CHAPTER 7: SUSTAINABLE DEVELOPMENT AND APICULTURE INDUSTRY

7.1: INTRODUCTION

Sustainable development, as defined by the Rio Declaration on Environment and Development at the UN Earth Summit 1992, means "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Makerere University, Faculty of Agriculture, 2001, p. 17). Sustainable development, as the preceding chapters have demonstrated, has an intrinsic relationship with apiculture industry. Apiculture industry is important in a sense that it has ability to save the planet and plants through pollination. Further, for many it is also a means of livelihood. "A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base" (Bradbear, 2003, p. 1).

The main thrust of the chapter is to establish the linkages between sustainable development and the apiculture industry. In doing so, the chapter seeks to suggest ways and means for the development of apiculture industry such as livelihood development through apiculture, and pollination services through the same. Here it is imperative to note that the environment can also be rectified through apiculture. Yet without nature, apiculture is impossible and without bees (the main actors of apiculture), nature will be in a disorder. Since honey, the main product of apiculture, is created from nectar, environment can also be judged by examining contaminated elements in the honey. In other words, in the degraded environment honey has now turned out to be of a lesser quality. This makes it pertinent for us to produce organic honey, but for that, it is imperative that we create environment for the simultaneous development of organic agriculture. Needless to say, the production of a good quality of honey requires organic agriculture. As such there is a need of various initiatives at a global level to encourage apicultural practices which can help people to sustain and improve their livelihoods and at the same time, balance ecological biodiversity (Makerere University, Faculty of Agriculture, 2001, p. 17).

Honey and beeswax as well known are products from bees. But the main service provided by bees is pollination. Pollination services, more often than not, are undermined and underrated in most countries (Bradbear, 2009, p. 3). Thus, one of the main focuses of the chapter is to give an idea regarding pollination services and the need for the preservation of Indian native bees, particularly, Apis Cerana. It needs to be mentioned here that there are about four crores bee colonies in the world. The United States has about fifty lacs bee colonies, The USSR has

about fifty five lacs and China has one crore bee colonies. In case of China, few decades back, it had sixty lacs bee colonies which they plan to increase to five crores in the next few decades. Consequently, China has come up with various agendas like - a big scale forestation, road-side plantation and other programmes which include bee-flora for bees and timbers for manufacturing large quantity of bee-boxes (Phadke, Beekeeping as an Industry and Its Role in Foresty, Agriculture and Horticulture, 2008, p. 45).

Such initiatives are also required in India as many in the country lie at the periphery. For instance, tribal, physically challenged individual, women and landless people can earn a way of empowerment through this activity. In addition, such activities can meet the needs of the present and simultaneously can enhance the quality of nature for present and future generations which gives them sustainable live and livelihood.

7.2: LIVELIHOOD

In India the pre-independence era, Mahatma Gandhi emphasized on the empowerment of the rural populace. According to him economic development in any country with a majority of population in poverty could be possible through the encouragement and revival of the labour intensive traditional cottage industries. For instance, khadi, the coarse cotton cloth manufactured with traditional hand-spinning and hand-weaving technologies in cottages of rural India, was adopted as a symbol of this programme. The objectives of this programme were rural upliftment, self-reliance, production of daily needs of the people indigenously. This, however, would be done by using indigenous resources and technologies. This had various advantages as it would avoid dependence on and exploitation by, the foreign government, accelerate decentralized production system, and moreover, it had provision for employment with self-respect to the rural poor, at their own place. With regard to apiculture industry, it has an added advantage as the industry needs little investment and gives nutritive and medicinal products. Hence, the apiculture industry was included as one of the activities in the Constructive Programme. (Suranarayana, 1994)

Being motivated by the experience of the industrial revolution in Europe, after independence, India launched a massive programme of rapid industrialization. However, this programme mainly benefited the elite section of the people coming from the cities and urban areas. But the poorest section of the rural population remained bypassed. Nevertheless, in the ‘second phase development programmes’ India gave more emphasis on agriculture. Huge investments

were made in agricultural research, extension and training in order to boost-up production of crops like cereals, oilseeds, pulses, tea, coffee, sugar etc. In the 'eighties' India witnessed first Green Revolution and became self-sufficient in food production, ranking world's fourth largest food grain producer. Special efforts were also made to develop various agro-based industries like dairy, poultry, fish farming, sericulture and beekeeping and the results achieved there on were spectacular. Out of these, Beekeeping Industry, however, received inadequate attention resulting into stagnation.

It is estimated that with the improved techniques, 50 per cent of the India's total land can be made available for agriculture which coupled with forests and plantation lands provides huge opportunities for apiculture to small and marginal farmers, landless agricultural labourers, tribal and educated unemployed can take up this apiculture industry as an avocation in order to improve their economic conditions. Thus, a new class of farmer-beekeeper can also be created who does not compete with agriculture or animal husbandry or bring any pressure on agricultural or forest lands but can accelerate the development of these industries (Phadke, Beekeeping as an Industry and Its Role in Foresty, Agriculture and Horticulture, 2008, pp. 39-43).

Apiculture practice can be categorized into three ways- such as 'honey hunting', 'beekeeping' and 'bee maintaining'. In 'honey hunting' people exploit honey by destroying natural bee-hives which are mainly found in trees and bushes. 'Beekeeping' on the other hand, is totally a modern technique. In this technique bees are kept, maintained, breed and moved from one place to another. 'Bee maintaining', falls somewhere between honey hunting and beekeeping – where the beekeeper provides a nest site, or protects a colony of wild bees for subsequent plundering (Bradbear, 2009, p. 29).

Apiculture is also practised for reasons apart from honey production. Some farmers tame bees to ensure the crops pollination; others keep bees to harvest honey and wax, and some farmers keep stingless bees for honey which is especially valued for medicinal purposes. Besides, recently there was a report from Laikipia Plateau in Kenya which highlighted as to how bees were being used as a 'living fence' to keep elephants away from smallholdings. (Bradbear, 2009, p. 1)

As mentioned earlier, bees and beekeeping contribute to peoples' livelihoods at the global level (Bradbear, 2009, p. 2). Beekeeping is a useful means of strengthening livelihoods

because it creates a variety of assets (Qaiser, Ali, Taj, & Akmal, 2013, p. 1). Beekeeping has enormous potential for poverty alleviation and sustainable use of forest resources (FAO, 1990). Besides this, it is an important subsidiary occupation providing supplementary income to most of the farmers and to a large number of rural and tribal populations (Tiwari, Tiwari, & Singh, 2013, p. 16).

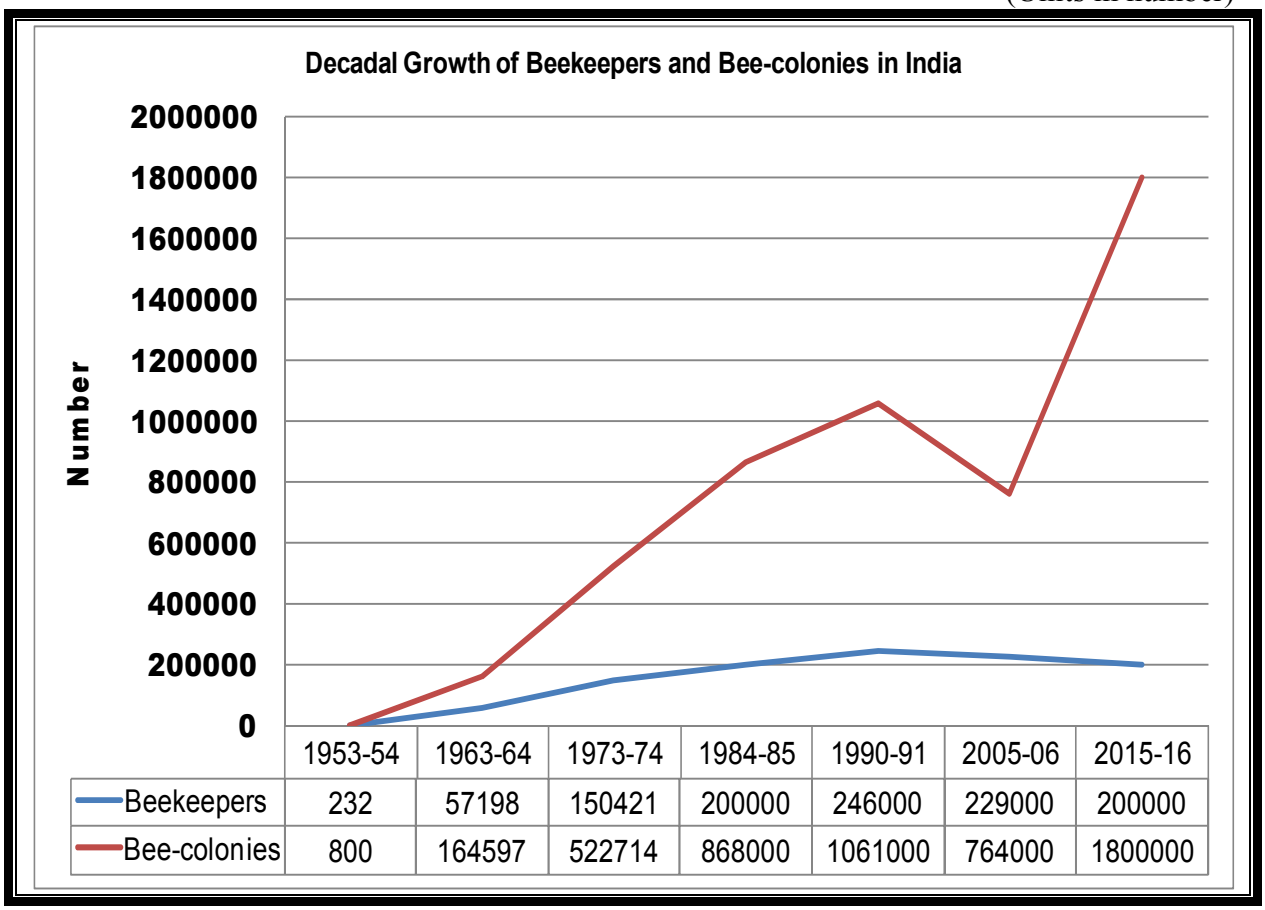
7.2.1: Apiculture as Livelihood in India

Dr. B.L. Sarswat, Executive Director, National Bee Board has said, in the Annual Action Plan Report of 2015, this industry has opportunity for employing about 215 lacs persons in India. Apiculture industry has great self-help potential for rural people, tribal, and land-less labourers, etc. This industry creates great opportunities for our livelihood development by giving honey, supplying great food value, providing cash income, by giving beeswax (with demand), giving pollen, propolis, bee-venom and royal jelly (which are very high value products). This industry also helps the people in livelihood development by providing part time employment without sacrificing main occupation; by rendering a double benefit service, by providing bee pollination services to farmers for increasing crop production and productivity of honeybees and by generating income through processing and value adding of Bee-products (Sarswat, 2015). In India, apiculture covers about 400000 villages providing part-time employment to 250000 persons (NPCS Board of Consultants & Engineers, p. 22). Graph 7.1 has depicted the decadal growth of livelihood as beekeepers in India and number of bee-colonies keeping by them. Where in 1953-54 there were 232 peoples accepted their livelihood as beekeepers and they hold 800 bee-colonies only in India, those are now (2015-16) reached at 1800000 bee-colonies which are kept by more than 200000 beekeepers. Growth of India in this sector is high but India can achieve at better position than now. Few accidental events have been occurred during this period. Mainly, the number of bee-colonies of north India had come down during few couple of years in early eighties and that of south India also had come down in early nineties mainly due to sac-brood disease (NPCS Board of Consultants & Engineers, p. 212). Table 7.1 has shown decade over decade growth of beekeepers and bee-colonies in India. Highest growth of beekeepers (24554%) and bee-colonies (20475%) is found in the year 1963-64. But after that, growth rate of beekeepers and bee-colonies in India have been declined decade after decade. Though in the year 2015-16 beekeepers' growth rate has declined (-12.66%), the growth rate of bee colonies has increased (135.60%) in this year (Table 7.1). It means bee-colony holding per beekeeper has

been increased now for attaining their better livelihood. More concentration is needed to popularise apiculture profession and at the same time attempts have to increase holding of bee-colonies per beekeeper in India. Because, it is estimated that India has Potential & requirement for 200 million bee colonies (Sarswat, 2015). Now, more than two lacs people of India have taken beekeeping profession for their livelihood and are maintaining around nine bee-colonies per beekeepers. Moreover many people are engaged indirectly with this profession. But in India according National Bee Board (NBB) only 5291persons (Table 2.11) are registered as beekeepers. All beekeepers have to be registered under NBB for a transparent picture of this profession.

GRAPH 7.1: DECADAL GROWTH OF LIVELIHOOD AS BEEKEEPERS IN INDIA AND NUMBER OF BEE-COLONIES KEEPING BY THEM

(Units in number)



	1953-54	1963-64	1973-74	1984-85	1990-91	2005-06	2015-16
Beekeepers	232	57198	150421	200000	246000	229000	200000
Bee-colonies	800	164597	522714	868000	1061000	764000	1800000

Source: (NPCS Board of Consultants & Engineers, p. 10), (Ezreth, 2010, p. 99) & (Sarswat, 2015)

TABLE 7.1: DECADE OVER DECADE GROWTH OF BEEKEEPERS AND BEE-COLONIES IN INDIA

Year	Beekeepers (number)	Bee-colonies (number)	Decadal Growth of Beekeepers (%)	Decadal Growth of Bee-colonies (%)
1953-54	232	800		
1963-64	57198	164597	24554.31	20474.63
1973-74	150421	522714	162.98	217.57
1984-85	200000	868000	32.96	66.06
1990-91	246000	1061000	23.00	22.24
2005-06	229000	764000	-6.91	-27.99
2015-16	>200000	1800000	-12.66	135.60

Source: (NPCS Board of Consultants & Engineers, p. 10), (Ezreth, 2010, p. 99) & (Sarswat, 2015)

7.2.2: Apiculture as Livelihood in West Bengal

In west Bengal around 7700 peoples have accepted this profession (Table 6.2). People of Malda, North and South 24 Parganas districts have accepted this profession for their livelihood more than in other districts. Having good sources of raw nectar and pollen mainly mustard crops the peoples of North Dinajpur district do not take beekeeping as their livelihood. South Dinajpur has similar opportunity like North Dinajpur but it has only twenty peoples who have taken beekeeping as their profession. West Bengal has seven apiculture cooperative societies. Average employee (like cashier, chemist etc.) of each cooperative society is four who are not directly engaged in beekeeping profession but they are maintaining their livelihood with the help of apiculture cooperative societies of West Bengal. Few people prepare and maintain wooden bee-box, frame and few people are also supply others bee apparatus. They are maintaining their livelihoods indirectly supported by apiculture. In West Bengal there is huge scope of development of apiculture industry. Till date few districts have no beekeepers and no apiculture cooperative societies. In the past some districts had apiculture cooperative societies but they have now been defunct. Many non-government organisations are doing various jobs under the motto of livelihood development, rural development or women empowerment and they have also considered apiculture profession as one of the constituents of such development. Few organisations are there also in West Bengal who take steps for livelihood development through apiculture.

West Bengal Beekeepers Association and Narendrapur Loko Shiksha Parisad are significant organisations who are doing their best for the development of apiculture (Chapter 1).

West Bengal has potential to create alternative occupation as beekeeping for its inhabitants. Total number of Villages is 40218 in West Bengal. Most of the people live in rural area. Total minority populations are 29.21 % in this state. Schedule caste and schedule tribe populations are 29.32% of total populations. Most of the populations are non-workers, which is 61.91% of total population. Among workers 14.72% workers are cultivators, 29.32% workers are agricultural workers. In West Bengal around 96 per cent land holding is with "marginal and small farmers" with less than two hectares land. Total number of bargadars in the state is 1539617. In addition, total houseless people are 134040 and partially disables (speech & hearing) are 462528 in the state. Total number of schools of West Bengal is 82522. In Primary / Junior Basic, Junior High and High & Higher Secondary schools total number of students is 15349373(Census of India, 2011).

Among the districts of the state, West Bengal, area of South 24 Parganas district is the biggest and the climate is pleasant with temperate weather. The mangroves are situated in this area which is called Sunderban. South 24 Parganas district is rich in sources of raw material, nectar (Chapter 1). Most of the populations are non-workers, which is 63.68% of total population. Among workers 11.99% workers are cultivators, 27.21% workers are agricultural workers and other Workers constitute the main work force i.e. 52.7 % of Total Workers. In South 24 Parganas around 605375 are "marginal and small farmers". Total number of bargadars and patta holders in the districts is 325459. In addition, total houseless people are 5436 and partially disables (speech & hearing) are 46528 in this district. This district is densely populated. Language and culture of the people are almost similar. There are total 2,042 villages and 111 Census Towns in the District. Most of the people live in rural area. South 24 Parganas District ranks 4th in decadal population growth rate among the Districts of the state with 18.2%. South 24 Parganas District has the highest Scheduled Caste Population in the State. 31.38% of total populations are schedule caste and schedule tribe. Total minority population is 36.52% of total population of South 24 Parganas District. Total number of educational institutes of this district is 16731 in which 1125888 students are studying. It is the only district in the state that has two active beekeepers' cooperative societies and these societies are formed and registered before the year 2000. Hence, this district has a remarkable experience of bee-keepers' cooperative society activities (Bureau of Applied Economics & Statistics, 2013).

It is known that most of the people of North Dinajpur district live in rural area. There are total 1494 villages and 5 Census Towns in the district. This district has the highest decadal population growth rate in the State with a figure of 23.2% and much higher than the State average (13.8%). North Dinajpur district has maximum proportion of child population (0-6 years) among all the districts in the State i.e. 16.1% of total population are children. The district North Dinajpur has the lowest rank in the State as per literacy. North Dinajpur district stands 15th among all the districts in terms of area (3140.00 sq km) in the State. But 88.48% of which are cropped area. This district is very rich in sources of raw material like nectar, which is collected by the beekeepers from outside the district. Around 60% honey of West Bengal (field Survey, 2015) is collected from North Dinajpur, South Dinajpur and Malda districts. But inspite of having potentiality North Dinajpur district has no beekeeper till date. Most of the populations are non-workers, which is 64.23% of total population. The Work Participation Rate has fallen from 38.3% (in 2001 Census) to 35.8% (in 2011 Census). In North Dinajpur district the percentage of main workers to total workers remains same over the decade at 76.6% in both 2001 Census and 2011 Census. Cultivators and Agricultural labourers constitute the main work force of the district. Hindu population and Minority population are almost same in this district. Schedule caste and schedule tribe populations are 32.28% of total populations. In North Dinajpur there are 257377 are cultivators. The number of "marginal and small farmers" is 270190. Total number of bargadars and patta holders in the districts is 189901. In addition, Total houseless people are 8251 and partially disables (speech & hearing) are 11024 in this district. This district has a remarkable experience of co-operative society activities but do not have any bee-keepers' cooperative society. Total number of educational institutes of this district is 7137 in which 1151445 students are studying (Bureau of Applied Economics and Statistics, 2012).

Hence, there is huge scope of self employment through apiculture in the state. Apiculture training and awareness programme can motivate people to be engaged in bee keeping as a means of livelihood. Beekeeping can give them (especially marginal and small farmers, bargadars, houseless people and partially disabled people) an alternative source of income and a scope for livelihood development.

7.3: POLLINATION

Pollination is essential for all seed and fruit production in flowering plants. Pollination is the process of transfer of pollen from the anthers (male part of a flower) to the stigmas (female

part of a flower), either on the same plant or on a separate plant that may be situated at a distance place. (Bradbear, 2003, pp. 7-9), (Phadke, Beekeeping as an Industry and Its Role in Foresty, Agriculture and Horticulture, 2008, pp. 43-45). Bees help to accelerate these activities. Other insects also do these. But people cannot tame other insects. Bees are tamed by the apiarists. Apiculture is the preservation of honey bee colonies to get pure honey and helps in pollination (Qaiser, Ali, Taj, & Akmal, 2013, pp. 1, 82).

7.3.1: Food Crisis and Honey Bees

Statisticians have estimated that by 2030 the population of India will be about 140 crores. For this population explosion India will have to face two major challenges in the coming decades. Those are to provide employment to large number of youths (for about 35 crore people of the age group between 20 to 40 years) and to provide enough nutritive food to this large population. Agricultural scientists have estimated that India needs minimum 75 lacs bee colonies just to pollinate and increase productivity of 12 major crops which are entomophilous and are dependent on insects like honey-bees for pollination. Beekeeping industry thus can play an integral role in addressing both these challenges (Maharashtra State Horticulture and Medicinal Plants Board, 2008, p. 10), (Phadke, Beekeeping as an Industry and Its Role in Foresty, Agriculture and Horticulture, 2008, p. 37).

It is important to note that three-quarters of our important food crops need bee pollination. Without honey bees, it would be difficult to produce apples, cherries, blueberries, watermelons, strawberries and so on. A world without bees would be fatal; most flowering plants would die out, followed by the animals that eat them. (Huber, 2012, p. 3) An estimated 80 percent of flowering plants are entomophilous i.e. depending more or less on insect pollination to be able to reproduce, and it is estimated that half of the pollinators of tropical plants are bees. (Bradbear, 2009, p. 13),(Phadke, A Background Paper on Bee Research Programme , 2008, p. 18). Dr. B.L. Sarswat, Executive Director, NBB, has shown the Potential benefits due to bee pollination in India, in the form of increase in yield, in various Orchard crops, Misc. Crops and Vegetables (Table 7.2) and in various Oilseeds and Legume crops (Table 7.3) due to bee pollination.

TABLE 7.2: POTENTIAL BENEFITS DUE TO BEE POLLINATION IN INDIA, IN THE FORM OF INCREASE IN YIELD, IN VARIOUS ORCHARD CROPS, MISC. CROPS AND VEGETABLES

Orchard crops	% increase in yields	Vegetables	% increase in yields
Apple Varieties	180 to 6,950	Radish	22 to 100
Pears	240 to 6,014	Cabbage	100 to 300
Plums	6.7 to 2,739	Turnip	100 to 125
Cherry	56.1 to 1000	Carrot	9.1 to 135.4
Straw-berry	17.4 to 91.9	Onion	353.5 to 9,878
Raspberry	291.3 to 462.5	Brinjal	35 to 67
Persimmon	20.8	Cucumbers	21.1 to 411
Litchi	4,538 to 10,246	Miscellaneous crops	
Citrus varieties	7 to 233.3	American cotton	5 to 20
Grapes	756.4 to 6,700	Egyptian cotton	16 to 24
Squashes	771.4 to 800	Buckwheat	62.5
Guava	70 to 140	Coffee	16.7 to 39.8
Papaya	22.4 to 88.9	This increase in yield is in addition to value honey and other hive products. Bee pollination results not only in yield increase but also improvement in quality of produce.	
Mosambi	36 to 750		
Orange	471 to 900		

Source: (Sarswat, 2015)

TABLE 7.3: POTENTIAL BENEFITS DUE TO BEE POLLINATION IN INDIA, IN THE FORM OF INCREASE IN YIELD, IN VARIOUS ORCHARD CROPS, MISC. CROPS AND VEGETABLES IN VARIOUS OILSEEDS AND LEGUME CROPS

Oilseeds	% increase in yields	Legume seeds	% increase in yields
Mustard	128.1 to 159.8	Alfalfa	23.4 to 19,733.3
Rai	18.4	Vetches	39 to 20,000
Rape	12.8 to 139.3	Board Beans	6.8 to 90.1
Toria	66 to 220	Dwarf beans	2.8 to 20.7
Sarson	222	Kidney beans	500 to 600
Sufflower	4.2 to 114.3	Runner beans	20.6 to 1,100.1
Linseed	1.7 to 40	Other pulses (Pigeon pea- 21 to 30%, etc.)	28.7 to 73.8
Niger	260.7	Berseem and other Clover	23.4 to 33,150
Sunflower	20 to 3,400		

Source: (Sarswat, 2015)

7.3.2: Value of pollination

For production in general, four inputs are needed such as– land, labour, capital and management. But in agricultural production another input which is most significantly needed and which is often ignored is the pollinator. This problem occurs as it is impossible to assess

financial value of honeybee pollination on plants and its contribution towards maintenance of biodiversity. Other assets created by apiculture such as honey and beeswax are far more tangible, but their value must be far less than the wealth created as a result of optimal pollination of plants (Bradbear, 2009, p. 3), (Makerere University, Faculty of Agriculture, 2001, p. 25) (Bradbear, 2003, pp. 7-9).

In many local communities in different parts of the world, beekeeping is perceived by many farmers as being important for their own crop production. This is because they are well aware of the pollination services that bees can perform on their crops. Pollination services conducted by bees do not only provide for improved crop production but also increases yields and provides for superior quality of such fruits. In addition, small-scale farmers who have a beekeeping enterprise can offer pollination services to other farmers in their area. Many a times their services are rewarded in kind but not in monetary terms. Thus, there is huge scope for increasing their income from the pollination services which can be generated by the apiculture activities (Hilmi, Bradbear, & Mejia, 2011, pp. 50-51).

The main service provided by bees, pollination remains poorly appreciated and underestimated in most countries. (Bradbear, 2009, p. 3) Until mid-20th century, honeybees were equated with the production of honey and beeswax. But since past 3-4 decades, utilizing honeybees to pollinate large number of agricultural and horticultural crops to increase per acre yield has become a routine practice in many developed countries (Maharashtra State Horticulture and Medicinal Plants Board, 2008, pp. 1-9). Use of bees for pollinating crops, to a certain degree, developed in Europe, North America, Australia, Japan and New Zealand. But in many countries (also in Europe) the bees are not used effectively partly owing to the lack of knowledge and partly because of the fact that the hives being big and heavy, are difficult to transfer to a field (Bradbear, 2009, p. 79).

Agricultural scientists in United States have estimated that the value of the increased crop yields through bee pollination is several times more than the value of the honey and beeswax produced by honey bees. In United States 80 per cent of the bee colonies are used for planned pollination of various crops. The beekeepers prefer to provide bee colonies on rental basis for pollination service to farmers and orchardists rather than for honey production (Maharashtra State Horticulture and Medicinal Plants Board, 2008, pp. 1-9).

A report published in 2014 by United States Department of Agriculture (USDA) regarding top ten Sources of pollination fees in U.S. during 2012, states that total fees collected by

pollination service is 656079383 US $ (Table 7.4). In case of California, beekeepers in California earn about $150 per bee colony per month as a rental for providing bee colonies for pollination service (Maharashtra State Horticulture and Medicinal Plants Board, 2008, pp. 1-9). In California, about two and half lakh acres of land are under almond cultivation. As per statisticians California needs three bee colonies per acre to pollinate all the flowers of almond. California State has only about three lakh honeybee colonies. About four lakh honeybee colonies are brought to California from adjacent States during the flowering of almond (Phadke, Beekeeping as an Industry and Its Role in Foresty, Agriculture and Horticulture, 2008, p. 45). According to Agricultural Scientists in U.S.A., value of increased crop yields due to honeybee pollination is 10 to 15 times more than the value of honey and beeswax produced by honeybees (Maharashtra State Horticulture and Medicinal Plants Board, 2008, pp. 1-9). In USA, scientists have attempted to measure the value of increased yield and quality of crops achieved by honeybee pollination. During the year 2000 in USA, this has been estimated to be worth around US$14.6 billion. For instance, coffee bean production has been increased by 50 percent in Panama with the help of pollination service of bees (Bradbear, 2009, p. 3).

TABLE 7.4: TOP TEN SOURCES OF POLLINATION FEES AND SHARES IN U.S. DURING 2012

Table 1: Top ten sources of pollination fees and shares in U.S., 2012

Crop	Pollination fees charged	Proportion of total collected fees
	---U.S. dollars---	*---Percent---*
Almonds	292,500,000	44.6
Sunflowers	110,460,000	16.8
Canola (seed)	108,927,000	16.6
Grapes	43,294,500	6.6
Apples	23,601,600	3.6
Sweet cherries	13,452,450	2.1
Watermelons	10,462,500	1.6
Dried prunes	8,525,000	1.3
Cultivated blueberries	8,215,200	1.3
Avocados	7,446,000	1.1
Total Top 10	***626,884,250***	**95.6**
Other Crops	*29,195,133*	4.4

Source: USDA, Economic Research Service calculations using data from USDA, Natural Resources Conservation Service and USDA, QuickStats data portal.

Source: (Bond, Plattner, & Hunt, 2014)

7.3.3: Honey Bee, an Effective Pollinator

Honeybees are highly efficient pollinating insects, because:

- they have hairy bodies that easily pick up thousands of grains of pollen as they move about inside the flower
- they visit only one species during each foraging trip
- each foraging bee not only collects sufficient food for its own requirements, but continuously forages for nectar and pollen to supply the daily food needs of the colony
- During a single day, one bee may visit several thousand flowers of one plant species, collecting nectar and pollen and continuously transferring pollen grains from one flower to another (Makerere University, Faculty of Agriculture, 2001, pp. 28-29), (Bradbear, 2003, pp. 7-9), (Phadke, Beekeeping as an Industry and Its Role in Foresty, Agriculture and Horticulture, 2008, pp. 43-45).

7.3.4: Natural Pollinators and Hand Pollination

In some of the agricultural zones useful insects are on the verge of extinction. Warnings have been, coming from environmentalists and scientists from all over the world that excessive use of insecticides, monoculture, pollution etc., resulting into depletion of useful pollinating insects, which in turn, is threatening to reduce the food production by 1/3 (Phadke, Beekeeping as an Industry and Its Role in Foresty, Agriculture and Horticulture, 2008, pp. 37,45), (Maharashtra State Horticulture and Medicinal Plants Board, 2008, pp. 8-9).

A study conducted by Uma Pratap and Tang Ya, in Maoxian County, China indicates that an insufficient proportion of pollinizer trees in the orchards and the declining populations of natural insect pollinators in the surrounding localities have created a perpetual need for human pollinators in the apple orchards of Maoxian County. After intensive visit in different villages and discussions with farmers the investigators found out that there was a shortage of pollinators in the area to ensure adequate natural pollination of apple trees. Further, it is believed that about four decades of pesticide sprays by the farmers have contributed to a serious decline in pollinators. In addition the continuing increase in farmland area, at the cost of forests and grasslands also compounds to this problem. This problem is also highlighted by several studies conducted in different parts of the world.

However, large-scale community-based hand pollination of apples and other fruit crops is unique in China. Nevertheless, farmers and institutions have begun to believe that it is not a viable option, and the findings of the above mentioned study too substantiate it. The increasing costs of hand pollination coupled with the low income from apples have forced Maoxian farmers to look for alternative farming options (Partap & Ya, 2012, pp. 176-185).

7.3.5: Present Situation in West Bengal

In India pollination service is not popular to the beekeepers and to the farmers. Farmers are trying to increase their crops by applying modern technology, fertilizers, insecticides etc. But they forget about the services of pollinators especially bees. In Malda mango farmers think that bees spoil mango buds thus their trees lose productivity. Like farmers of Malda, many farmers of different areas in West Bengal believe this 'wrong idea'. In some countries farmers or crops' owners pay some money to the beekeepers for pollination service. But in West Bengal, the beekeepers are prohibited to keep their colony in the different fields. The field survey on 150 beekeepers of West Bengal has been conducted. Beekeepers have told various external problems therein. The beekeepers have been asked which one is the major problem among various external problems. In the survey (Table 7.5) it has been revealed that 48.67% Beekeepers are not allowed to keep their bee-box in the farmers' or landlords' fields. Out of which 20.67% beekeepers get permission after giving promises to give them a certain amount of money or honey or both. Moreover it has been reported that without giving money to the local forest protection committees, beekeepers cannot be allowed to keep their bee colonies in the jungle of Eucalyptus near West Midnapure and Bankura.

TABLE 7.5: SINGLE MAJOR EXTERNAL PROBLEM HAVE BEEN ASKED OUT OF ALL EXTERNAL PROBLEMS HAVE BEEN FACED BY THE DIFFERENT BEEKEEPERS OF WEST BENGAL DURING MIGRATION IN DIFFERENT FIELDS IN WEST BENGAL

One Major External Problems which have been faced by Beekeepers during Fields' visit	No of Beekeepers' respondent (in numbers)	Percentage (%)
Beekeepers are not allowed to keep their bee-box in the farmers'/landlords' fields	42	28.00
Beekeepers are allowed to keep their bee-box in the farmers'/landlords' fields by paying charges	31	20.67
Harassment by the local clubs near the field	22	14.67
Harassment by the traffic police during transportation from one field to another	21	14.00
Destroy bee population indirectly by using parasites, harmful mites, insecticides, pesticides, weedicides etc. by the farmers	17	11.33
Destroy bee population indirectly by de-forestation, urbanization and decreasing agriculture as well as horticulture	12	8.00
Destroy bee population indirectly by creating pollution of water and air.	2	1.33
Climate Change	3	2.00
Total No of Beekeepers' respondent	**150**	

Source: Field Survey During2013-14
No of Respondents 150

7.4: INDIGENOUS BEES, APIS CERANA

Apis Cerana is known as the Asian hive bee because, like European Apis Mellifera, it can be kept and managed inside a hive (Bradbear, 2009, p. 9). However, there is a serious problem with the Apis Cerana as the hived honeybee colony number of Apis Cerana has come down to 7 lakhs from 10 lakhs in India during last couple of years, mainly due to a disease called sac-brood (Phadke, A Background Paper on Bee Research Programme , 2008, p. 17). In West Bengal, keeping of these indigenous bees, Apis Cerana is also declining. Now beekeepers of India are more interested to keep Apis Mellifera bees for getting good returns.

7.4.1: Necessity of Apis Cerana Bees

- **Most Efficient Pollinators-** Amongst various pollinators available, Dyer and Seeley (1991) reported that, Apis Cerana shows a disproportionately high mass-specific metabolic rate. In other words, their foragers make many more trips per day in the same habitat than

foragers of the other species do. Apis Cerana can therefore, be considered as one of most efficient pollinators. In India, with the help of beekeeping with indigenous honey bee, Apis Cerana, its density and availability as a pollinator have increased in some areas. Interestingly some organisations have come forward in this regard. For instance, Under The Mango Tree (UTMT), an organisation, works with small and marginal farmers in Gujarat, Maharashtra and Madhya Pradesh through its Bees for Poverty Reduction (BPR) programme to increase incomes and agricultural productivity through beekeeping with the indigenous bee Apis Cerana Indica. Further, a four month study was commissioned by UTMT for a short term assessment of the impact of indigenous beekeeping on farms of marginal farmers in Dharampur Taluka of Valsad district in Gujarat, India. The findings of the study revealed that out of 16 plants, studied for the productivity, fifteen plant species have shown considerable increase in productivity in areas with Apis Cerana bee boxes. It has also been observed that Apis Cerana has long working schedule from morning 07:00h to evening 18:00h and is found to remain longer at floral Quadrates. This means that it is more efficient and can possibly pollinate more number of flowers compared to other flower visitors (Under The Mango Tree, 2011, pp. 30-31).

Another study has been conducted on 'Foraging Behaviour of the Himalayan Honeybee, Apis Cerana, on Flowers of Fagopyrum Esculentum M. and its Impact on Grain Quality and Yield' by Madhusudan Man Singh under Research Centre for Applied Science and Technology (RECAST), Tribhuvan University, Kirtipur, Kathmandu, Nepal. According to the study, Apis Cerana bee pollination has increased grain set in terms of the total number of grains per plant, grain weight and grain yield. In addition, it has also increased the value of fertility and harvest index (Singh, 2008, p. 37).

- **Metainance of heritage-** Rafal Beszterda, in the study on Traditional beekeeping in Kinnaur district, Himachal Pradesh asserts that the mere act of introduction of hundreds of modern hives will not resolve the problems. Thus it is important to find ways to harmonise the modern techniques with the traditional knowledge. For centuries the keeping of Apis Cerana has been done through traditional means and ways. To put it in simple words, it would be unwise to neglect their knowledge in the process of modernisation (Beszterda, 2000).
- **Well adopted and indigenous-** Apis Cerana is gentle in temperament, industrious and well adapted to the ecological conditions of south and south east-Asia. Beekeeping with Apis Cerana is an indigenous industry and forms an integral part of the social and cultural

heritage of rural and tribal communities in the region. It is also an environment friendly occupation. (Verma & Attri, 2008, pp. 221-225)

- **Requirement of Least Management-** Beekeeping with Apis Cerana does not require a lot of management like sugar feeding, disease control and migration. Therefore, it is easy for an isolated farming community to practice beekeeping with this bee species on the basis of their indigenous knowledge (Verma & Attri, 2008, pp. 221-225).

7.4.2: Apis Cerana Bees in West Bengal

Out of 150 respondent beekeepers in field survey, no beekeepers are keeping the indigenous bees (Apis Cerana Bees). Since return is very low the beekeepers of West Bengal do not want to keep it. If labour cost is considered along with opportunity cost of labour, the return will be negative. Table 7.6 has shown that net cash flow is Rs. -58750 for keeping migratory beekeeping of Apis Cerana Indica of 50 bee-colonies. Table 7.6 has also shown that net cash flow is Rs. -64000 for keeping non-migratory beekeeping of Apis Cerana Indica of 50 bee-colonies. Though these native bees have various potential and adoptability in West Bengal but no beekeeper wants to bear loss for keeping these bees. On the other side it is observed that when the beekeepers keep Apis Mellifera of 50 bee-colonies, the beekeepers can get net cash flow of Rs. 112500 (Table 5.1).

TABLE 7.6: DETAILS OF CASH FLOWS FOR INVESTING IN 50 BEE-COLONIES OF APIS CERANA INDICA IN WEST BENGAL DURING 2012-13

Sl. No.	Items	Migratory	Non-migratory
1	**Initial Investment**		
a.	Cost of bee-hives (full set)	30000	30000
b.	Cost of bees (10 Frames)	40000	40000
c.	Cost of Smoker	300	300
d.	Cost of Honey Extractor	2500	2500
e.	Face Vail	90	90
f.	Others small tools & parts	300	300
	Total	**73190**	**73190**
2	**Recurring Expenditure**		
a.	Medicine	1500	1500
b.	Sugar for Migratory- (12Kg to 15 Kg) Non- migratory- (15Kg to 20 Kg)	20250	26250
c.	Travelling and carrying	12000	X
d.	Frame making and repairing	5000	4000
e.	Field expenses	18250	X
f.	Labour (Rs.300 X 365)	109500	109500
g.	Contingency	20000	2500
	Total Cash Outflows	**186500**	**143750**
a.	Honey from migratory- (20kg @Rs.100) Non- migratory- (12kg @Rs.100)	100000	60000
b.	Sell of bees For migratory- (30 pieces) For non- migratory- (20 pieces)	24000	16000
c.	Sell of Comb (Wax)	3750	3750
3	**Total Cash Inflows**	**127750**	**79750**
	Net cash inflows	**- 58750**	**- 64000**

Source: Field Survey (2013-14)

No of Respondents 150

7.5: MOULEY, THE HONEY HUNTER

Honey hunters can be found in many countries and are commonly involved in subsistence farming. They hunt for honey in the wild as a way to diversify their food supply as well as to sell honey (Hilmi, Bradbear, & Mejia, 2011, p. 2). In Sundarban region these people are called 'Mouley'. People who collect honey from forest are called 'Mouley'. The local name of honey is 'Mou'. For this reason, who goes to forest for collecting 'Mou' is called 'Mouley'. They have been doing this job from almost 3 to 4 ancestors. People of different religions can get the title 'Mouley'. Mainly they are Hindu, Muslim and Santal. They live in the island villages namely Maypit, Damkal, Vasha, Deulbadi, Godamothura, Chandanpidi, Basanti, Gosaba, Kumirmari, Raidhighi, Kankandhighi, Mousumi, Pathar Pratima, Satjelia, Dayapur and Buriburirtat of Sundarban region of West Bengal. In earlier these villages were situated in the forest of Sundarban. Coming from Midnapur district, Orisa state, Bangladesh and the other villages of both South and North 24 Parganas district they (mouleys) have been living there by cutting and cleaning trees and woods. These people are engaged in various types of activities for their livelihood. These activities are based on Sundarban, like collection of honey, cutting of woods, catching of fishes, crabs etc. On an average 25 families in each village are engaged in the 'Mouley' profession, (approximately there are 1500 in total). Mouley is their hereditary profession and they want to depend on this profession for their livelihood.

7.5.1: Problems in Honey Hunting

There are some pertinent problems in honey hunting which makes it difficult for the long term sustenance of the profession. The problems are as follows:

- In honey hunting large numbers of bees are killed and their colonies are destroyed in the process. (Bradbear, 2009, pp. 30-31).
- Moreover the risk involved in hunting of the Himalayan honeybee (Apis laboriosa) may indeed be the closest equivalent to the hunting of tigers (Bradbear, 2009, pp. 30-31). Many people (mainly Mouley in Sundarban jungle) are killed by tiger or snake during honey hunting.
- Fire and smoke that are used to drive away the bees can ignite wild fires some times. This type of practice also affects the surrounding environment in such a way that pollination services are no longer available. This puts in jeopardy the honey hunter's

livelihood as well as making crops and other plants in the area more vulnerable (Hilmi, Bradbear, & Mejia, 2011, p. 2).

- The honey which is extracted from this honey hunting practices is of low quality which is contaminated with parts of honey comb, ash and brood as well as brood juices. Wax from the honey comb is usually either thrown away or used as burning fuel (Hilmi, Bradbear, & Mejia, 2011, p. 2), (Suranarayana, 1994).
- Efforts have been made to encourage honey hunters to harvest without destroying the whole colony, that is, to harvest only comb containing honey and leave comb-containing brood intact. (Bradbear, 2009, pp. 30-31). But these practices are not exercised properly in jungle for lack of awareness and lack of time.
- Immature honey comb are also hunted (owing to fierce competition) which has a negative impact on the sustainable extraction of the honey.

7.5.2: Mouley of Chandanpidi Village

A sample study has been conducted in Chandanpidi village of Namkhana forest range. Around 600 Mouleys are lived there. 30 Mouley families (Table 7.7) have been interviewed during this period (January, 2016) of this study. Mouley families want to leave their profession. Few Mouley families maintain their livelihood with the help of other forest based occupations. But they all want that their future generation will not stay in this Mouley profession. They earn on average 150 kg honey per head per year, value of which is around Rs.15000 and they become compelled to sell honey to the forest department at the department's declared rate. Sometimes they return from the jungle without getting honey in a trip and have to bear the burden of loss. This way, they become least interested about the "Mouley Profession".

7.5.3: Problems of Mouleys

In recent few years the Mouley profession has become very tough. The sample study has noticed few reasons for the gray condition of this profession (Table 7.7). Most noticeable reasons are - seasonal profession and risky and uncertain profession. 30 Mouley families (sample taken) have supported these reasons. It has also been noticed that new generations of Mouley family are not interested to enter in this risky and uncertain profession. At a glance the problems are-

- Mouley profession is only for three months' activities. Earnings from this three months profession cannot give the way of livelihood for a year.
- This profession is risky and uncertain.
- High competition is created due to engagement of many people other than Mouley in this profession.
- Area of forest is decreasing day by day.
- Honeycombs are shifted to the deep forest because of unscientific collection procedure.
- Mouley profession is also suffering from disguised unemployment. This is due to two reasons. One is - forest area is diminishing and another is - the people other than Mouley profession (like wood-cutters, fishermen etc.) accept this profession casually without giving much importance on the Mouley profession.
- New generations of Mouley family are not interested to enter in this risky and uncertain profession.
- Many a times hard competition among Mouleys leads to the destruction of immature combs.
- They cannot stay in honey (Mou) related profession because do not know the technique of modern beekeeping.

TABLE 7.7: DETAILS OF FIELD SURVEY REGARDING PROBLEMS OF MOULEYS WHICH INVOLVE IN HONEY HUNTING FROM SUNDERBAN

Problems of Mouleys	Number of Respondents say 'Yes' out of 30
Three months' business	30
Risky and uncertain	30
High competition	12
Forest area is decreasing	25
Honeycombs are shifted to the deep forest because of unscientific collection procedure	18
Collection of honey before time	15
Interest of new generations to accept Mouley profession	0
know about modern bee keeping	1

Source: Field Survey during January 2016
No. of Respondent Mouley Families 30

7.5.4: Encourage Mouley to accept modern bee-keeping

Beekeeping offers a good way for people to create income from natural resources without damaging them (Bradbear, 2009, p. 3). Thus, honey hunters eventually turn to beekeeping as they realise that it is much easier to get honey if they provide the bees a home at ground level (Huber, 2012). It is essential to introduce modern bee keeping practice with this wild profession. Otherwise this profession will be ruined in the near future. Collection of honey from jungle involves risk, uncertainty and unscientific method. In many cases Mouleys go to jungle but after spending time, money and labour they do not find any jungle beehive. Often the Mouleys are killed by tiger, crocodile or snake. Sometimes they become harassed by forest department's employees. They may get honey from jungle only for three months i.e. March, April and May of every year. In other months of the year they are either jobless or engaged in other professions. For these reasons new generation do not want to accept this profession. If modern beekeeping technique and equipments can be provided during their jobless periods of the year they may get additional earnings to maintain their livelihood.

7.6: QUALITY OF HONEY

Universally, honey is believed to be a natural product. The Codex Alimentarius Commission is a global body set up jointly by the UN's Food and Agriculture Organization (FAO) and the World Health Organization (WHO) to develop food standards for international trade. In India, honey is currently regulated under three legislations: Prevention of Food Adulteration (PFA) Rules, 1955, a mandatory standard, implemented by the Food Safety and Standards Authority; The voluntary Bureau of Indian Standards (BIS) norm for extracted honey under IS4941:1994, (brands wishing to obtain the ISI mark will have to follow it); Honey Grading and Marking rules, 2008 under the Agricultural Produce (Grading and Marking) Act, 1937 (AGMARK), implemented by the Union Ministry of Agriculture (Bhushan, Misra, & Dutta, 2010).

There are, however, many reports on antibiotic contamination of honey consumed within the country. India also imports honey, but there is no such standard to check its quality. Having come up against this regulatory black hole, CSE's Pollution Monitoring Laboratory (PML) has decided to investigate the extent of antibiotic components in the honey which is sold in the domestic market by testing some of the best known and most commonly consumed brands (Bhushan, Misra, & Dutta, 2010). Altogether twelve brands have been selected, out of which Dabur Honey of Dabur India Ltd, Himalaya Forest Honey of Himalaya Drug Company, Patanjali

Pure Honey of Patanjali Ayurved Ltd, Baidyanath Wild Flower Honey of Shree Baidyanath Ayurved Bhavan Pvt Ltd (Kolkata), Khadi Honey of Khadi Gramudyog Sewa Samiti (Bihar), Mehsons Honey of Mehsons India Ltd, Gold Honey of Vardhman Food & Pharmaceuticals, Umang Honey of Udyog Bhartiya (Delhi), Hitkari Honey of Hitkari Pharmacy and Himflora Gold of Food Max are domestic brands and Capilano Pure & Natural Honey of Capilano Honey Ltd (Australia) and Nectaflor Natural Blossom Honey of Narimpex AG (Switzerland) are two Imported Brands. The tests have shown that high amounts of multiple antibiotics were found in 11 out of the 12 samples. In other words, all 11 samples failed the antibiotics standards set by the Indian government's Export Inspection Council (EIC) for exported honey. The two imported honey samples were also highly contaminated with antibiotics. Both would have failed in their own domestic standards. The only sample in which no antibiotic residues were detected was Hitkari Honey of Hitkari Pharmacy, Delhi which is a small company involved in the seasonal honey business (Bhushan, Misra, & Dutta, 2010).

In India, another study was carried out to explore the extent of pesticide residue in honey produced in the various parts of Himachal Pradesh. It is found that HCH (Hexachlorocyclohexane) and its isomers are most frequently detected followed by dichlor-diphenyl-trichlorethylene (DDT) and its isomers. Malathion's residues are found exceeding the MRLs (Maximum Residue Limits) proposed by the Ministry of Commerce, Government of India. The results showed that honey from natural vegetation contain lesser residues. High levels of antibiotics in honey exported from India to EU and US have been reported by Agricultural Processed Food Product Export Development Agency from 2005 onwards. In 2006, about 14% samples were contaminated with tetracycline and in 2007-2008 about 28% samples were contaminated with same antibiotic. While in 2009-2010, out of the 362 honey samples tested, 29.2% samples were found to contain more than the prescribed limit of antibiotics (Al-Waili, Salom, Al-Ghamdi, & Ansari, 2012).

In February 2002, the world honey market was strongly affected by an EU ban on Chinese honey, following the identification of antibiotics in samples of Chinese honey. Since China was Europe's largest supplier of honey, this immediately led to a shortage of honey meeting EU criteria, and honey prices increased rapidly (Bradbear, 2009, pp. 137-138*)*. Indian honey, for some time, was also forbidden to enter the EU markets. However, after about 18 months ban *t*he European Economic Commission (EEC) has lifted the ban on import of Indian honey, with effect from November 1, 2011 (BeekeepingTimes, 2012).

To promote the exports of honey, the Ministry of Commerce and Industries, Government of India has setup a Residue Monitoring Plan (RMP) to monitor the level of antibiotics, heavy metals and pesticides contamination in honey destined for exports. The Export Inspection Council (EIC) is responsible for implementing the RMP (Johnson & Jadon, 2010, pp. 1-3). The demand of residue free honey is on the rise now but the problem is that it is almost impossible to collect residue-free honey. Today honey is produced in an environment, polluted by different sources of contamination. The contamination sources can be environmental and/or apicultural ones. Environmental contaminants are pesticides, heavy metals, bacteria and radioactivity. These contaminants are present in air, water, soil and plants and are transported to beehives by bees. On the other hand, contaminants from beekeeping practice includes acaricides used for parasitic mites (mainly Varroa) control, bee repellents used at honey harvest, pesticides for wax moth and small hive beetle control and antibiotics (Johnson & Jadon, 2010, pp. 1-3).

The demand for residue-free honey opens opportunities for honey producers in the poorest countries. It is in these parts of the world that honeybees remain relatively disease free, and environments may be relatively unpolluted (Bradbear, 2009, pp. 137-138). Pollution free environment of countries gain high price from their honey for residue-free. By watching the price of honey the environmental aspect of a country can be measured. Table 7.8 has shown the top twenty countries those have got higher price of their produced honey. Honey of Morocco has got highest price during 2010 (14 $/Kg). Table 7.9 has shown price of honey in international market of those countries who are top ten exporters, top ten producers and top ten importers in the year 1998 and are maintaining their rank almost same position during 1998 to 2012. In this table three countries are also included. These three significant countries are Egypt, Greece and Pakistan. The former two countries had ancient history on beekeeping (Chapter 2). The Imperial Council of Agricultural Research in 1945 established a Central Beekeeping Research Station at Lyallpur, India, but after the Partition, Lyallpur and the Research Station went over to Pakistan. For this reason Pakistan has been taken in the list to compare with India. Table 7.9 has shown the average of honey prices of fifteen years (from 1998 to 2012). It has been noticed that Yemen has got highest price (mean price 9.40$/Kg). Greece has got mean price of 5.43$/Kg and then France has got mean price of 4.85$/Kg for their honey ranking 2nd and 3rd respectively. Whereas Pakistan has got mean price of 2$/Kg (ranks 20) and India has got mean price of 1.80$/Kg (ranks 22).

TABLE 7.8: TOP TWENTY COUNTRIES WHO HAVE GOT HIGHER PRICE FOR THEIR PRODUCED HONEY AMONG ALL COUNTRIES AROUND THE WORLD

Rank	Country	Unit value ($/Kg)
1	Morocco	14.00
2	Lebanon	12.44
3	Kazakhstan	11.40
4	Estonia	11.33
4	Jordan	11.33
6	Bolivia	11.00
7	Luxembourg	10.86
8	Cyprus	10.50
9	New Zealand	9.73
10	Indonesia	9.27
11	Norway	9.22
12	Yemen	9.07
13	Switzerland	8.77
14	Sweden	8.70
15	Republic of Korea	8.25
16	Georgia	8.00
17	Armenia	7.56
18	Greece	7.23
19	Slovenia	6.98
20	Ireland	6.90

Source FAOSTAT 2010

7.7: ORGANIC APICULTURE

Honey is related with purity. Person consumes it thinking a pure and natural product. But due to environmental pollution and unscientific practices of people who are related with apiculture, honey is now becoming contaminated with various hazardous things like antibiotic, pesticide, bacteria, heavy metals and radioactive element. In the survey (Table 7.5) it has revealed that 22.66% beekeepers have faced the problems which have come from environmental pollution. Organic beekeeping can provide pure and natural honey. In this context it can be said that organic beekeeping gives organic honey for which natural plant and organic agriculture are essentially needed.

TABLE 7.9: PRICE OF HONEY IN INTERNATIONAL MARKET OF THOSE COUNTRIES WHO ARE TOP TEN EXPORTERS, TOP TEN PRODUCERS, TOP TEN IMPORTERS IN THE YEAR 1998 AND THREE SIGNIFICANT COUNTRIES

(Unit in $/KG)

TOP 10	RANK	COUNTRIES	In 1998	In 2012	MEAN During 1998-2012	RANK of MEAN
Ranked in Top 10 Exporting Countries in 1998	1	China, mainland (P=1)	1.06	1.95	1.33	24
	2	Argentina(P=3)	1.30	2.86	1.91	21
	3	Mexico(P=6)	1.28	3.17	2.18	19
	4	Germany(I=1)	2.42	5.73	3.66	7
	5	Canada(P=9)	1.71	4.03	2.61	15
	6	Australia	1.51	5.38	3.09	11
	7	Spain(P=10) & (I=7)	2.13	4.01	3.01	12
	8	Hungary	2.12	4.37	2.97	13
	9	Romania	1.48	3.89	2.55	16
	10	Turkey(P=4)	1.99	4.76	3.19	9
Ranked in Top 10 Producing Countries in 1998	2	United States of America(I=2)	1.85	3.49	2.39	17
	5	Ukraine	1.35	2.33	1.74	23
	7	India	1.09	2.44	1.80	22
	8	Russian Federation	1.13	4.62	3.17	10
Ranked in Top 10 Importing Countries in 1998	3	Japan	3.48	15.30	4.39	5
	4	United Kingdom	2.26	7.67	4.77	4
	5	France	3.04	6.38	4.85	3
	6	Italy	2.85	4.60	3.63	8
	8	Belgium(-Luxembourg)	2.11	3.27	2.71	14
	9	Yemen	12.33	7.81	9.40	1
	10	Denmark	2.47	4.96	3.67	6
Specially Important		Pakistan	2.11	3.33	2.00	20
		Egypt	2.48	3.77	2.19	18
		Greece	4.53	6.18	5.43	2
		World	1.49	3.34	2.20	
		Asia	1.21	2.32	1.54	

P = Rank position in World Production in 1998

I = Rank position in World Import in 1998

Source: FAOSTAT

7.7.1: Organic Honey

Commonly bees forage within a range of two kilometres from their hive which is over an area of 12.6 square km. Thus, to ensure the honey is organic, this entire area must be organic. In most industrialized countries this requirement is difficult or almost impossible. But this opens the door to beekeepers who are working in areas with indigenous vegetation, uncultivated land and extensive agriculture. For instance, countries like UK, Netherlands, Australia, Scotland, Turkey, Mexico, Nicaragua, and New Zealand etc. have produced organic honey

(Bradbear, 2009, pp. 139-140). Moreover, few countries have implement regulations in order to promote organic honey. Nevertheless, to ensure the production of organic honey, there are few essential requirements which are to be taken care of; they are as follows: (Bradbear, 2009, pp. 139-140), (Loon & Koekoek, 2006, p. 7)

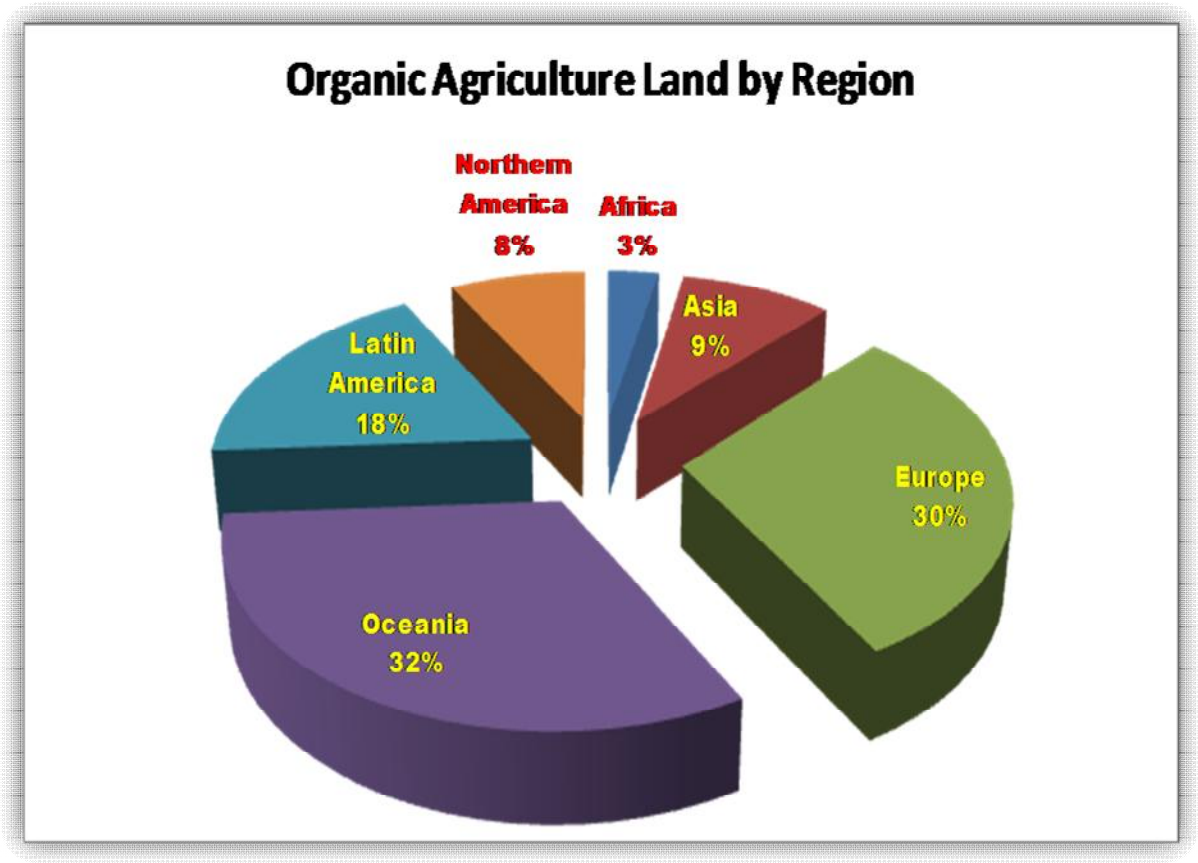
- Crops – Crops on which the bees feed should be devoid of chemicals.
- Foraging – within a radius of three kilometres around an apiary, nectar and pollen sources must be essentially either organic or wild/uncultivated. This area must not be subject to significant sources of pollution from roads, industry or urban centres or airports.
- Hive construction – must be of natural, untreated materials.
- Foundation and comb – must be made of organic beeswax.
- Feed– Any feeding of bees must be with organic honey or organic sugar and this may take place only after the last honey harvest, or 15 days before the first nectar flow. The other option is to feed the bees with the natural and self-produced honey during the dearth period.
- Medicine– Homeopathic and herbal treatments and natural acids (lactic, acetic, formic, oxalic) may be used in case of need.
- Clipping – Clipping of queens' wings must be prohibited.

7.7.2: Organic Agriculture and Natural Forest

First and foremost requirement to produce organic honey is organic apiculture which is mainly based on organic agriculture and natural forest. Figure 7.1 has shown that 9% of organic agriculture land of the world is occupied by Asia. Figure 7.2 has shown top ten countries with the largest areas of organic agriculture land in the world. Australia has largest areas of organic agriculture land (12 million hectares) among all ten countries. In this table India cannot take place as India has only 0.50 million hectares organic agriculture land (Research Institute of Organic Agriculture FiBL and International Federation of Organic Agriculture Movements (IFOAM), 2014, p. 72). Figure 7.3 has shown top ten countries according to the proportion of organic agriculture land out of total agriculture land. Most of the countries are of Europe. Share of India in this field is only 0.28% (Research Institute of Organic Agriculture FiBL and International Federation of Organic Agriculture Movements (IFOAM), 2014, p. 44). Figure 7.4 has shown top ten countries with the largest number of organic (agriculture) producers among the world. India is the topper in this field. Figure 7.5

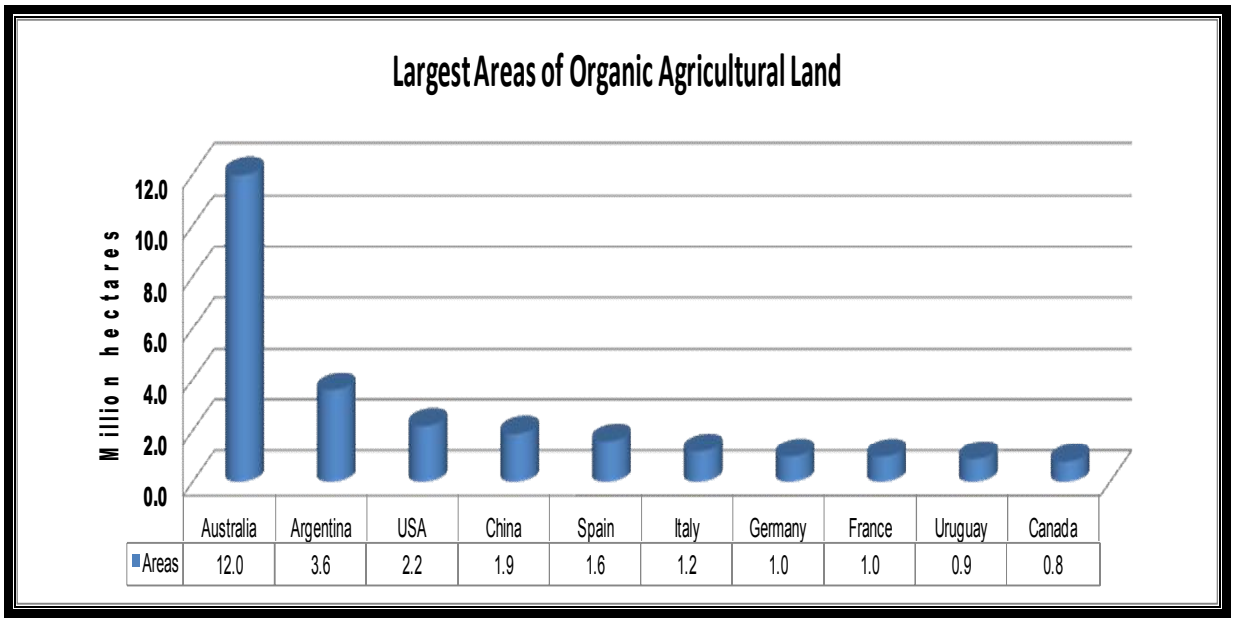
has shown top ten countries with the largest organic wild collection areas and bee pastures, where position of India is satisfactory (third). Figure 7.6 has shown the distribution of organic bee hives by region. It is found that 57% of total organic bee hives are of Europe; whereas share of Asia is the poorest. Growth of organic apiculture of the world is very much positive (Figure 7.7). Figure 7.7 has shown that, world organic bee hives have become double during the period of six years (from 2007 to 2012). There are more than one million beehives in the world which are maintained organically in 2012. Number of organic bee hives is one percent of total bee hives around the world. Figure 7.8 has shown top ten countries those have largest number of organic bee hives. Zambia has the highest number of organic bee hives (191434 bee hives). India does not have any organic bee hive (Research Institute of Organic Agriculture FiBL and International Federation of Organic Agriculture Movements (IFOAM), 2014, p. 88).

FIGURE 7.1: DISTRIBUTION OF ORGANIC AGRICULTURE LAND BY REGION IN THE WORLD DURING 2012



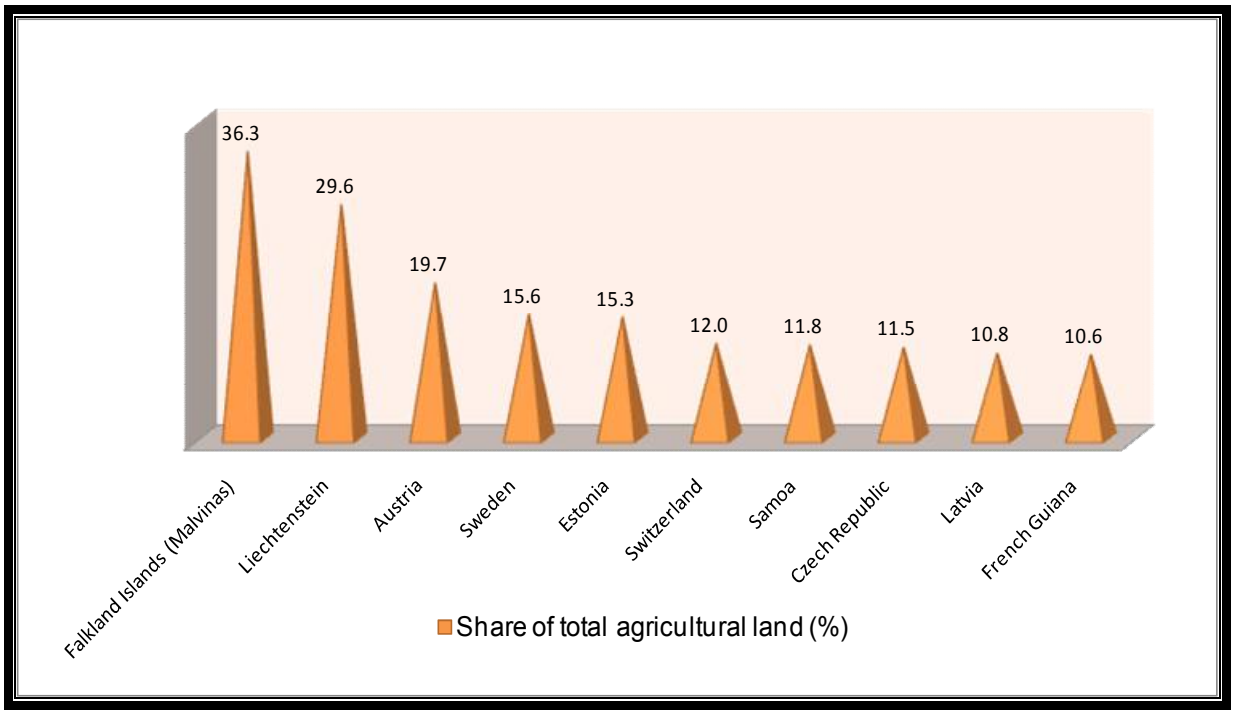
Source: (Research Institute of Organic Agriculture FiBL and International Federation of Organic Agriculture Movements (IFOAM), 2014, p. 38)

FIGURE 7.2: TOP TEN COUNTRIES THOSE HAVE LARGEST AREAS OF ORGANIC AGRICULTURAL LAND IN THE WORLD DURING 2012



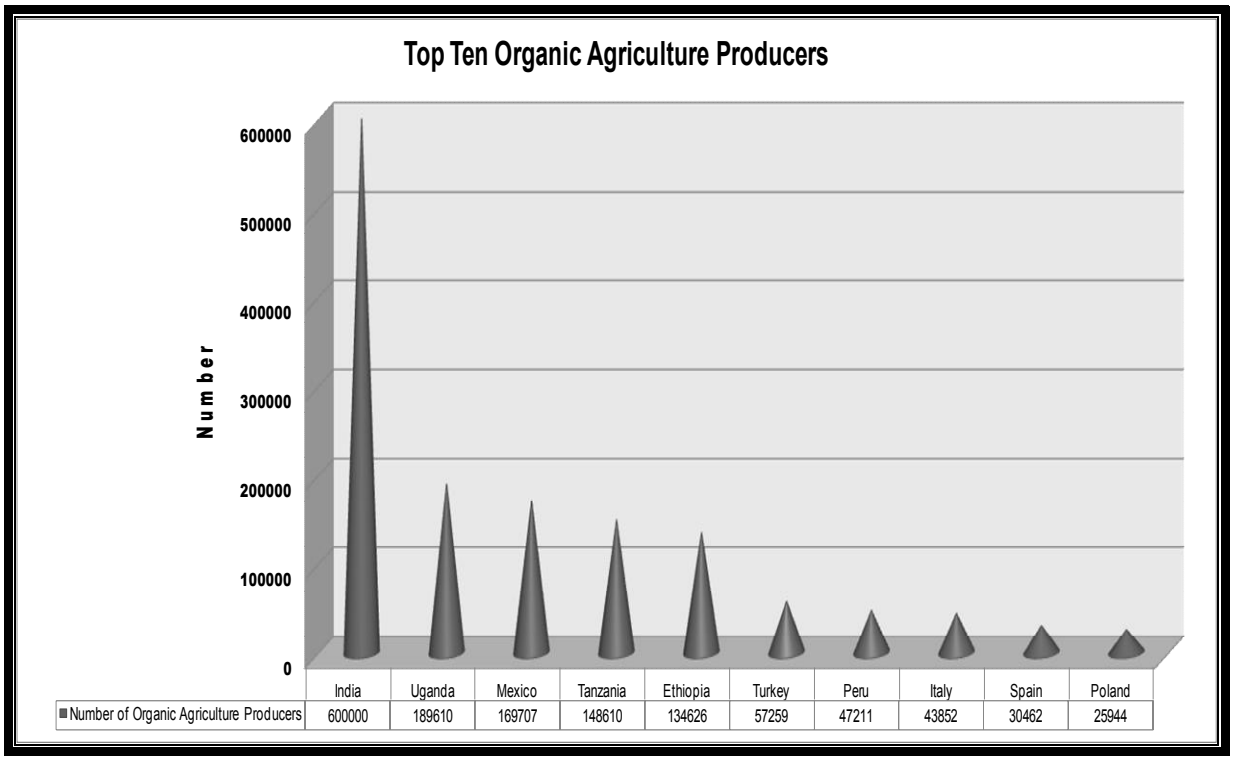
Source: (Research Institute of Organic Agriculture FiBL and International Federation of Organic Agriculture Movements (IFOAM), 2014, p. 38)

FIGURE 7.3: TOP TEN COUNTRIES THOSE HAVE HIGHEST SHARES OF ORGANIC AGRICULTURAL LAND IN PROPORTION TO THEIR OWN AGRICULTURAL LAND IN THE WORLD DURING 2012



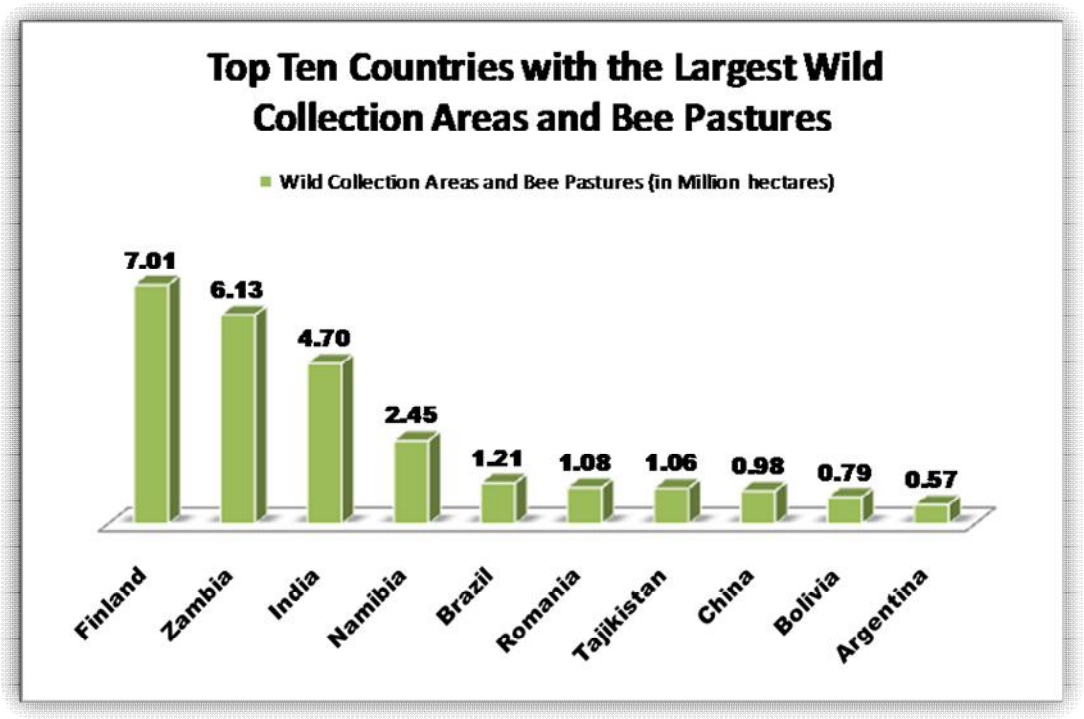
Source: (Research Institute of Organic Agriculture FiBL and International Federation of Organic Agriculture Movements (IFOAM), 2014, p. 42)

FIGURE 7.4: TOP TEN COUNTRIES THOSE HAVE LARGEST NUMBERS OF ORGANIC AGRICULTURAL PRODUCERS IN THE WORLD DURING 2012



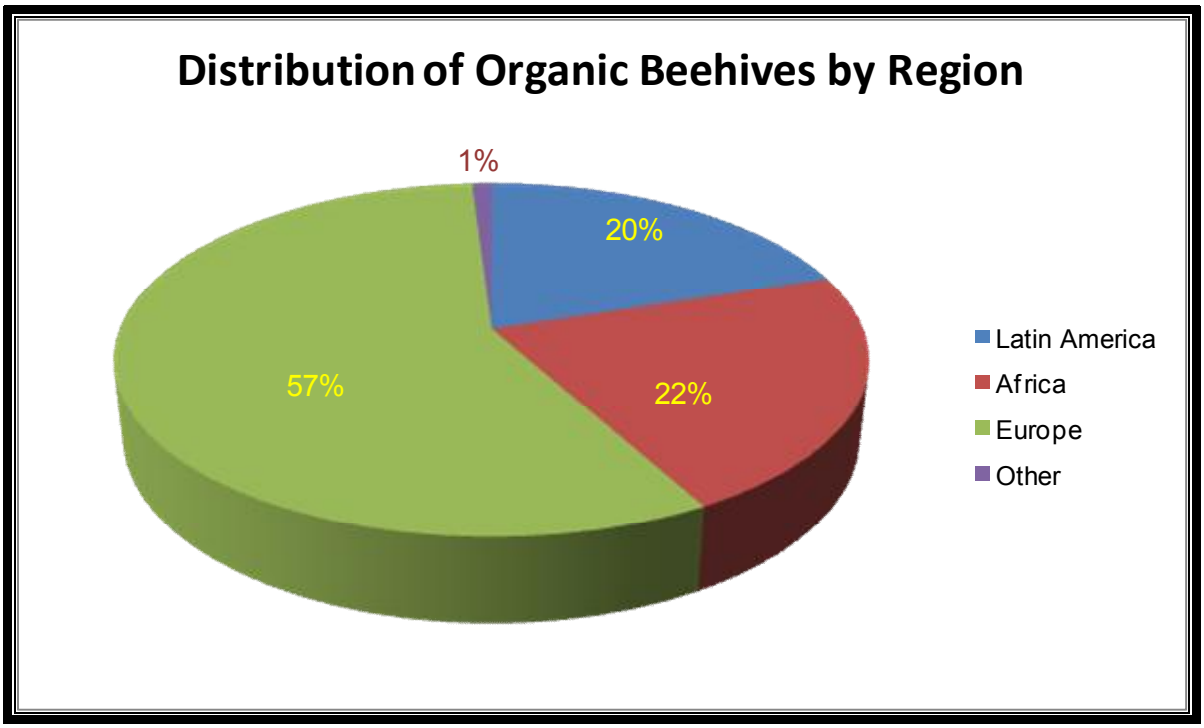
Source: (Research Institute of Organic Agriculture FiBL and International Federation of Organic Agriculture Movements (IFOAM), 2014, p. 61)

FIGURE 7.5: TOP TEN COUNTRIES THOSE HAVE THE LARGEST ORGANIC WILD COLLECTION AREAS AND BEE PASTURES IN THE WORLD DURING 2012



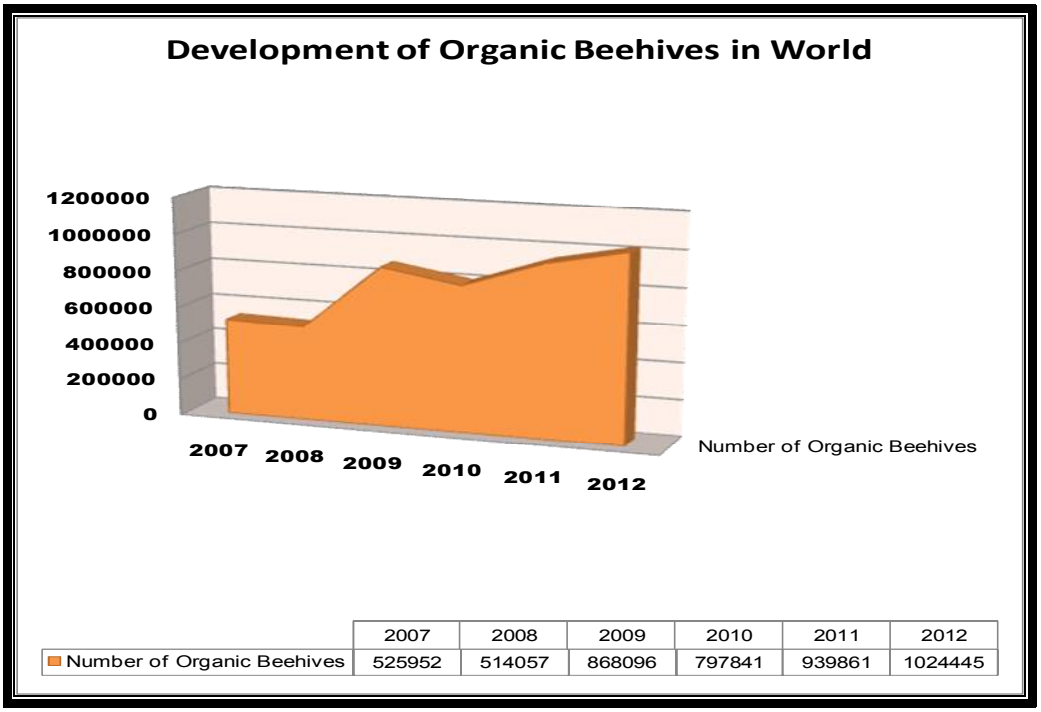
Source: (Research Institute of Organic Agriculture FiBL and International Federation of Organic Agriculture Movements (IFOAM), 2014, p. 83)

FIGURE 7.6: DISTRIBUTION OF ORGANIC BEEHIVES BY REGION IN THE WORLD DURING 2012



Source: (Research Institute of Organic Agriculture FiBL and International Federation of Organic Agriculture Movements (IFOAM), 2014, p. 86)

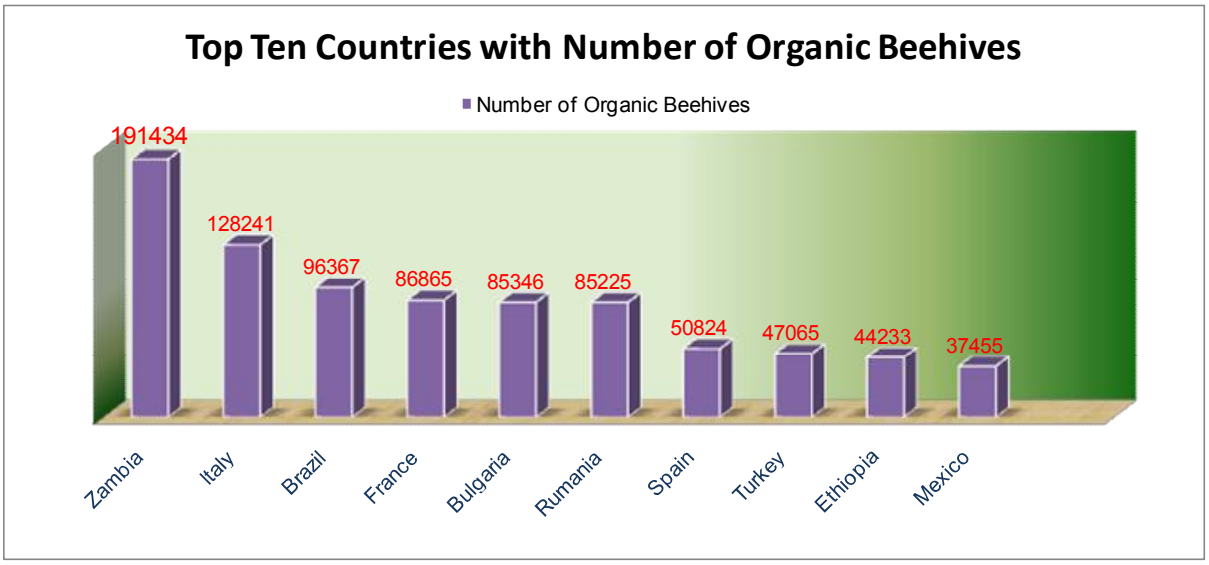
FIGURE 7.7: DEVELOPMENT OF ORGANIC BEEHIVES THROUGHOUT THE WORLD DURING 2007 TO 2012



	2007	2008	2009	2010	2011	2012
Number of Organic Beehives	525952	514057	868096	797841	939861	1024445

Source: (Research Institute of Organic Agriculture FiBL and International Federation of Organic Agriculture Movements (IFOAM), 2014, p. 87)

FIGURE 7.8: TOP TEN COUNTRIES THOSE HAVE THE LARGEST NUMBER OF ORGANIC BEEHIVES IN THE WORLD DURING 2012



Source: (Research Institute of Organic Agriculture FiBL and International Federation of Organic Agriculture Movements (IFOAM), 2014, p. 87)

7.7.3: Organic Apiculture in India and in West Bengal: Prospects and Potentials

In India, historically agriculture farming systems were by and large organic, where crop rotation, choice of cultivar for region, and utilization of solar radiation for soil sterilization were used, and soil fertility was maintained through organic manure and symbiotic soil micro-flora. In recent times the concept of organic farming is rapidly gaining importance among Indian farmers and entrepreneurs, especially in low productivity areas, rain-fed zones, hilly areas, and the north-eastern states, where fertilizer consumption is less than 25 kg/ha/year. In fact, few states in India have promoted policies and programs on organic farming. Uttrakhand has gone for organic farming in order to improve its mountain agriculture farm economy and livelihood. Similarly, Mizoram and Sikkim declared their intentions to move to total organic farming. Karnataka too has formulated organic policies, and Maharashtra, Tamil Nadu, and Kerala have supported public–private partnerships for the promotion of organic farming (Mitra & Devi, 2016). Moreover, India's forest and tree cover has increased by 5,081 sq km., while the total forest cover of the country has increased by 3,775 sq km, the tree cover has gone up by 1,306 sq km. According to the India State of Forest Report (ISFR) 2015, the total forest and tree cover is 79.42 million hectare, which is 24.16 percent of the total geographical area (Press Information Bureau, Government of India, Ministry of Environment and Forests, 2015). Though India has no organic beehive, it has potential to maintain organic apiculture.

Out of Total reporting area of 8684 thousand hectares in West Bengal, 1174 thousand hectares (13.52%) are forest area (Table 1.4). Among the districts of the state 'West Bengal', area of South 24 Parganas district is the biggest and the climate is pleasant with temperate weather. Total reporting area is 948710 hectares in South 24 Parganas district, out of which 426300 hectares (44.93%) are forest area (Table 1.18). The mangroves forests are situated in this area called Sunderbans. In North Dinajpur district 88.48% of total area is cropped area. Paddy, jute, sugarcane, mustard and corn are grown in large numbers here. This district is very rich in sources of raw material, nectar, especially mustard. Around 60% honey of West Bengal is collected from North Dinajpur, South Dinajpur and Malda districts. Moreover mustard crops are low fertilizer, low pesticide and low insecticide using crops. In North Dinajpur, 580 hectares is forest area (Table 1.28) which gives a scope for organic apiculture. West Bengal has huge possibility to introduce organic agriculture as well as organic apiculture if proper measures are taken.

7.8: WOMEN AND APICULTURE

Agriculture is still the most important mainstays in India's rural areas and women's share in agricultural and related works often exceed than that of men. Yet women are most neglected in every aspect in the society. Women also play very significant role in traditional activities like house hold chores, food production and processing and in various types of crafts. It is a generally prevalent notion that women need those types of occupation which are not physically demanding and will not interfere with their family obligations but which will provide a monetary return on a small investment. Apiculture industry has ability to provide such type of occupation for women.

Jobs such as 'fixed apiary'or stationary type of beekeeping can be done by women, while heavier tasks like honey extraction, migration, moving bee colonies for pollination, other male members of the family can help (Phadke, 2008, pp. 13-14). India is not now ready to engage women as migratory beekeepers. Social security for women on the ways and in the fields of migration is not sufficient in India as well as in West Bengal. Table 7.5 has shown 77.34% male beekeepers are harassed by farmers, land owners, club members and even police men.

7.8.1: Misconception

With regard to apiculture, its ancient history lies in Egypt but ancient representations of honey harvesting show only men, not women. Similarly all Greek and Roman writers on beekeeping were men and beekeepers were referred to as male. Not only were women regarded inapt for apiculture but were also regarded as a potential danger to the bees. There was a prevailing notion that even if a menstruous woman touches a bee hive, the bees would forsake the hive and would never return. In fact, even men were prohibited from sexual relations for a specified period before handling hives. The community of Angami Nagas believed that in order to gain immunity from stings while gathering honey, men must abstain from sexual relation from the day on which the honey expedition is fixed (Bodenheimer, 1951, p. 234)

In some of the honey hunting societies recently studied in tropical Africa, women were actually prohibited from collecting honey from honey bee nests; although among the Ngindo in Tanzania they might participate in the work in an emergency. In India, among the Andaman islanders the 'honey-eating' is a very important ceremony but women are prohibited from taking part in the ceremony unless they have borne their first child (Bodenheimer, 1951, pp. 234-35). In Sundarban region of West Bengal Mouley's wives are not allowed to oil their hair or comb it when the husband stays in jungle for honey hunting (Field Survey during January 2016).

7.8.2: Women in Apiculture

Honey hunting since ancient times is associated with men. Women suffer some drawbacks when it comes to honey hunting. Women are physically weaker compared to men and are slightly smaller than men generally. As such women are often unable to reach the honey bee nests in places that are not easily accessible.

During Mesolithic and Post-Mesolithic periods a rock art provides a little evidence on gender roles in collecting honey. In one rock painting in Zombepata cave in Zimbabwe, the person at the nest entrance, carrying a long stick, can be identified as a woman. It was also identified that Malaya women as well as men might participate in harvesting from A. Dorsata nests in Kalimantan. Similarly, in Sri Lanka, women were associated with honey collected from Apis Dorsats nests. In Tamil Nadu, Southern India, among the Peechi-Keni people, five generations ago (but not now), women as well as men climbed down a steep cliff to harvest

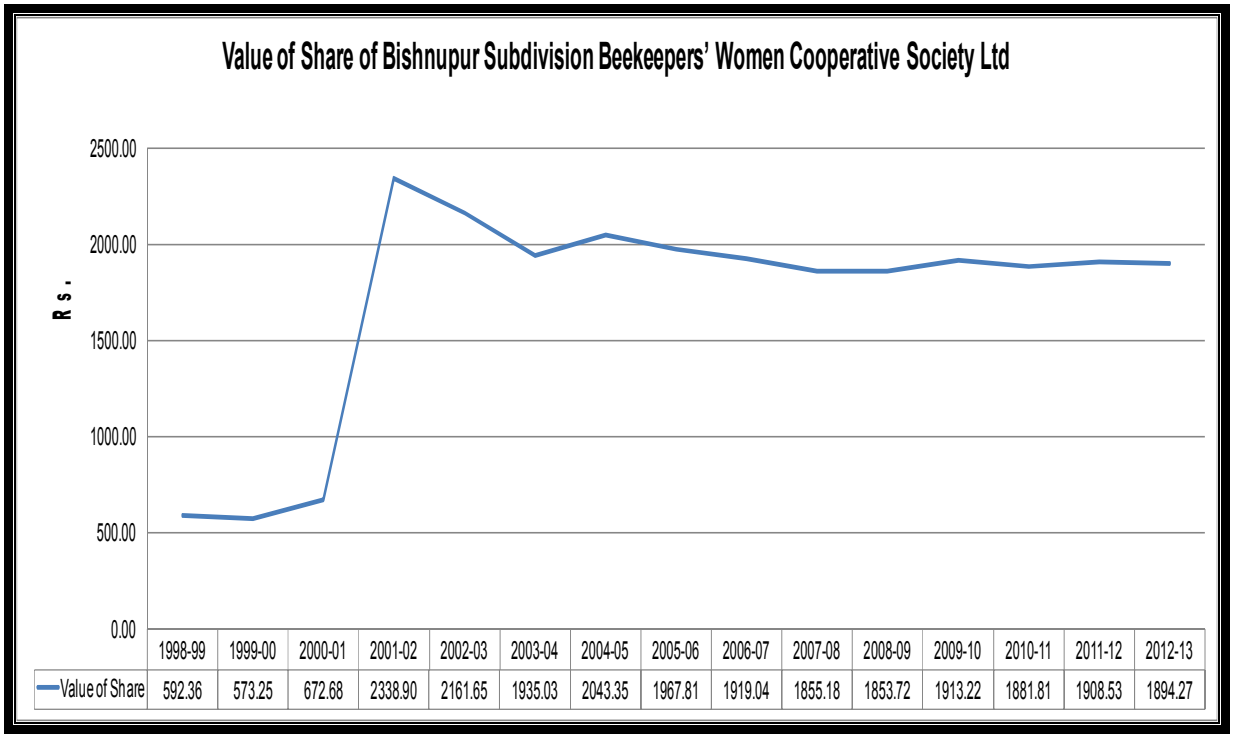
Apis Dorsata honey (Crane, 1999, pp. 583-585). It is interesting to note that in New Zealand, popularly known country in apiculture, the introduction of apiculture was done by women named Mary Bumby in 1839, when she brought two straw hives from England (Huber, 2012). The United States Department of Agriculture (USDA) recently released a report on the impact of women in agriculture. It has noticed that 31 % of all farmers in USA are women. In national/regional beekeeping/pollinator groups, 30.4% are women, in state beekeeping associations, 30% are women and in local beekeeping clubs, 42% are women (Colopy, 2015).

7.8.3: Women Empowerment in Modern Beekeeping

Previously, behavioural taboos and cultural practices prevented women from partaking in the practice of beekeeping. However, the introduction of modern beekeeping, which includes modernised hives and technological practices, has enabled women a greater penetration into the practice of beekeeping (Makerere University, Faculty of Agriculture, 2001, p. 22). It is important to note that beekeeping is a lucrative trade even using simple management with little need for tendering (Hilmi, Bradbear, & Mejia, 2011, pp. 4-5). It can be practiced equally by men, women, grown up children and even by physically handicapped and old persons. Moreover, the investment required is low, and the economic returns are comparatively very high (Maharashtra State Horticulture and Medicinal Plants Board, 2008, p. 3). It has shown that in West Bengal total 36426780 women are non-workers. Out of 34756355 workers population of West Bengal, 4031957 females are marginal workers. Female cultivators and female agricultural labourers are 616647 and 2736028 respectively (Census of India, 2011). It has shown that in 24 Parganas district total 3380260 women are non-workers. Out of 2964494 workers population of 24 Parganas district, 352952 females are marginal workers. Female cultivators and female agricultural labourers are 53232 and 151300 respectively (Bureau of Applied Economics & Statistics, 2013). It has also shown that in North Dinajpur district total 1180069 women are non-workers. Out of 1075626 workers population of North Dinajpur district, 140426 females are marginal workers. Female cultivators and female agricultural labourers are 32137 and 136363 respectively (Bureau of Applied Economics and Statistics, 2012). The apiculture industry can utilise the huge numbers of women resources and women also can get alternative source of income. If socio-economic conditions of West Bengal can provide safe and secure environment for migration especially for women, the women can accept modern migratory apiculture. In this present condition, a single woman, Rina Saha of Sahapur, Malda, has shown her braveness by accepting modern migratory beekeeping. Other than Rina, no female beekeeper in West Bengal can take this migratory

apiculture as her occupation. In 2012-13 she had 50 bee colonies (Field Survey, 2012-13). A few women of West Bengal have been contributing their efforts in apiculture development since 1987 (Field Survey 2013-14 & Table 2.7). In the year 1987, thirty women joined their hands after getting apiculture training from KVIC and formed a cooperative society at Joypur, Bankura, in the year 1988. The name of the society is Bishnupur Subdivision Beekeepers' Women Cooperative Society Ltd (Registration No. 14BK Dated 02.06.1988). They started keeping bee colonies but could not move the colonies in various fields of different districts of the state. But they had shown their entrepreneurships in apiculture in West Bengal. Among those thirty members the significant names are Panchubala Nandi, Gita Singh, Anjali Dey, Bijali Mondal, Seema Ghosh and Arpita Mondal. Panchubala Nandi was the first Chairman of the Society. Anjali Dey was the first Secretary of the Society. Now they are 106 members (2012-13). Other mentionable names associated with the only women apiculture cooperative society of West Bengal are Rekha Samanta, Mala Senapati, Sobha Karmakar, Angur Roy, Anjali Kundu, Usha Das, Mira Lohar, Tarubala Biswas, Arati Koley, Shila Barik, Pratima Lohar, Sabita Pandit and Pari Pramanik. They are doing jobs like Purchasing of raw honey from beekeepers, Processing of raw honey, Selling of honey (loose or bottled), organizing Training programme on modern beekeeping and Providing 'lorry' (transport) services for migration to the beekeepers. But most of them are not maintaining bee colonies. A few of them maintains bee colonies but not migrate the colonies. The good thing is that the honey is graded and branded by them which make them easy to compete with other societies. They had started the society with 393 number of shares face value of which is Rs. 10 each. In other words, these 30 women had started the business with Rs 3930 in the year 1988. The value of each share now has stood at Rs.1894.27 (Graph 7.2). Graph 7.2 has shown the year wise growth of value of each share capital. From this graph it has been noticed that they have increased the value of their cooperative society's share capital. If 106 women can do it, other women of West Bengal can also do so for the development of apiculture industry of the state and at the same time they can be able to earn income for their livelihood.

GRAPH 7.2: GROWTH OF VALUE OF EACH SHARE OF BISHNUPUR SUBDIVISION BEEKEEPERS' WOMEN COOPERATIVE SOCIETY LTD



Source: Annual Reports (1998-99 to 2012-13) of Bishnupur Subdivision Beekeepers' Women Cooperative Society Ltd [Valuation is based on Intrinsic Value Method on a Going Concern Basis (Basu & Das, 1997)]

7.9: BY-PRODUCTS OF APICULTURE

Besides honey, apiculture gives subsidiary products which are beeswax, pollen (bee bread), royal jelly, propolis, bee-venom and pollination services. These are the by-products of apiculture. The production and value addition of by-products would supplement the income of beekeepers (Qaiser, Ali, Taj, & Akmal, 2013, p. 83). Few organisations of India produce and sale these by-products (except beeswax) but these are less popular in Indian market. In West Bengal also these by-products other than beeswax are not popular in market. The survey (Table 7.10) on 150 general people has revealed that out of 150 respondents 149 know about beeswax. Other by-products are not popular to the general people. Most of them know that bees help to pollinate but only one person knows beekeepers can earn money from pollination service. This particular person knows about pollen, royal jelly and bee-venom also but he does not know about propolis. The person knows this information from journals, not from any market or elsewhere. Table 7.11 has shown other than honey all beekeepers produce beeswax but no beekeepers produce other by-products of apiculture. Further study is needed to know the detail reasons behind it. Till date by-products of apiculture are not popular to beekeepers as well as general people.

TABLE 7.10: POPULARITY OF OTHER BEE-PRODUCTS (BY-PRODUCTS) OF APICULTURE IN WEST BENGAL AMONG GENERAL PEOPLE

Know about following	General People Respondents (150)
Beeswax	149
Pollen (Bee Bread)	1
Royal Jelly	1
Propolis	0
Bee-venom	1
Pollination Service	1

Sources: Field Survey January 2016
No of respondents (General people): 150

TABLE 7.11: OTHER BEE PRODUCTS (BY-PRODUCTS) OF APICULTURE PRODUCED BY THE BEEKEEPERS OF WEST BENGAL

Produce the following	Beekeeper Respondents (150)
Beeswax	150
Pollen (Bee Bread)	0
Royal Jelly	0
Propolis	0
Bee-venom	0
Pollination Service	0

Sources: Field Survey 2013-14
No of respondents (beekeepers): 150

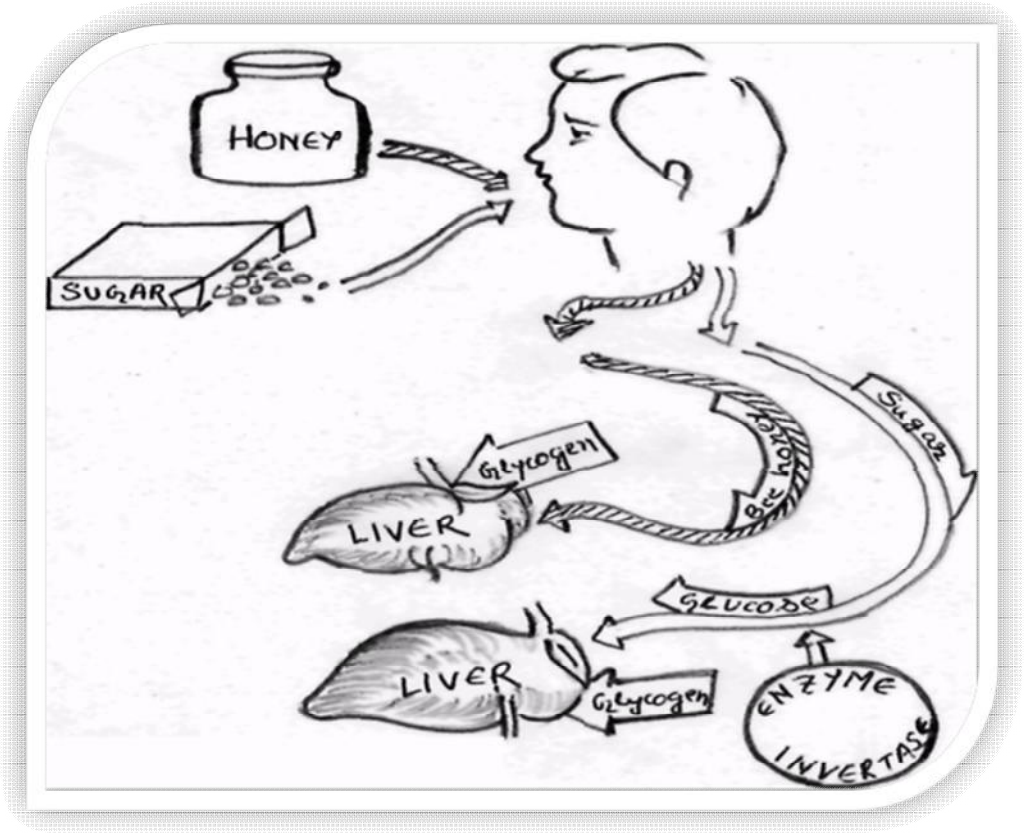
7.10: CONSUMPTION OF HONEY

The benefits and qualities of honey have already been mentioned in the previous chapters. Here it is imperative to mention that honey is more than a healthy substitute for sugar; it is a complete food. The daily uses of honey present no risk or problems. Honey gives us pre-digested sugars, vitamins and minerals. Honey consists of natural sugar required by the body and it does not have to be oxidized by the digestive tract. Honey after consumption comes in the blood stream at the end of twenty minutes, whereas it takes about two and a half hours for usual sugar to reach the blood. When sugar is taken, it must be changed in the digestive tract by the action of enzymes or ferments into the simple sugars-laevulose and glucose (Figure 7.9). But honey is such a source of sweetening that contains a larger proportion of these simple sugars. All artificial sugars and syrups are manufactured by a process in which all

their nutritive elements are destroyed. Sugar is detrimental and it may give rise to ulceration. The use of sugar is a common cause of gastric catarrh and hyperacidity. Sugars oxidized aggressively in the human stomach upon the slightest contact with oxygen, producing a powerful dangerous affect upon the digestive system which in turn compels the vital organs suddenly to work harder and faster. Sugar is a drug, not a food. Sugars are powerful stimulants and habit-forming. Sugar addiction leads to exhaustion of the pancreas and which in turn, may lead to diabetes. But honey has capacity to active pancreas and increase secretion of insulin if applied appropriately, hence can cure diabetes. Refined sugar has a caloric content that will also provide heat and energy but does not provide nourishment. Honey gives us much greater quantity of calories than any other form of sugar or carbohydrate. One tablespoon of lactose contains 40 calories; cane sugars contain 60 calories while honey contains 100 calories. Moreover it has been proved that honey is sweeter than sugar. Hence, a lesser amount of honey is sufficient to replace a certain amount of sugar (Ghosh & Ghosh, 1999, pp. 32-34, 134-136), (Singh S. J., 1958, pp. 16-28).

Dabur India Ltd, Patanjali, Kasmir Ariary, the Cooperative Societies of West Bengal, West Bengal Beekeeper Association and others are always trying to increase the popularity of honey. But the popularization activities cannot go to the targeted people. Though Dabur India Ltd has shown little achievements in this area but uses of honey still remain unpopular. In chapter 6 it is observed that only 24% people of West Bengal use honey. Out of these 24% people no one uses mainly for food purpose. Most of them prefer honey for use in religious and medicinal purposes, where the quantity of consumption is very low. The Table7.12 has shown that per capita consumption of honey country wise. It has been noticed that annual consumption of honey per capita of Germany and Greece exceeds one kilogram. Indian people consume very poor amount. Most of the uses are related to religious and medicinal purpose.

FIGURE 7.9: THE SPLITTING OF SUGAR (BEET OR CANE) IN THE HUMAN BODY INTO GLYCOGEN AND DIRECT STORING OF HONEY (GLUCOSE, LAEVULOSE) IN LIVER WITHOUT ANY CHANGES.



Source: (Yoirish, 1959, p. 48)

TABLE 7.12: PER CAPITA CONSUMPTION OF HONEY COUNTRY WISE

Country	Consumption per Capita (in KG)	Country	Consumption per Capita (in KG)	Country	Consumption per Capita (in KG)
China	0.1	Spain	0.8	Brazil	0.1
USA	0.6	Germany	1.5	Egypt	0.2
Argentina	<0.1	Canada	0.7	Hungary	0.9
Turkey	0.7	France	0.6	Iran	0.3
Mexico	0.3	Greece	1.8	Israel	0.9
Ukraine	0.8	Italy	0.6	Japan	0.3
India	<0.1	Australia	0.4	UK	0.4

Source: (Bogdanov, 2009, p. 2)

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