# Chapter 31

# The Potential for Linking Conservation of Endangered Species with Productive Crop Farming: Case of the Endangered Himalayan Honeybee, *Apis cerana*

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At present, many species of the true honeybee (*Apis* spp) are found throughout the world, although they are only native to the old world. Of these species only two, *Apis cerana* and *Apis mellifera*, are kept in hives and managed for honey production and crop pollination. The European honeybee, *Apis mellifera*, is native to Europe and Africa. This bee species has been successfully introduced to Australia, America, and many countries of Asia where it has become very popular. The Asian honeybee, *Apis cerana*, is native to Asia. Beekeeping with this species has been a traditional activity among subsistence farmers in many countries. However, the populations of this bee species are decreasing both in terms of the number of colonies and the area in which they are found. The species has almost disappeared from Japan and South Korea and has become threatened in other countries of Asia such as Bangladesh, China, India, Myanmar, and Pakistan. This probably happened as a result of the introduction of the more productive European bee, *Apis mellifera*, which is now becoming more popular with beekeepers in Asian countries. Figure 31.1 shows the present distribution of *Apis cerana* and *Apis mellifera* in the Hindu Kush-Himalayan (HKH) region.

## Honeybee Diversity in the Himalayan Region

Five species of honeybee are found in the HKH region. Of these, *Apis dorsata*, *Apis florea*, *Apis laboriosa*, and *Apis cerana* are native to the region. During the past few years *Apis mellifera* has been introduced into the region for higher honey production. The first three species are found in the wild and cannot be managed, whereas both *Apis cerana* and *Apis mellifera* are kept in hives and managed largely for honey production. In addition to the true honeybees, the HKH region is

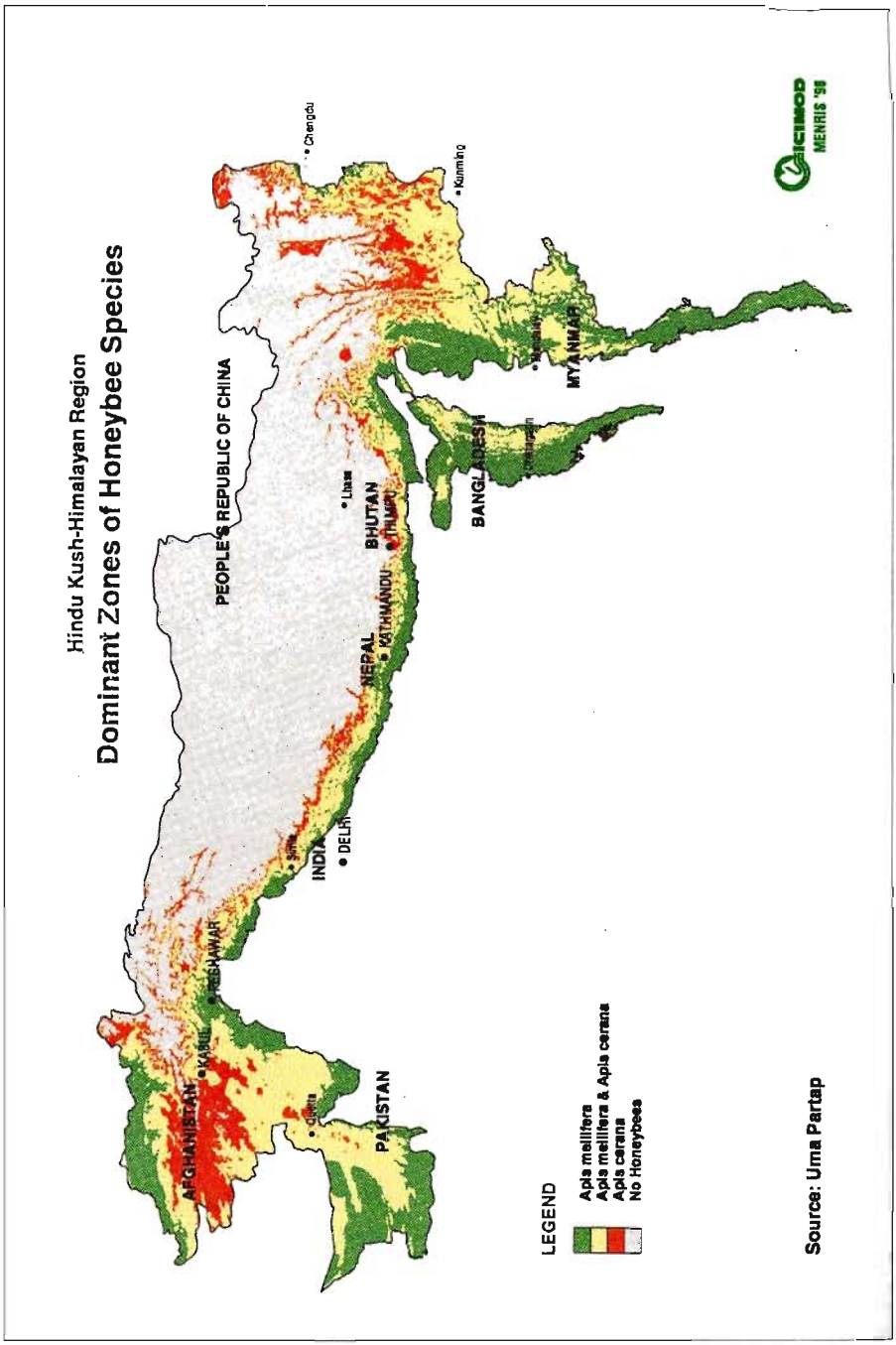


Figure 31.1: Dominant Zones of Honeybee Species

also home to many species of stingless bees (*Melipona* and *Trigona* spp), bumble bees, and solitary bees.

## The Genetic Diversity of *Apis cerana* in the HKH Region

The Genetic Diversity of *Apis cerana* in the HKH region was studied in ICIMOD between 1991 and 1994 as part of an attempt to identify commercially valuable sub-species of the bee (ICIMOD 1994). A morphometric analysis was performed of *Apis cerana* collected from 68 localities. The results of this analysis and of preliminary research into the honey production potential of different populations (Verma 1990 1992; ICIMOD 1993), suggested that *Apis cerana* from the Indian and Nepali Himalayas can be classified into three sub-species, namely, *A. cerana cerana*, *A. cerana himalaya*, and *A. cerana indica* (Figs. 31.2 and 31.3). *A. cerana cerana* is found in the high mountain areas of Nepal and northwest India (Himachal Pradesh and Jammu and Kashmir); *Apis cerana himalaya* in the middle hills of Nepal, Uttar Pradesh, and the northeastern Indian Himalayas; and *Apis cerana indica* in the plains of India and Nepal (ICIMOD 1994). Similarly, five sub-species have been identified in China, *A. cerana cerana*, *A. cerana skorikovi*, *A. cerana abaensis*, *A. cerana hainanensis*, and *A. cerana indica* (Zhen-Ming et al. 1992).

Each sub-species has further locally adapted geographic ecotypes which differ from each other in several biological and economic characteristics. Discriminant

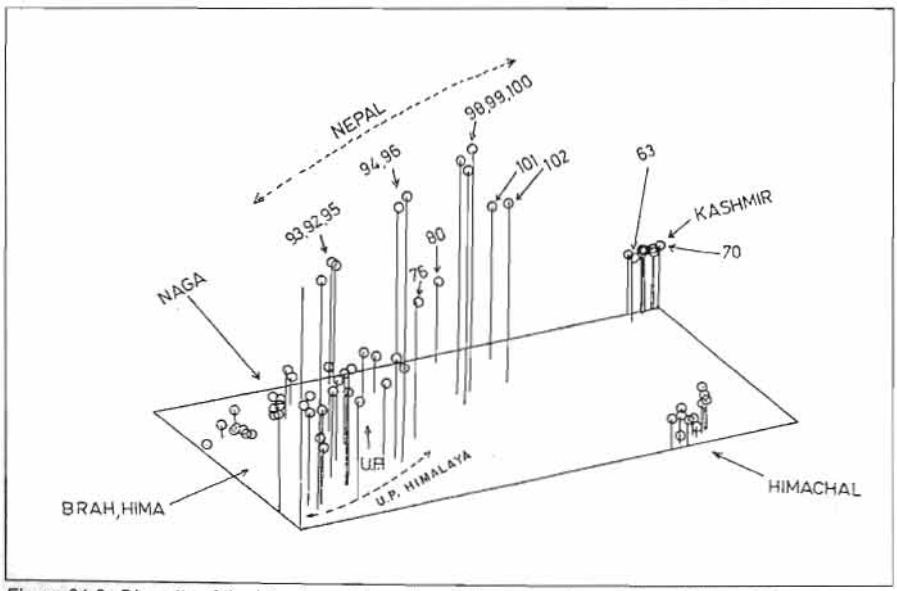


*Figure 31.2: Diversity of the Himalayan Honeybee, Apis cerana, from 66 Localities as Shown by Biometric Analysis (Source: ICIMOD 1994)*

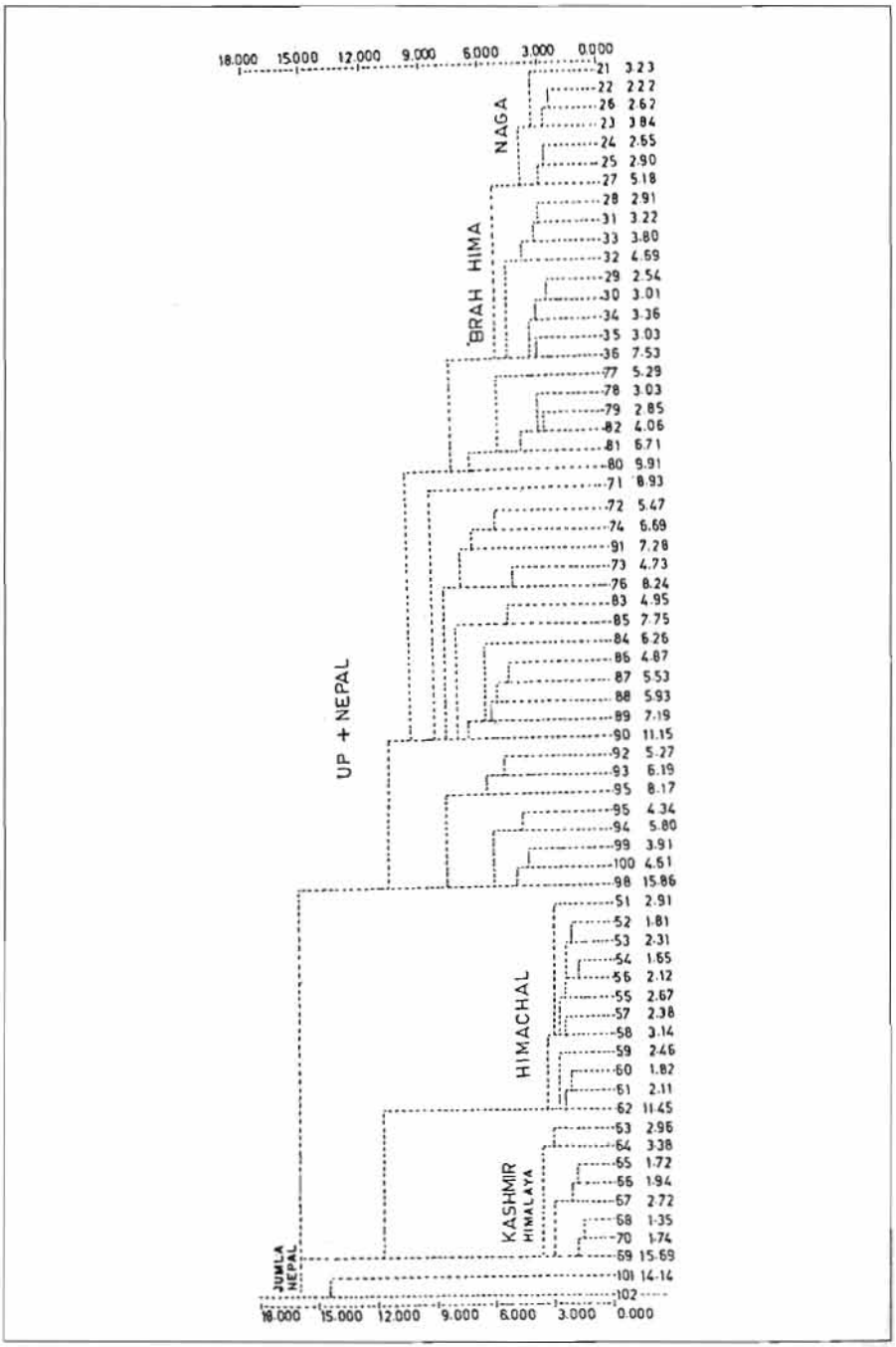


*Figure 31.3: Diversity and Relationship of Apis cerana in the Himalayan Region as Shown by Biometric Analysis (Source: ICIMOD 1994)*

function analysis and cluster analysis of 55 morphometric characteristics of *Apis cerana cerana* from 20 localities in Himachal Pradesh and Jammu and Kashmir revealed two further distinct groups (Figure 31.4). These groups are linked to the differences in climate in the Himachal and Kashmir region (ICIMOD 1994). The phonetic clustering of samples within each region corresponded to general physiography (Figures 31.5 and 31.6) (ICIMOD 1994).

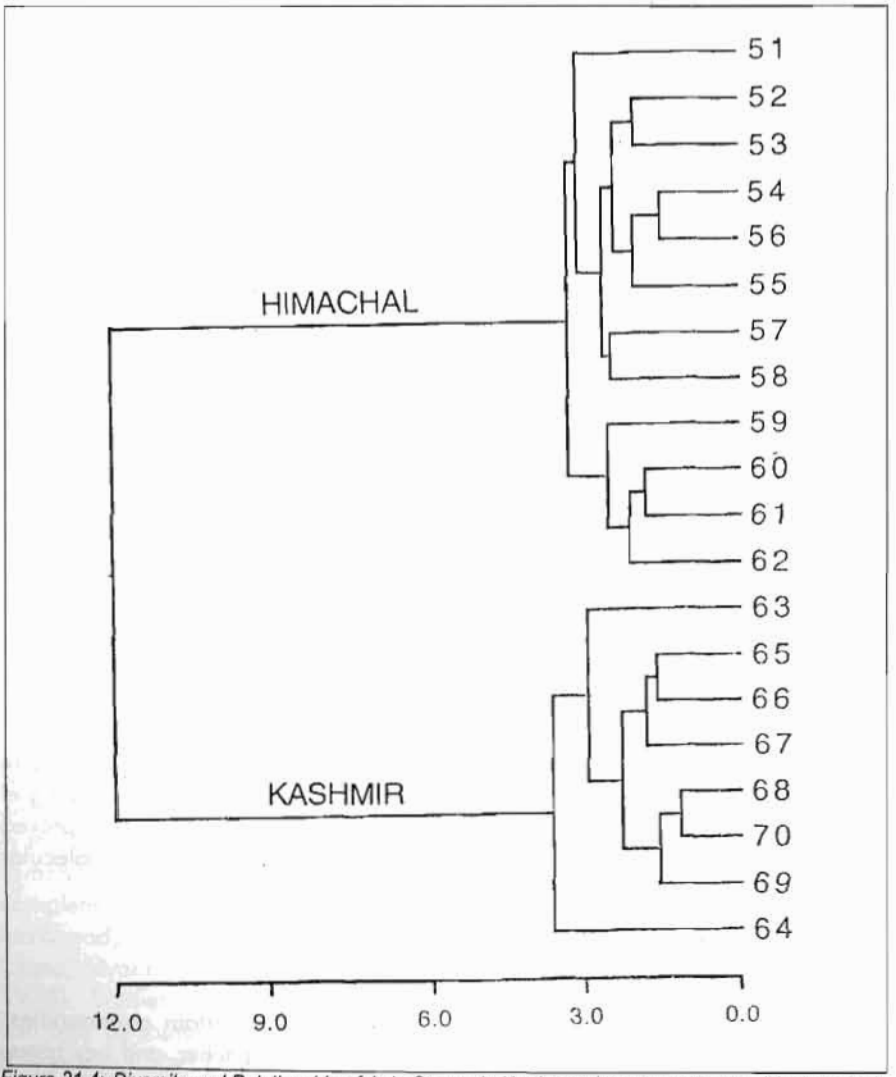


*Figure 31.4: Diversity and Relationship of Apis Cerana in Northwest Himalayan Region (Kashmir and Himachal Pradesh) as Shown by Biometric Analysis (Souce: ICIMOD 1994)*

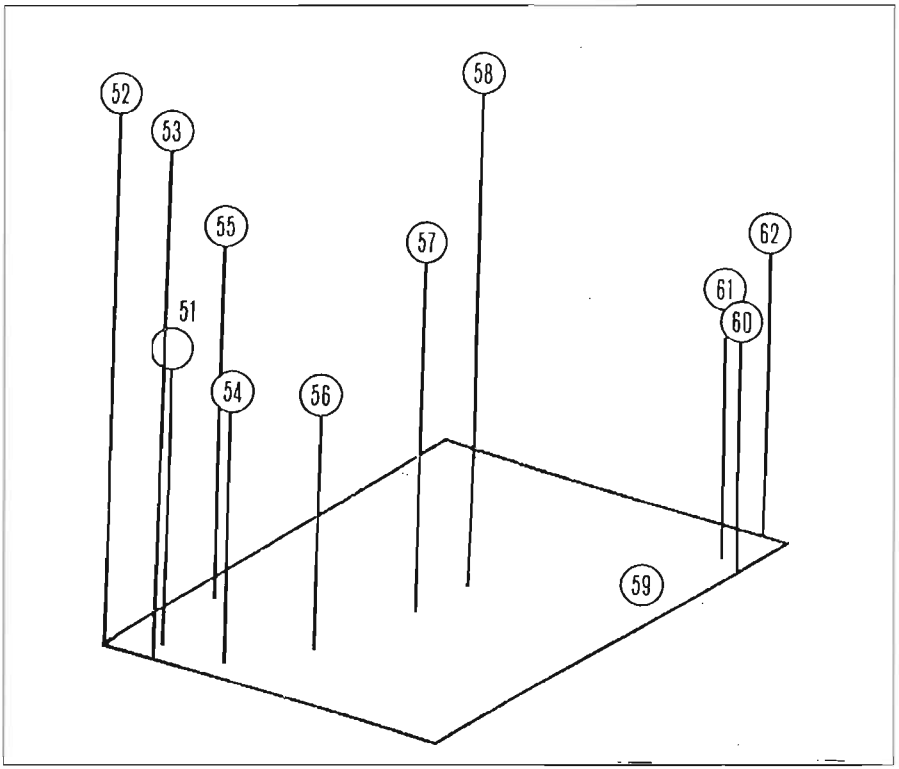


*Figure 31.5: Diversity and Relationship of Apis Cerana from12 Locations of Himachal Pradesh Shown by Biometric Analysis (Source: ICIMOD 1994)*

These studies on the Genetic Diversity of *Apis cerana* also showed variations in characteristics related to the potential commercial value of the different sub-species. For example, the bees of *A. cerana cerana* found in the high altitude areas of Jumla (Nepal), Himachal Pradesh and Kashmir (India), and northern China are larger in size, more productive, and comparable to *A. mellifera* in terms of honey production and other behavioural characteristics (Zhen-Ming et al. 1992; ICIMOD 1994; Partap and Verma 1997). These bees could be improved further for commercial use by means of further selection, breeding, and molecular research.

## The Species and Its Genetic Diversity at Risk

*Apis cerana* is a part of the natural heritage of mountain communities. Traditionally, farmers have kept this species in log, wall, pitcher, and box hives. Beekeeping with this bee species was a low cost technology, but it produced less honey than the imported *Apis mellifera*. This bee species is being rejected by

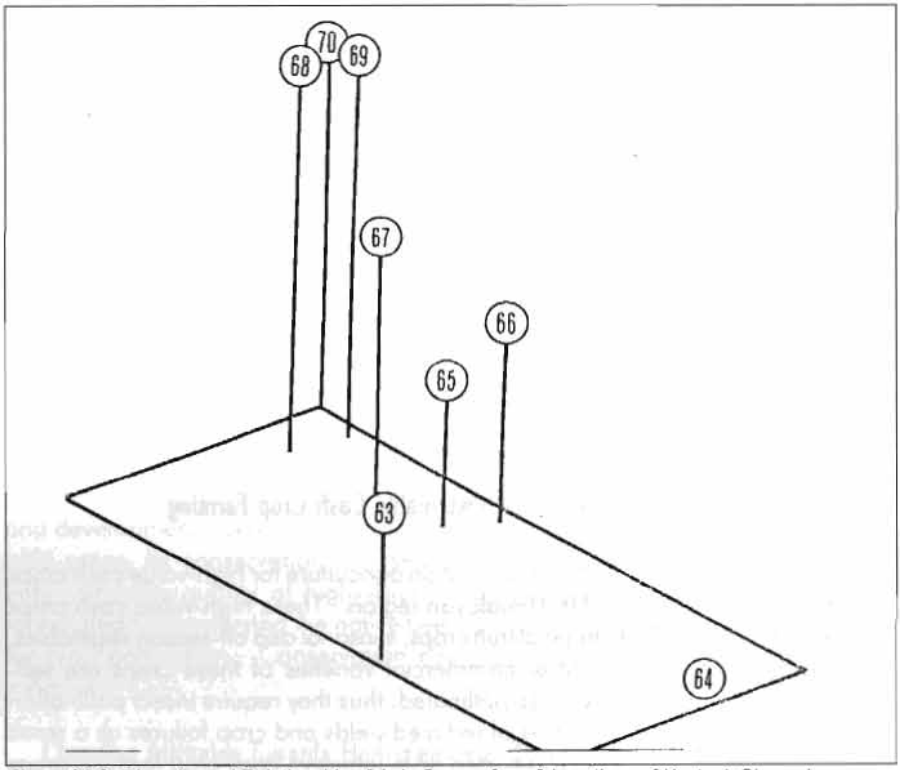


*Figure 31.6: Diversity and Relationship of Apis Cerana from 8 Locations of Kashmir Shown by Biometric Analysis (Source: ICIMOD 1994)*

commercial beekeepers and farmers because of its low honey yield and undesirable behavioural characteristics such as frequent swarming, absconding, and robbing, and production of a large number of laying workers.

*Apis mellifera* has been introduced into the region and is popular among commercial beekeepers. As a result, populations of the native, *Apis cerana*, are declining at an alarming rate, threatening its existence in the last gene pool areas in the Himalayan region (Verma 1993). If the process of replacement of *Apis cerana* with *Apis mellifera* continues for another decade, it could lead to the complete extinction of this valuable Himalayan bee. The process of extinction has already been started and the species is endangered in hill areas of Bangladesh, China, Myanmar, Pakistan, and to some extent India (Verma 1993; ICIMOD 1994). Studies carried out by ICIMOD have shown that at present *Apis cerana* can only be found in a few mountain areas in Nepal and India and in Yunnan Province in China (ICIMOD 1994, Bangyu and Tan 1996). In Pakistan, where *Apis mellifera* has been promoted much more vigorously, the last strains of Apis cerana are kept by a few villagers in the Kalash Valley of Chitral.

In the Himalayan region, Nepal was the biggest gene pool of *Apis cerana* until 1990. Before this there was a ban on the importation of *Apis mellifera* and beekeeping with the native bee flourished throughout Nepal. When the ban was lifted in 1990, *Apis mellifera* was brought in on a large scale, and within six to seven years it replaced the native *Apis cerana* throughout the *Terai* region and the Kathmandu Valley. *Apis cerana* is now only kept by subsistence mountain farmers in highly remote areas such as Jumla and Humla. *Apis mellifera* has not reached these places as a result of both their inaccessibility and the fact that farmers cannot afford winter management practices such as keeping the colonies warm, feeding sugar, or relocating to lower areas. Recent information from Pakistan shows that there are a few hundred colonies of *Apis cerana* left in Pakistan, in comparison with over 90,000 colonies of *Apis mellifera* (Muzzaffar 1998). Thus there is clear evidence of a process of extinction of *Apis cerana* in the HKH region.

## Potential for Using *Apis Cerana* in Sustainable Cash Crop Farming

The process of diversification of mountain agriculture for high-value cash crops is gaining popularity in the HK-Himalayan region. These high-value cash crops include temperate and sub-tropical fruit crops, seasonal and off-season vegetables, and vegetable seed crops. Most commercial varieties of these crops are self-incompatible and essentially cross-pollinated, thus they require insect pollination to set fruit or seed. Already cases of reduced yields and crop failures as a result of failed pollination have been reported from intensive cash crop farming areas (Partap and Partap 1997).

The natural insect pollinators play an important role in the pollination of crops that bloom during the summer season, but they are mostly absent during the late winter and early spring seasons when apple and other fruit and vegetable crops bloom in the high mountain areas. Moreover, the area under cultivation of crops requiring cross-pollination by insects is also increasing, creating an artificial shortage of pollinators. Other problems are the decline in the population of natural insect pollinators as a result of habitat alteration, which has caused a decline in their nesting habitats and food sources, and the negative impact of modern agricultural inputs. The indiscriminate use of pesticides has killed many useful insects. Thus honeybees and other natural insects should be managed for the pollination of different crops (Partap and Partap 1997).

The information available shows that the value of honeybees in crop pollination is many times more than their value as producers of honey and other bee products (Verma 1992, Verma and Partap 1993, Partap and Partap 1997). The diversity of mountain crops that are dependant on or benefit from bee pollination includes fruit and nuts, vegetables and pulses, cereals, oilseed crops, condiment and spice

crops, drugs and beverage plants, forage crops, timber trees, and natural vegetables. Studies carried out in ICIMOD and elsewhere show that *Apis cerana* is an excellent pollinator. It is better than *Apis mellifera* at pollinating mountain crops such as almonds, apples, cherries, pears, plums, and the various seed vegetables that bloom in early spring (Partap and Verma 1992, 1994; Verma and Partap 1993, 1994; Partap and Partap 1997). *Apis mellifera* is also an excellent crop pollinator, but the race of *Apis mellifera* that has been imported to this region is highly susceptible to cold and needs to be migrated to low hill areas during the winter. Thus it cannot be used for pollination of early blooming mountain crops. Since the native *Apis cerana* is cold resistant, there are good prospects for promoting this bee for crop pollination in hill and mountain areas. This would help in the conservation of this valuable bee, as well as benefitting the development of sustainable cash crop farming in hill and mountain areas.

If beekeeping is only done for honey production, there is no match for *Apis mellifera* and no way we can save *Apis cerana*. But mountain farmers, institutions, and development agencies will need *Apis cerana* for pollination of cash crops in cold areas. Its conservation is essential for maintaining the productivity and enhancing the quality of high-value mountain crops. Strategies need to be formulated for conserving the native bee, *Apis cerana*, by promoting its wider use for crop pollination. Conservation could be achieved through the following initiatives.

### Changing Attitudes Towards Honeybees and Beekeeping

The traditional way of thinking is that beekeeping is for honey production. Crop pollination has been given only a secondary role. At present, policies are only formulated to favour increased honey production. However, the recently introduced high-value cash crops, such as fruit and seasonal and off-season vegetables, require cold-resistant insects for cross pollination. *Apis cerana* is ideally suited for playing this role. Thus there is a strong need to change the mind-set of planners, policy makers, beekeepers, and farmers about honeybees in order to recognise their role as crop pollinators rather than simply as honey producers. New policies need to be formulated that place more emphasis on the use of bees for pollination.

### The Promotion of *Apis Cerana* for Pollination

As discussed earlier, the wild honeybee species native to the region, *Apis dorsata*, *Apis florea*, and *Apis laboriosa*, cannot be managed for pollination. *Apis cerana* is the only species kept in hives that can be transported to fields for pollination of the crops that flower during spring and early winter in hill and mountain areas.

As mentioned above, the sub-species *A. cerana cerana* found in high altitude areas of Nepal, India, and northern China is highly productive, with honey production and behavioural characteristics comparable to those of *A. mellifera*. Research efforts are now needed to multiply the colonies of this sub-species through selection, breeding, and mass rearing of queens. This would require a large-scale selection programme carried out over many years. Those colonies that maintain highly prolific queens and a good number of brood and adult bees are resistant to different diseases and parasites (particularly the dreaded Thai Sac Brood Virus disease), have less swarming and absconding tendencies, and have good honey gathering qualities should be selected and multiplied. Such colonies would be chosen by those farmers and commercial beekeepers who might otherwise prefer *A. mellifera*. To produce such a race of *Apis cerana* would require a lot of research effort and at least five to ten years of selection work. However, the outcome could be a race of *Apis cerana* that is comparable to *Apis mellifera* in honey production and which at the same time has a niche in the Himalayan agricultural systems.

These days, non-government organizations (NGOs) are playing an important role in development. Since the native bee, *Apis cerana*, is more effective as a pollinator of the early blooming mountain crops, NGOs should help promote this bee species for crop pollination as the number of bee colonies at present is much less than required for this purpose. In addition to NGOs, the commercial beekeepers who mainly keep *Apis mellifera* for honey production could be encouraged to keep *Apis cerana* for crop pollination by giving them adequate training in managing honeybees for this purpose; and other incentives such as a support price.

### Encouraging Farmers to Keep *Apis cerana* Colonies

Mountain farmers and keepers of orchards clearly need bee colonies for the pollination of their apple and other fruit crops. However, most beekeepers are not interested in renting out their bee colonies for pollination. The awareness among farmers of the importance of beekeeping for fruit crop pollination needs to be raised. In addition, farmers should be encouraged to keep their own bee colonies to ensure adequate pollination of their cash crops.

The population of the native bee species, *Apis cerana*, is declining. Since there is a serious pollination problem in mountain areas leading to very low crop yields, and sometimes even crop failure, there are great prospects for promoting *Apis cerana* for pollination. Once the use of *Apis cerana* for crop pollination becomes popular, the goal of conservation will be achieved automatically.

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