CHAPTER 6

Apicultural Practices

6.1 HONEY HUNTING

Honey collection from wild nests of *Apis laboriosa*/*Apis dorsata* is a very ancient art and still a common practice in the entire region of the Hindu Kush-Himalaya. Palaeolithic cave paintings in Spain, South Africa and India reveal that the art of honey hunting is 12,000 years old and one finds a lot of similarity between the ancient methods and those being used now by hill tribes in certain parts of Nepal and Tibet (Dams, 1978; Harnandez-Pacheco, 1924; Pager, 1973; Woodhouse, 1982; Gordon, 1960; Mathpal, 1978, 1984).

Honey hunting in China dates back to the Tsin-dynasty (265–419 AD). Harvesting of honey from nests of honeybees located in inaccessible steep mountain rocks was done by lowering the honey hunter down in a basket with the help of ropes so that he could reach as close to the bee nest as possible. At the time, it was the monopoly of ruling class in China to own the entire honey crop. In the thirteenth century, honey hunting was forbidden because a large number of deaths occurred due to the risky operation (Kelogg, 1967; Tang and Kelogg, 1963; and Svensson, 1977).

Breadbear (1986) reported Zamba, Wogmbra, Gaylegphug, Sarbhang, Bubja, Paro and Phuntsholing as major places of honey hunting operations in Bhutan. Surveys of these places revealed 20 to 32 nests of *Apis dorsata*/*Apis laboriosa* either inhabited by bees or in the form of empty damaged combs. These nests were generally located either on cliffs or in large forest trees especially myna trees, *Tetrameles nudiflora,* (Breadbear, 1986).

The two wild species of honey bees, *Apis laboriosa* and *Apis dorsata*, make their single comb nests in difficult mountain rock areas which are quite inaccessible to man. So it is only the very experienced, daring and knowledgeable persons, who have learnt the art of

honey hunting from their ancestors, who can harvest honey from such colonies. Such honey-hunting methods involve killing the entire brood as well as large numbers of adult bees. As a result of this practice, and also due to mass deforestation, these two wild species of honeybees face the danger of extinction from the Hindu Kush-Himalaya.

In recent year, very interesting studies describing the methods of honey hunting as well as the socio-economic and religious factors involved in this practice have been reviewed by Strickland (1982) and Valli and Summers (1988). Harrer (1953) also described the honey hunting methods by the Nepalese in Tibet.

6.1.1 Honey-hunting Equipment

The equipment involved in honey hunting includes about a 50-metre-long bamboo-fibre ladder for descending to the site of the bee nest, a bamboo pole for cutting the nest comb, a bamboo basket for honey collection, a loose cap around the head and back of the honey hunter to save him from the attack of aggressive bees, two short sticks tied to a rope for lowering the brood comb, and wood and foliage cuttings to generate smoke to disorient and calm down the aggressive bees.

6.1.2 Honey-hunting Method

After performing certain religious rites considered necessary for the success of the honey-hunting operations, the leader of the honey-hunting team (usually an elderly villager with several years of honey-hunting experience) climbs to the top of the cliff, and from this point a bamboo ladder is suspended, after tightening it firmly to the trees at both the upper and lower ends. The leader descends the ladder. He holds a bamboo "reaching pole" about 3 cm long, to cut the honey comb. Another person somewhere between the cliff and the nest, manipulates the hanging ladder so that the honey hunter get as close to the bees nest as possible. At the base of the cliff, a fire is let to produce smoke which will calm down and disorient the bees from the nest. As a result of this, bees fly off and the golden comb becomes visible. A single comb nest of *Apis dorsata/laboriosa* consists of two parts, the portion attached to the cliff which is full of honey and is called the honey comb, and the lower crescent of the nest housing brood (the larvae and pupae), known as the brood comb. First the brood-containing part of the nest is removed. This is done by pushing two short sticks tied to a rope from the cliff, into this part of the comb, with the help of a bamboo pole. Once the brood comb-part has been separated from the honey comb, it is gently lowered with the help of the rope, and put into a basket for the extraction and processing of wax.

After the brood comb is separated, honey starts oozing out from the honey comb while it is still attached to the cliff, and several men gather at the base of cliff to get a taste of it. Finally, this part of the nest is broken off in parts with bamboo poles and the honey collection basket is swung to and fro guided to catch the honey chunks as they fall. When the basket is full, it is lowered to the ground, emptied and used again. Some wise and experienced honey hunters do not destroy the nest comb, completely leaving a part of it attached to the rock cliff for the next year's harvest. New combs would be built much faster on an old existing one. *Apis dorsata / laboriosa* are very quick in building new combs. This honey-hunting method involves teamwork and is a very risky task. A slight error on the part of the hunter could mean sure death.

Honey-hunting seasons in Nepal are Spring and Fall. According to Valli and Summers (1988) earlier honey hunters used to harvest as many as 600 combs per year. But now due to the decline in number of these wild nests of *Apis dorsata* and *Apis laboriosa,* the number has come down to 80 per year. In Nepal and also in other parts of the Hindu Kush-Himalaya, *Rhododendron anthopogon,* a species which grows near the tree line of the high altitude forest produces honey which is toxic to man and its consumption leads to cold sweats, vomiting and impaired vision (Valli and Summers, 1988). Honey hunters in Nepal through experience have come to know about it and they avoid taking such toxic honey. Its toxicity is tested by pouring a drop of the honey on the palm and if it tingles, then it may not be safe to eat. The scientific value of such a test is still a mystery.

Honey harvested by honey-hunting methods is distributed among the members of honey-hunting team in proportion to the risk and labour put in by each member. For example, the leader of the honey-hunting team gets the maximum share, this is followed by the mayor of the village who calculates each member's share. The next share goes to members who help in relaying the equipment, smoke the comb, and filter the honey. Besides, at the base of the cliff, other villagers are allowed to thrust out pots and pans to collect the "raining honey" from the comb because they also pay the tax to the Government which in turn permits honey hunting.

A part of the honey collected by honey hunters is used for family consumption and the remaining is bartered for grain, yoghurt, milk, chicken or even a day's work. In the year when a good amount of honey gets collected, it is sold in the village market at the rate of one U.S. Dollar per kilogramme.

The brood comb collected by the honey hunters is used for wax. First it is melted over a fire and then poured through bamboo strains into cold water and finally, it is shaped into bricks of two-and-a-half

kilogrammes each. The beeswax is sold in Kathmandu market where it is used in the lost-wax process of casting bronze.

Keeping in view the great risk of life involved in honey hunting and also the declining number of *Apis dorsata/laboriosa* nests in the Hindu Kush-Himalayan region, the profession of honey hunting is now coming to an end.

6.2 TRADITIONAL BEEKEEPING

In different countries of the Hindu Kush-Himalaya, several different types of hives such as hollowed logs, wall recesses and boxes of various dimensions and designs are in use even today for beekeeping with *Apis cerana*. These traditional bee hives reflect the remnants of ancient bee knowledge and are the relics of honey-collection techniques being practised by mountain farmers through the centuries. Although these indigenous hives evolved under different beekeeping traditions and socio-economic conditions, they show remarkable similarities in shape and design. This may so because from the very early times, man attempted to keep bees as close to the natural conditions as was possible. Different types of traditional hives along with their advantages and disadvantages are discussed here.

6.2.1 Log Hive

The idea of using log hives originated when attempts were made by man to domesticate honeybees for harvesting honey. In India, the traditional log hives are used commonly at a higher altitude from about 2000 m above sea level (Kapil; 1971; Sharma, 1948; and Singh, 1962). In Burma, 30–35 cm long hollowed log hives are found in Kachin, Kaven and Keyer states. In Bhutan, traditional log hives are used in Gaylephung, Suri, Phuntsholing and Thimphu-Yusipang (Breadbear, 1986). Nepal has a long history of using log hives for beekeeping with *Apis cerana* and in recent years several attempts have been made to improve the design and dimensions of this traditional hive suited to the smaller body and colony size of *Apis cerana* (Kafle, 1990).

A traditional log hive is a simple structure without any frames, separate brood or super chamber. It is basically made by hollowing out a piece of tree trunk, closing both its sides and boring a small hole of suitable size along its length to serve as an entrance for the bees.

Among the most traditional log hives are horizontal and vertical log hives (Saubolle and Bachmann, 1979; Wadhi, 1961). The length of a hollowed horizontal log hive varies from 60 to 75 cm, and the entrance hole of 6 mm diameter or of pencil thickness is made in the middle of the log. The two open ends of the log are closed with a piece of tin or wooden plank or stone fixed with a mixture of cowdung and clay.

In these horizontal log hives, strips of old combs at two ends are fixed with melted wax or candle drippings. The space between the old combs from centre to centre is 3 cm which provides enough space for the free movement of bees. Each end of the log hive is provided with four to five such old combs strips and the central ones are left empty for the bees to build new combs themselves. In such a horizontal log hive, the bees build the combs parallel to the ends of the log. While harvesting honey, only the combs at the two ends of the log are removed and the central combs with the brood and honey are kept intact.

The vertical log hive is similar to the horizontal one except that it is kept in an upright vertical position instead of a horizontal position. The hive is generally placed on a piece of tin or flat stone with five to six holes, of pencil thickness above the base, which act as entrances for bees. The top of the vertical log hive is closed with a wooden or tin plank in which eight to 10 holes of one centimetre diameter are made through which the bees can freely move to the super box placed on the top of the vertical log. The super chamber may be in the form of a box, mud pot or altar. From the vertical top bar hive, honey is harvested from the super combs during the second year after bees have inhabited the hives, because in the first year, bees will fill the vertical log with brood, pollen and honey.

In China, traditional wooden log hives are used in some parts even today (Ooschmann, 1961). These, hives are 40 cm high, 30 cm in diameter, and open at both ends. As the colony strength increases, the volume of these hives can be increased by the addition of more wooden rings to the bottom and top, of the hives. Rings are tied with cords to keep these parts of the hive together and both the ends are closed with the help of wooden planks. However, honey yield from *Apis cerana* colonies kept in such hive as low as 5 kg/colony, which is only about one-fourth of that obtained from modern moveable frame hives (Ooschmann, 1961).

In Nepal attempts have been made to improve the design of these hives by adding top bars to them for holding the combs, on the same principle as used in the African top-bar hives which have proved quite successful in Tanzania and other parts of Africa for beekeeping with African races of *Apis mellifera*. Saubolle and Bachmann (1979) attempted to improve the design of the horizontal log hive by adding top bars and using discarded wood, matting or bricks for constructing the main body of the hive. Such hives are oblong in shape and each was provided with 30 top bars. From such hives, only the side top bars with combs are removed while harvesting the honey and the central ones are left undisturbed for brood rearing.

Further, improvement in top-bar hives was made by Gordon Temple who was working for a UNICEF beekeeping project in Nepal. Keep-

ing in view the small population size as well as body size of the native hive bee *Apis cerana* as compared to the African hive bee, Gordon Temple reduced the size of top-bar log hive to two-third-linear. At both ends of the hive, he provided metal supports for hanging it above the ground so that ants, martens, small mammals and lizards would not disturb the bees. He also reduced the number of top bars from 30 to 20. Instead of in the middle, a rectangular bee entrance was made at one end of the log side and its size was regulated with an entrance block which served as queen excluder to check frequent swarming and absconding. As soon as the colony showed signs of absconding, the entrance blocks were put into position to prevent the queen from leaving the hive. Provision for feeding sugar syrup to the bees was also made by providing an external broadman-type feeder to this improved log top-bar hive. The design, specifications and measurement of the different parts of the African type top-bar hive is given in Fig. 6.1. With the help of Mr. Thomas from France, a centrifugal honey extractor was also designed in which top-bar combs from log hives could fit, but it never came in to practical use.

Crane (1984) during her visit to Nepal suggested changes in the design of the above top-bar hive. In African top-bar hives, there is no space between the top bars and this is done to avoid attacks of aggressive African honeybees when the hive is opened for inspection. However, the native hive bee, *Apis cerana* is very gentle to handle. Keeping this in view, Crane (1984), suggested that for improved ventilation of the log hive, narrower top bars should be used so that enough space is left between them. She also advised that a frame feeder be put inside the hive because the external feeder would enhance the chances of robbing. In order to save precious timber, the use of bamboo for constructing the top-bar hive was also suggested.

Speth (1986) prepared detailed instructions for constructing the top-bar log hive for beekeeping with *Apis cerana* in which a hollow log traditionally used could be changed into a top-bar hive. He suggested that the width of each top bar should be 30 mm and a 10 mm wide entrance in the middle to hive.

In Nepal, different agencies like UNICEF, the Agricultural Development Bank, and Kathmandu Agricultural Assistance Association launched an ambitious programme of beekeeping with the native hive bee *Apis cerana* in top-bar log hives. These agencies also started three-day training courses in different parts of Nepal for the popularization of top-bar log hives and distributed a large number of them to the farmers. However, after the termination of the UNICEF beekeeping project in Nepal, these top-bar log hives are now not in common in Nepal.

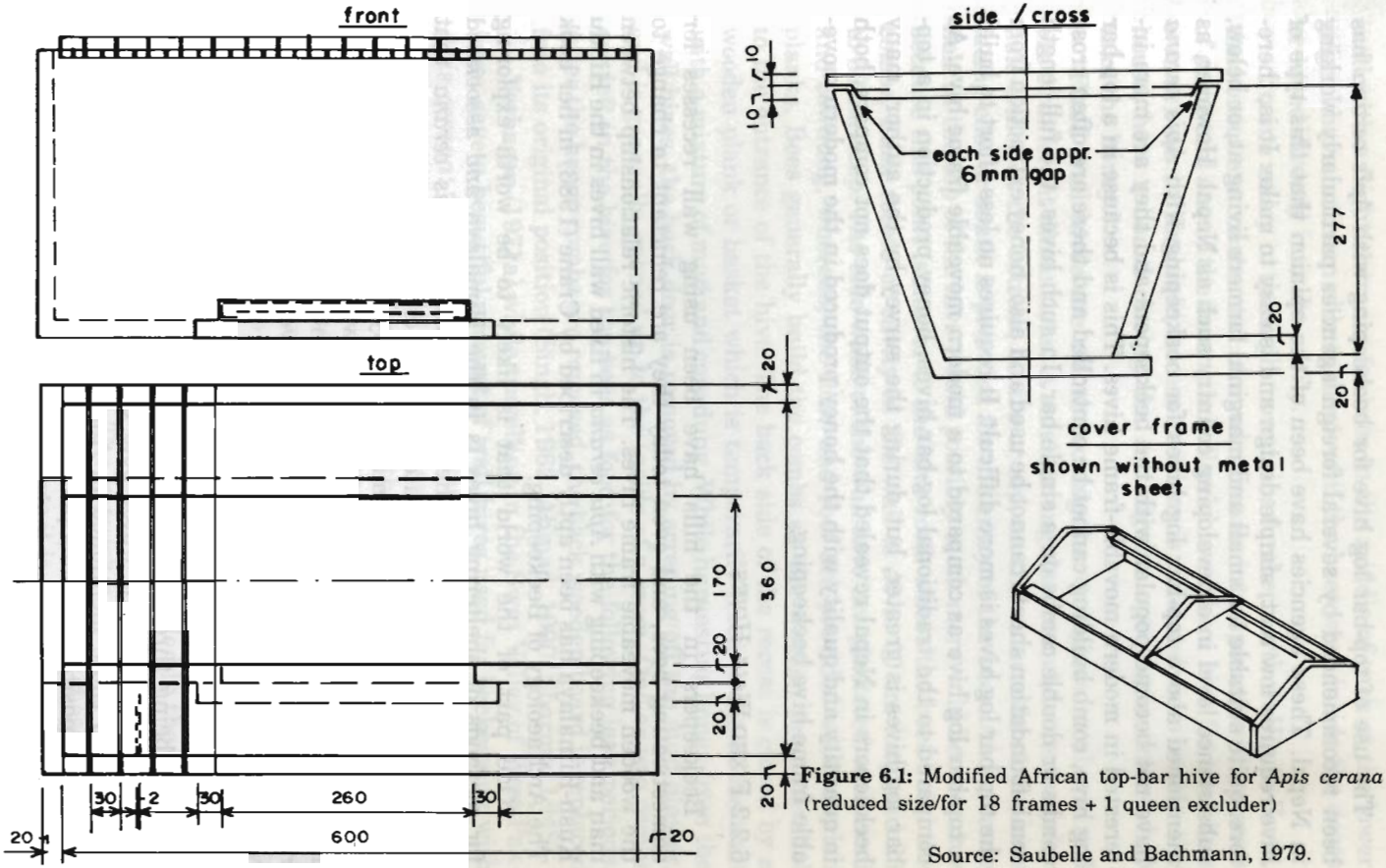


Figure 6.1: Modified African top-bar hive for *Apis cerana* (reduced size/for 18 frames + 1 queen excluder)

Source: Saubelle and Bachmann, 1979.

The use of top-bar log hive for beekeeping with *Apis cerana* has been recommended by several foreign agencies particularly working in Nepal. These agencies have been of the opinion that this type of hive requires low cost, simple design and is easy to make. It is, therefore, quite suitable for small and marginal farmers living at, or below, subsistence level in a developing country such as Nepal. However, as mentioned above top-bar log hives for beekeeping with *Apis cerana* have not become popular with the beekeepers and they are more interested in modern movable-frame hives. This is because in a top-bar log hive, comb building cannot be controlled and there are often cross combs or double combs on a single bar. In such hives, the full-length comb foundation sheets cannot be used and also, honey extraction from the top-bar log hives is more difficult. It requires no less effort to build a top-bar log hive as compared to a modern moveable frame hive. As compared to the traditional log-bar hives, honey production in a top-bar log hives is greater, but during the survey by the author, many beekeepers in Nepal revealed that the output does not compare, both in quantity and quality with the honey produced in the modern moveable frame hive beekeeping.

6.2.2 Fixed Wall Hives

Beekeepers in the hills have been using wall recesses for domesticating bees, and even today they are reluctant to change to the wooden moveable frame hives. The historic relationship between man and beekeeping with *Apis cerana* in fixed wall hives in the Hindu Kush-Himalaya has been aptly described by Crane (1983) in her book The Archaeology of Beekeeping:

"One part of the world that is likely to be worth exploring for methods of sheltering hives is in the Himalaya and associated mountain ranges. The bees here are strains of *Apis cerana* that can withstand the harsh climate about which rather little is known. Winters are cold but summers may give fairly good honey yields. Many of the valleys are isolated and traditional ways survive. In Kashmir, I have seen many houses with internal shelves in the thickness of mud walls containing rows of horizontal hives of mud, clay, wicker or wood, a flight entrance being provided for each to the outside. The wall warmed by the cooking hearth was always well stocked with hives. Honey is taken from the end of the hive inside the house, the shutters being thrown open to let flying bees escape. There are no glazed windows. I saw water pots embedded in walls on a similar principle to those mentioned in Anatolia except that alternate hive faced in opposite directions perhaps to reduce drifting.

"In Ladakh, a higher and more remote valley, a row of wooden doors was found to be filled between the upright beams of a house

wall with a flight entrance for bees in the middle of each at the lower edge. I have not been able to discover if the bees were inside the doors or hived directly into the cavity.

"In one valley in the high mountains further north in Hindu Kush, the houses are constructed of wooden beams interspersed with courses of stone and one of the beams is hollowed to make a hive for bee (*Apis cerana*). As in Kashmir, access to them is obtained from inside the house, here a board closing the rectangular opening is removed to take the honey."

Fixed wall hives are either rectangular or square in shape and are of different dimensions. A small triangular, round, or rectangular hole either at the bottom, centre or top, on the outer side of the hive facing east or south is provided for the entry of the bees. An entrance hole at the top of the hive would possibly catch more wild bee swarms because this point is nearer to the hive roofs where the bees build the combs. Each recess or cavity in the wall is 40 to 60 cm long and 25 to 30 cm deep. The side walls of the wall hive are plastered with mud and cowdung, whereas, the floor and roof are provided with wooden planks. Bees generally build the combs on the wooden room parallel to the entrance of the hive. The back side of the recess is closed by a wooden plank or basket which is temporarily fixed to the house wall with a mixture of mud and cow-dung. While harvesting honey from the wall hives, the back door is removed by scraping off the mud plaster, and is generally opened up to the inside of a room. One or two combs are left in the hive for the bees as food for the following lean periods. After the honey combs are removed, the back wooden board is replaced into its original position (Singh, 1962; Ahmad, 1990; Sharma, 1948).

Verhagen (1971a) while travelling in the Swat Valley of West Pakistan gave a beautiful account of wall hives used for beekeeping with *Apis cerana*: "In Swat, a mountainous region at the foot of the Himalaya and which until recently was a little independent kingdom, there exists a form of beekeeping that is almost unique. The Pakistani says that Swat is the homeland of the bee. It is certainly the region which supplies the greater part of the table honey produced in Pakistan and where men and bees live together in a kind of bucolic symbiosis. In fact, when a farm is built in Swat, care is taken that cavities are made in the walls with an orifice the size of a finger, on the outside and a more or less rectangular window about 20 cm in length on the inside. After a swarm has been settled in the cavity, the large opening is sealed with a plank and mortar. Afterwards the small orifice on the outside is opened. The harvest is taken by removing the combs from the inside of the rooms. The location of these cavities or hives, (which can be seen easily because it is customary to mark these orifices with a ring of dark colour), is some times very unexpected.

"I have seen them in the wall of verandah, living room or kitchen of a home with the bees flying about without any hazard to the people including several boisterous children, and also various domestic animals."

In Afghanistan, *Apis cerana* is found in the southeast region comprising Jalalabad, Nouristan and Pactia. In these places, this native hive bee is kept in wall hives as in the Swat Valley of West Pakistan. However, in this region the design of the wall hive is somewhat different. Instead of making a cavity in the wall, hollow timber forms the main body of the hive. These timber hives are built into the house walls at the time of construction. Each hollow timber hive contains two colonies of bees, separated from the inside by a board and mortar, and each having an independent entrance (Verhagen, 1971b).

According to Ahmad (1984) wall hives are commonly used in Swat, Dir and Hazara, in Pakistan. In these places, some wall hives are also provided with moveable frames. A further development of wall hives in Pakistan is the "pitcher hive" made of clay. These are inserted into the housewall and the cavity is inhabited by bees. A clay lid acts as a covering for opening it from inside the house.

A preliminary survey reveals that *Apis cerana* colonies abscond/migrate less frequently from fixed wall hives than from modern moveable frame hives. This is possibly due to the fact that wall hives in the hills are generally more than six to eight feet above the ground. They are not easily accessible and are therefore not subjected to disturbance. Keeping this aspect in mind efforts should be made to design wall hives in such a way that moveable frames can fit into them, which would make the extraction of honey more easy and hygienic.

Besides curtailing absconding, other advantages of wall hives are that larger colonies can be accommodated in smaller spaced wall cavities, ample insulation to the bees is provided particularly in the winter season; and there is no interference from cattle, wild animals and other enemies.

However, the traditional or commonly used wall hives have several disadvantages also: increased chances of queen losses: robbing, frames getting glued, and difficulty in handling. Colony movement is difficult and expensive, and there is also the problem of proper ventilation.

6.2.3 Miscellaneous Traditional Hives

All sorts of boxes, clay pitchers, tree barks and mud receptacles of variable dimensions are used by beekeepers for rearing bees. These are generally suspended in a verandah or open corridor of a house immediately below the roof so that they are clearly visible to the swarms of bees. It has often been observed that *Apis cerana* colonies deserted their indigenous hives during the lean periods and at the onset of the

next honey-flow season, then return to these hives. A survey carried out by Nakamura (1988), a Japan Overseas Corporation Volunteer, reveals that in certain parts of Nepal, more than 50 per cent of traditional hives are always empty and such beekeepers are referred to as "waiting beekeeper".

Villagers collect swarms of bees from branches, rock cavities or grass heaps in small bamboo baskets and generally sprinkle water or dust over the bees so that they may not fly off swiftly. Finally, these swarms are domesticated and housed in the vacant traditional hives.

In Burma, besides traditional log hives, the following other types are also in common use (Nyein, 1984):

1. Bamboo Hives: Hill tribes from the Dawna range of Karen state utilize bamboo stems as beehives. Such hives are hung vertically from the ceiling of a hut with the help of a rope.
2. Underground clay pot hives: Hill tribes from the Chil hills bury clay pitchers underground to protect the bees.
3. Underground cave hives: Hill tribes in Chin state of Burma practise another peculiar traditional method of using underground cave hives for beekeeping with *Apis cerana*. First, a hole is dug in the earthen slope and this is covered with a wooden board which has a small opening for the bees to enter. This is generally used for catching swarms of wild bees and a piece of old comb is kept near the entrance to attract such swarms.

6.2.4 Honey Harvesting from Traditional Hives

Honey is squeezed out of the comb by pressing it through a piece of cloth. It is either used for household consumption or taken to the market in pre-used earthen pitchers, bottles or other household utensils for sale. One often finds farmers sitting on the pavements of markets of the mountain cities or going from door to door to sell the honey. A survey revealed that honey collected through traditional methods is often adulterated with cheaper edible products like sugar.

The traditional methods of beekeeping explained above have several disadvantages, both to beekeepers and honey consumers. It is only a matter of chance that the above-mentioned indigenous and simple hives attract swarms of bees, and that colonies would be established in such hives. Thus, a farmer cannot help keep the desired number of hives through traditional beekeeping. In the traditional hives, frequent inspections of colonies to check the incidence of pests and diseases, requeening, provision of artificial feeding during dearth periods and occasional cleaning is not possible. This often leads to frequent abscond-

ing/deserting of the hive, which is one of the most serious problems in beekeeping with *Apis cerana*.

Honey extracted by the traditional squeezing method is not pure as it contains brood extracts, parts of the bodies of bees, hive debris and dirt. Furthermore, a number of bees get killed leading to reduction in the colony strength. Also, bees have to waste lot of their energy in making a new comb since the old one is destroyed while squeezing honey out of it. Honey is generally stored in pre-used bottle, tins, earthen pitchers and is sometimes in advanced stage of fermentation, and is thus unfit for human consumption.

6.3 MODERN HIVE BEEKEEPING

6.3.1 Historical Perspectives

Modern hive beekeeping in the Hindu Kush-Himalaya has its origin in India during the later nineteenth century (1881–1884). In South India, it was Rev. Father Newton, who designed a small modern bee hive with moveable frames for beekeeping with *Apis cerana*. In the northern temperate region of India, Mr. John Douglas (1980) introduced modern bee hives to domesticate this native bee species. Before his modern bee hive came into use, Mr. Douglas unfortunately died but his experiences with beekeeping in northern India were published in the form of a book entitled *A Text Book of Beekeeping in India*. From 1882–1884, Sir Louis Dane, an Assistant Commissioner in Kulu (Himachal Pradesh) and a hobbyist beekeeper, kept bees in modern hives. Later, as Lieutenant Governor of Punjab, be introduced modern bee hives in his residence apiary at Barnes Court, Shimla, which is even today the official residence of the present Governor of the state. In 1909, the Punjab Beekeepers Association was formed at Shimla under the patronage of Sir Louis Dane. The Punjab Government in (1913) appointed Mr. F. S. Cousin, Lieutenant (retired) as an apiarist in the Department of Agriculture and Industries, with headquarters at Sanawar (Himachal Pradesh). Mr. Dorafeef, an engineer employed in the hydro-electric scheme, Joginder Nagar established an apiary (1930) at Kahul (Kulu in Himachal Pradesh). This apiary was looked after by Melisko, a Romanian, for about two years, and later by Litenkov, a Russian, who shifted this apiary to Raison (Kulu). In 1937, R. N. Muttoo formed an All India Beekeepers' Association and started publication of the Indian Bee Journal. On the recommendation of the Punjab Government and at the instance of Colonel Brayne, Commissioner Rural Construction, commercial bee farms with improved beekeeping equipment were established at Nagrota in district Kangra of Himachal Pradesh (1936) and one at Raison (Kulu) was shifted to its present

site at Katrain (Himachal Pradesh) in 1939. After independence, Saradara Singh and P. L. Sharma made considerable efforts to develop beekeeping in the mountain parts of Himachal Pradesh and the Punjab. In 1953, the All India Khadi and Village Industries Board was formed which was reconstituted as Khadi and Village Industry Commission later. Under this commission beekeeping in mountain areas of northeast and northwest India received enough attention for its development in a coordinated manner. In the early sixties, A. S. Atwal and his research group working in Punjab Agricultural University, Ludhiana, introduced the European honeybee (*Apis mellifera ligustica*) successfully in the plains of the Punjab and submountainous areas of Himachal Pradesh (Verma, 1989b).

6.3.2 Evolution and Standardization of the Modern *Apis cerana* Bee Hive in India

For nearly 50 years (1880–1930), a hive designed by Father Newton was commonly used all over India for beekeeping with *Apis cerana*. However, the worker bees of *Apis cerana* in southern India are of much smaller body size and also the colony population size is smaller than bees of this species found at higher altitudes of northwest India. So the Newton hive was not suitable for beekeeping with *Apis cerana* in southern India as it was in the mountainous parts of Himachal Pradesh, Uttar Pradesh, Jammu and Kashmir. Consequently, *Apis cerana* colonies swarmed and absconded quite frequently from such hives. Moreover, honey yields obtained by using the Newton hive was only 5 kg per colony. Keeping in view these limitations of the Newton hive, Muttoo (1944, 1952, 1954, 1956) designed a new hive for larger sized *Apis cerana* as found in the higher altitudes of the Uttar Pradesh hills and named it the Joelikote Villagers' hive. This hive became quite popular not only in other mountainous parts but also in the plains of northern India. Simultaneously, as many as 15 different types of bee hives in different sizes came into existence for beekeeping with *Apis cerana* throughout India, and all were known as modified Newton or Villagers' hive.

Keeping in view this kind of multiplicity of hive designs at that time, a strong need was felt to evolve different definite standards of bee hives suited to different sub-species/geographic ecotypes of *Apis cerana* found in different climatic zones and beekeeping areas of the country. The first suggestion for the standardization of bee hives in India was made at the XIth All India Beekeepers conference held at Nandgat, Bombay, in 1949. This suggestion was repeated in subsequent annual meetings of the All India Beekeepers' Association and it was in 1956 that an "Apiary Industrial Selection Committee" was con-

stituted as a part of the Indian Standard Institution (ISI) programme. In this committee, representatives of the following organizations were included (Kapil, 1971):

1) Khadi and Village Industry Commission (Beekeeping section), Bombay.
2) Bombay Village Industries Board, Bombay.
3) Department of Agriculture (Apiary Section) Government of Mysore.
4) Government Beekeeping Station, Joelikote, Uttar Pradesh.
5) Apicultural Development Officer, Mysore State,
6) All India Beekeepers Association, Rampur, Uttar Pradesh.

As a result of the recommendation of this committee, the following two types of bee hives (Type A and B) were adopted.

Type A: Modified Newton type of bee hive.

Type B: Modified Joelikote village type of bee hive.

This committee was also of the view that due to the different environmental conditions existing in a vast country like India, different sub species/ecotypes or races of *Apis cerana* may be found. Based on this assumption, each of the above hive types was further sub-divided into three sub-types depending upon the distance between the centres of two adjacent frames and also the different sizes of be space.

Besides prescribing the above standards, a frame size of 40.64 × 20.32 cm was also chosen as the standard, and through the use of dummy or division board, it was possible to convert this size of frame hive into a Newton, Joelikote or even a Langstroth type, depending upon the colony size of *Apis cerana*. However, the most important feature in all these types of bee hives is bee space, and the sizes recommended are 4.76 mm, 6.35 mm and 7.94 mm depending upon the sub species/race/ecotype of the bees (Kapil, 1971).

It has now been experimentally proved that the above proposed standards for different hives have worked very well in beekeeping with *Apis cerana* in India. For example, the Khadi and Village Industries Commission, Government of India has distributed thousands of both modified Newton types and Joelikote villager types to beekeepers. Joelikote has proved very successful for the larger and "hilly variety" of *Apis cerana*, whereas the Newton type is being successfully used for the smaller "plains variety" of this native bee species. Specifications for these bee hives, hive stands, comb foundation mill, comb foundation sheets as well as travelling bees box have been laid out by the Indian Standard Institution (1961, 1962, 1967, 1970 and 1981). Design and dimensions of various parts of type A and type B bee hives with 8 and 10 frames is given in Fig. 6.2 and Tables 6.1 to 6.4. Experimental data

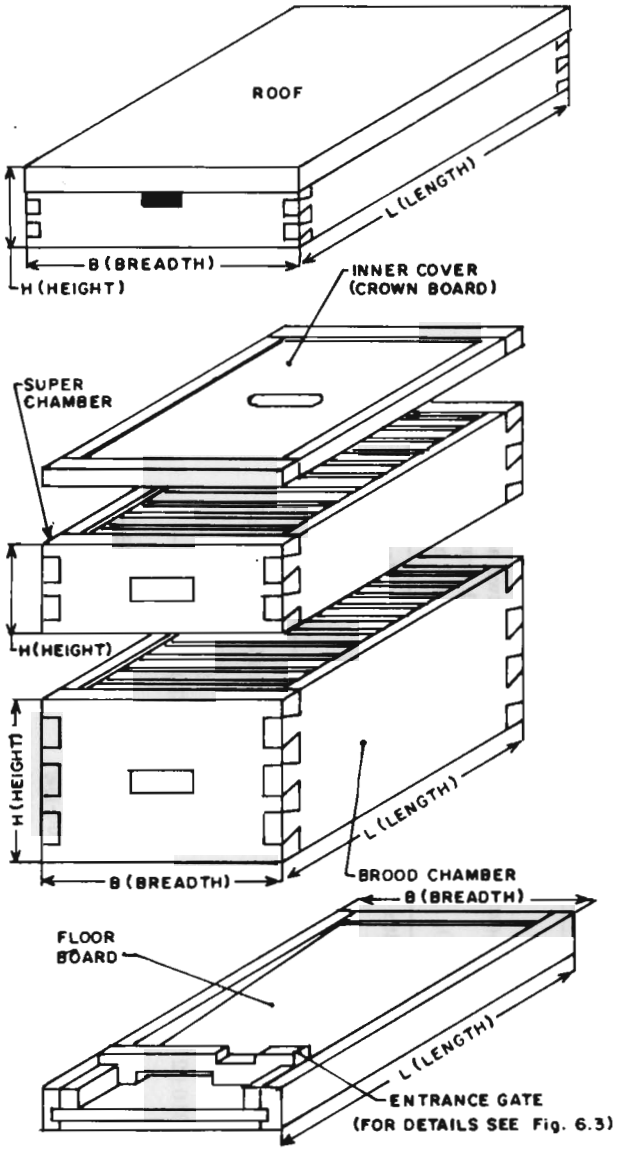


Figure 6.2: Indian beehives type A and B for *Apis cerana*. (For details of dimensions of various parts of type A and B bee hives with different number of frames, please see Tables 6.1 to 6.4).

Source: Indian Standard Institution, 1981

Table 6.1: Dimensions of various parts of *Apis cerana* type A beehives with ten frames (in mm)

Description	Distance between centres of two adjacent frames = 30 mm (bee space = 7 mm)			Distance between centres of two adjacent frames = 31 mm (bee space = 8 mm)			Distance between centres of two adjacent frames = 32 mm (bee space = 9 mm)		
	Length (L)	Breadth (B)	Height (H)	Length (L)	Breadth (B)	Height (H)	Length (L)	Breadth (B)	Height (H)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Floor board	361±2	356±2	50±2	361±2	366±2	50±2	361±2	376±2	50±2
Brood frame:									
Outside	230	—	165	230	—	165	230	—	165
Inside	210±2	—	145±2	210±2	—	145±2	210±2	—	145±2
Brood chamber:									
Outside	286±2	356±2	172	286±2	366±2	173	286±2	376±2	174
Inside	240	310	172	240	320	173	240	330	174
Super frame:									
Outside	230	—	85	230	—	85	230	—	85
Inside	210±2	—	65±2	210±2	—	65±2	210±2	—	65±2
Super chamber:									
Outside	286±2	356±2	92	286±2	366±2	93	286±2	376±2	94
Inside	240	310	92	240	320	93	240	330	94
Inner cover (crown board)	286±2	356±2	22	286±2	366±2	23	286±2	376±2	24

Roof (top):									
outside	328±2	398±2	100±2	328±2	408±2	100±2	328±2	418±2	100±2
Dummy board	230±2	—	165±2	230±2	—	165±2	230±2	—	165±2
Division board	236	—	One-end 182 Other end-194	236	—	One-end 183 Other end-195	236	—	One-end 184 Other end-196

Source: Indian Standards Institution 1981.

Table 6.2: Dimensions of various parts of *Apis cerana* type A beehives with eight frames (in mm)

Description	Distance between centres of two adjacent frames = 30 mm (bee space = 7 mm)			Distance between centres of two adjacent frames = 31 mm (bee space = 8mm)			Distance between centres of two adjacent frames = 32 mm (bee space = 9mm)		
	Length (L)	Breadth (B)	Height (H)	Length (L)	Breadth (B)	Height (H)	Length (L)	Breadth (B)	Height (H)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Floor board	361±2	296±2	50±2	361±2	304±2	50±2	361±2	312±2	50±2
Brood frame:									
Outside	230	—	165	230	—	165	230	—	165
Inside	210±2	—	145±2	210±2	—	145±2	210±2	—	145±2
Brood chamber:									
Outside	286±2	296±2	172	286±2	304±2	173	286±2	312±2	174
Inside	240	250	172	240	258	173	240	266	174
Super frame:									
Outside	230	—	85	230	—	85	230	—	85
Inside	210±2	—	65±2	210±2	—	65±2	216±2	—	63±2
Super chamber:									
Outside	286±2	296±2	92	286±2	304±2	93	286±2	312±2	94
Inside	240	250	92	240	258	93	240	266	94
Inner cover (crown board)	286±2	296±2	22	286±2	304±2	23	286±2	312±2	24

Roof (top):									
outside	328±2	338±2	100±2	328±2	346±2	100±2	328±2	354±2	100±2
Dummy board	230±2	—	165±2	230±2	—	165±2	230±2	—	165±2
Division board	236	—	One-end 182 Other end-194	236	—	One-end 183 Other end-195	236	—	One-end 184 Other end-196

Source: Indian Standards Institution 1981.

Table 6.3: Dimensions of various parts of *Apis cerana* type B beehives with ten frames (in mm)

Description	Distance between centres of two adjacent frames = 31 mm (bee space = 8mm)			Distance between centres of two adjacent frames = 32 mm (bee space = 9mm)		
	Length (L)	Breadth (B)	Height (H)	Length (L)	Breadth (B)	Height (H)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Floor board	431±2	366±2	50±2	431±2	376±2	50±2
Brood frame:						
Outside	300	—	195	300	—	195
Inside	280±2	—	175±2	280±2	—	175±2
Brood chamber:						
Outside	356±2	366±2	203	356±2	376±2	204
Inside	310	320	203	310	330	204
Super frame:						
Outside	300	—	105	300	—	105
Inside	280±2	—	85±2	280±2	—	85±2
Super chamber:						
Outside	356±2	366±2	113	356±2	376±2	114
Inside	310	320	113	310	330	114
Inner cover (crown board)	356±2	366±2	23	356±2	376±2	24
Roof (top):						
outside	398±2	408±2	100±2	398±2	418±2	100±2
Dummy board	300±2	—	195±2	300±2	—	195±2
Division board	306	—	One-end 213 Other-end 225	306	—	One-end 214 Other-end 226

Source: Indian Standards Institution 1981.

are available to prove that by adopting such standards, it has been possible to increase yield of honey by 22 to 32 per cent, and significantly reduce the absconding and frequent swarming of *Apis cerana* colonies (Kapil, 1971). Bisht et al. (1982) tested the comparative efficiency of the Joelikote Villager and Newton Bee hives on a heterogeneous mixture of the plains and hilly varieties of *Apis cerana*. As expected, the Joelikote Villager hive is superior and more productive with respect to brood rearing, and pollen and honey storage.

In the late fifties (1957–1959), when the above-mentioned hives were adopted, only the "plains and hilly variety" of *Apis cerana* were arbitrarily known, based on preliminary biometric investigations.

Table 6.4: Dimensions of various parts of *Apis cerana* type B beehives with eight frames (in mm)

Description	Distance between centres of two adjacent frames = 31 mm (bee space = 8mm)			Distance between centres of two adjacent frames = 32 mm (bee space = 9mm)		
	Length (L)	Breadth (B)	Height (H)	Length (L)	Breadth (B)	Height (H)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Floor board	431±2	304±2	50±2	431±2	312±2	50±2
Brood frame:						
Outside	300	—	195	300	—	195
Inside	280±2	—	175±2	280±2	—	175±2
Brood chamber:						
Outside	356±2	304±2	203	356±2	312±2	204
Inside	310	258	203	310	266	204
Super frame:						
Outside	300	—	105	300	—	105
Inside	280±2	—	85±2	280±2	—	85±2
Super chamber:						
Outside	356±2	304±2	113	356±2	312±2	114
Inside	310	258	113	310	266	114
Inner cover (crown board)	356±2	304±2	23	356±2	312±2	24
Roof (top):						
outside	398±2	346±2	100±2	398±2	354±2	100±2
Dummy board	300±2	—	195±2	300±2	—	195±2
Division board	306	—	One-end 213 Other-end 225	306	—	One-end 214 Other-end 226

Source: Indian Standards Institution 1981.

However, recent detailed biometric analysis of *Apis cerana* carried out by Ruttner (1987) and by Verma and Mattu, (1982), and Verma et. al. (1988a and b) with the help of computer-assisted multivariate analysis revealed that there are three different sub-species of *Apis cerana* found in India. Out of these, *Apis cerana cerana* is found in Jammu, Kashmir and Himachal Pradesh, and *Apis cerana himalaya* is found in northeast India. The third ecotype *Apis cerana indica* is found in South India. Keeping in view the body sizes of the three different races, the following trend was observed: *Apis cerana cerana* > *Apis cerana himalaya* > *Apis cerana indica*. Further, each race has further locally adopted population or groups called ecotypes which

differ from each other again in body size and the sizes of bee space required in different hives would also vary. In the Kashmir Valley (India), beekeepers use the standard 10 frames Langstroth hive for *Apis cerana* (Mahindre, 1983).

Modern Hive Beekeeping with *Apis cerana* in Other Parts of the Hindu Kush-Himalayan Countries

Hive standards developed in India are now being used with slight modifications in other countries of the Hindu Kush-Himalaya such as Nepal, Pakistan, Afghanistan, Bangladesh, Bhutan and Burma for beekeeping with *Apis cerana*. However, in these countries the earlier Indian experiences of using different sizes and dimensions of bee hives are being repeated. For example, in the Kathmandu valley of Nepal, the author has observed four different types of box hives, varying in dimensions and designs, being used for beekeeping with *Apis cerana*. The number of moveable frames in such hives varies from 8 to 12. The dimensions of the "Godavari" moveable frame hive has been worked out by Saubolle and Bachmann (1979) and are given in Figs. 6.3A to 6.3L. In Nepal generally, champ or Tuniwood is used for constructing the hive.

In Bangladesh, wooden hives of different sizes and designs are in use for beekeeping with *Apis cerana*, and they are all diminutive versions of the Indian "Newton hive" (Kevan, 1983). Most bee boxes used are 13 × 10 × 7 inches or 11 × 11× 7 inches. CUSO (Canadian University Services Overseas) has recommended the "type A" eight-frame hives for the small sized *Apis cerana* found in the plains of Bangladesh. Generally, jackfruit wood is used for constructing the hives and, to a limited extent, teakwood is also used (Nash and Murrell, 1981).

In Burma, a modified mini Langstroth hive has been designed for beekeeping with *Apis cerana*. The dimensions of the different hive parts are as follow (Nyein, 1984).

Length of brood frame	=	300 mm
Breadth of brood frame	=	195 mm
Distance of two adjacent frames from centre to centre	=	31 mm
Bee entrance size	=	10–25 mm

In Bhutan, moveable frame hive beekeeping is practised to a very limited extent in Galylephug, Phuntsholing, Wangdephodrang, Paro, Thimpu, Yusipang and Bumthang. At each of these places, the number of hives varies from two to six suggesting that beekeeping with modern moveable frame hives is yet to be developed. (Breadbear, 1986).

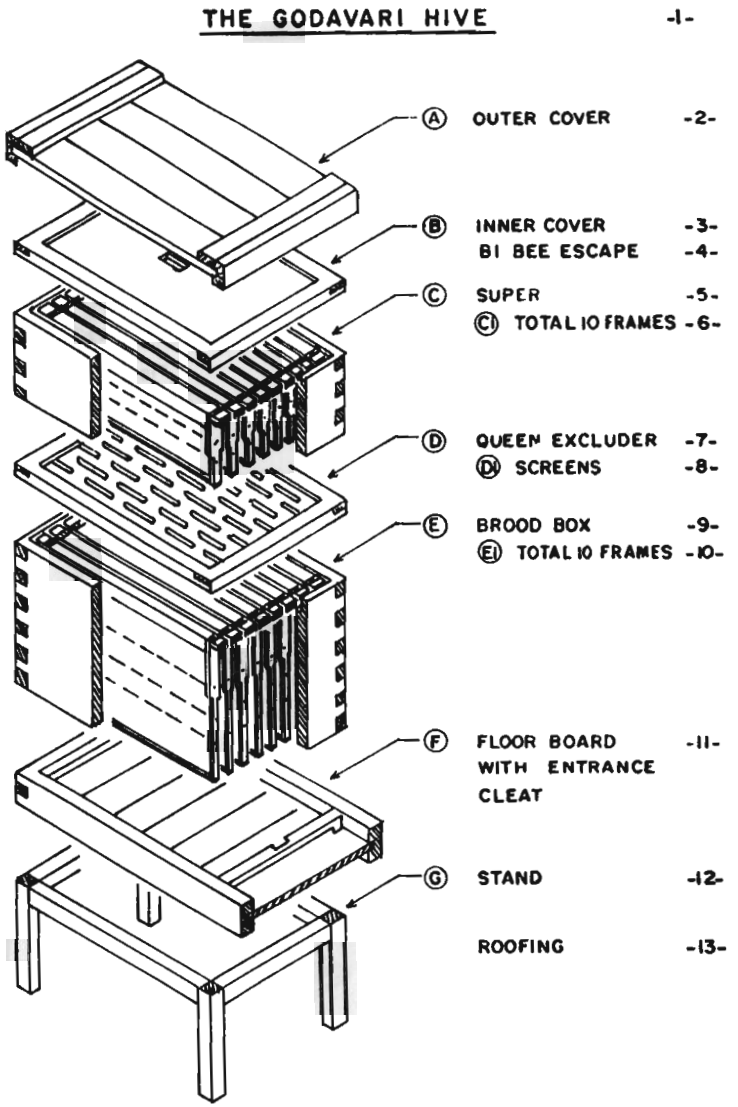


Figure 6.3A: Nepalese Godavari beehive for *Apis cerana* (For dimensions of various parts. Please see Figs. 6.3B to 6.3L).

Source: Saubolle and Bachmann, 1979.

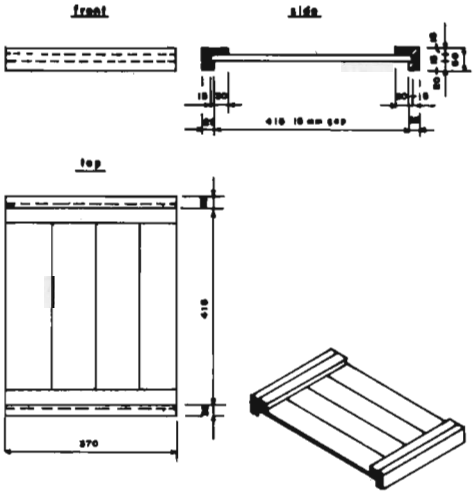


Fig. 6.3 B

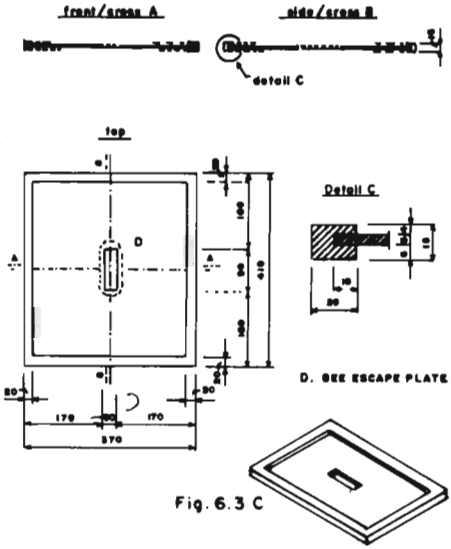


Fig. 6.3 C

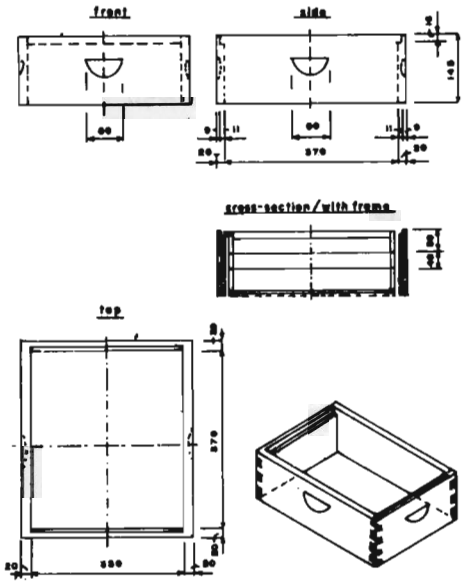


Fig. 6.3 D

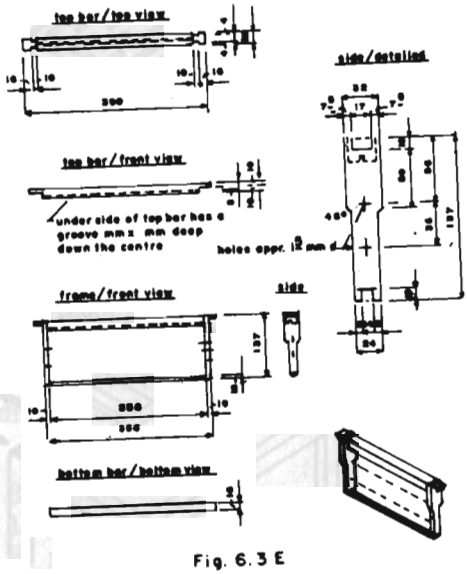


Fig. 6.3 E

Nepalese Godavari Beehive

Figure 6.3B: Dimension of different parts of top cover (roof)

Figure 6.3C: Dimension of different parts of inner cover

Figure 6.3D: Dimension of different parts of super chamber.

Figure 6.3E: Dimension of different parts of super frame.

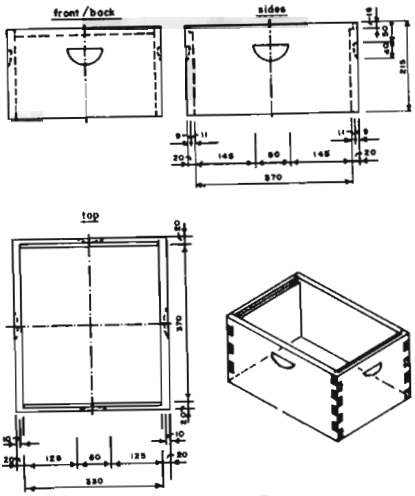


Fig. 6.3 F

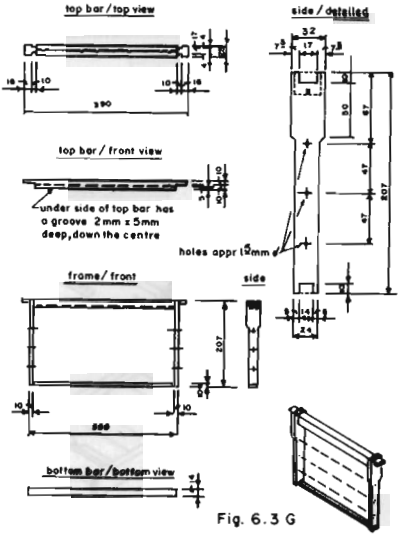


Fig. 6.3 G

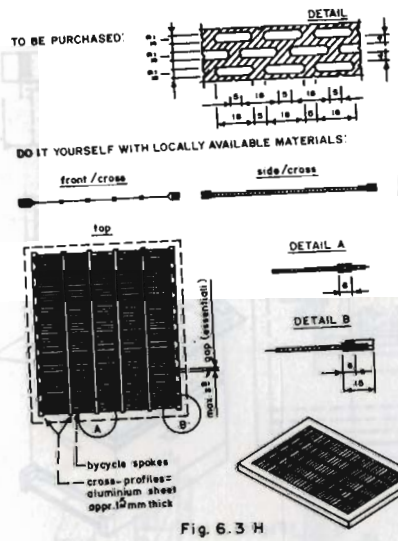


Fig. 6.3 H

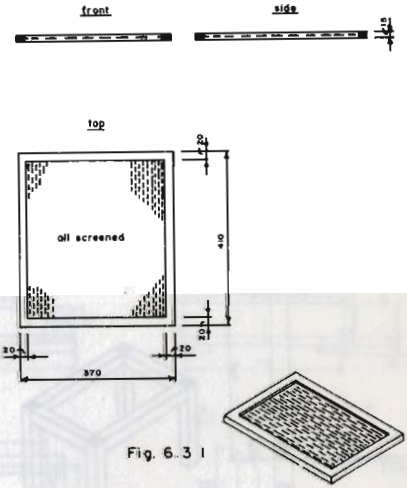


Fig. 6.3 I

Nepalese Godavari Beehive

Figure 6.3F: Dimension of different parts of brood chamber

Figure 6.3G: Dimension of different parts of brood frame.

Figure 6.3H: Dimension of different parts of queen excluder (screens)

Figure 6.3I: Dimension of different parts of queen excluder (frame).

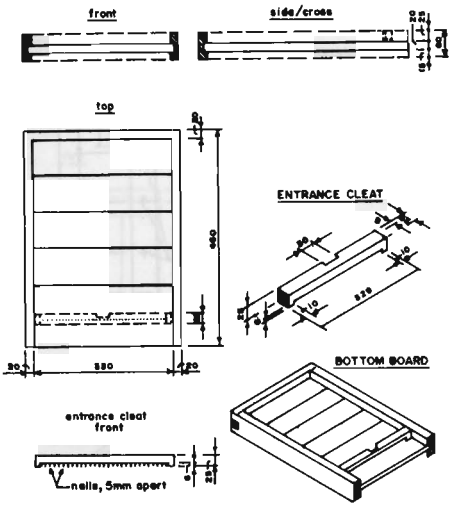


Fig. 6.3 J

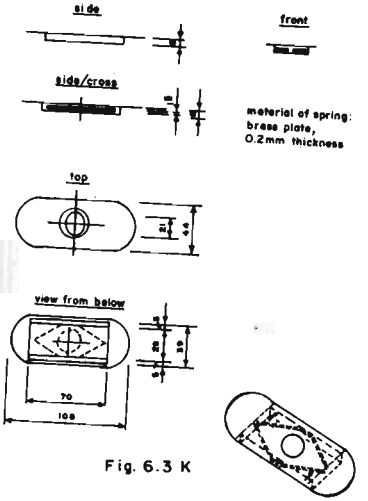


Fig. 6.3 K

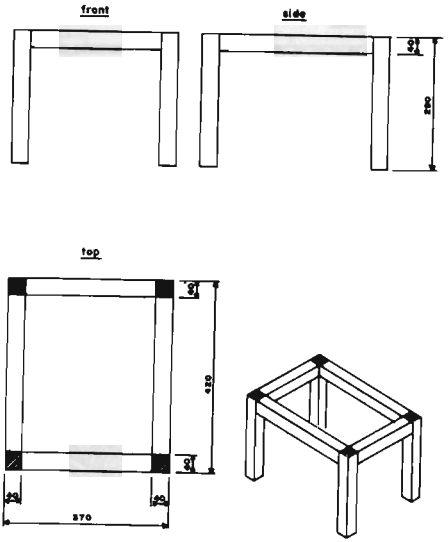


Fig. 6.3 L

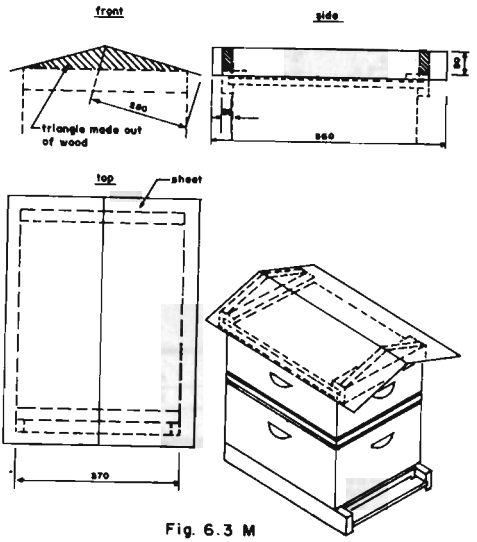


Fig. 6.3 M

Nepalese Godavari Beehive

Figure 6.3J: Dimension of different parts of bottom board

Figure 6.3K: Dimension of different parts of entrance gate

Figure 6.3L: Dimension of different parts of hive stand

Figure 6.3M: Dimension of different parts of roof.

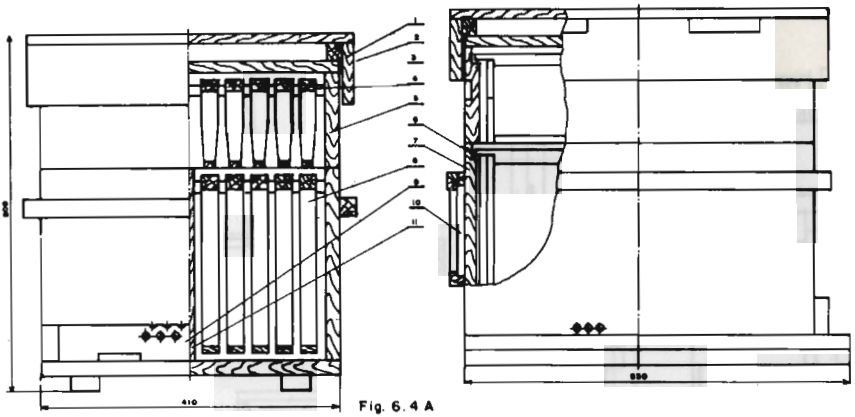


Figure 6.4A: Chinese ten-frame standard beehive for *Apis cerana* (For dimensions of various parts of hive, please see Figs. 6B to 6J).

Source: Yuan et al. 1983.

1 — Top cover (roof); 2 — Inner cover; 3 — Screen;
2 — Super frame; 5 — Super chamber; 6 — Iron slip;
7 — Brood chamber; 8 — Brood frame; 9 — Entrance gate;
10 — Movable screen; 11 — Isolating plate.

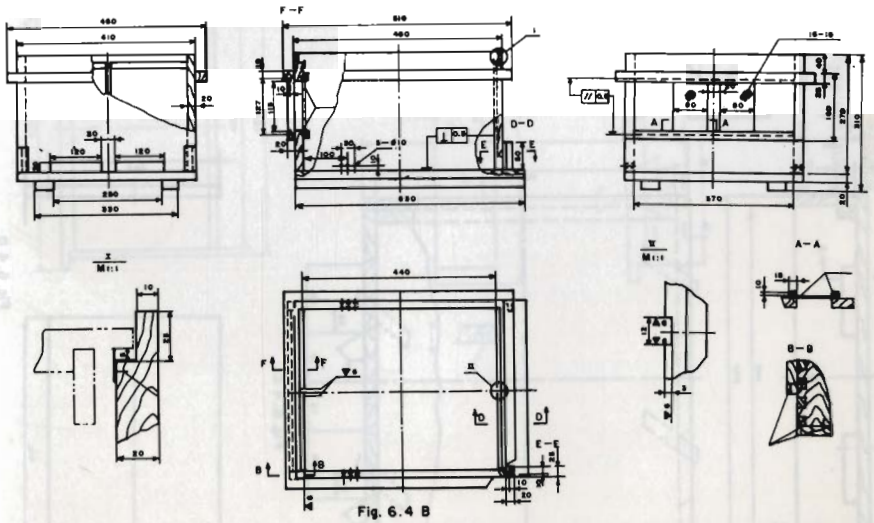


Figure 6.4B: Dimensions of various parts of brood chamber.

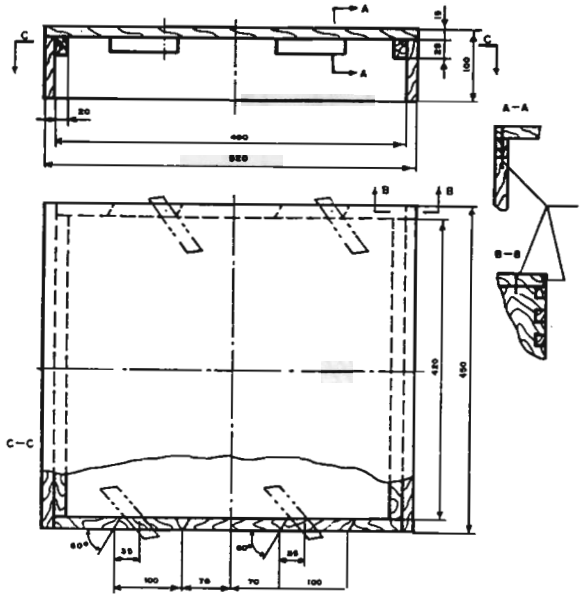


Fig. 6.4 C

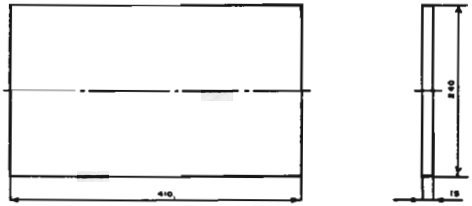


Fig. 6.4 D

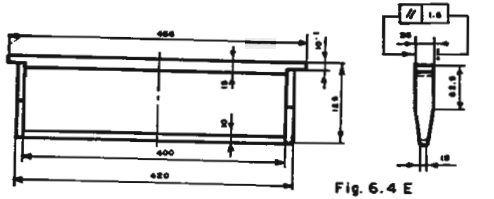


Fig. 6.4 E

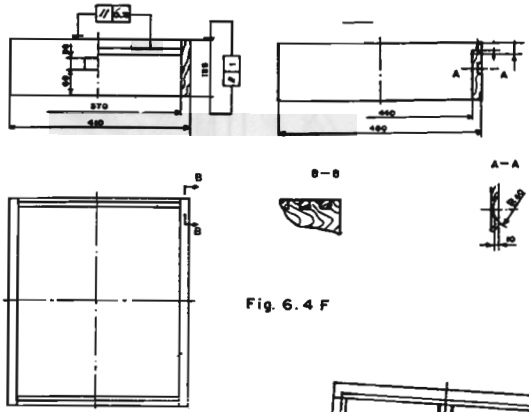
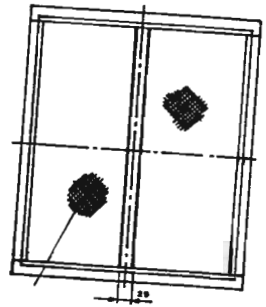


Fig. 6.4 F

Chinese *Apis cerana* Beehive

Figure 6.4C: Dimension of various parts of hive cover.
Figure 6.4D: Dimension of various parts of side cover.
Figure 6.4E: Dimension of various parts of super frame.
Figure 6.4F: Dimension of various parts of super chamber.



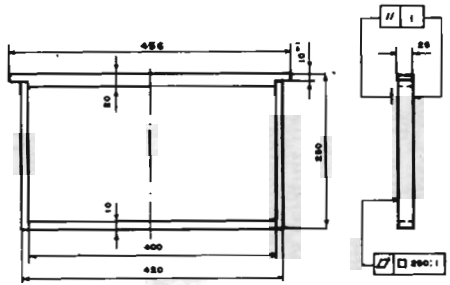


Fig. 6.4 G

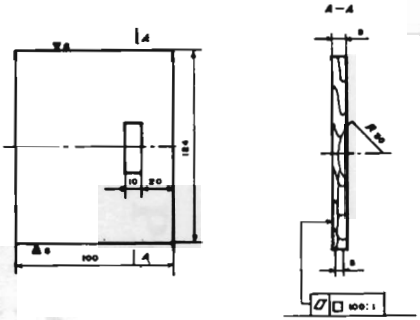


Fig. 6.4 I

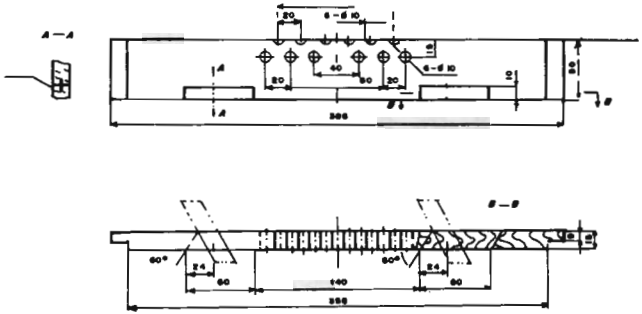


Fig. 6.4 H

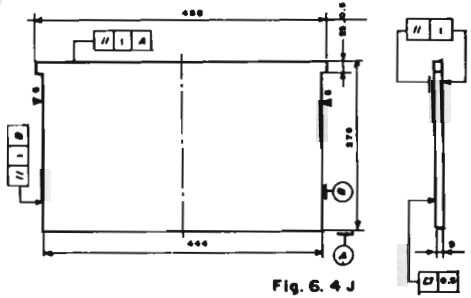


Fig. 6.4 J

Chinese *Apis cerana* Beehive

Figure 6.4G: Dimension of different parts of brood frame.

Figure 6.4H: Dimension of different parts of entrance gate.

Figure 6.4I: Dimension of different parts of moving screen.

Figure 6.4J: Dimension of different parts of isolating plate.

In Pakistan, besides the use of wooden boxes, attempts have been made to construct cement or mud wall moveable frame hives by using the ingredients given on page 138 (Ahmad, 1988).

A. Cement hive:	Cement	=	1 part
	Sand	=	3 parts
B. Mud wall hive:	Clay	=	16 parts
	Chopped Wheat straw or Multani mitti	=	1 part 6 parts
	Newspaper	=	11 parts
	Wheat flour	=	1 part
	Agave leaves	=	1 part

In China, *Apis cerana* kept in traditional bee hives yielded very little honey (5 kg/colony). So a great effort was made to introduce moveable frame hive beekeeping. As result of such an effort, the Chinese Ministry of Agriculture in collaboration with the Institute of Beekeeping, Chinese Academy of Agricultural Sciences and State Bureau of Standardization has proposed a "national standard" beehive for beekeeping with *Apis cerana* in the People's Republic of China. The ten-frame hive is adopted as standard throughout China. The design and specifications of this hive are given in Figs. 6.4A to 6.4J. The introduction of moveable frame hive beekeeping with *Apis cerana* has been most successful, and at present more than one million colonies of *Apis cerana* are being kept in such hives in China. The average honey yield per colony is 20 kg/annum.

However, *Apis cerana* beekeeping on such a large scale requires a lot of timber and beeswax. To meet this demand China, started a very ambitious programme of afforestation which has now ensured the supply of enough timber for the manufacture of wooden hive boxes. At the same time, attempts are being made to find suitable substitutes for wood which could be used for constructing the hives. One such alternate being tried is long immovable stone hives fitted with movable frames (Xianshu, 1985; Gong, 1983; Oschmann, 1961).