



Just over **100** major crop species account for about **90%** of all food production. Of these, **71%** rely on bee pollination to be able to reproduce season after season

icipe's Bee Health Programme: Protecting African Bees for Food Security and Health

The smallest farmhands, for free

Food production will have to increase by 70% to feed a population that will increase by 2 billion more people in 2050, as the global population surges from the current 7 billion to more than 9 billion people.

Often the humble bee is left out of the equation amid the debate on ensuring global food supplies and nutrition in the future, while using the same or less land and fewer inputs. Yet without bee pollinators – not just honeybees, but bumblebees, stingless bees, carpenter bees (and other solitary bees) – global production and consumption of fruits, vegetables and nuts, as well as meat and dairy products would decrease. Food and fodder crops would not reproduce harvest after harvest, if these farmers' little helpers were one day to simply disappear.

Yet disappearing is just what bees are doing in some parts of the world.

Colony Collapse Disorder

Although bee disappearances have been reported throughout the history of apiculture, in 2006 the term 'colony collapse disorder' was coined when commercial beekeepers in the United States noted significant die-offs of bees, sometimes losing entire colonies. Many of the worker bees—the adult females that forage for pollen and other substances to feed the colony—were just not returning to the hive. The same problem was reported by European beekeepers soon afterward, and it has since become a global worry.

Experts agree that there is no one cause of CCD. Instead, it is likely the result of a combination of factors that are harming honeybee health—the effects of pesticide use, climate change, shifts in habitat and land use, urbanisation, logging, and the stresses associated with industrial-style beekeeping practices, which see beehives transported long distances to perform pollination services for different crops according to the time of year.

In the Northern Hemisphere, the diversity of bees (and other insects) is falling alongside the diversity of the plants they feed on and pollinate. That biodiversity would normally provide protective defences: First, because genetically diverse bee populations with different characters and responses to ambient conditions would have the ability to keep body temperature steady even if the surrounding situation is different (and also minimise the impacts of climate change as their



Honeybees are important pollinators of passion fruit (above) as well as many other food crops

pollination would yield the best crops). Second, bees that feed on a varied diet of different pollen types have a stronger immune system due to higher levels of a special enzyme that they use to preserve honey and the larval food against infestation by bacteria, which serves to protect the hive against disease. And third, the worker vitality and thus productivity is superior.

Painting a picture of bee health in Africa

There is little information on honeybee health across the African continent in general. Although major pests and diseases such as varroa mite and *Nosema apis* have been detected in African bees, to-date no systematic monitoring and analysis for pollinator diseases has been carried out. It remains difficult to say which bees have what diseases and in which areas, thus addressing threats to honeybee health remains a challenge. Scientists simply do not have a clear picture of what is out there.

Yet bee health in Africa is of paramount importance. If colony collapse disorder were to hit the African continent, it would have a direct impact on food security and people's livelihoods far beyond the direct impact on beekeepers. Pollination is an essential function of the Earth's natural ecosystems, as it is required to produce fruits and seeds in up to 90% of the world's 250,000 species of agricultural, medicinal, fibre and other flowering plants (including native plants), as well as fodder for livestock. Thus pollination (primarily by bees) also contributes to milk production. Presence of bees is important to increase yields, and hence, food security and income in Africa.

Not all bee pollinators are equal

icipe has begun field experiments to see which bees might be the best pollinators for certain crops. Carpenter bees, for example, are outstanding pollinators, but have not yet been domesticated for pollination services in Africa. Different species of bees prefer specific flowering crops, and where these bees are more active, crop yields improve significantly. Generally, fruit and vegetable yields improve by 15–20%, while onion seed production sees even sharper increases of more than 40% after bee pollination.

The birds and the bees, and the bats too

In addition to bees, which are the most important, other invertebrate pollinators include butterflies, wasps, flies and moths, and vertebrates such as hummingbirds and bats.



icipe has designed hives for domesticating afrotropical carpenter bees (above) and stingless bees (below)

Coordinated action to protect bees from pesticides, diseases and pests: Case of the African Reference Laboratory for Bee Health

In 2013 *icipe* and the African Union InterAfrican Bureau for Animal Resources (AU-IBAR) launched the project "African reference laboratory (with satellite stations) for the management of pollinator bee diseases and pests for food security." The sites in Burkina Faso, Cameroon, Ethiopia and Liberia will provide similar monitoring and surveillance for bee diseases in each of their respective geographic areas. The main African Bee Health Reference Laboratory, based in Nairobi, Kenya will also have advanced technological capacity for testing for pesticide residues in bee products, for certification purposes. **It is a first for the African continent:** At present, there is no such system for verifying honey or royal jelly as organic and pesticide-free.

The laboratory will also house hi-tech facilities for developing plant-based biopesticides to combat the pests and diseases that might be affecting African bees.

The laboratories will serve as a hub of knowledge and innovation for farmers' federations, national agricultural research systems scientists, NGOs and community-based organisations, and it will provide a forum for creating links with the private sector and agribusiness. The laboratories organise regular trainings to raise the standards and productivity of beekeeping in Africa.

The goals of creating a network of labs for bee health are to:

- Generate knowledge on bee diseases and pests and their control for farmers and beekeepers
- Improve honey production and enhance access to markets in Africa and beyond
- Provide evidence-based knowledge that can help guide policymaking to support a robust beekeeping community and to scale up the undertakings to make more beekeepers into entrepreneurs
- Create rural employment for youth and women especially, who can easily diversify and boost their sources of income by also raising bees.



Views of the African Reference Laboratory for Bee Health at the International Centre of Insect Physiology and Ecology (*icipe*)

Beeswax production in Africa

Beeswax is a substance used by bees to build the comb, to cap ripened honey or is mixed with propolis to protect the hive from infections. It can be the most valued product of beekeeping. Beeswax has many uses including for the cosmetics industry, in pharmaceutical preparations, for candle making, in making varnishes and polish for cars, furniture, shoes and for treatment of other leather products, in making drawing crayons, and even in food processing. Beekeepers recycle their own beeswax for making beeswax comb foundations or in attracting swarms to empty hives. In Africa beekeepers often discard pieces of wax combs. Ethiopia is the leading producer of beeswax in Africa and the 3rd largest producer of this beehive product in the world. It has the highest honeybee population in Africa. Beehives used by Ethiopian farmers are mostly traditional, which provides bigger yields of beeswax, and this beeswax is unique. Ethiopia exports 4300 metric tonnes of beeswax annually. Other leading competitors in Africa are Kenya, which exports 2490 metric tonnes annually, followed by Angola, with annual exports of 2300 metric tonnes.

Organic certified honey and hive products

A growing number of farmers the world over are now shifting to organic farming, since it provides numerous benefits over conventional farming. However, for honey to be certified organic, beekeepers have to meet stringent production standards and conditions. Not only do plants (the bees' source of nectar and pollen) need to be pesticide-free, but also the entire foraging area. This means, therefore, that honey must come from areas where there is no human activity. *icipe*, together with the Kenya Organic Agriculture Network (KOAN) designed an Internal Control System (ICS) training programme for community groups (smallholder organisations and farmers' associations) and government stakeholders, to facilitate submissions for organic certification. Certification for honey and hive products was undertaken in Kenya and Ethiopia, where the community members and relevant stakeholders were taken through the ICS training programme. Community field officers conducted internal inspections, and an independent body was contracted to undertake the external evaluations. Organic certificates have been issued to three marketplaces and the process is ongoing for a fourth marketplace in Tolay, Ethiopia.



icipe-trained farmers produce packed organic certified honey and candles in Kenya and Ethiopia as well as many other African countries

Honey marketplace development in Africa

icipe has assisted in the construction and renovation of marketplace facilities and provision of honey processing equipment (e.g. processors, extractors, bottles and labels, honey harvesting buckets, candle moulds and refractometers) in several locations in Africa.

Honey marketplaces established by *icipe* to-date include:

- Hoima Honey Marketplace, Uganda
- Kadougli Honey Marketplace, The Sudan
- Kassala State Sericulture and Apiculture Market Centre, The Sudan
- Maridi Honey Marketplace, South Sudan
- Mt. Kenya East Honey Marketplace, Kenya
- Taita Honey Marketplace, Kenya
- Mwingi Honey Marketplace, Kenya
- Arabuko Sokoke Honey and Silk Marketplace, Kenya
- Kakamega Forest Honey and Silk Marketplace, Kenya
- Isiolo Honey Marketplace, Kenya
- Cabesi Honey Marketplace, Kenya
- Eastern Tigray Honey Marketplace, Ethiopia
- Tolay Honey Marketplace, Ethiopia
- Madagascar Honey Marketplace.



Three honey marketplaces established by *icipe* in eastern, western and coastal Kenya, respectively



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icipe: Home of the African Reference Laboratory for Bee Health

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Researching bees since 1995

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icipe's donors

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