

Indigenous honeybees: allies for mountain farmers

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In mountain agriculture, field crops, fruits, vegetables, livestock and honeybees combine to provide self-sufficiency for farmers. Together, they help provide the resilience necessary to live with the hardships and extremes of mountain environments.

Indigenous honeybees play an important role in mountain ecosystems. They are the natural pollinators for a wide variety of mountain crops as well as indigenous plants. While visiting flowers to collect nectar, the bees transfer pollen from one flower to another. Three quarters of the world's cultivated crops are pollinated by different species of bees, and honeybees are the most effective and reliable pollinators. They also play an often unrecognized role in maintaining the vegetation cover: more pollination means more seed, more young plants and eventually more biomass, providing food and habitats for birds, insects and other animals.

There are very few areas in the world where indigenous species of honeybees other than *Apis mellifera* still exist, and even fewer where the indigenous honeybees can be kept in hives and managed by farmers.

In the Hindu Kush Himalayas, indigenous honeybees include *Apis dorsata*, *Apis florea*, *Apis laboriosa* (bees whose products can be collected but which cannot be kept in hives) and *Apis cerana*. In addition to their importance for pollination, these bees contribute directly to the livelihoods of mountain people by providing honey and other bee products. *Apis cerana*, the Asian hive bee, is particularly important to mountain farmers as a source of cash income. This species is well suited both to the climatic conditions in the region and to the farming practices that are typical of these marginal, mountainous areas. It has the ideal characteristics to ensure the pollination of mountain crops, having adapted its foraging patterns to suit the changing flowering and nectar production rhythms that result from the uncertain and variable climatic conditions in mountain areas. It can work under cool conditions up to an altitude of 3000 metres and is ideally suited as a pollinator of early flowering crops like almonds, peaches and plums. Kept in hives in the backyards, these bees pollinate kitchen garden crops, usually the main source of vegetables. The indigenous bee offers a further advantage in that it keeps going even under adverse conditions; if the situation becomes really difficult the colonies may migrate temporarily, but the bees come back to their hives when conditions allow them to do so.

Decline in native pollinators

Despite an increasing recognition of their important role in pollination, the population and diversity of native bees is declining in the region. Factors causing the decline include habitat loss through land use changes, increasing monoculture and negative impacts of pesticides and herbicides. In addition, the well-intended introduction of the European honey bee, *Apis mellifera*, to the Himalayas has brought difficulties for indigenous bee species, partly because of competition for nectar in some areas, but more importantly through the introduction of



Photo: S.R. Joshi/ICIMOD

A mountain village in Nepal.

different types of contagious bee diseases and harmful mites. Although *Apis mellifera* potentially produces more honey than the indigenous honeybees, it is not as well adapted to the local climatic conditions and the indigenous vegetation, making it a less effective pollinator. The introduction has therefore adversely affected the livelihoods of mountain farmers. In spite of these developments, *Apis cerana* beekeepers with backyard bees are still being confronted by development extensionists trying to encourage introduction of *Apis mellifera* – in the areas of origin of *Apis cerana*.

In isolated mountain areas like Jumla and Humla in Nepal and in many parts of Afghanistan, Pakistan and India, subsistence farmers are totally dependent on their own resources for their survival. Due to environmental degradation as well as poor pollination, the quantity and quality of many life-saving mountain crops is declining significantly, making survival increasingly difficult and forcing people to migrate to the plains. The situation is similar in many other areas of Nepal and Afghanistan.

Decline in fruit and seed production

Agriculture in the Hindu Kush-Himalayan region is in a stage of transition from traditional cereal crop farming to high-value cash crops such as fruits and vegetables. This ongoing transformation from subsistence to cash crop farming poses a number of new challenges, including low production or crop failures due to inadequate pollination. This emerging problem has been documented in a series of field studies carried out by ICIMOD across the region. Findings suggest that the decline in pollinator intensity presents a serious threat to agricultural production and maintenance of biodiversity. The negative impact of declining pollinator intensity is visible in Himachal Pradesh of India, Azad Jammu and Kashmir of Pakistan as well as in mountain areas of Afghanistan and China.

Despite increasing agronomic inputs, there is a clear decline in the production and quality of fruit crops such as apples, pears and almonds, and seed crops such as buckwheat. In fact, the negative effects of these agronomic inputs on pollinators is one of the major causes of pollination failure and hence the observed declines in productivity. For example, apple cultivation in Himachal Pradesh in India, though it initially gave significant economic gains, has resulted in a loss of agricultural biodiversity and a decline in natural insect pollinators. In this area, farmers are now compelled to rent colonies of honeybees for pollinating their apple orchards. At present, it is mostly the Department of Horticulture and a few private beekeepers that rent out bee colonies to apple farmers. The current rate for renting an *Apis cerana* or *Apis mellifera* colony for apple pollination is US\$20 per colony. Only a few farmers keep their own colonies for pollination. A heavy demand for honeybees for pollination has been created, and there are not enough bee colonies to meet this demand. Hence, in the apple growing areas of Himachal Pradesh, there is a tremendous scope for entrepreneurial beekeeping for pollination.

In Maoxian County, Sichuan, China, farmers have resorted to hand pollination of their apples and pears, as there are not enough natural insect pollinators to ensure a proper fruit setting. Awareness about the use and function of honeybees is lacking, and the beekeepers in this area hesitate to let their bees into this fruit-producing valley because of the serious overuse of pesticides in apple orchards. In Pakistan, disappointed farmers are cutting down their apple trees and recently ICIMOD found evidence of cutting down almond orchards in the Bamiyan valley of Afghanistan due to low yields caused by insufficient pollination.

A major reason for this development is the lack of awareness on the importance of pollinators for crop production, as well as lack of knowledge about the habits and management of bees. The promotion of beekeeping has focused only on honey production, neglecting the more valuable role of bees in pollination. Farmers

The importance of polliniser trees

In Himachal Pradesh in India, farmers used to plant many varieties of apples. However, due to the better market value farmers have been planting only Royal Delicious and uprooting other varieties. Royal Delicious is self-sterile and requires cross-pollination from other compatible varieties for fruit setting. Some farmers do not have even a single polliniser tree in their orchards. So, wherever the orchards have Royal Delicious only, there are serious pollination problems.

Some farmers are now including "polliniser" trees in their orchards. These are grafted on to commercially premium varieties for fast results. Farmers have even devised short-term solutions to bridge the gap until the grafted branches or newly-planted polliniser trees begin flowering: Bunches of small flowering branches of the pollinisers called "bouquets" are put in plastic bags filled with water. These bouquets are hung in the branches of commercially premium varieties. This type of pollination method is locally referred to as "bouquet pollination". The large-scale use of plastic bags has increased the price of plastic bags in the local market from US\$0.75 per kg to US\$2.10 per kg.

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are therefore usually unaware of the role of bees as well as of the need for suitable polliniser varieties in the pollination process: In order to pollinate fruit such as apples, for example, the bees first need to take pollen from a compatible variety of apple and bring this pollen to the tree being pollinated (see box).

New focus in beekeeping

ICIMOD is working to address the pollination issue in partnership with local people and grassroots networks and more than 25 institutions of Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal and Pakistan. ICIMOD is engaged from policy to action level in promoting the importance of pollination for mountain agriculture. The programme is focusing on the conservation and sustainable management of wild bees, *Apis dorsata* and *Apis laboriosa*, and on promotion and sustainable management of the Asian hive bee, *Apis cerana*, through selection and breeding in collaboration with local communities.

This programme intends to improve livelihoods by increasing pollinator intensity without disturbing local biodiversity.

A selection and multiplication programme on indigenous *Apis cerana* in India, Nepal and Pakistan

is being implemented through action research. Farmers are involved in recording selection data and identifying better colonies for multiplication. Mass queen rearing from these colonies helps in increasing pollinator intensity and honey yield.

Databases on the cliff sites and nesting habitats of wild honeybees are also being developed to monitor the trends in their population with the help of local communities. Honey gathering communities have been sensitized to protect and conserve the nesting habitats of the wild bees, which provide them with additional income, thereby contributing to the conservation of biodiversity.

In addition to playing a crucial role in pollination and thereby improving crop yields, honeybees contribute in a balanced way to rural development efforts leading to secure and sustainable livelihoods. ■

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Photo: U. Partap/ICIMOD

Hand pollination by "human bees" in China.