cultivation systems of high-value crops, should be explored more widely. Managed pollination using species like *Megachile rotundata* (alfalfa leafcutter bee), *Osmia* spp. (used in apple and almond pollination), and *Bombus* spp. (for greenhouse tomatoes) has already shown significant promise and should be integrated into mainstream agricultural practices.

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