

Honeybees as Providers of Pollination Services

Uma Partap

Introduction

Pollination is an essential environmental service that results in gene flow in many crops and natural and wild flora. Reduced agricultural yields and deformed fruits often result from insufficient pollination rather than deficiency of agricultural inputs such as agrochemicals, agronomic practices and irrigation. In natural ecosystems, visual clues of insufficient pollination are more subtle than in agriculture,



Honeybees colonies placed in apple orchard for pollination. Photo: Uma Partap.

but the consequences can be as severe as the local extinction of a plant species, a noticeable decline in fruit and seed eating animals, the loss of vegetation cover, and, ultimately, if keystone species are involved, the demise of healthy ecosystems and their services. In recent years the Convention of Biological Diversity (CBD) has recognised pollination as a key driver in the maintenance of biodiversity in agricultural and natural ecosystems.

The value of honeybees

Natural and many agricultural ecosystems depend on pollinator diversity to maintain overall productivity and biological diversity. More than 75% of the major world crops and 80% of all flowering plant species rely on animal pollinators, with bees principal amongst them. Of different types of bees, honeybees are the most effective and efficient pollinators of a wide diversity of agricultural and wild plants (Free 1993). Honeybees are therefore essential for “food diversity”, biodiversity, and the maintenance of natural resources.

Research carried out in the countries of the Himalayan region has demonstrated that bee pollination increases the yield and quality of a range of crops. For example, fruit and seed set was widely increased across different sorts of crops; premature fruit drop reduced in apple, peach and plum and citrus; the percentage of misshapen fruits reduced in strawberry, and juice and sugar content increased in citrus fruits (Partap and Verma 1994, Verma and Partap 1993). Similar studies in various vegetable crops such as cabbage, cauliflower, radish, broad leaf mustard and lettuce revealed enhanced seed production, quality of seeds and oil contents as a result of honeybee pollination (Partap and Verma 1994, Verma and Partap 1993).

The benefit of using honeybees for enhancing crop yields

⁵ Based on interviews conducted with selected representatives of the Afforestation Companies between May and August 2009.

⁶ Ibid.

through cross pollination is estimated to be much higher than for their role as producers of honey and beeswax. The annual value of honeybee pollination to crop production is estimated at US \$14.6 billion in the USA, \$1.5 billion in Canada, about \$3 billion in Europe, and \$2.3 billion in New Zealand (Winston and Scott 1984, Matheson and Schrader 1987, Williams 1992, Morse and Calderone 2000).

Payments for the pollination services of honeybees: examples from the Himalayas

Studies carried out by ICIMOD have revealed that farmers cultivating cash crops in several hills and valleys of the Himalayan region have suffered during recent years as a result of insufficient fruit set provided by the free environmental services of bees. This is especially the case for farmers in the apple farming areas across the Hindu Kush-Himalayan (HKH) region, who are losing millions of dollars every year due to reduced yield and quality of fruit (Partap and Partap 2002, Partap et al 2001) caused by a lack of natural pollinators during the flowering period. Factors responsible for reduced pollinator populations and diversity include habitat change, insufficient availability of forage for nesting and hibernation; continued expansion of monoculture, reducing the diversity of forage resources; heavy use of pesticides and overall changes in climate.

Keeping in mind the ever increasing decline in the yield and quality of apples, local governments have been undertaking special efforts to promote managed pollination since the late 1990s, particularly in Himachal Pradesh (a small State in the northwestern Indian Himalayas). Himachal Pradesh is so far the only area in the whole of the HKH where an organised system of payment for pollination services of honeybees exists. Here the government, university and the farmers' association play important roles in promoting this service and encouraging private entrepreneurship for bee pollination of cash crops (see box 1). Beekeepers receive money for the pollination services of honeybees and sale of honey, and farmers' income is increased through boosting crop productivity as a result of the pollination services of bees (see box 2). In this way beekeeping is of great benefit not only to the farmers, but also to the beekeeper.

This has led to the growth of a whole new vocation. Every year tens of beekeepers with hundreds of bee colonies move to various hills and valleys of Himachal Pradesh. Farmers pay beekeepers IRs 600 (US\$ 12) as pollination fees for one colony of honeybees during each flowering season. In mountainous areas a beekeeper can rent each of his bee colonies at least twice - once in lower valleys where apple flowering starts about two weeks earlier and once in higher altitude areas. As a result, the requirement for honeybee colonies for apple pollination in Himachal Pradesh is about 250,000, but currently only a few thousand - less than 20,000 - are available. As such there is considerable scope for expansion.

Conclusion

In the countries of the HKH region, apple has been planted on 594,000 hectares of land producing 3,409,000 tonnes of fruit every year. Pollination services can very easily increase the production of apple and other fruit crops by 20-50 percent without increasing the area under cultivation. Use of beekeeping for crop pollination is a relatively new effort in the HKH region. Most individuals and institutions (GOs and NGOs) have focused on the honey production aspects of beekeeping, but the case of Himachal Pradesh exists as an

Box 1: Institutional efforts to promote beekeeping for apple crop pollination in Himachal Pradesh

The role of the Himachal Horticulture and Forestry University

- Strong scientific expertise is available on honeybees, beekeeping, and pollination.
- Field stations in apple-farming areas monitor problems related to horticulture and focus on problem-solving research.
- On-farm research, demonstrations and on-demand trainings are provided to farmers and interested new entrepreneurs.
- Beekeeping and Horticulture Research Stations maintain both *Apis cerana* and *Apis mellifera* (Himalayan and European honeybees) for pollination purposes.

The role of the Department of Horticulture, Himachal Pradesh

- Establishment of a Beekeeping Development Office for Pollination (BKDO), which maintains and rents honeybee colonies to farmers; *Apis mellifera* colonies sold at a subsidised rate (IRs 300 [US \$7.5] per colony, against a market price of about IRs 2000 [US \$50]).
- Annual assessments of the demand for honeybee colonies by apple farmers, and arrangements for supply facilitated with private beekeepers.
- Attractive financial support for starting a beekeeping enterprise for pollination.
- Provision of honeybee colonies at a subsidised rate to promote their use for pollination.

The role of the Himachal Apple Growers' Association

- Platform for farmers to discuss emerging problems and to act as a pressure group to seek government intervention.
- Raised the apple-pollination problem faced by farmers with the university and government and sought rapid solutions.
- Raised awareness about the scale of the problem in the state and encouraged farmers to become beekeeping entrepreneurs for pollination; coordinated honeybee demand-supply aspects.

Source: Partap and Partap 2002



Manually pollinating apple flowers in Maoxian County of China. Photo: Uma Partap.

Box 2: Income flows from pollination services of honeybees: testimonies from the field

One beekeeper Charan Das Mahant has been bringing colonies for pollination every year. He brings nearly 200 colonies and rents them all. This brings him an annual cash income of INRs 200,000-250,000 (about US \$4000-5000). As Mr. Mahant puts it, "For pollination services we get certain money. Farmers pay in advance. We use this money to improve our lives, eating good food, buying good clothes, sending our children to good schools. Honey production and market price, on the other hand, depend upon the season."

As for apple farmers, the use of honeybees for pollination increases both the yield and quality of their crops. For those who have more serious pollination problems, the yield can be more than doubled. In the words of one apple farmer, Mr. Rup Lal Seth, "Pollination problems started over the last few years and our fruit yield declined to less than 50 percent. The quality - the colour, the shape, and the size of fruit - was also not attractive. This had decreased the market for my fruit. The Government Department of Horticulture and the Horticulture University advised us to use honeybees for pollination. I am using them and for the last few years I am harvesting good crops of apple every year. People use both the Himalayan honeybee, *Apis cerana*, and the European species, *Apis mellifera*, but I have seen that *Apis mellifera* does not work as well under bad weather conditions - when it is cold or cloudy - in these mountain areas. I now keep 20-25 colonies of *Apis cerana*. They are sufficient for pollinating my orchard. We keep honeybees only for apple pollination, not for honey".

Source: Partap 2001

isolated example where special efforts have been made by government agencies to strengthen research and extension systems to enable the promotion of beekeeping for crop pollination. Governments in other countries of the HKH region would benefit from the exploration of similar initiatives, using beekeeping to enhance livelihoods of farmers and beekeepers and to conserve biological diversity.

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Uma Partap (upartap@icimod.org) is a Research Officer in the Sustainable Livelihoods and Poverty Reduction Programme (SLPR), ICIMOD.