HIMALAYAN HONEYBEES AND BEEKEEPING IN NEPAL

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Abstract
Nepal, the central Himalayan kingdom, has five geographical regions: high Himalaya, high mountain, middle mountain, Swanlike and Terai. There exist four native species of honeybees, Apis laboriosa*,* Apis dorsata*,* Apis cerana *and* Apis florea *are found from Terai up to the base of Himalaya.* A. cerana *are kept in traditional log and wall hives.* A. cerana *is very aggressive, frequently swarms, and easily absconds, but is well adapted to the extremely cold climatic conditions of Himalaya.* A. cerana *usually swarms two times: in summer (March-May) and in winter (November-December). Subsequently honey is also harvested in summer and in autumn. Beekeeping with* A. cerana *means not only of income generation for traditional beekeepers, but also a valuable resource of Himalayan regions.*

Keywords: *Nepal / honeybees / beekeeping*

Introduction

Nepal, occupying the central third of Himalayan kingdom, with an area of 147,181 square km, a length of 880 m and less than 200 km wide from south to north, is a small country with five different geographical regions: high Himalaya, high mountain, middle mountain, Siwalik and Terai. Nepal is climatically divided into four zones: alpine zone (above 4000 m), cool temperate zone (above 2000 m), warm temperate zone (above 1000 m) and subtropical zone (below 1000 m). The vegetation of Nepal exhibits a remarkable diversity in different elevation and climate. Every ten kilometers upland has different types of vegetations and climates. There are five seasons: spring (March-April), summer (May-June), rainy (July-September), autumn (October-November) and winter season (December-February). Approximately 7,000 flowering plants have been recorded in Nepal. Himalayan honeybees are characterized through greatly variations based on the altitude and topography of these regions.

Honeybees Diversity

Four out of nine honeybees, *Apis laboriosa* (Smith 1871), *Apis dorsata* (Fabricius 1793), *Apis florea* (Fabricius 1787) and *Apis cerana* (Fabricius 1793) are native to Nepal.

Apis laboriosa, the Himalayan world largest honeybee, is distributed from 850 m up to 3500 m in northern parts of fragile ecological Himalayan regions (Fig. 1). *Apis laboriosa* is commonly known as the cliff honeybees. They are absolutely black in color with white stripes on each abdominal segment. *Apis laboriosa* constructs a single comb, 0.8 m wide and 1m long, suspended from steep cliffs (THAPA, 2001). *Apis laboriosa* stores honey in one corner of the comb. The key factor of survival of this species in an extremely harsh environment of Himalayan regions is the seasonal migration (Fig. 2). In winter season, *Apis laboriosa* migrates en masse to warm temperate regions up to 850 m, where they spend around seven months (October-April). At this time of the year, different flowers are bloom (Fig. 3). In summer season, when the ambient temperature is gradually increased above 25 ºC than *Apis laboriosa* colonies start to migrate to sub-alpine areas between 2500 m to 3500 m at the base of Himalaya, where they spend five months (May-September) (UNDERWOOD, 1990; THAPA, 2001). However, in some areas, *Apis laboriosa* colonies were found all round the year. Currently the population of this star species has due to environmental degradation, indiscriminate application of pesticides and over harvesting (burning and chopping down the whole comb) caused a precipitous decline from Himalayan regions.

Apis dorsata, tropical giant honeybee, is found in the tropical regions of Asia (RUTTNER, 1988). In Nepal *Apis dorsata* is distributed in the southern lowlands (Terai belts) regions between 190 m-1200 m (Fig. 1). They are commonly known as *Khad mauri* or *Singkushe* or cliff bee or King bees. *Apis dorsata* is yellow in color with black strips on each abdominal segment. *Apis dorsata* builds a single comb, 1 to 1.6 m wide and 0.8 to 1.5 m long, underneath a stout branch of tall tree or building or water tower or cliff to protect their nests from top predators (FLETCHER, 1952; SEELEY et al., 1982; CRANE, 1990; WONGSIRI et. al., 1996). The comb is protected by several layers of protective curtains. The protective curtains maintain a constant brood nest temperature between 30-33 °C. *Apis dorsata* also seasonally migrates back and forth between low (10 m) and uplands (1100 m) to escape from harsh environmental condition (Fig. 2). In winter season, when the ambient temperature is dropped below 10 °C in hilly areas, they migrate between 60 m to 350 m in Terai regions, where the maximum ambient temperature is fairly remained above 10 °C throughout the winter period. When *Apis dorsata* migrates in low agricultural lands, they always aggregate en masse from 25-120 colonies (depend on nesting spaces availability) on a single man made structure probably they need strong

support to hold their huge nest. At this time of the year different types of honey crops are bloom (Fig. 3). A single fully-grown nest may weigh over 20 kg including brood, honey, pollen and adult bees. However, in wet season they never aggregate en masse probably due to scarcity of food, strong wind, heavy rainfall, storms and the low number of individuals in the colony (THAPA et al., 1999; THAPA 1999).

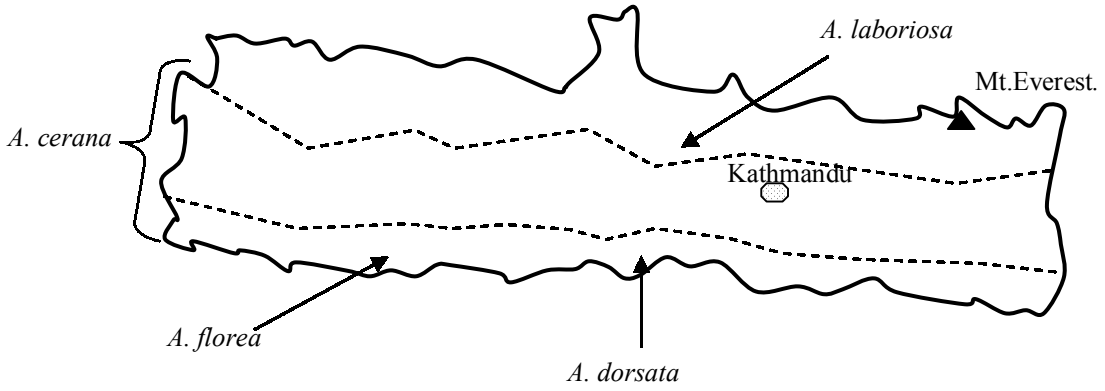

Figure 1 - Distribution of Himalayan honeybees in Nepal.

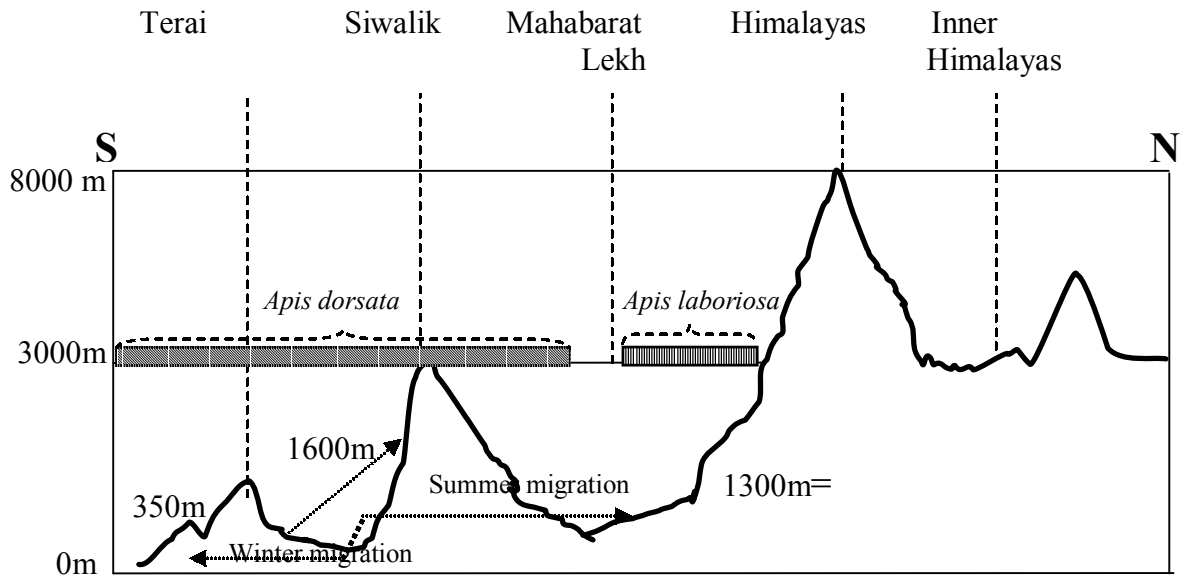

Figure 2 - Colony migration of Apis dorsata *and* Apis laboriosa *in Nepal.*

Apis florea, dwarf honeybee, is a low land species found from 10 m up to 1000 m in Nepal (Fig. 1). They are commonly known as Kathori mauri. They build a small comb (15.24 cm) across on the branches of small trees or dense bushes. The comb encircles completely the twig. The comb is built in a partially covered area. *Apis florea* stores their honey on the upper part of the comb. A colony yields less one kilogram of honey per year. The honey is widely used in rural areas as a natural medicine for eye diseases, stomach pain, joint pains, headache and sometime ever for snake bites (religion based). They are a good pollinator of several fruit plants such as *Magnifera indica* and *Litchi chinensis*. However, indiscriminate application of pesticides in crop fields may also contribute to destroy the whole population of *Apis florea* (THAPA and WONGSIRI, 1996).

Apis cerana, the eastern hive bees, is occurred from 60 m to 3500 m in Nepal (Fig. 1). Three subspecies of *Apis cerana*, *Apis cerana cerana*, *Apis cerana himalaya* and *Apis cerana indica* have been recorded from Nepal (VERMA, 1990). *Apis cerana cerana* is found in high western hilly regions, *Apis cerana himalaya* is in mid eastern hilly regions and *Apis cerana indica* is in Terai regions. *Apis cerana cerana* is commonly known as a golden honeybee, be compatible with *Apis mellifera* in honey production, whereas *Apis cerana indica* is commonly known as black poor bee, because they produce a small amount of honey. *Apis cerana* usually swarms two times; one time in summer (March-May) and another time in winter (November-December). In winter season most of the *Apis cerana* colonies are very small in population due to extremely harsh environmental conditions and lack of floral resources in hilly areas. Those colonies which do not migrate or abscond die in the mid of the winter by being unable to maintain constant brood nest temperature and by lack of honey. However, the unique feature of *Apis cerana* is that they can vigorously survive even below -0.1ºC in high hilly areas, whereas *Apis mellifera* bees are completely freeze at the same temperature.

Himalayan bee flora

A key factor for survival of Himalayan honeybees in fragile Himalayan regions is the diverse bee flora blooming almost round the year (Fig. 3). Topographically, every ten kilometers up land diverse vegetation is available (THAPA et. al., 2000a).

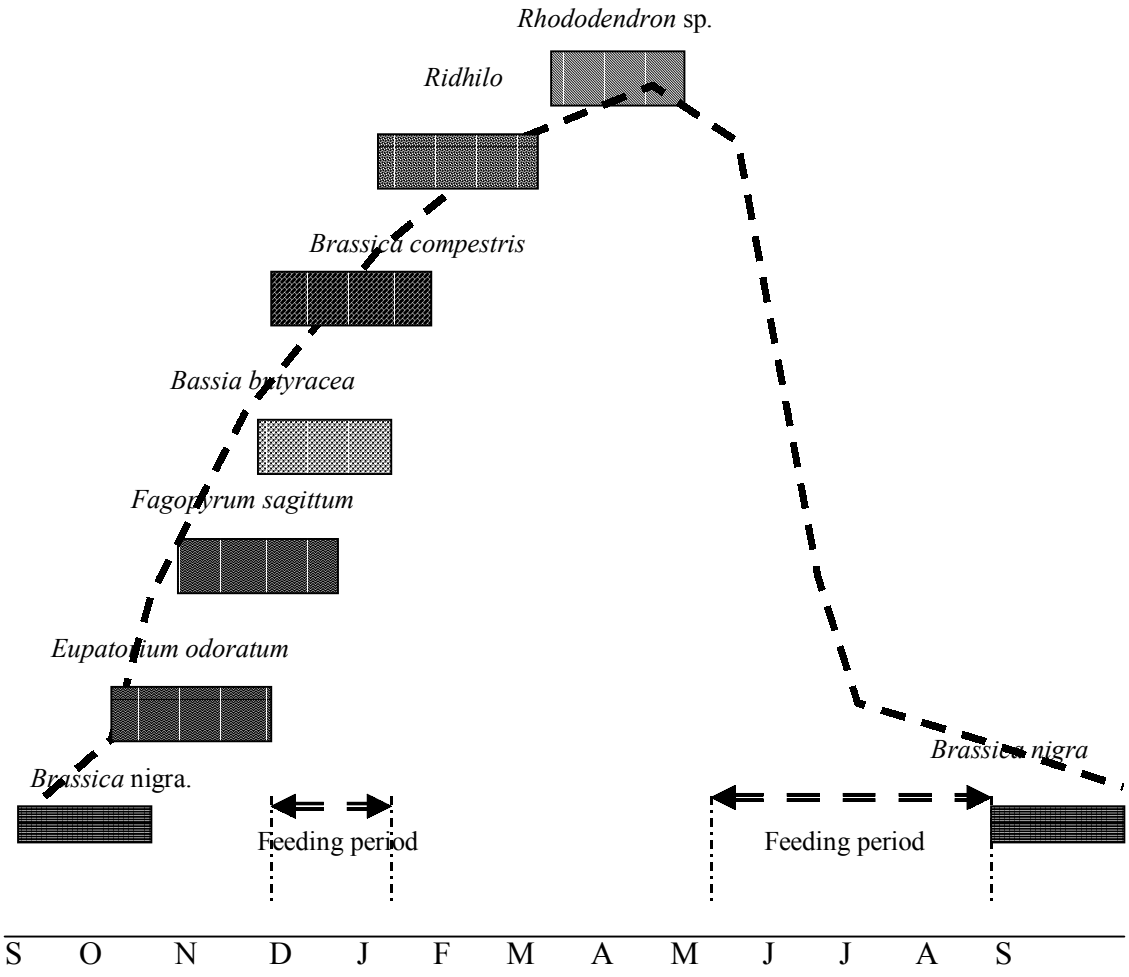

Figure 3 - Main bee flora and flowering time of Himalayan bee flora in Nepal.

Traditional hives

Traditional beekeepers use only traditional hives: horizontal log hives and wall hives. The log hives are made by scratching the central solid rotten part of the log. The log hives are usually about 1-1.5 feet in diameter and 2-2.5 feet in length (n=50). The log hives are placed on the balcony platforms or roofs affording them some protection from theft and the Himalayan yellow-throated pine marten, *Martes flavigula* (CRANE 1990; THAPA et. al., 2000b). The wall hives are made simply by removing the bricks from the wall of the house. The thick walls of the wall hives may provide a considerable insulation during the extreme harse environmental condition in the hilly areas (CRANE, 1998). The wall hives are never attacked by bee-eaters and *Martes flavigula*. One-survey reveals that 42% of beekeepers use traditional hives (NAKAMURA, 1989). The log hives and wall hives are commonly used as bait hives. Besides the traditional hives, several other modern hives - Newton hives, modified modern hives and African top bar - have been used in order to alleviate the poverty of the hill tribe people. All these modified hives were introduced by several aid agencies.

Traditional beekeeping with *Apis cerana*

In total there are around 119,428 colonies of *Apis cerana* in traditional hives (BDS 2003), out of which 101,684 colonies of *Apis cerana* are kept in log hives and 17,744 colonies in wall hives (Table I). *Apis cerana* is very popular among the farmers in rural areas, probably due to the lowest cost of construction of traditional hives (log and wall) via using locally available materials (Table II). Another reason is that *Apis cerana* colonies never feed during the dearth season unlike *Apis mellifera*. Sugar is relatively expensive and many traditional beekeepers are unable to afford sugar syrup to their bees. The main problem in modern beekeeping with *Apis cerana* is that after transferring the *Apis cerana* colonies from traditional hives into the modern hives they immediately absconded (n=25). Around 60 % of the rural people are engaged in traditional beekeeping (NAKAMURA, 1989).

Table I

Total number of colonies of Apis cerana and honey production in East, Central, Western, Midwestern and Far Western regions

Zones	Species of honeybees	Number of Colonies		Total honey production	Honey production per hives
		Log hives	Wall hives		
East	*A. cerana*	34324	2545	103.08	2.8
Central	*A. cerana*	16212	3489	133.44	6.8
Western	*A. cerana*	19442	5576	88.5	3.5
Mid western	*A. cerana*	22776	4971	130.30	4.7
Far western	*A. cerana*	8930	1163	49.72	5.0

Table II

Relationship between climatic conditions, hive technology and potential returns from traditional beekeeping with Apis cerana

Climatic conditions	Species of honeybees	Type of traditional hives	Hive cost (Rs)	Honey production	Cash return
Alpine (below 3000 m)	*A.cerana*	Wall hive	<250.00	Poor	Poor
Cool temperate (above 2000 m)	*A. cerana*	Wall hive (without frame) Log hive	<250.00 <500.00	Fair Fair	Poor Poor
Warm temperate (above 1000 m)	*A. cerana*	Wall hive (fixed combs) Log hive	<1000.00 <500.00	Good Poor	Good Poor
Subtropical (below 1000 m)	*A. cerana*	Modern moveable hive (fixed combs) Log hive	>1200.00 <500.00	Good Poor	Good Poor

Apis cerana stores little amount of surplus honey on an average 4.5 kilogram of honey per colony (Table I). Beekeepers usually harvest honey two times from traditional hives. The first honey harvesting time is in autumn (October-November). The honey harvested in autumn is called the autumn honey and it is believed that the honey of this time of the year is considered as the best medicinal honey for apitherapy purposes. The autumn honey is used as medicine for cough, sore throat, abdominal pains, joint pains and fever. The second honey harvesting time is in summer (March-April). The honey harvested in summer is called the summer honey. The summer honey is not so popular for apitherapy purposes as the autumn honey. The autumn honey is more expensive than the summer honey. At present, the honey and the other bee products are highly demanded. Honey sells for as much as Rs. 200 per kilo (equivalent to EURO 2.5)

and beeswax at Rs. 375 (equivalent to EURO 4.80) per kilo. Local beekeepers who raise native or imported bees have no problem in marketing their products. The demand for honey is still very high. Usually, 10 % of people in the upper levels of society can afford to buy bee products, but the rest of 90 % of the population, which needs this nutritious food, cannot buy it. Honey is used mainly in the Nepal as a sweetener food rather than medicine. Nevertheless, ayurved (traditional medical center) utilize honey as a base for cough syrup and energy drinks.

Modern beekeeping with *Apis mellifera*

Apis mellifera was introduced in early 1990 via commercial beekeepers after Thai sacbrood virus killed over 90 % of the colonies of *Apis cerana* from entire Hindu Khus Himalayan regions. In total around 10,000 colonies of *Apis mellifera* are kept in Langstroth hives all over the country (Fig. 4). Around 8000 colonies of *Apis mellifera* are located in the central parts of the country. The introduction of *Apis mellifera* in Nepal seems to be successful only in Terai regions, but not in hilly areas. The commercial beekeepers do migrate their colonies between mid hills and Terai regions according to floral cycles. The honey yields from *Apis mellifera* colonies are reported to be high (around 50-70 kg of honey per hive). However, *Apis mellifera* beekeeping due to large financial investment and intensive management techniques make unsuitable to rural farmers-beekeepers (THAPA et al., 2000a).

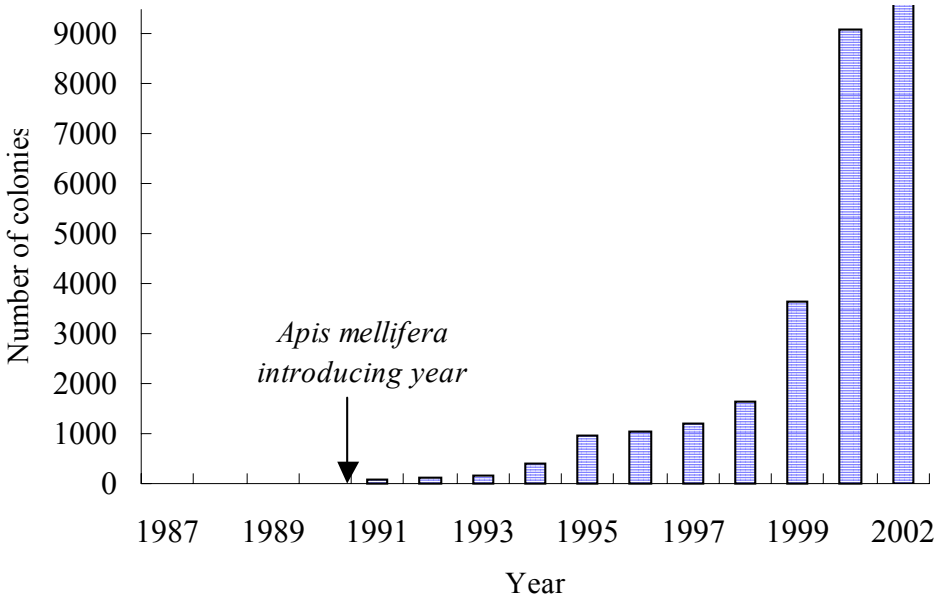

Figure.4 - Number of Apis mellifera colonies in Nepal.

Diseases, pests and predators

Sac brood disease is an endemic disease, which causes severe damages in colony management. Thai sac brood disease is a widely spread disease in colonies of *Apis cerana* all over the country. *Apis cerana* colonies have also been severely infested by European foulbrood (*Melissococcus pluton*) disease after introducing *Apis mellifera* (THAPA et al., 2000b).

Apis cerana a primary host of *Varroa jacobsoni* is highly susceptible to tracheal mite, *Acarapis woodi*. When *Apis cerana* is infected by *Acarpis woodi* early in the spring season hundred of adult bees are death within a week. *Acarapis woodi*, however, control within a month as the ambient temperature is gradually increased. Traditional beekeeping never use any chemical to control *Acarapis woodi* or *Varroa jacobsoni*.

Vespa basalis and *Vespa magnifica* are two major predators of *Apis cerana*. *Vespa basalis* attacks only incoming field bees, whereas *Vespa magnifica* attacks the whole colony for brood. *Apis cerana*, however, has effective defense against *Vespa basalis* but not against *Vespa magnifica*. When *Vespa basalis* attacked *Apis cerana* colonies, the guard bees are crowded in front of the entrance, catch *Vespa basalis* and

form a tight ball by hundred of bees until *Vespa* is overheated and eventually dies. But when *Vespa magnifica* attacked *Apis cerana* colony, they immediately abscond rather than defense their nest. *Apis cerana* obviously cannot match in size with *Vespa magnifica*.

Achroia grisella (lesser wax moth) is also a serious pest of both *Apis cerana* and *Apis mellifera*. They usually lay eggs in the debris deposited at the bottom of board in weaker colonies. The larvae attack only weak colonies (THAPA et. al., 2000b).

Martes flavigula is another serious predator of *Apis cerana*, but not of *Apis mellifera*. They usually attack *Apis cerana* colony nesting in log hives. After eating all the combs and brood, they urinate on the hive probably to mark their territory (CRANE, 1990; THAPA et. al., 2000b). Once the colony of *Apis cerana* is under attacked by *Martes flavigula,* it never will reoccupy the same nesting site in the subsequent years.

Conclusion

The beekeeping with *Apis cerana* was started in mid 1960. Agriculture department and several foreign aid agencies - UNICEF, IUCN, ICIMOD, MEDEP (UNDP) - have been involved to conserve the Himalayan honeybee, *Apis cerana,* and to promote beekeeping for more than two decades, but the number of colonies persistence and honey yield data reveal that *Apis cerana* beekeeping is hinder due to cyclic occurrences of sac brood diseases and lack of a proper knowledge of modern beekeeping. On the other hand, the wild bee; *Apis laboriosa,* is a rare species still exploit for honey, brood and wax production. If the nests exploitation by human predators cannot stop, than *Apis laboriosa* will disappear forever from the whole Himalayan ecosystems. So it is urgently need to conserve this species to maintain the biodiversity of Himalayan regions.

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