

CHAPTER 3

Apiculture and Integrated Rural Development

3.1 INTRODUCTION

Majority of the population in the Hindu Kush-Himalayan region lives at, or below, the subsistence level, and mainly in the rural areas. These include tenant farmers, landless people, farm labourers who have no access to land for the purpose of farming for themselves. Due to demographic pressures unemployment is increasing and the numbers of poor and destitute are constantly increasing. Efforts, therefore, must be made to raise the economic and social status of the weaker sections of the mountain rural communities within the overall context of human resource development. In this task, large multimillion dollar and multifaceted projects may be important; however, small farmers' projects such as on apiculture can also play an important role in a developing rural economy. Apiculture has great self-help potentials for the rural people of the developing countries. It can make a significant contribution to the economic upliftment of small and marginal farmers for the following reasons:

- provides food and cash income
- does not require ownership of land
- provides opportunities for small-, medium- and large-scale farming
- provides gainful employment close to home
- promotes cooperation within the family and society
- can be adopted as a spare-time, part-time, or full-time occupation
- requires little investment and infrastructure
- the technology is simple to follow
- helps local craftsmen to earn extra wages

- the hive products are harvested locally and do not require special storage facilities
- diversifies the economy
- earns foreign exchange
- enhances the productivity level of agricultural, horticultural and fodder seed crops
- helps in overcoming the problems of malnutrition and health in rural areas
- solves social and environmental problems

Traditional knowledge about beekeeping acquired over centuries has always been an important and substantial aspect of the culture and technology of mountain farmers. However, ecological degradation, changing agricultural patterns, use of biocides and diminishing faith in traditional wisdom has led to a decline in honey production. As a result, an item contributing to the subsistence economy of hill farmers has been left out. Today, it is difficult for the common man to purchase honey as it costs more than US \$3.00 per kilogramme in the Hindu Kush-Himalayan region.

3.2 APICULTURE AND RURAL ECONOMY

Broad rational development of apiculture in the Hindu Kush-Himalayan region offers varied possibilities, several advantages and great promise to a developing economy. Even rough estimates show that modern beekeeping can contribute millions of dollars through the sale of hive products and pollination services. The impact of beekeeping as a cottage industry on rural income in the Hindu Kush-Himalayan countries is reviewed as follows:

3.2.1 INDIA

As per 1985–1986 statistics, there are about 1 million bee colonies of native *Apis cerana* and exotic *Apis mellifera* kept in modern and traditional hives in India and annual honey production is more than 18,000 metric tons. At present more than 40,000 villages are covered by different national agencies under the beekeeping development programme and it provides part-time employment and cash income to more than 250,000 persons (Anonymous, 1987).

Keeping in view the vast areas of land under field crops and forests in the country, there exists tremendous potential for the expansion of apiculture in India. For example, total cropped area in India is about 160 million hectares, and out of this 55 million hectares are under entomophilous crops requiring cross-pollination by bees and other insect

pollinators. So the number of colonies required exclusively for pollination purposes would exceed 150 million against the present strength of only one million (Mishra and Singh, 1987).

3.2.2 CHINA

China is a vast country with 9.6 million sq km in area. After the USSR, this country is one of the largest producers of honey in the world.

There are at present more than 8.5 million honeybee colonies kept in modern hives in China. Out of these, 70 per cent are European honeybees *Apis mellifera* and the others are the native hive bee *Apis cerana*. The annual honey production is over 200,000 tons per year. China has also developed technology for royal jelly, pollen and propolis production on a commercial scale. The total royal jelly and bee pollen production is 800 and 1000 metric tons, respectively. In addition, beeswax and propolis are the other two important hive products harvested. About 30 to 40 per cent hive products are used for domestic consumption (Zhenming, 1990). At present China produces 60-70 per cent of the total Asian honey production and 13 to 14 per cent of the total world honey production (ITC-UNCTAD-GATT, 1986).

China is the largest honey exporter in the world. In 1984, this country exported more than 45,000 tons of honey which is about 93 per cent of the total Asian export and 16.72 per cent of the total world production export (ITC-UNCTAD-GATT, 1986). This has greatly helped in increasing the state income because for each ton of honey exported, it can import 3.5 tons of steel and 6 tons of fertilizers (Svensson, 1977). China plans to expand beekeeping on a larger scale still by establishing new commercial apiaries. The project target is to increase honey production by 1,300 tons every year.

3.2.3 PAKISTAN

There are at present 35,000 to 40,000 *Apis cerana* and 65,000 to 75,000 *Apis dorsata* colonies in Pakistan. In recent years, the European honeybee, *Apis mellifera*, has been introduced, and its present number is about 14,000. The current annual honey production from different species of honeybees is about 640 tons. The price of honey varies from 40 to 50 rupees at the producer level and 80-140 rupees per kilogramme in the city markets. At present more than 7.3 million hectares of land are under entomophilous crops which require about 21 million colonies of bees exclusively for pollination purposes. In addition, more than 10 million hectares of land area are under forests which can also support a large number of bee colonies. The projected target is to have 0.5 to 0.6 million bee colonies in Pakistan and to

increase honey production to 8,000 to 10,000 tons per annum. Such expansion of the beekeeping industry in Pakistan is expected to provide employment to 35,000 to 40,000 persons (Ahmad, 1990).

The North West Frontier Province (NWFP) of Pakistan is very suitable for beekeeping on account of its different ecological zones containing rich bee flora and ideal climatic conditions. It has 8.33 million hectares of land of which 2 million hectares are cultivated. This province has the potential to produce 35 tons of honey per annum against the present low production of 2 tons (Shahid, 1990, Khan, 1990).

3.2.4 BANGLADESH

Bangladesh at present produces 350 tons of honey worth about 42 million takka. There are about 8,000 beekeepers in Bangladesh maintaining 10,000 *Apis cerana* colonies in modern and traditional hives. There are certain potential beekeeping areas which can support 10 bee colonies per sq km. It has been estimated that Bangladesh has the potential to produce honey worth about 10 to 50 million US dollars (Svensson, 1988 and Mohamed, 1984).

3.3 APICULTURE AND FOOD SECURITY

In the developing countries of south and southeast Asia, a "Green Revolution" has been possible through the introduction of new high yielding varieties of crops which require substantial inputs of chemical fertilizers, biocides, irrigation facilities and heavy machinery, etc. It is only in plains, however that the "Green Revolution" has been successful because governments have provided capital, infrastructure and price incentives to help farmers take advantage of the new production package. For the majority of the mountain farmers this new technology continues to be unaffordable and unavailable. Further, indiscriminate use of biocides and fertilizers creates immediate dangers for the farmer's family, and long-term negative ecological consequences. The major emphasis for the socio-economic uplift of mountain farmers should therefore be to concentrate research and development efforts on technologies that are low cost, appropriate in scale and operations, safe and affordable.

Swaminathan (1986) in his forwarding note in FAO Service Bulletin on Tropical and Sub-tropical Apiculture stated "In spite of all global resolutions on food security, several hundred million children, women and men are going to bed hungry every day, particularly in the countries of 'South'. Since, prospects for a global food security system appear to be small at the present moment, it will be for the developing countries, characterized by poverty and under-nutrition, to build their own national food security systems. In this task, apiculture can play a

useful role. At very little expenditure, honeybees will not only provide food and income, but will also enhance the productivity of horticultural and other field crops by their pollination activities."

The cultivated crop plants that are dependent on or benefited by honeybee pollination are listed here (Kevan, 1984).

- 1) Fruits and nuts
- 2) Vegetables and pulses
- 3) Cereals
- 4) Drug, beverage, condiment and spice plants
- 5) Oil crops
- 6) Forage crops
- 7) Timber trees and natural vegetation
- 8) Fibre plants and rubber

Beekeeping thus forms an integral component of the different farming systems such as agriculture, horticulture and animal husbandry. The importance of beekeeping lies in the fact that it does not compete with other farming systems for resources because the bees simply collect honey and pollen from the plants which would otherwise go waste in nature. It has been estimated that the value of honeybees as pollinators of different agricultural, horticultural and fodder crops are 10 to 20 times more than their value as honey producers.

The following facts and figures support this statement:

1) After achieving self-sufficiency in wheat and rice production, increasing the production of oil seeds is one of the major thrust areas in agriculture production being ensured by planners and policy makers, because half of the world's diet of fats and oils comes from these crops. Many of these plants are dependent on or benefited by honeybee pollination. Thus one-third of the total diet is directly or indirectly dependent on honeybee-pollinated plants.

2) The yield of animal husbandry products (dairy products, poultry, lamb, pork and beef) can be enhanced considerably because fodder and livestock ration feed is derived one way or another from honeybee-pollinated crops such as alfalfa, clover, trefoil and lespedza.

3) Increased use of fertilizers is creating serious problems of environmental pollution. Therefore, at present the major focus is on the utilization of atmospheric nitrogen for enriching the soil. Many honeybee-pollinated legume plants play an important role in this process.

4) Several commercial varieties of temperate fruits, vegetables and nuts are self-incompatible and require cross-pollination for which honeybees are the most efficient. This aspect is discussed in detail in Chapter 4.

One good example of beekeeping as an integral component of different hill-farming systems is being followed by the apple growers of Himachal Pradesh in northern India. Apple orchardists put honeybee

colonies in the orchard at the time of apple bloom for cross-pollination of self-incompatible commercial varieties like Red or Royal Delicious without which efficient and sufficient pollination does not take place, and ultimately the yield of the apple crop is affected. At the same time, they also sow certain legumes in the orchard as cover crops. Such diversity of inter-crop systems not only provides the orchardist with oil seeds, fodder and soil-enriching nitrogen, but these cover crops are also excellent sources of nectar and pollen for honeybees. Thus they act as alternate bee forage plants particularly at a time when apple orchards are not in bloom and there is a scarcity of bee flora (Verma, 1989b).

3.4 APICULTURE AND NUTRITIONAL SECURITY

In the developing countries of the Hindu Kush-Himalayan region, malnutrition among the underprivileged and children, and lowered working capacity of the adult population offer serious constraints within the overall context of human resource development. In order to alleviate such nutritional problems, national development strategies are being reoriented. Now greater emphasis is being laid on food diversity through the production of supplementary foods, instead of putting their thrust on a few cereal crops such as maize, wheat and rice through monoculture practices. This new strategy will broaden the food base of the poor rural people and will ensure good nutrition and health. In solving the problem of malnutrition due to overall shortage of calories and proteins, different hive products of the apiculture industry can be of great help.

The natural products which honeybees produce and humans now use are honey, royal jelly, pollen, propolis, beeswax and bee venom. These materials have been widely used as nutritious food and for medicinal and pharmacological purposes since ancient times. Extensive research on the chemical and biological properties of honey has shown that it contains most elements found in food and pharmaceutical products. Besides sugars, honey is rich in minerals, proteins, amino acids, vitamins, enzymes and about 181 other minor constituents. It is generally eaten as table honey and is also used in packing, confectionery, preserves, spreads, syrups, meat packing, or in cosmetics, etc. Many tribal people in the Himalayan region are almost entirely dependent upon honey for sweetness because cane sugar cannot be grown in the hilly region. Even otherwise, honey is considered superior to other sugars because of its flavours, texture and preserving qualities.

Man has also been a consumer of pollen or pollen-containing foods. Pollen collected by honeybees is very rich in minerals, protein, carbohydrates, lipids and is considered a highly concentrated energy source.

Pollen products are now being marketed as human food supplements with various nutritional and health benefits. Pollen is also beneficial when incorporated in feed rations for certain farm animals. The importance of pollen for beekeeping was already recognized in ancient times, as it is required for the normal growth and development of the bee larvae. However, now pollen as a tablet or mixed with honey is often used as a 'natural food' for human consumption. Pollen and pollen protein extracts can serve as biostimulants in feeding rations of domestic animals. For example, pollen feeding increases egg production in poultry by 17 per cent.

Another miracle food produced by honeybees is royal jelly. The nutritional effects of royal jelly may be attributed to the combined action of various components such as sugars, proteins, vitamin B and sterols. It is used either fresh or raw, mixed with honey, or freeze dried. Royal jelly improves health and longevity. Several Asian countries have already taken a lead and are the world's largest producers of royal jelly. For example, China produces about 800 tons of royal jelly. The wholesale price of royal jelly is US \$100/kg (FAO, 1986). The comparative chemical composition of these hive products is given in Table 3.1.

Table 3.1: Comparative chemical composition of hive and other food products (all mean values and ranges in percentages)

Product	Water	Protein	Carbo- hydrate	Fat	Minerals
Honey	17	—	80	—	0.02–1.0
Pollen (Bee collected)	7–17	7–30	21–48	1–14	1–6
Royal Jelly	65–70	14–18	9–18	2–6	0.7–1.2
Bee Brood (mature worker larvae)	77	15	0.4	4	3
Beef	64	19	16	Zero	1
Milk	87.2	3.5	4.9	3.7	0.7

Source: F.A.O. bulletin 68 (1986).

The above natural products of the hive, besides their nutritive role, have been used for centuries all over the world in therapy as medical agents. These materials along with bee venom (Acupuncture), beeswax and propolis can cure more than 50 human diseases varying from simple body burns or cuts to complex diseases like cancer. The list of such diseases curable through apitherapy is given in Table 3.2.

Table 3.2: Medicinal properties of hive products*

Honey:	<ul style="list-style-type: none"> — Anti-microbial properties — Curing burns and wounds — Respiratory infections — Heart diseases — Rapid source of energy — Sedative properties — Golden wonder
Royal Jelly:	<ul style="list-style-type: none"> — Anti-tumour activity — Anti-microbial properties — High blood pressure — Arthritis — Joint pains
Propolis:	<ul style="list-style-type: none"> — Anti-microbial activity — Skin burns — Joint pains
Bee Venom: (Acupuncture therapy)	<ul style="list-style-type: none"> — Paralysis — Rheumatism — Arthritis — Cancer — High blood pressure — Anti-microbial activity

*Compiled from multiple sources.

3.5 APICULTURE AND WOMEN'S DEVELOPMENT

In the overall socio-economic scenario of the Hindu Kush-Himalayan region, women are the most neglected and under-privileged group of the rural community. One of the important tasks for future policy planners must be integration of this under-privileged section of women into the social life of the whole rural population. The word integration implies full utilization of under-utilized resources which can improve the income, living standard and social status of women in rural communities. One such resource which comes under this category is beekeeping.

Projects to encourage beekeeping programmes for women are needed because the work is not heavy and they can perform all types of hive management operations such as harvesting, processing, packing and marketing of the hive products. It allows time flexibility and provides gainful employment close to home, nutritional benefits to the elderly and to children, and financial independence to housewives. It broadens the food base of rural communities and provides an excellent sweetening source particularly in the hills where sugar

cane is not grown. The Asiatic hive bee, *Apis cerana*, is gentle in temperament and much easier to handle than the European honeybee, *Apis mellifera*. *Apis cerana* is ideally suited for women entrepreneurs to start beekeeping with this local honeybee species.

As compared to men, the level of education of women in the mountain areas is very low. For example in Nepal, women's literacy is 12.5 per cent as compared to men's literacy of 33.96 per cent (Shrestha, 1988). Even illiterate persons can practice beekeeping. Although women in the Hindu Kush-Himalayan region have been practising traditional methods of beekeeping since ancient times, there are only a few women entrepreneurs engaged in modern beekeeping.

4.1 INTRODUCTION

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The vital role which honeybees play in the pollination of large numbers of agricultural and horticultural crops is often underestimated. As a matter of fact, the main significance of honeybees and beekeeping is pollination, whereas hive products, like honey and beeswax, are of secondary value. This is evident by the fact that income from agriculture by the use of honeybees in crop pollination is many times greater than their value as honey and beeswax producers. Many cultivated crops do not yield seeds or fruits without cross-pollination of their flowers by honeybees and other wild insects. Cross-pollination of entomophilous crops by honeybees is one of the most effective and cheapest methods of increasing their yield. Other agronomic practices like manuring, fertilizers, pesticides and irrigation are quite cost-effective and these may not yield the desired results without the use of honeybees for enhancing the productivity levels of different cultivated crops through