Consequences of beekeeping with *Apis mellifera*

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Introduction

The European honeybee, *Apis mellifera* is not a native bee of India and other Asian countries. Introduction of *A. mellifera* into areas outside its natural habitat has not met with any success earlier. Obviously, introduction of *A. mellifera* into Karnataka was not successful earlier and will not be possible in future also. Failure of beekeeping with *A. mellifera* in Karnataka was mainly due to its non-adaptability to the local conditions and partly non-application of sound management practices. *A. mellifera* cannot possibly survive outside its natural habitat without constant human care.

Coexistence and consequences

The three indigenous species of India, *A. cerana*, *A. dorsata*, and *A. florea* harmoniously coexist and are sympatric in distribution. The natural distribution of *A. mellifera* is restricted to Europe and some parts of Africa. *A mellifera* and *A. cerana* complimentary to each other in many characters and at the same time have specific differences. Unfortunately, both hive bees are allopatric, their territories are geographically isolated from each other (Ruttner et. al. 1985). No natural overlapping or direct contact between *A. cerana* and *A. mellifera* is ever reported. The coexistence between them in some countries is a mere speculation or it may happen during transitional stage (Deodikar & Thakar, 1966; Shah, 1980). Even today, no scientific information supporting their co-existence is available.

The main problem of coexistence results from the similarity in biological and behavioral characters. The overlapping of many characters obviously leads to inter-specific competition during feeding, mating and robbing. Normally, bees of strong colonies defend themselves well against conspecific robbers, but failed to do so against heterospecific robbers. Because of high foraging success, the workers of A. mellifera regularly invade, rob and destroy the colonies of *A. cerana*. In Pakistan, *A. cerana* robs *A. mellifera* but the loss of colonies is rare. *A. dorsata* is highly successful in robbing the colonies of *A.mellifera* in Karnataka. Often robbing between A. mellifera and A. cerana takes place resulting in the loss of either *A. cerana* or *A. mellifera* depending upon the size of colony population. Similarly, competition also takes place during mating. In a classical study, imported A. mellifera did not produce mated queens in Asia (Aakratanakul, 1976; Ahmed, 1984) and imported A. cerana did not successfully mate in Germany.

The most important danger of importing of exotic bees is the inter-specific exchange of parasites. The original hosts are well protected by natural adaptation unlike the imported species. The incidence of Thai Sac brood virus disease in *A. cerana* (Verma, 1985) and reverse cases are the damage caused by parasitic mites Varroa jacobsoni and Tropilaelaps clareae to *A. mellifera*.

Introduction of Apis mellifera and reasons for its failure

Apis mellifera has long been a favorite choice of many beekeepers of Asia. It was introduced into Indonesia (1877, 1921, 1972), India (1910, 1927,1960), Sri Lanka (1890), Japan (1890), Korea (1900), China (1900-1909), USSR (1904), Taiwan (1920), Singapore (1929), Thailand (1940,1950,1970), Vietnam (1947), Afghanistan (1955, 1961) and Pakistan (1927, 1977).

Introduction and re-introduction has failed in many countries. In Karnataka, the *A. mellifera* was introduced by private beekeepers and Government agencies ever since 1940's. Despite several attempts of introduction, it vanished from the beekeeping scenario of Karnataka quietly. The best progressive beekeepers, foreign trained scientists and beekeeping extension staff also could not save the "golden" honeybee. Even the much promised mega FAO assisted bee project started to revolutionize beekeeping in Karnataka merely ended up with providing high technology, infrastructure and foreign trained bee personnel without saving even a single colony of either *A. mellifera* or *A. cerana*.

The golden era of beekeeping in Karnataka quietly faded into history. The present bee scenario in Karnataka is disgusting and pathetic as the once well performing bee *A. cerana* is languishing without any care and dying with a deadly virus disease and the much promising foreign bee is disappearing at a lightening speed without yielding a drop of honey.

Apis cerana is a better bee

The Asian hive bee is the predominant honeybee in tropical and subtropical climates and has been well adapted to the local climates, environment and bee flora. Many comparative studies reveal the following significant differences, which have a direct bearing on beekeeping.

- Beekeeping with *A. cerana* is simple, inexpensive and highly economical.
- It is free from many known pests, parasites and diseases except Thai sac brood virus disease.
- It is well known to defend against flying pests and predators particularly wasps and hornets.
- It shakes body vigorously to get ride off ecto-parasites including mites.
- It actively prevents landing flying predators at the entrance of a colony more effectively.
- It gives faster and stronger responses to light and mechanical stumuli.
- It effectively repels enemies including the Monkey, Bear etc. by producing "hissing" sound quite loudly.
- It can survive longer dearth periods quite effectively.
- It can sustain without any modern management practices.
- It is a far better pollinator with longer foraging time and shorter foraging trip and visits diverse bee plants of all categories of entomophilously pollinated crops.

Conclusion

Unequivocal evidence is available in Karnataka and in other parts of India and Asia that A. mellifera and *A. cerana* can not possibly coexist, the success of one leads to the destruction of the other. The classical recent examples are the Punjab and Japan where the native bee *A. cerana* totally disappeared altogether. The A. mellifera can not possibly survive even after destroying all its competitors, predators, pests, parasites and diseases without constant human care especially in Asia. The statements of the best three bee scientists, Townsend, Koneigner and Kevan "Promote Asiatic bee as an interesting species with great potential for apiculture and development throughout tropical and subtropical Asia" is very much relevant and appropriate. Beekeeping with *A. cerana* is simple and economically more viable and technically better plausible.

Reference

Gordon F. Townsend (Canada) whose pioneering devotion to apicultural development with indigenous bees and appropriate technology has been an inspiration to so many beekeepers of Apis cerana.

Study of Honeybees
in
Tropical Forests of Western Ghats, Karnataka, India



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STATUS OF HONEYBEES IN TROPICAL FORESTS OF WESTERN GHATS, KARNATAKA, INDIA

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EXECUTIVE SUMMARY

- Beekeepers Society is an important institution that can help in propagation of apiculture in the Tropical Rain Forests of Western Ghats. However, they have become a wing of government and have lost creativity.
- The beekeepers in Tropical Rain Forests of Western Ghats are educated and have great potential. This resource needs to be harnessed.
- The exotic *Apis mellifera* has not performed satisfactorily in Tropical Rain Forests of Western Ghats. Further introduction of *Apis mellifera* will not be congenial for development of beekeeping in Western Ghats.
- To control T.S.B.V. the resident strains of *Apis cerana* colonies should be identified and there is a need to establish a breeding programme.
- Deforestation of Tropical Rain Forests has destroyed honeybee diversity and nesting sites.
- Tropical Rain Forests of Western Ghats have the potential for sustainable use of the resources of Tropical Rain Forests through beekeeping development and employment generation and enhancement of biodiversity.

Study of Honeybees in Tropical forests of Western Ghats, Karnataka, India

1.0 INTRODUCTION

Honeybees play an important role in evolution of genetic diversity of forest flora. The tropical forest region of Western Ghats in Karnataka, Southern India, is one of the important spots of biodiversity. The tropical forest ecosystem also supports the livelihood of people. These resources provide renewable energy in the form of hydro electricity; the biomass supports agricultural systems and watershed is the basis for large-scale irrigation projects in the region. Thus, the continued existence of tropical forest cover is the essential requirement for supporting the sustainable development in the region. The exploitation of bees in India is of great antiquity, having been known since prehistoric times. The use of honey for religious and medicinal purposes is also ancient and well known but its consumption, as food is a recent development. Beekeeping is undoubtedly a fascinating occupation and profitable industry. Beekeeping in ancient India including traditional methods of beekeeping has been reported.

The tropical forests of Western Ghats are facing threat from developmental projects. The hydel dams across the rivers, wood based industries and establishment of monoculture plantations are recurring threats to the diversity of tropical forests. There are forest dwellers and indigenous groups depending on the non-timber forest produce (NTFP). Honey is one of the main non-timber forest produce from the tropical forest region. The tropical forests and the diverse flora and fauna provide an excellent opportunity for harnessing honeybees in this region.

The diversity of honeybees is the tropical forest region of Western Ghats is unique. There are many species of honeybees found in this region. They are *Apis dorsata*, *Apis cerana, Apis florea* and many species of stingless bees. Each one of these honeybees yields different kind of honey. Some of them, especially honey from *Apis florea*, are regarded as highly medicinal. Many families are dependent on honey harvesting and they earn cash-income from honeybees.

Beekeeping is perhaps the only industry which, besides production of honey and wax, helps in increasing the yields of many agricultural and horticultural crops and at the same time helps in the maintenance of ecological balance. The development of

beekeeping industry depends on a balanced environment in association with the flowering plants (Suryanarayana *et al.* 1983). Progressive and commercial beekeeping has gradually emerged and it has grown steadily into an important industry with new methods of management. There is vast scope for qualitative improvement in the bee industry through modern beekeeping technology.

Beekeeping is perhaps the only industry which, besides production of honey and wax, helps in increasing the yields of many agricultural and horticultural crops and at the same time helps in the maintenance of ecological balance. The development of beekeeping industry depends on a balanced environment in association with the flowering plants (Suryanarayana *et al.* 1983). Progressive and commercial beekeeping has gradually emerged and it has grown steadily into an important industry with new methods of management. There is vast scope for qualitative improvement in the bee industry through modern beekeeping technology.

In recent years, the introduction of exotic honeybees has brought virus disease and it has adversely affected the local honeybees. Beekeeping is passing through a difficult time. Under these circumstances, we (***Prakruti***) have launched a Campaign to save indigenous honeybees in the tropical forest region of Western Ghats. The proposed study of honeybees is an attempt to assess the status of honeybees, to generate database, documentation on indigenous honeybees, and to strengthen the *Save Honeybees Campaign*. This is an attempt to understand the status of bee husbandry in the tropical forests and its role in supporting the livelihood of the people in these regions.

1.1 BEEKEEPING IN WESTERN GHATS, KARNATAKA

Traditionally bees were kept in small earthen pots and wooden logs. Beekeeping was restricted to harvesting of the honey from *Apis cerana*. Though *Apis cerana* was domesticated, there was no systematic management of these bees. In the traditional system, honey was harvested only once, before monsoon.

The organised modern beekeeping was launched in Kodagu District in Western Ghats in 1929 by swami Shambavananda of Ramakrishna Ashram, Ponnempet. The Swamiji started a model apiary with systematic approach to beekeeping equipment and propagated modern beekeeping in Kodagu. He trained people in craft and established the first Beekeepers Society in Virajpet, in 1936. Similarly in Dakshina Kannada, Shri

Pailoor Narayana and Pailoor Shivaramaih started Dakshina Kannada Beekeeping society in 1938. In 1940 another beekeepers society was formed in Sakleshpur, Hassan. In the post-independent India beekeeping, industry was developed by the Khadi and Village Industries Commission (KVIC).

Although the foundation of modern, scientific beekeeping was laid in Kodagu by Swami Shambarvananda, its practice was limited to adopting the Newton box and provision of foundation sheets. Normally the bees were harnessed from the wild. This change has to increase in honey yield from two kg a year by traditional method to 5 kg per colony. At present in Western Ghats, both traditional and modern beekeeping systems are followed. However, the numbers of traditional beekeepers are small.

1.2 REVIEW OF LITERATURE

There is an enormous scope for interesting research work on the indigenous honeybees in the tropical forest regions and equally greater scope for beekeeping in India (Crane, 1978). Though beekeeping including honey collection from wild in the tropical forests is known from very long time, scientific investigation on beekeeping, bee flora and economic importance of bees and their by-products has not been made. The first information on beekeeping in the Western Ghats, particularly *Malnad* (hilly tropical forest regions) region was provided by Krishnamurthy (1928). He has provided preliminary information on number of beekeepers, number of colonies, method of beekeeping practices, honey yield per colony per year, the type of bee equipment used and types of bee flora. He also suggested the ways and means of improving beekeeping including queen rearing and importing of disease free European honeybee *Apis mellifera*. He further suggested that beekeeping is a multi-disciplinary field and beekeepers have to exploit bees in order to harvest more honey and higher crop yield through pollination.

Beekeeping in the tropical forests of the Western Ghats is undoubtedly a fascinating occupation and profitable industry. Beekeeping in ancient India including the traditional methods of bee keeping have been reported (Canus, 1886; Seligmann, 1911; Ransome, 1937; Ayyar & Ramakrishna, 1940; Muttoo, 1951,1954; Cardon, 1960; Gauter, 1974).

In the tropical forests of the Western Ghats, bees are important pollinators but little is known about their ecology (Davidar, *et al.* 1993). The status of *Apis dorsata* that

is active throughout the year except from November to January should be ascertained and adequate conservation measures should be taken against over-exploitation of bees for honey.

The scope for beekeeping in the tropical forests region is indeed unlimited (Reddy, 1995). The *Malnad* region has vast beekeeping areas with diversified bee flora and suitable climatic conditions all through the year that can sustain modern and commercial beekeeping. There is a great scope for increasing number of colonies as well as increasing honey-yielding capacity of the colony from the present 6 kg. per year to 15 kg. per year.

Introduction of *Apis mellifera* in Kodagu (Coorg) district initially was not encouraging as the colony development was very slow, which may be due to the lack of availability of continuous and abundant flora and foraging throughout the year (Reddy & Jacob, 1997). However, development of *Apis mellifera* was sustained exclusively by artificial feeding in the lean period.

Soligas of Biligiri Rangan hills of Mysore district extracted honey from rockbee hives (*Apis dorsata*) in a sustainable fashion. Soligas harvested only 80% of hives in 1995 although the production potential was 22 tons. Therefore, the pattern of harvesting hives is sustainable (Setty, *et al.* 1997).

Melittopalynological study of Bangardka forest region of Dakshina Kannada indicated the presence of unifloral type of flora (Agashe, *et al.* 1997). The study recommended the cultivation of *Syzygium caryophyllatum* and *Psidium guajava* in the study area that not only yield edible fruits but also large quantity of nectar.

The arrival of *Apis dorsata* in Kakachi forest of Southern Western Ghats was seasonal. Wild bees arrived during the flowering of *Palaquium ellipticum,* a dominant species and were greatly responsible for proper fruit-set through pollination. Loss of bee pollinators due to destructive honey harvesting methods could prove to be detrimental and have a cascading effect on both the plant and bees (Devy, 1977).

The Khadi and Village Industries Board at State level (K.V.I.B.) and Khadi and Village Industries Commission (K.V.I.C.) and All India Coordinated Project on Honeybee Research and Training (AICRP-H.B) at the Central level have been responsible for beekeeping including establishment of colonies, training of

beekeepers, the use of the modern methods of management practices, conducting research on various aspects and extension of latest information.

The existing information on beekeeping is too meagre. Much of the available information is limited to the occurrence and spread of *Thai sacbrood* disease. No systematic information on the distribution and density of bee flora and fauna in the tropical forests of Western Ghats is available. The existing knowledge on socio-economic conditions or beekeepers of the Western Ghats is inadequate and there is an urgent need for a detailed investigation.

1.3 HONEY HUNTERS

Honey hunting is a common practice followed by many forest dwelling communities in tropical forest region of Western Ghats.

The Siddi community in Uttara Kannada the Phaniyas in Kodagu and the Jenu Kurubas in Mysore are some of the forest dwelling communities who are involved in honey hunting.

The honey hunters harvest both wild *Apis dorsata* combs as well as *Apis cerana* colonies in the wild. Nevertheless, they earn cash income from harvesting *Apis dorsata* colonies. This is one of the toughest jobs and is a highly skilled work. Often they have to climb huge trees or steep rocky cliffs in the night with the help of a rope or climber and they risk their life in honey harvesting. The honey hunters follow certain ceremonies and rituals before performing the job of honey hunting. For most honey hunters, the job is of hunting is spiritual in nature and they have faith in the spirits that exist in forests. They call upon these 'spirits' to protect them in the highly risky job of honey hunting.

1.4 HONEYBEES

The tropical forests of Western Ghats provide a great opportunity for development of apiculture. The diversity of plants and shrubs of the forests is ideal foraging base for honeybees. The existence of diversity of honeybees, especially *Apis dorsata*, (the rock bee) *Apis cerana* and *Apis florea* offers enormous scope for development of beekeeping in the region.

The main areas of beekeeping in Karnataka lie in Western Ghats region. There are about 68% beekeepers and 89% of colonies lie in region of Western Ghats only. This

region contributes for about 75% of total honey production in Karnataka. (Table 60).

Through modern beekeeping was launched 1930, the spread is limited to certain regions like Kodagu and Dakshina Kannada. The arrival of Thai Sacbrood virus disease (TSBD) sounded a death knell to beekeeping in Karnataka. Almost 90% of the bee colonies were destroyed due to spread of the TSBV.

In the recent years, the introduction of *Apis mellifera* has led to a controversy over the suitability of exotic honeybee in the tropical forest region, as Government has pushed the exotic *mellifera* in this region. We can say that the present status of beekeeping is mixed beekeeping with *Apis mellifera* and *Apis cerana.*

Realising the difficulties in establishing *Apis mellifera* in the tropical forest region, *Save Honeybees Campaign* (SHBC) was launched in 1992 to create awareness about the importance of conservation and propagation of *Apis cerana* and *Apis dorsata* in the region.

Inspite of the systematic beekeeping development project launched by government, we have to admit the reality that the honey available in the market as well as the honey purchased by beekeepers societies in the state is mainly the honey from *Apis dorsata.* This shows the crucial role played by honey hunters in meeting the demand for honey.

2.1 THE STUDY

Several factors are considered while studying honeybees in the tropical forests. Beekeeping with *Apis cerana* and *Apis florea* is very common. So, the beekeepers are contacted to get in-depth information. A number of beekeepers' societies is there in the region. These co-operative institutions play a dominant role in extension of beekeeping in the tropical forest region. These co-operative societies were visited by the study team. The third level of research involves the documentation and gathering of data from honey hunters and forest dwellers who collect honey from the wild, especially from the tropical forests. Thus, the study is comprehensive in nature and it attempts to understand the status of honeybees in the tropical forest ecosystems in the Western Ghats.

2.2 OBJECTIVES OF THE STUDY

The present studies primarily aim to provide comprehensive information on bee flora, bee fauna, beekeepers, beekeeping and its status, level and scope in the tropical forests of Western Ghats of Karnataka. The study also highlights the current problems of beekeepers and beekeeping in the light of the existence of twin dangers, the incidence of Thai sacbrood virus disease and the introduction of the European honey bee *Apis mellifera* in Karnataka.

The following major objectives were identified and selected for the detailed study.

1. To understand and provide scientific information on the current status of bees, beekeepers and beekeeping in the tropical forest of Western Ghats of Karnataka.
2. To assess the possible impact of the introduction of exotic honeybee species and its relevance to Western Ghats.
3. To identify the linkage between deforestation of tropical forest and beekeeping including the needs of local forest dwellers.
4. To provide suggestion for sustainable land use and forestry through biodiversity and conservation.
5. To strengthen the ongoing '*save honeybee campaign*' concerned with the conservation of indigenous bees of tropical forests.

In addition to studying the major objectives, the study also intended to gather detailed information on the following minor objectives.

1. Distribution of wild non-apis species in the tropical forests.
2. Occurrence of pests, predators, and diseases in Western Ghats.
3. Existence of market facilities for the products and by-products of beekeeping.
4. Information on socio-economic conditions of beekeepers.
5. Assessment of the existing extension facilities and its role in the development of beekeeping.

The study also intended to identify the various constraints of practical beekeeping and suggest various ways to make beekeeping an economically viable activity.

2.3 STUDY AREA

The Western Ghats of Karnataka are spread over whole or parts of six districts namely Belgaum, Uttara Kannada, Dakshina Kannada, Shimoga, Chikmagalur, Kodagu and Hassan. The Western Ghats are situated between 12° and 18° North latitude and 74° and 78° East longitude and cover an area of 28,004.75 square kilometres including

closed forests (18,225 sq. kilometres), open forests (4504 sq. kms), degraded forests (2605 sq.kms), plantation (1850 sq.kms) and grass land (120.75 sq. kms).

The study area (Western Ghats of Karnataka) was divided into study centres based on districts, namely Uttara Kannada, Dakshina Kannada, Shimoga, Chikmagalur, Kodagu and Hassan. Further, 375 beekeepers were studied. Information collected has been grouped on the basis of centres

3.0 METHODOLOGY

Standard methods particularly of ecology and beekeeping are selected for gathering scientific information on beekeepers, bee species, bee flora, pests, parasites and diseases and also the socio-economic conditions of beekeepers including the bee tribes.

SURVEY: Detailed survey of the Western Ghats was undertaken to gather information on the number of beekeepers, bee colonies, honey production and socio-economic conditions of beekeepers. Both verbal and non-verbal surveys were conducted to obtain detailed information.

QUESTIONNAIRE: As the proposed study area of the Western Ghats is relatively vast, and also beekeeping is being practised in the entire area, a questionnaire was prepared to obtain information on beekeeping, beekeepers and their socio-economic conditions. In order to obtain tangible results, the study area has been divided into five study units considering each district as a unit. There exit beekeepers co-operative societies in each of the study unit. These are immensely helpful in getting the requisite information on beekeeping. Consequently, the beekeepers co-operative society has become not only an information-generating centre but also a focal point for the study. Through the beekeepers co-operative societies, information on beekeepers including the socio-economic conditions has been gathered. The methodology so selected is flexible and could be modified or altered suitably according to the needs of the research.

WEATHER CONDITIONS: Information on weather parameters such as monthly average temperature, relative humidity and wind speed were collected from the meteorological departments of the respective study centres for the year 1996.

VEGETATION: The vegetation of Western Ghats particularly bee flora was

identified and classified into 1) Nectar flora 2) Pollen flora and 3) Pollen and nectar flora for each study centre. Reference pollen slides as well as the available taxonomic keys were exclusively used for the identification of bee flora.

BEEKEEPERS: The number of beekeepers in each study centre was determined with the help of a questionnaire and information gathered from beekeepers co-operative societies and Department of Industries and Commerce, Government of Karnataka of the respective study centre. In addition, a select group of 60 progressive beekeepers in each study centre was identified and information on all aspects of beekeeping was obtained from them.

BEE COLONIES: Number of bee colonies in each study centre was obtained from the Department of Industries and Commerce, beekeepers co-operative societies and through questionnaire. Information was also obtained on the wild colonies of *Apis dorsata* in each study centre by the questionnaire and personnel contact with beekeepers and honey hunters.

HONEY PRODUCTION: Information the total honey harvested by the beekeepers of each study centre was obtained primarily from Department of Industries and Commerce, beekeepers co-operative societies and the questionnaire. In addition, the honey produced by select progressive beekeepers of each study centre was also obtained.

PESTS, PARASITES AND DISEASES: Information on common pests, parasites and diseases was obtained from beekeepers with the help of the questionnaire. The scientific names of pests, parasites and disease causing agents were obtained with the help of bee research workers in the State and also from standard symptoms as described by beekeepers. Visual observations of diagnostic features were also used in the identification of the pests, parasites and diseases.

COMPARATIVE PERFORMANCE OF EXOTIC HONEYBEE: The indigenous hive bee *Apis cerana indica* F. is not only widely distributed in Indian sub-continent but also well adapted to different climatic conditions. Recently attempts have been made to introduce the occidental hive bee *Apis mellifera* in different parts of India including Karnataka. Generally, *Apis mellifera* is known to yield more honey than *Apis cerana indica* under temperate climates. However, information on the foraging behaviour of *Apis mellifera* visiting tropical bee plants is not available. The aim of

this study is to determine the colony as well as foraging index of *Apis cerana indica* and *Apis mellifera* for the purpose of assessing the relative performance of two hive bee species under sub-tropical climates.

ECOZONE STUDY: An attempt to study the honeybee species in the wild was made by selecting eight study sites in Uttara Kannada District. Nest sites of honeybee species in wild were identified and possible requirements of such habitats of each type of honeybee species were studied.

To study the status of honeybee species in the wild, high potential areas of honeybees nest sites were identified. Nest sites regularly used by different bee species in previous years and other nest sites which fulfil the requirements of a good shelter were identified with the help of the local people, who were familiar with that particular area. A transect of 1 km length and 20 m. wide was laid and in each transect nest sites with honeybees, disturbed shelters, reasons for destruction of shelter etc. were recorded. Density of honeybee species per hectare was calculated for each study area.

CASE STUDY OF HONEY HUNTERS: Traditional and experienced honey hunters were identified and experiences of such persons were recorded. Besides some tribal groups who had been collecting honey from wild were also identified and their knowledge and experiences were documented.

4.0 RESULTS

4.1 Introduction and growth of beekeeping

Keeping honeybee is a fascinating and profitable industry. Beekeeping can be practised by men, women and children alike. One may want to keep honeybees for the honey and other materials they produce, for the benefit of their valuable services as pollinators on pulse crops, oil seed crops, horticultural crops, certain food crops and to learn about one of the world's most interesting beneficial insects.

In India 2200 tonnes of honey are produced annually from 0.55 million modern beehives. During 1990-91 Karnataka State alone produced about 750 tonnes of honey from 158,300 modern beehives (Table 59). Kodagu, Dakshina Kannada and Uttara Kannada districts, certain areas in Hassan, Chikmagalur, Shimoga, Dharwad and Belgaum districts are potential honey producing areas in Karnataka State. Besides the

Table 17

Beekeepers, Bee colonies and honey production in Shimoga during 1990-1996.

Sl.No.	Partiuclars	Years 1990	1992	1993	1994	1994	1995	1996
1	No.of Beekeepers	6,121	5,521	3,157	2,140	2,790	2,095	2,675
2	No.of Bee colonies	28,732	20,172	19,721	17,141	9,650	5,396	2,912
3	Honey Production	79,221	40,545	37,847	29,311	14,571	4,856	2,038
4	No.of Bee colonies/beekeeper	4.69	3.65	6.24	8	3.45	2.57	1.08
5	Honey yield/colony/year (kgs).	2.75	2	1.91	1.7	1.5	0.89	0.69

Table -18

Beekeepers, Bee colonies and honey production in Kodagu during 1990-1996.

	Particulars	1990	1991	1992	1993	1994	1995	1996
	No.of Beekeepers	10,790	9,121	8,921	7,092	5,658	3,560	3,110
	No.of Bee colonies	27,115	16,085	13,159	8,132	5,168	3,107	2,119
	No.of Bee colonies/beekeeper	2.51	1.76	1.47	1.14	0.91	0.87	0.68
	Honey Production	72,138	51,318	27,115	16,085	8,132	2,149	1,716
	Honey yield/colony/year (Kgs).	2.66	3.19	2.06	1.97	1.57	0.69	0.8

Table 19

Beekeepers, Bee colonies and honey production in Hassan during 1990-1996.

Sl.No.	Particulars	Years 1990	1991	1992	1993	1994	1995	1996
1	No. of Beekeepers	7,152	6,591	5,951	5,618	4,107	3,651	2,185
2	No.of Bee colonies	21,121	15,612	10,521	9,718	8,172	5,192	4,121
3	Honey Production	65,121	52,121	32,124	28,151	17,121	9,512	8,121
4	No.of Bee colonies/beekeper	2.95	2.36	1.76	1.72	1.98	1.42	1.88
5	Honey yield/colony/year (Kgs).	3.08	3.33	3.05	2.89	2.09	1.83	1.97

Table 14

Beekeepers, Bee colonies and honey production in Uttara Kannada during 1990-1996.

		Years						
Sl.No.	Particulars	1990	1991	1992	1993	1994	1995	1996
1	No. of Beekeepers	4,619	4,799	4,889	3,014	3,776	2,617	2,674
2	No. of Bee colonies	28,144	22,708	19,971	18,562	19,516	20,729	19,624
3	No.of Bee colonies/beekeeper	6.09	4.73	4.08	6.15	5.16	7.9	7.3
4	Honey Production	22,164	21,341	15,185	14,781	7,862	9,654	5.396
5	Honey yield/colony/year (Kgs).	0.79	0.93	0.76	0.79	0.4	0.46	0.27

Table -15

Beekeepers, Bee colonies and honey production in Dakshina Kannada during 1990-1996.

		Year						
Sl.No.	Particulars	1990	1991	1992	993	1994	1995	1996
1	No.of Beekeepers	9,108	8,964	7,564	6,195	5,872	5,689	5,512
2	No.of Bee colonies	60,129	55,192	42,109	40,108	33,182	23,102	20,102
3	No.of Bee colonies/beekeeper	6.6	6.15	5.56	6.47	5.65	4.06	3.64
4	Honey Production	171229	150,123	101,119	97,012	81,812	70,129	60,159
5	Honey yield/colony/year (Kgs).	2.84	2.72	2.4	2.41	2.46	3.03	2.99

Table - 16

Beekeepers, Bee colonies and honey production in Chickmagalur during 1990-1996.

					Years			
Sl.No.	Particulars	1990	1991	1992	1993	1994	1995	1996
1	No.of Beekeepers	8,072	7,814	6,512	5,921	3,151	2,917	1,907
2	No.of Bee colonies	18,121	15,193	13,141	11,193	9,121	6,121	4,312
3	Honey Production	54,363	46,121	33,169	21,156	20,171	17.18	1.512
4	No.of Bee colonies/beekeeper	2.24	1.94	2.01	1.89	2.89	2.36	2.26
5	Honey yield/colony/year (Kgs).	3	3.03	2.52	1.88	2.21	0.24	0.35

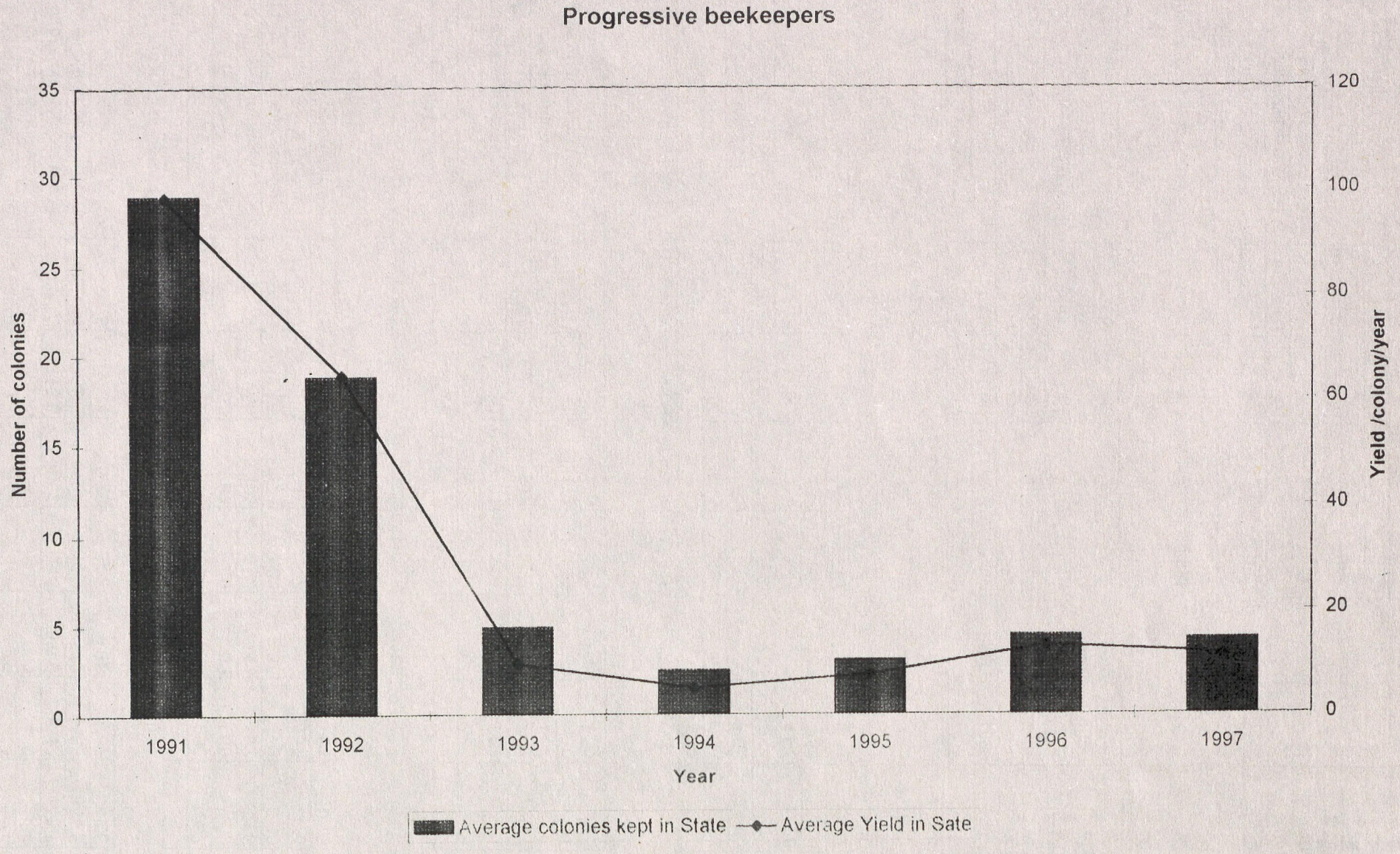

Progressive beekeepers
35
30
25
20
15
10
5
0
Number of colonies
120
100
80
60
40
20
0
Yield /colony/year
1991
1992
1993
1994
1995
1996
1997
Year
Average colonies kept in State
Average Yield in Sate

Table 37

Performance of Selected Progressive beekeepers of Uttara Kannada during 1991-98

Sl.No.	Particulars	Years						
		1991	1992	1993	1994	1995	1996	1997
1	No. of Beekeepers	73	73	73	73	73	73	73
2	No. of bee colonies	1497	1357	898	596	504	400	334
3	No. of Colonies/beekeeper	20.5	18.5	12.3	8.16	6.9	5.47	4.57
4	Honey harvested (Kg)	6375.4	5763.5	4724	1839	2110	1483	1364.5
5	Honey yield/Colony/Yr (Kg)	4.25	4.24	5.26	3.08	4.18	3.7	4.08

Table 38

Performance of Selected Progressive beekeepers of Dakshina Kannada during 1991-97

Sl.No.	Particulars	Years						
		1991	1992	1993	1994	1995	1996	1997
1	No. of Beekeepers	60	60	60	60	60	60	60
2	No. of Bee colonies	2379	759	286	182	141	192	236
3	No. of colonies/beekeeper	39.65	12.65	4.76	3.03	2.35	3.2	3.93
4	Honey harvested (Kg)	8169	891	247	102	116	157	174
5	Honey yield/colony/Yr (Kg)	3.43	1.17	0.86	0.56	0.82	0.81	0.73

Table 39

Performance of Selected Progressive beekeepers of Chickmagalur during 1991-97

Sl.No.	Particulars	Years						
		1991	1992	1993	1994	1995	1996	1997
1	No. of beekeepers	61	61	61	61	61	61	61
2	No. of bee colonies	1652	1438	250	69	141	291	289
3	No. of colonies/beekeeper	27.08	23.57	4.09	1.13	2.31	4.77	4.73
4	Honey harvested (Kg)	9770	8372	117	60	360	1170	1121
5	Honey yield/colony/Yr (Kg)	5.91	5.82	0.46	0.86	2.55	4.02	4.19

Table -40

Performance of Selected Progressive beekeepers of Kodagu during 1991-97

Sl.No.	Particulars	Years						
		1991	1992	1993	1994	1995	1996	1997
1	No. of beekeepers	60	60	60	60	60	60	60
2	No. of bee colonies	2227	956	300	148	157	244	377
3	No. of colonies/beekeeper	37.1	15.9	5	1.46	2.6	4.06	6.28
4	Honey harvested (Kg)	7775	2957	439	159	167	286	480
5	Honey Yield/colony/Yr (Kg)	3.49	3.09	1.44	1.07	1.06	1.17	1.27

Table 41

Performance of selected Progressive beekeepers of Shimoga during 1991-97

Sl.No.	Particulars	Years						
		1991	1992	1993	1994	1995	1996	1997
1	No. of beekeepers	60	60	60	60	60	60	60
2	No. of bee colonies	1993	630	181	78	218	243	176
3	No. of colonies/beekeeper	33.21	27.16	3.19	1.3	3.6	4.05	2.93
4	Honey harvested (Kg)	4170	3514	435	276	643	1009	427
5	Honey yield/colony/Yr (Kg)	2.09	2.15	2.5	3.5	2.9	4.15	2.42

Table 42

Performance of Selected Progressive beekeepers of Hassan during 1991-97

Sl.No.	Particulars	Years						
1		1991	1992	1993	1994	1995	1996	1997
2	No. of beekeepers	61	61	61	61	61	61	61
3	No. of bee colonies	1301	1166	222	62	71	285	170
4	No. of colonies/beekeeper	21.32	19.11	3.63	1.01	1.16	4.67	2.78
5	Honey harvested (Kg)	7060	6039	411	65	197	820	774
	Honey yield/colony/Yr (Kg)	5.42	5.17	0.85	1.04	2.77	2.87	4.55

Performance ofProgressive Beekeepers in Western Ghats of Karnataka

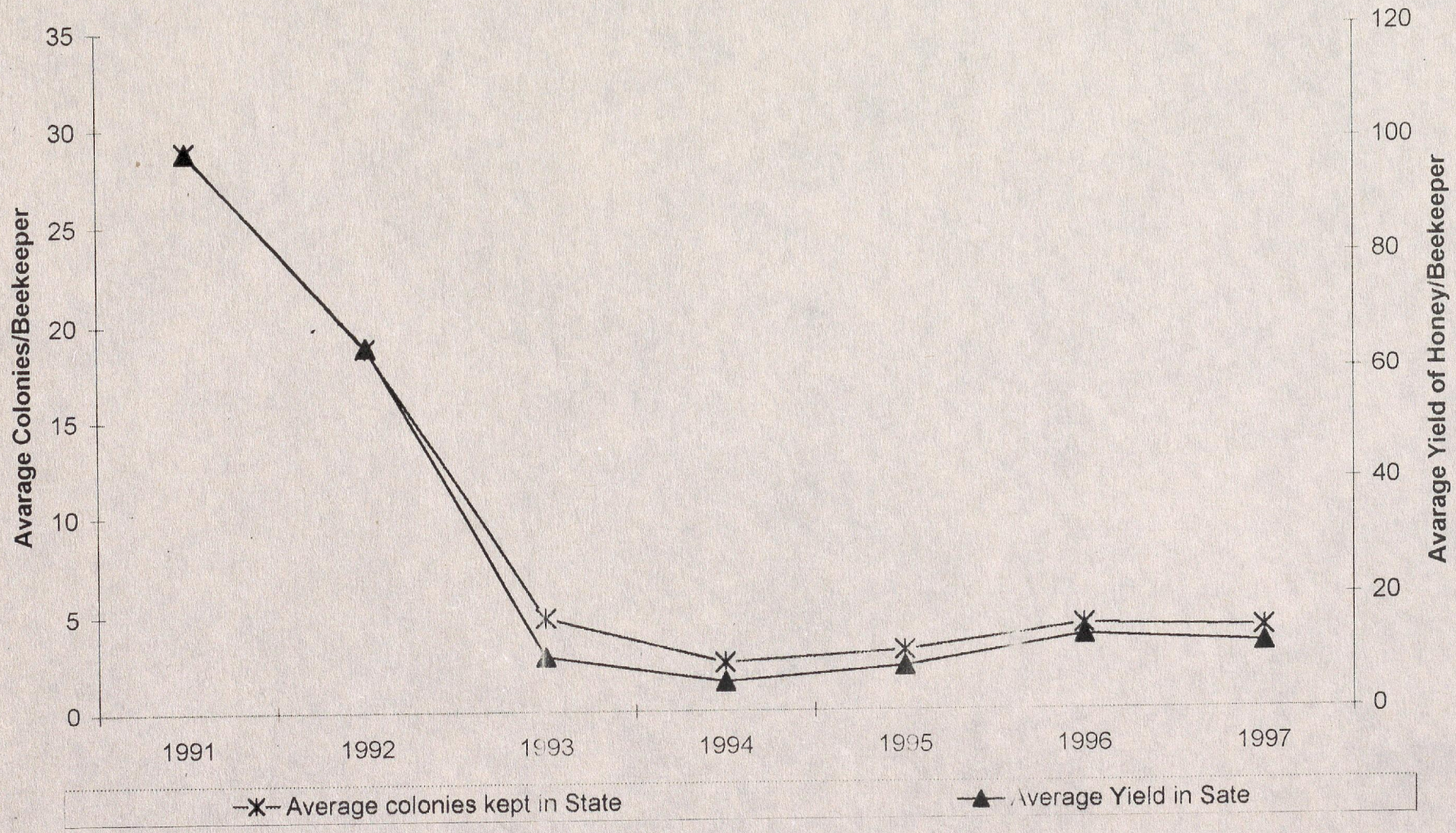


Chart- a- 1

Beekeeping Profile in Chikmagalur

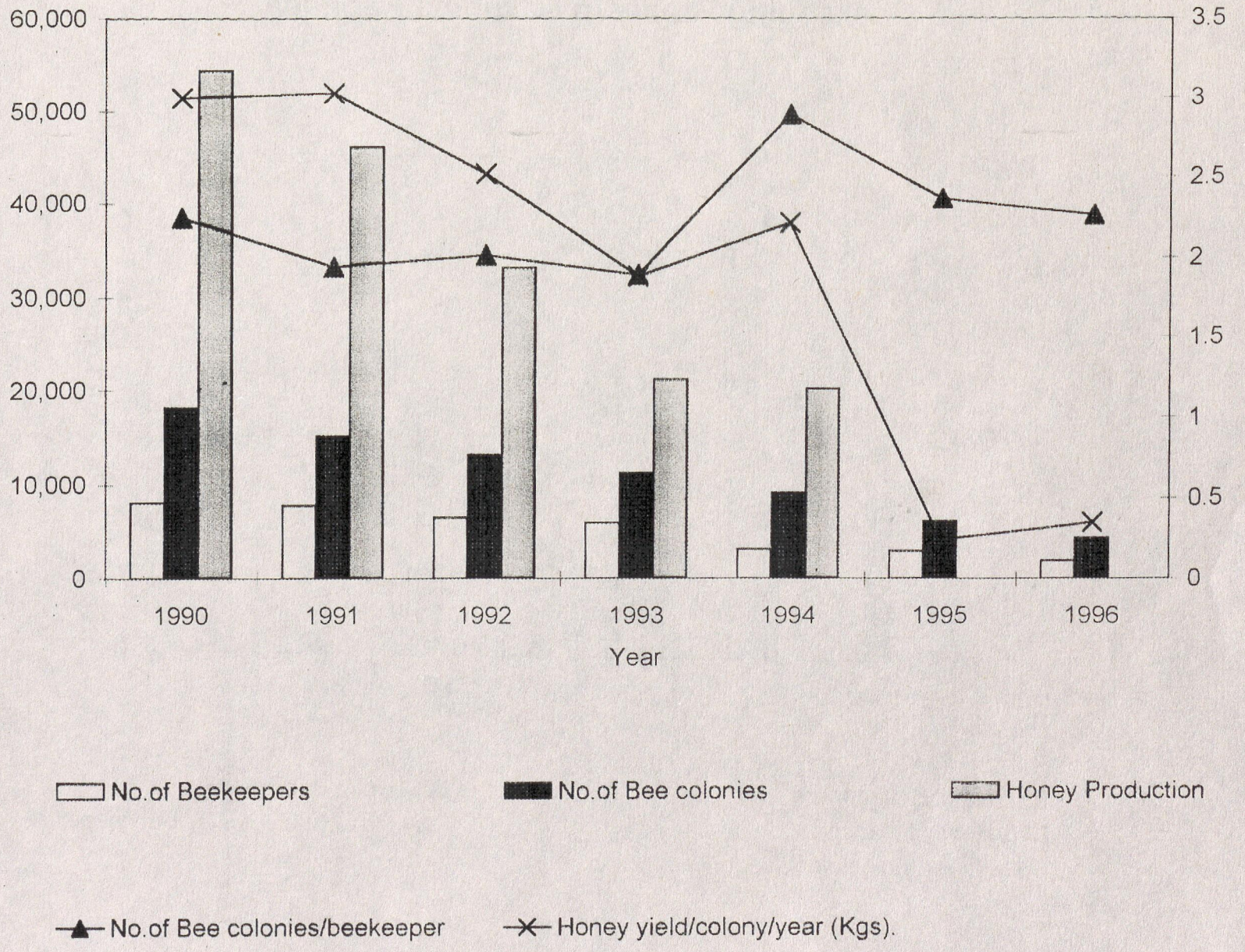


Chart - A-2

Beekeeping Profile in Dakshina Kannada

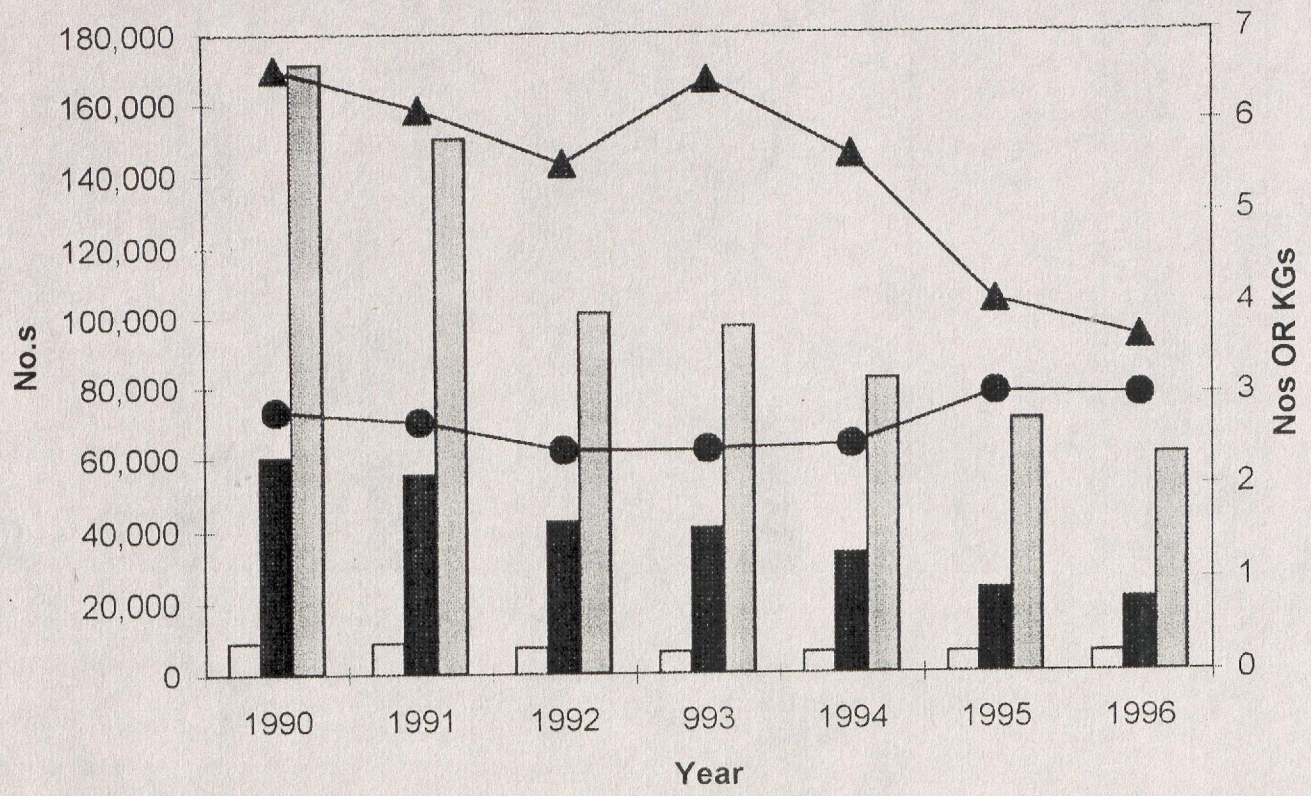


Chart-A-5

Beekeeping Profile in Shimoga

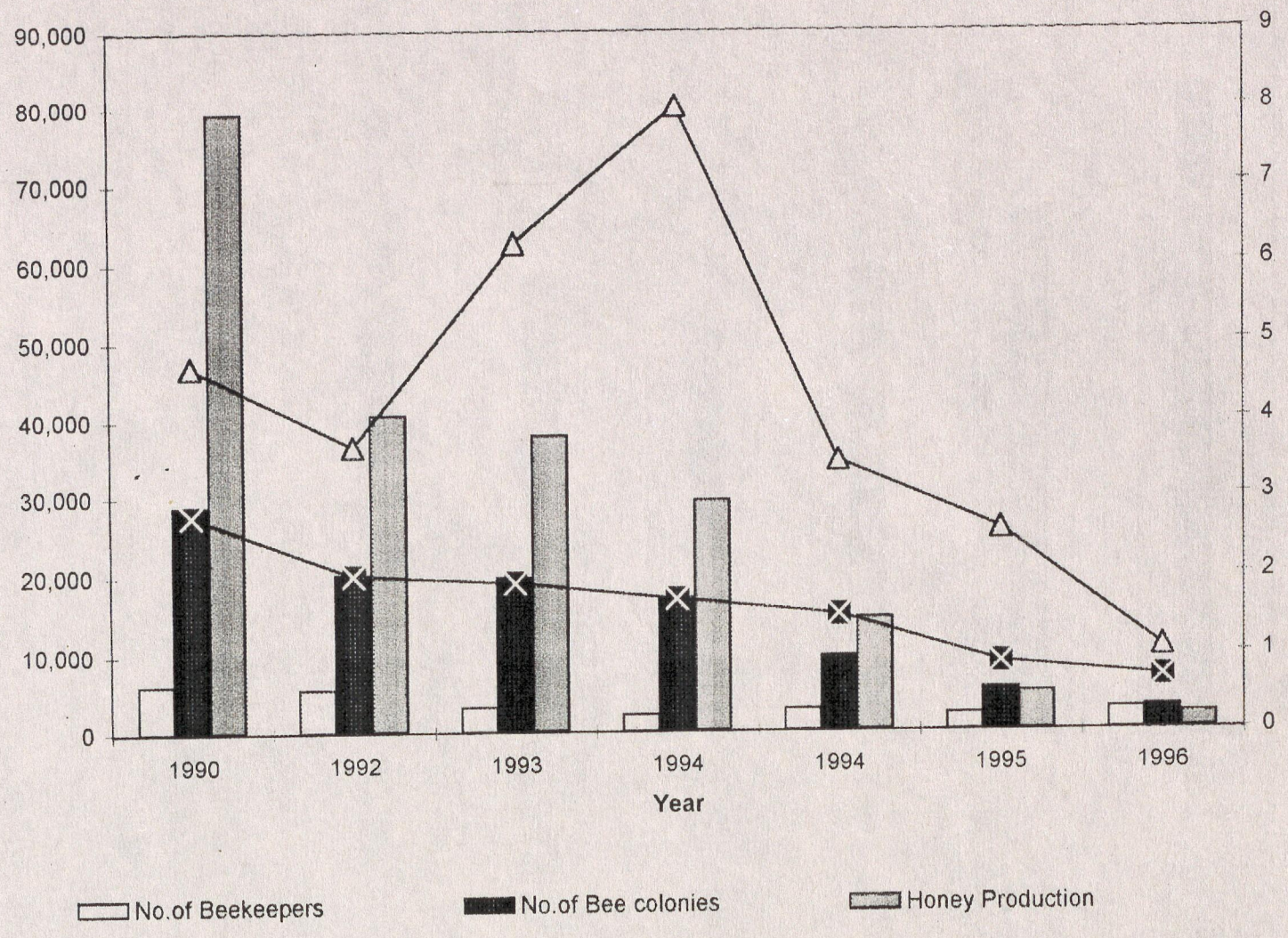


Chart-A-6

Beekeeping Profile in Uttara Kannada

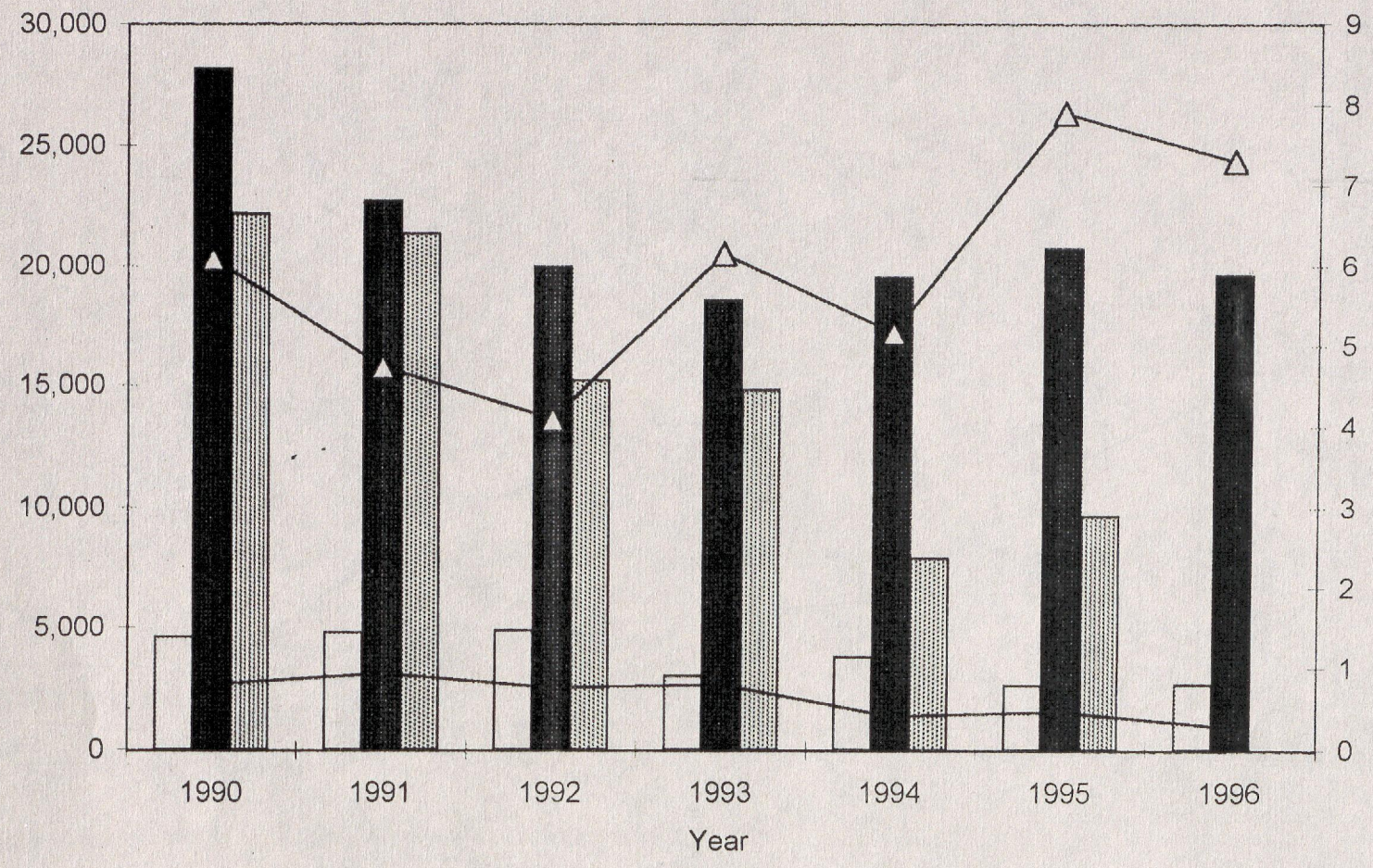


Chart-A-5

Beekeeping Profile in Shimoga

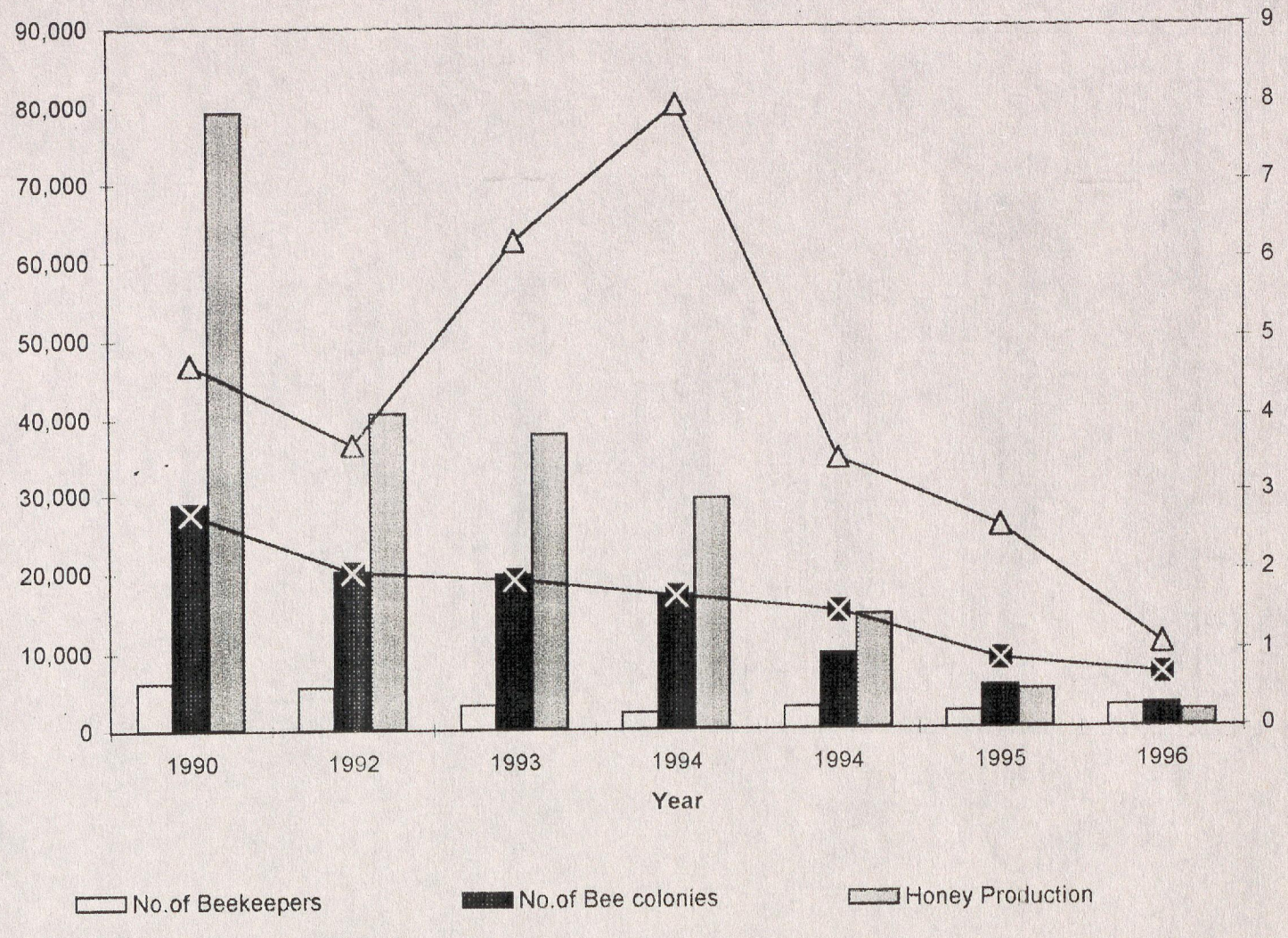


Chart-A-6

Beekeeping Profile in Uttara Kannada

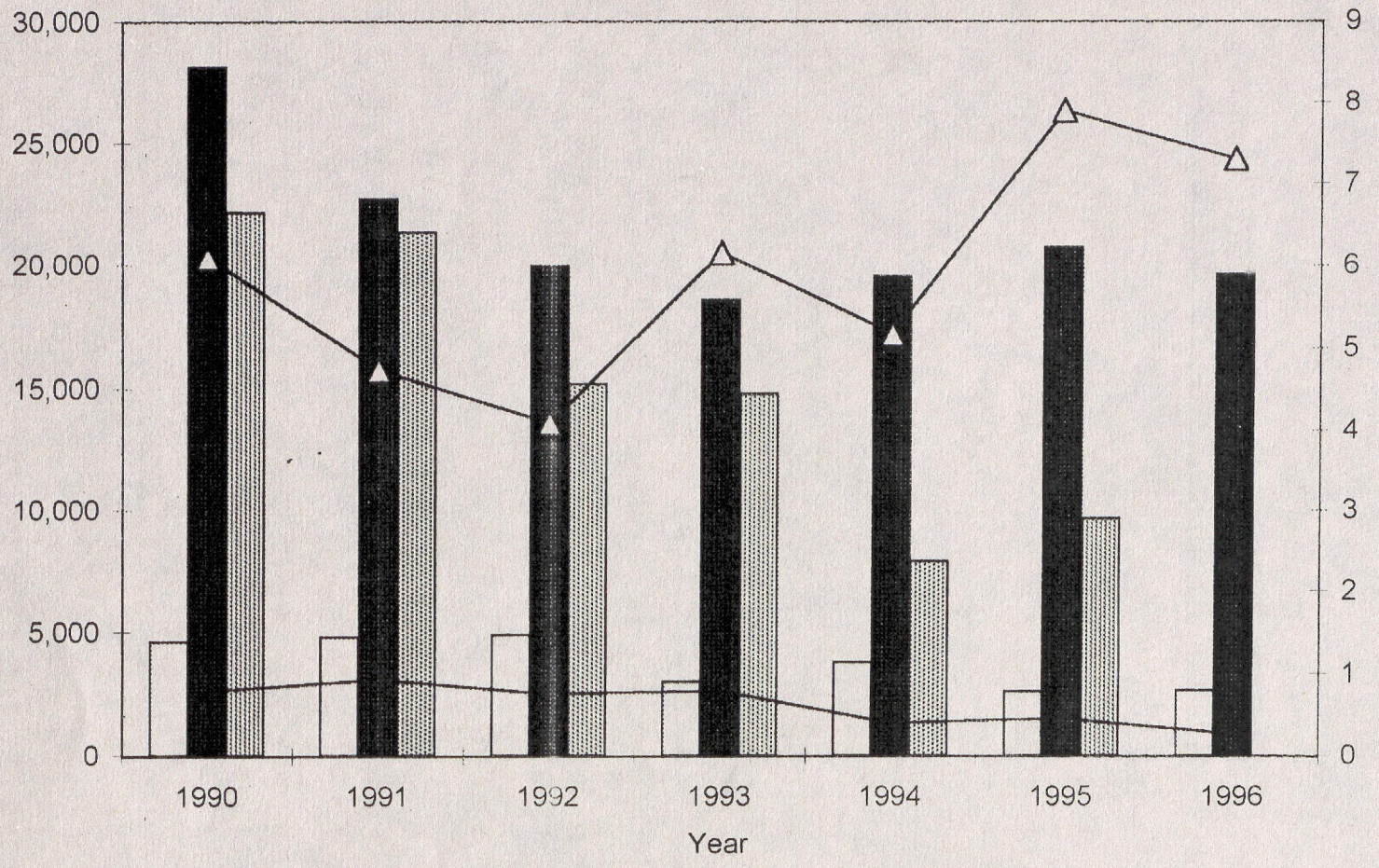


Table 20

Nest site and nest density of giant honeybee *Apis dorsata* F in UttaraKannada

Sl.No	Place of Nest sites	Name of Nest sites	Nature of Nest sites	Botanical Name of Trees	Nest density
1	Sirsi	Nandi Mara	A	*Lagerstroemia lanceolata*	150
2	Ullandi	Burukula Mara	A		25
3	Nilkunda	Goli Mara	A		45
4	Bennali	Matti Mara	A	*Terminalia arjuna*	60
5	Karimane	Pade Mara	A		200
6	Agasarabommana halli	Heddi Mara	A		18
7	Bale gadde	Heddi Mara	A		10
8	Singana mane	Thare Mara	A	*Tarminalia bellarica*	15
9	Chare	Rock	T		15
10	Honnale gadde	Burula Mara	A		40
11	Heggarini	Rock	T		60
12	Hithala halli	Honalu	A	*Terminalia paniculata*	30
13	Hebbala mane	Thare Mara	A	*Tarminalia bellarica*	30
14	Koppara gadde	Neeru atti	A		28
15	Lodom gadde	Heddi Mara	A		65
16	Vanalli	Matti Mara	A	*Terminalia arjuna*	35
17	Koligar	Honalu	A	*Terminalia paniculata*	50
18	Savene	Goli Mara	A		150
19	Mani gadde	Rock	T		150
20	Jaddi gadde	Pade Mara	A		300
21	Kamati mane	Nandi Mara	A	*Lagerstroemia lanceolata*	150
22	Kelagina voni keri	Basiri Mara	A		15
23	chowthi	Maddali Mara	A		20
24	Melina vonikeri	Nertuatti	A		44
25	Kalla halli	Malayali Mara	A		35
26	Manju guni	Nandi Mara	A	*Lagerstroemia lanceolata*	225
27	Kansur	Bili Basaru Mara	A		160
28	Sara guppa	Bili Basaru Mara	A		30
29	Munchagodu	Nandi Mara	A	*Lagerstroemia lanceolata*	25
30	Illimane	Thare Mara	A	*Tarminalia bellarica*	32
31	Bilagi	Maddali Mara	A		65
32	Ankola	Building	T		20
33	Algeri	Rock	A		65
34	Majali (Karwar)	Thare Mara	A	*Tarminalia bellarica*	18
35	Etagi	Burukula Mara	A		75
36	Honna gudda	Maddi Mara	A		64
37	Yana (Kumta)	Rock	T		350
38	Harana godi	Nerruatti	A		125
39	Bhaskeri	Matthi	A		138
40	Karki	Rock	A		48
41	Surakatte	Matti Mara	A	*Terminalia arjuna*	85
42	Haruge	Nandi Mara	A	*Lagerstroemia lanceolata*	44
43	Khandgar	Bili Basari Mara	A		110

Table 21.

Nest sites and nest density of giant honeybee *Apis dorsata* F in Dakshina Kannada.

Sl.No	Place of Nest sites	Name of Nest sites	Nature of Nest sites	Botanical Name of Trees	Nest density
1	Aanthrodu	Booragadamara	A		93
2	Shivalli	Lingadaregida	A		20
3	Bykadi	Kiralbhagi	A		24
4	Nenkadiuru	Kadusurgie	A		10
5	Indrali	Ulipe	A		12
6	Aambalapadi	Beegadamara	A		213
7	Bandara	Muttagala Mara	A		12
8	Kadri	Mango	A	*Mangifera india*	22
9	Begi	Jack fruit	A		14
10	Illanthila	Dodddkandakki	A		15
11	Puttilu	Kodali Mara	A		26
12	Kyyuru	Sanna kenka	A		14
13	Kadila	Gulu Mara	A		42
14	Belavayu	Jambu Nerala	A		22
15	Ubardka	Mango	A	*Mangifera india*	24
16	Kukkjadka	Jack fruit	A		28
17	Balnadu	Honge Mara	A		14
18	Mani	Srigandha	A		12
19	Bhantvala	Rudhrakshi Mara	A		11
20	Belthangadi	Nawaladi	A		8
21	Sulya	Bendiya	A		12
22	Puttur	Jack fruit	A		14
23	Sulya	Bengal Tree	A		15
24	Sampaje	Bengal Tree	A		25

Table 22.

Nest sites and nest density of giant honeybee Apis dorsata F. in Chikmagalur

Sl.No	Place of Nest site	Name of Nest site	Nature of Nest sites	Botanical name of Trees	Nest density
1	Agla	Mango	A	*Mangifera india*	6
2	Aldur	Beegada Mara	A		4
3	Ilekhan	Jambu Nerala	A	*Syzygium cumini*	12
4	Holada bayalu	Honge Mara	A	*Pongamia pinnata*	15
5	Koppa	Rock	T		10
6	Karimane	Maddale Mara	A	*Alstonia scholaris*	20
7	Gullan Pete	Building	T		4
8	Gunavanthe	Thare Mara	A	*Tarminalia bellarica*	18
9	Hosa Godu	Neeruatti	A		25
10	Biji Katte	Neeruatti	A		6
11	Bommala Pura	Beegada Mara	A		20
12	Sanuvalli	Goli Mara	A		8
13	Kumbatti	Honalu	A	*Terminalia paniculata*	4
14	devarunda	Neeru atti	A		4
15	Banakal	Jambu Nerale	A	*Syzygium cumini*	4
16	Mudagere	Building	T		6
17	Hale Kote	Honge Mara	A	*Pongamia pinnata*	10
18	Bidara Halli	Madali mara	A		18
19	Kesha Holalu	Thare Mara	A	*Tarminalia bellarica*	6
20	Kundur	Rock	T		5
21	Makana Gadde	Rock	T		4
22	Horati	Nandi Mara	A	*Lagerstroemia lanceolata*	11
23	Battadavuru	Nandi Mara	A	*Lagerstroemia lanceolata*	12
24	Gutti	Thare Mara	A		30
25	Nandi Pura	Rock	T		4
26	Kumbara Halli	Jambu Nerala	A		5
27	Gowda Halli	Kodali Mara	A		10
28	Boluru	Sannakena	A		2
29	Mahal Godu	Jambu Nerale	A		12
30	Magundi	Honge Mara	A		6
31	Menasuru	Nerale Gida	A		15
32	Medar beedi	Bhootala Mara	A		5
33	Kalli Koppa	Rock	T		4
34	Shetti Koppa	Madali mara	A		20
35	N.R.Pura	Building	T		5
36	Kade Gadde	Honge Mara	A		8
37	Bannur	Jambu Nerale	A		9
38	Mallandur	Rock	T		6
39	Malalur	Neeruati	A		15
40	K.R.Pete	Building	T		3
41	Bukka Sagara	Beegada Mara	A		4
42	Bisile Halli	Bili Basara Mara	A		25
43	Mudanae	Thare Mara	A		18
44	Gudugatta	Madali mara	A		15
45	Sringeri	Building	T		5
46	Yemmegundi	Honge Mara	A		5
47	Dodda Magaravalli	Goli Mara	A		8
48	Beli Halli	Jambu Nerale	A		10
49	Somala Pura	Rock	T		5

Table 23

Nest sites and nest density of giant honey bee Apis dorsata F. in Shimoga

Sl.No	Place of Nest sites	Name of Nest sites	Nature of Nest sites	Botanical Name of Trees	Nest density
1	Tirtha Halli	Nandi Mara	A	*Lagerstroemia lanceolata*	20
2	Kera Halli	Burukula Mara	A		38
3	Kappagala	Matthi Mara	A	*Terminalia arjuna*	50
4	Kasaravalli	Maddu Naa	A		120
5	Kyasanur	Goli Mara	A		85
6	Sorab	Rock	T		15
7	Kattenegere	Pade Mara	A		35
8	Kadam Kalli	Thare Mara	A	*Tarminalia bellarica*	24
9	Otha Godu	Madali Mara	A		75
10	Hosabale	Maddi Mara	A		14
11	Sagar	Building	T		8
12	Bandi Koppa	Rock	T		6
13	Kanne Halli	Basiri Mara	A	*Ficus tsila*	32
14	Betta Giri	Maddi Mara	A		80
15	Sirrure	Neeruatti	A		25
16	Anavatti	Rock	T		18
17	Gudde Kere	Basiri Mara	A	*Ficus tsila*	90
18	Bargi	Honalu	A	*Terminalia paniculata*	70
19	Nagavadi	Maddali Mara	A		60
20	Anavatti	Pade Mara	A		45
21	Amachi	Rock	T		18
22	Tyavo godu	Nandi Mara	A		5
23	B.Doddere	Maddali Mara	A		95
24	Agumbe	Basiri Mara	A	*Ficus tsila*	120
25	Hosabale	Rock	T		10
26	Karava Valli	Bili Basiri Mara	A	*Ficus tsila*	20
27	Bettagiri	Neeruatti	A		45
28	Kanne Halli	Mathi Mara	A	*Terminalia arjuna*	30

Table 24

Nest sites and nest density of giant honeybee Apis dorsata F. in Kodagu

Sl.No	Place of Nest sites	Name of Nest sites	Nature of Nest sites	Botanical Name of Trees	Nest density
1	Birnani	Mango	A	*Mangifera india*	121
2	Chenganamada	Jack Fruit	A		15
3	Kalemedu	Booragada Mara	A		13
4	Thannimani	Kadusurgie	A		11
5	Thavur	Kiralbhogi	A		12
6	Bhagamandala	Beegadamara	A		22
7	Thalacavery	Dooddakankakki	A		25
8	Patti	Sannakenka	A		25
9	Bangakeri	Kodalimara	A		8
10	Galibedu	Builings	T		19
11	Singathoor	Hongemara	A		17
12	Madikeri	Builingss	T		13
13	Virajpet	Builings	T		42
14	Ponnampet	Sriganda	A		19
15	Somvarpet	Builings	T		32
16	Kushal Nagar	Builingss	T		14
17	Korangala	Bhootala Mara	A		11
18	B.Shettigeri	Kadhuvala	A		14
19	Birnani	Kiralbhogi	A		14
20	Virajpet	Buildings	T		18
21	Thannimani	Jack Fruit	A		24
22	Thavur	Buildings	T		19
23	Kalimedu	Mango	A	*Mangifera india*	25
24	Patti	Sriganda	A		26

Table 25

Nest sites and nest density of giant honeybee Apis dorsata F. in Hassan.

Sl.No	Place of Nest sites	Name of Nest sites	Nature of Nest sites	Botanical Name of Trees	Nest density
1	Netta Halli	Madali Mara	A		20
2	Heggade	Bili Basiri Mara	A		15
3	Mesala Mane	Mathi	A		4
4	Koganavalli	Nerala Gida	A		8
5	Kasuganahalli	Jambu Nerale	A		10
6	Agalatti	Rock	A		5
7	Kumbaragatte	Honge Mara	A		8
8	Marma Halli	Nerale Mara	A		6
9	Kethana Halli	Bhootala Mara	a		4
10	Devalada Keri	Kodali Mara	a		3
11	Nekana Halli	Rock	T		5
12	Anuvalli	Neerutti	A		4
13	Shankala Pura	Matti	A		10
14	Thimmanna Halli	Thare	A	*Tarminalia bellarica*	6
15	Maladevi Halli	Honalu	A		4
16	Sankena Halli	Beegada Mara	A		8
17	Balegodu	Maddi Mara	A		25
18	Auchangi	Nandi Mara	A		5
19	Masavalli	Rock	T		4
20	Kalla Halli	Rock	T		5
21	Mata Sagar	Jambu Nerale	A		6
22	Yenka Shetty Halli	Thare	A	*Tarminalia bellarica*	6
23	Dambadi Halli	Kadusurgie	A		3
24	Honavalli	Building	T		5
25	Alsur	Kodali Mara	A		4
26	R.K.Koppal	Bili Basiri Mara	A		15
27	Kadur	Maddli Mara	A		15
28	Nidugodi	Matti	A		5
29	Belur	Building	T		4
30	Koneralue	Nerale Mara	A		5
31	Koravangala Gatte	Honge Mara	A		8
32	Dommenahalli	Jambu Nerale	A		9
33	Malagalae	Rock	T		10
34	Dabba	Thare	A	*Tarminalia bellarica*	12
35	Vanana Koppalu	Goli Mara	A		6
36	Isslur	Dhupada Mara	A		8
37	K.Hoskote	Building	T		5
38	Kadalur Koppal	Thare	A	*Tarminalia bellarica*	9
39	Mattige	Bili Basiri Mara	A		25
40	Kithagalale	Neerutti	A		4
41	Alasur	Rock	T		6
42	Heragalale	Honalu	A	*Terminalia paniculata*	5
43	Sakaleshpra	Maddali Mara	A		12
44	Hassan	Building	T		14
45	Arsikere	Maddi Mara	A		16
46	Hulu Gunda Estate	Nandi Mara	A	*Lagerstroemia lanceolata*	3
47	Harsha Forms	Nandi Mara	A	*Lagerstroemia lanceolata*	5
48	Kana Halli	Rock	T		6
49	Bhage	Bili Basiri Mara	A		12

Average No ofColonies kept by Beekeepers

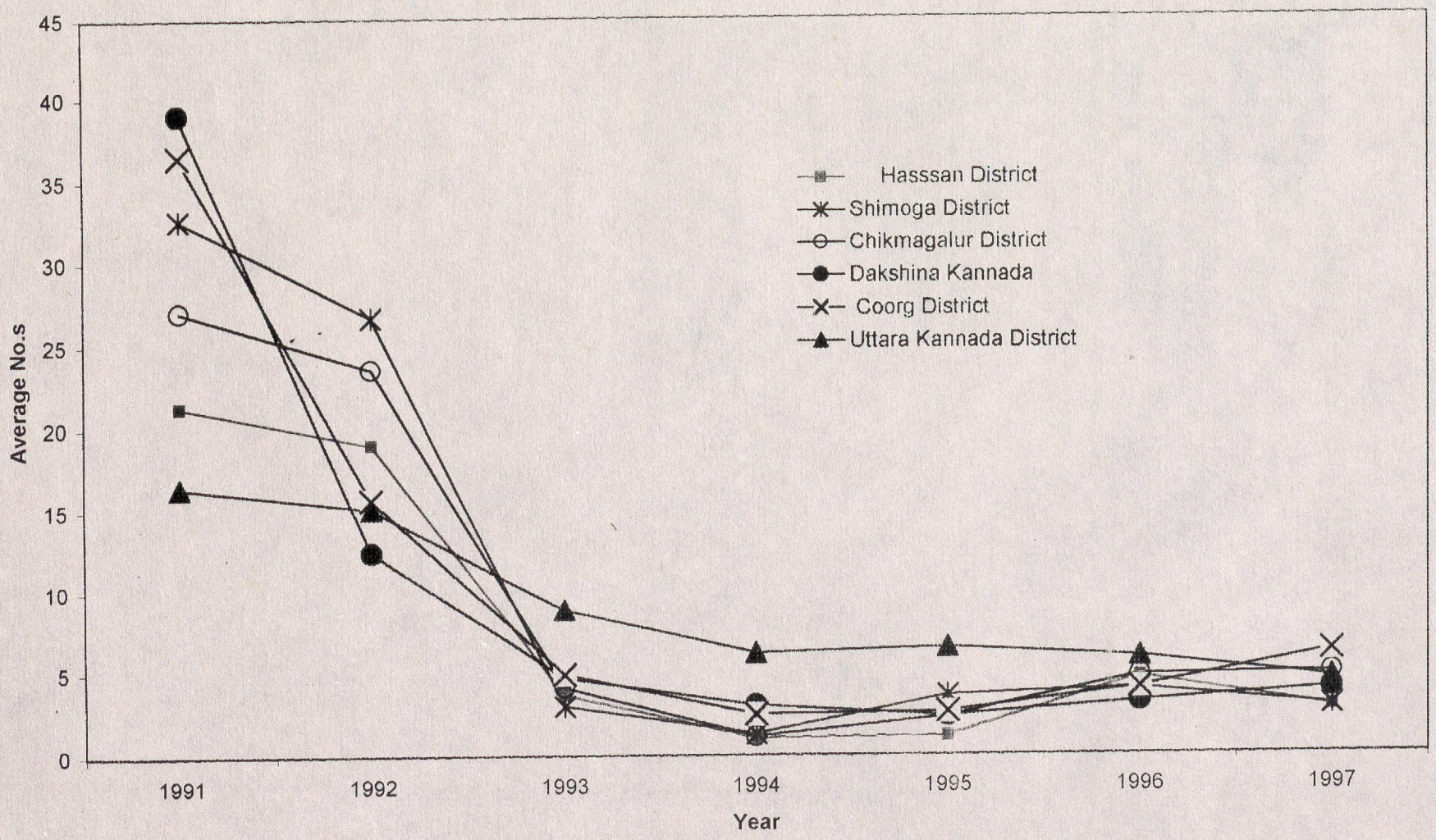
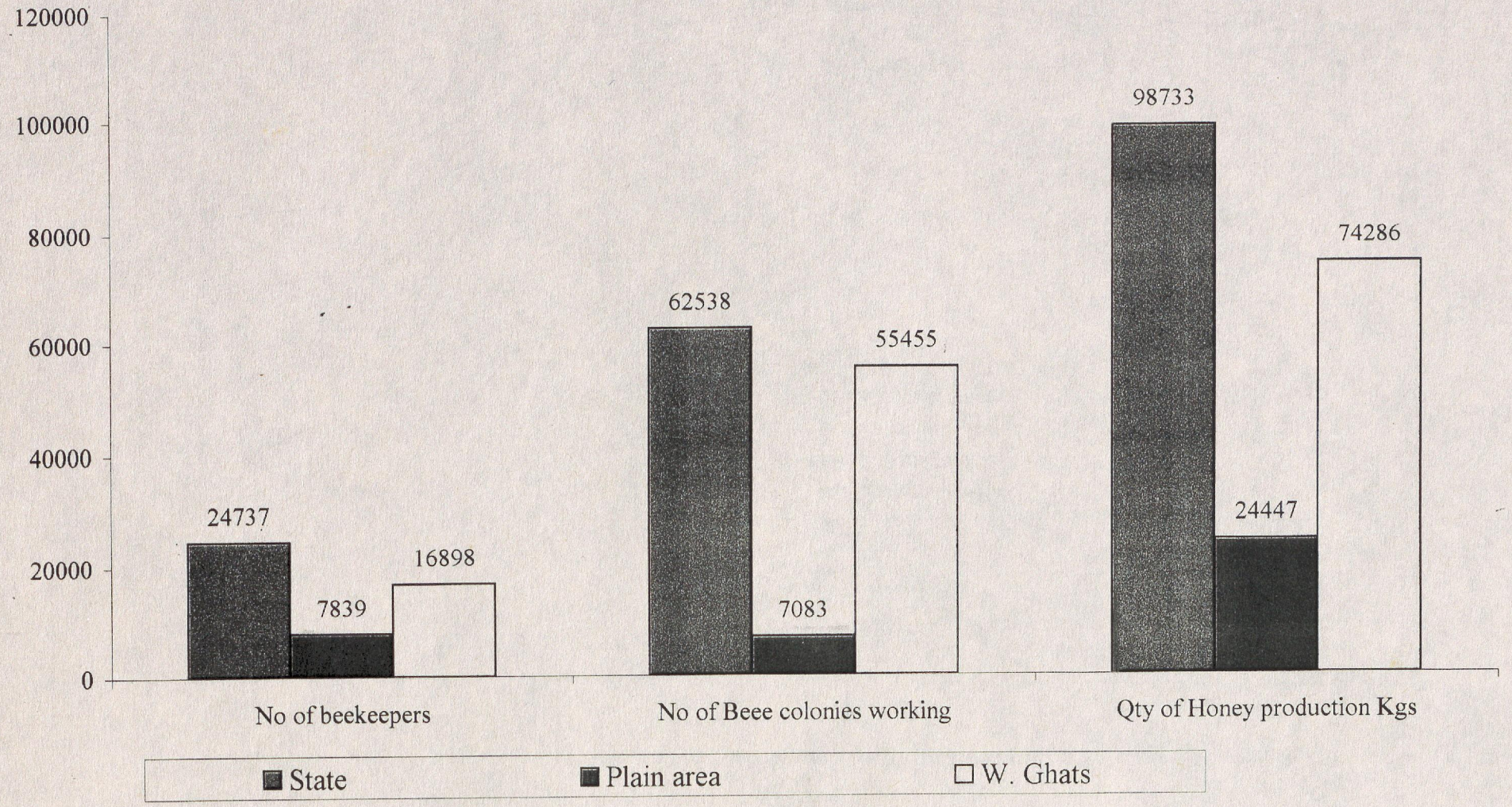


Fig 1- Beekeeping statestics in Karnataka



above, certain irrigated areas in canal belts of harnessed river projects also produce honey from cultivated crops. Fig. 2 illustrates the contribution of the Western Ghats region and the plains to the beekeeping industry in the State. Fig. 48 gives the status of beekeeping in the region excluding the Western Ghats.

Beekeeping is not developed uniformly in all regions, and many potential areas remain unexplored for no apparent reason. Though beekeeping is a many faceted activity, the value of many aspects like bee pollination, wax production, medicinal properties of honey and dietary importance of honey, have yet to be realised. The yield of honey per colony per year is found to be very low. Tropical countries like India have an advantage over other countries because of the variety of flora and the suitable rich climate for beekeeping almost throughout the year.

Primitive methods of beekeeping have been practised in almost every country from time immemorial. Beekeeping in India was established as a modern industry only after the invention of movable frame hives in 1882 in the U.S.A., and the transfer of this technology to India. In India, beekeeping industry evolved from different bases and practices and fits under various categories of rural activity such as village cottage industry, agro-based rural industry, forest based industry, decentralised industry, subsidiary and part time industry and above all a profitable hobby (Reddy, 1995). It was only in the later part of the 19th century that some steps were taken to modernise. Beekeeping is a scientific method of conservation and rearing of bees for production of honey, wax, royal jelly, pollen, bee venom and pollination of crop plants (Reddy, 1995).

Though Indians knew bees and honey for ages, beekeeping in general still remained unorganised, undeveloped and uneconomical. The potential areas like Western Ghats, despite having diversified bee flora, abundant distribution of bee fauna, copious production of nectar and pollen and favourable weather conditions, are not fully studied and explored for commercial honey production.

The present study was mainly concerned with the status and level of beekeeping including the bee fauna, bee flora, and the factors affecting the bees and beekeeping. Keeping the status of beekeeping in view the flexible methodology so adopted immensely helped to generate sufficient data not only enough of fulfil the objective of the study but also provided visible and tangible results for formulating strategies for

both the short and long term development of apiculture. The intensive and extensive survey undertaken has generated data on most of the objectives of the study.

4.2 HONEYBEE SPECIES

All the three important species of honeybees, *Apis cerana*, *Apis dorsata*, *Apis florea* are widely distributed in the study area (Table 1.) The two wild species namely the giant honeybee (*Apis dorsata*) and the little honeybee (*Apis florea*) are well distributed in most parts of Western Ghats. The two species continue to exist in wild and attempts to domesticate these species have not yielded fruitful results. Unlike the domesticated *Apis cerana*, *Apis florea* is known for its peculiar yet interesting nesting habits. These two wild species build a single comb beneath the branches of shrubs, trees, rocks, buildings and other natural and man-made structures at a considerable height from the ground. Open nesting coupled with arboreal way of life immensely helps in escaping from ground pests and predators. Evidently, both *Apis dorsata* and *Apis florea* are relatively free from pests, predators and even severe brood diseases. Both wild species are known to exploit floral resources efficiently.

Table 1. **HONEY BEE SPECIES OF WESTERN GHATS.**

Sl. No.	Species	Common name	Remarks
1	*Apis cerana F.*	Indian honeybee	Domesticated/ Wild
2	*Apis dorsata F.*	Gaint honeybee	Wild
3	*Apis florea F.*	Dwarf honeybee	Wild
4	*Apis mellifera L.*	European honeybee	Domesticated (introduced during 1990-91)
5	*Trigona species*	Stingless Bees	Wild

The giant honeybee (*Apis dorsata*) is usually found in aggregation of colonies ranging from a few to several hundreds. The maximum number of colonies of *Apis dorsata* observed on a single nest site was 236. The height of nests from ground level varies from a few meters to as high as 70m. It is not uncommon to find the colonies of *Apis dorsata* on tall buildings, water tanks, big rocks and tall-branched trees. The nesting behaviour is not only interesting but also fascinating, as the nests tend to orient towards north-east direction which provide greater protection against wind speed. The comb is built judiciously successfully incorporating the principles of architecture and structural engineering.

Apis dorsata is widely distributed in the study area. Many important nest sites and their nest density of *Apis dorsata* in all 6 study centres were recorded (Tables 20-25). A maximum of 49 nest sites each in Chikmagalur and Hassan and minimum of 24 and 28 nest sites in Kodagu and Shimoga were recorded. A total of 6925 nests with a maximum in Uttara Kannada (3419) and a minimum of 447 in Hassan were recorded. Though the number of nest sites identified in the study area was a small sample, it indicates the wide distribution *Apis dorsata*. It is practically impossible to count the number of nest sites directly or even indirectly, partly because of inability to locate the innumerable nest sites often distributed in inhospitable and inaccessible places.

Similarly, the nest sites of *Apis florea* were observed in each of the six study centres. *Apis florea* is more widely distributed than *Apis dorsata* and its nests were found generally in a small trees and bushes slightly above the ground level. Nests are found in singles and are normally small in size when compared to the nests of *Apis dorsata*. It is rather difficult to find the nests of *Apis florea* as they are partly hidden beneath thick foliage.

The Indian honeybee *Apis cerana* can be seen both as wild and domesticated form. The natural nests of *Apis cerana* include a variety of natural and manmade structures. The natural nest sites are mainly small trees profusely branched with dense foliage, old termite mounds, small opening of wood, rocks, big trees trunks and pots and numerous other structures. The height of nests varies from ground level to 5 – 10m above the ground.

Apart from above three popular honeybee species, another important non-Apis species is *Trigona* species. *Trigona* species are also widely distributed in the study

area. They are commonly called stingless bees as they are devoid of any stinging apparatus. *Trigona* species are specially known for their sweet honey whose medicinal value is far superior to the honey of other Apis species. The honey of *Trigona* species is widely used in Ayurvedic medicine to cure variety ailments. The demand for *Trigona* honey is very high partly because of non-availability coupled with very low production of honey.

Trigona species usually nest in the minute openings of wood, trees, bushes, rocks, stones buildings, termite mounds and numerous man-made structures. The nests are generally not visible and not accessible without breaking the nest structure. The average nest density is highly variable from place to place and it was found to be between 0.5 and 66.4 per sq. km.

Results of ecozone study; density of each honeybee species and nest sites are discussed in Chapter 6.0 (section 4.0)

4.3 WEATHER CONDITIONS

Favourable weather conditions prevailed in most parts of the study area to promote the growth and development of all 3 indigenous honeybee species and stingless bees all through the year. There are no significant differences in the climates of different study centres (Tables 2-7).

The monthly maximum average temperature, relative humidity (evening) and wind speed was 31°C, 81% and 7.2 km/hr in Uttara Kannada 30.4 °C, 77%, in Dakshina Kannada, 27.3 °C, 76%, 8.2 km/hr in Chikmagalur, 30.7°C, 55%, 4.5 km/hr in Shimoga, 24.7°C, 76%, 10.6 km/hr in Kodagu, and 28.3° C, 59%, 77 km/hr in Hassan respectively. A maximum of 35.8°C in Shimoga and a minimum of 13.6°C, in Hassan were recorded during April and January respectively.

The relative humidity varied between 27% and 96%. The wind speed was maximum during June to August/September as a result of onset of monsoon. A wind speed greater than 10 km/hr is known to affect the foraging particularly flower visitation and load carrying capacity of bees which eventually reduce significantly the flow of pollen and nectar into the colony.

Table 2.

Monthly average temperature, relative humidity and wind speed in Uttara Kannada during 1996.

Months	Temperature		Relative Humidity		Average Wind speed Km. per Hr
	Max in°C	Min in°C	Morning %	Evening %	
January	31.9	20.0	58	70	6.2
February	31.5	20.5	63	75	6.7
March	32.2	22.9	67	80	6.9
April	32.9	25.2	70	78	7.2
May	32.5	25.8	84	79	8.4
June	29.5	23.9	88	90	9.2
July	28.2	23.4	86	92	9.4
August	28.3	23.5	82	92	8.4
September	29.1	23.2	77	91	5.9
October	30.9	23.3	64	86	5.7
November	32.6	22.2	67	72	5.9
December	32.8	21.2	65	64	7.0
Average	**31.0**	**22.9**	**72**	**81**	**7.2**

- Recorded at Honnavar

Table –3 Monthly average temperature, relative humidity and wind speed in Dakshina Kannada during 1996.

Months	Temperature		Relative % Humidity	Average wind speed Km. per Hr
	Max in°C	Min in°C		
January	31.3	21.3	69	
February	31.1	22.5	71	
March	31.9	23.8	70	
April	32.7	26.0	69	
May	32.3	26.2	74	**No Data**
June	29.1	23.8	87	
July	28.4	23.4	89	
August	28.1	23.7	89	
September	28.4	22.4	88	
October	29.1	23.1	82	
November	30.1	22.7	76	
December	31.8	21.2	68	
Average	**30.4**	**23.4**	77	

- Recorded at Mangalore (Panambur),

Table 4. Monthly average temperature, relative humidity and wind speed in Chikmagalur during **1996.**

Months	Temperature		Relative Humidity % Average	Av. Wind speed Km. Per Hr.
	Max. in °C .	Min. in °C.		
January	26.7	14.2	73	5.7
February	29.1	15.9	66	5.5
March	31.5	17.8	60	5.6
April	32.2	19.1	68	6.5
May	30.7	19.4	72	8.5
June	26.2	19.0	82	13.2
July	24.4	18.6	87	12.2
August	24.3	18.4	86	13.0
September	25.9	18.2	84	8.8
October	26.7	18.0	79	6.6
November	25.8	17.1	78	6.4
December	25.5	14.9	77	6.4
Average	27.5	17.5	76	8.2

Table 5. Monthly average temperature, relative humidity and wind speed in Shimoga during 1996.

Months	Temperature		Relative Humidity %		Av. Wind Speed Km. Per Hr.
	Max. in °C.	Min in °C	Morning	Evening	
January	30.3	14.3	77	34	3.8
February	32.7	16.3	76	28	3.7
March	35.2	19.2	77	27	4.0
April	35.8	21.8	76	41	4.3
May	33.9	22.3	77	55	5.4
June	29.3	21.6	83	73	6.3
July	27.0	21.0	88	80	6.0
August	27.2	20.9	88	79	4.7
September	28.6	20.4	86	73	4.4
October	29.6	20.1	86	67	3.4
November	29.2	17.4	81	56	4.0
December	29.0	15.0	71	45	4.3
Average	30.7	19.2	81	55	4.5

Recorded at Shimoga.

Table 6. Monthly average temperature, relative humidity and wind speed in Kodagu during 1996.

Months	Temperature		Relative Humidity %		Av. Wind Speed
	Max in ° C	Min in ° C	Morning	Evening	
January	25.1	14.1	80	56	9.5
February	27.3	15.3	72	54	8.7
March	29.1	16.5	70	54	7.6
April	28.9	17.9	80	70	7.6
May	26.6	18.2	87	79	9.8
June	22.5	17.3	95	72	12.6
July	20.8	16.6	97	96	16.2
August	21.0	16.7	97	95	15.4
September	22.7	16.1	93	90	11.1
October	24.1	16.8	90	86	7.6
November	24.2	16.1	84	76	9.6
December	24.1	14.5	85	67	10.9
Average	**24.7**	**16.4**	**86**	**76**	**10.6**

Recorded at Madikeri.

Table 7. Monthly average temperature, relative humidity and wind speed in Hassan during 1996.

Months	Temperature		Relative Humidity %		Av. Wind Speed
	Max in °C	Min in °C	Morning	Evening	Km. Per Hr.
January	27.8	13.6	77	38	5.0
February	30.2	15.0	73	35	5.4
March	32.6	17.4	75	35	6.1
April	33.3	19.3	81	47	6.7
May	31.2	19.3	84	65	9.4
June	26.7	18.7	88	77	11.9
July	24.6	18.3	90	82	11.9
August	25.0	18.1	90	80	10.9
September	26.7	17.7	89	75	9.4
October	27.5	17.9	87	68	6.1
November	26.9	16.3	80	58	5.8
December	26.6	14.1	79	51	5.2
	28.3	17.1	83	59	7.7

Recorded at Hassan.

4.4 BEE FLORA

Intensive survey on bee flora resulted in the identification of important pollen, nectar and both pollen and nectar bee flower species of each study centre (Table 8-13). Bee flower species yielding pollen only, nectar only and both pollen and nectar were found distributed in all the study centres. The major nectar plants such as rubber tree (*Hevea brasiliensis*), Beegadamara (*Elaeocarpus tuberculatus*) and Honge (*Pongamia pinnata*) are known to produce copious quantities of nectar and thus help in higher harvest of honey. On the other hand major pollen plants such as arecanut (*Areca catechu*), jack fruit (*Artocarpus hyterophyllus*), hulliballi (*Ipomea eriocarpa*), kasturimallige (*Jasminium multiflorum*), coconut (*Cocos nucifera*), and muttidare muni (*Mimosa pudica*), tend to promote brood rearing activity as a result of greater supply of pollen which is rich in protein. Bee flora producing both pollen and nectar are equally important in increasing bee population as well as honey production. In all study centres, bee plants yielding both pollen and nectar were more in number than those yielding pollen only and nectar only.

The Western Ghats has varied and diversified bee flora. The floral calendar indicated that flowers are available throughout the year. Results revealed the occurrence of two honey flow seasons, one during summer (March – April) and the other in winter (September-October). The bee flora of the study area consists of important honey plants of both winter and summer seasons. Presence of plant species blooming in all the seasons plays a crucial role in the development of beekeeping. In addition to the availability of diversified bee flora, blooming of flowers all through the year is equally important for continuous supply of pollen and nectar for an all round development of apiary.

Table 8. Important bee flora of Uttara Kannada.

S.No	Botanical Name	Local Name	Nectar/Pollen	Flowering Season.
1	*Musa parasidica*	Banana	N	Most part of the year.
2	*Mangifera indica*	Mango	N	Feb. - March.
3	*Santanam album*	Sandal wood	N + P	April
4	*Acacia senegalinses*	Soapnut	N + P	April
5	*Cedrela toona*	Nandi	N + P	March
6	*Areca catechu*	Betel nut	P	Throughout the year.
7	*Bombax ceiba*	Booragada Mara	N + P	November
8	*Bridelia crenulata*	Kadusurgie	N+P	Apr. – July
9	*Momordica dioica*	Kaduhagalakai	N + P	July

Table 9. Important Bee flora of Dakshina Kannada.

Sl. No.	Botanical Name	Local Name	Nectar/ Pollen	Flowering Season.
1.	*Hevea brasileensis*	Rubber tree	N	Feb. - Mar
2	*Syzygium Caryophyllatum*	Lavanga	N	October.
3.	*Syzygium cumini*	Jambu nerale	N + P	April
4.	*Atrocarpus Hetrophylus*	Jack fruit	P	Dec.- Jan.
5.	*Areca catechu*	Betel nut	P	Through out the year.
6.	*Trichosanthes Nervifolia*	Kadubimbe	N+ P	-

Table 10. Important Bee flora of Chikmagalur.

Sl. No	Botanical Name	Local Name	Nectar/Pollen	Flowering Season.
1	*Justica simples*	Yeluva sandhigida	N+ P	December
2	*Rauvolfia Serpentina*	Patala garuda	N	-
3	*Pimpinella Wallichiana*	Kaduoma	N+ P	November
4.	*Elaeocarpus Tuberculatus*	Beegadamara	N	Nov. - Dec.
5.	*Bauhinia tomentosa*	Ulipe	N + P	-
6.	*Scolopia crenata*	Kodalimara	N + P	March.
7.	*Gloriosa superta*	Gowri hoovu	N + P	August
8.	*Stereospermum Personatum*	Lingada regida	P	April
9.	*Ipomea eriocarpa*	Mulliballi	P	November
10.	*Ipomea hederifolia*	Halliballi	P	November
11.	*Jasminium multifolium*	Kasturi malliga	P	January

Table 11. Important Bee flora of Shimoga

Sl. No	Botanical Name	Local Name	Nectar/ Pollen	Flowering Season.
1.	*Helianthus annums*	Sunflower	N + P	October
2.	*Pisum sativum*	Pea	N + P	October
3	*Cucumis sativus*	Cucumber	N	December
4	*Albizia lebback*	Bange	N + P	April
5	*Cocos nucifera*	Coconut	P	Throughout the year
6	*Mimosa pudica*	Muttidare Muni	P	Throughout the year
7	*Bambusa bambos*	Bamboo	N + P	November
8	*Clematis similacifolia*	Hotte hambu		April.

Table 12. Important Bee flora of Kodagu

Sl. No.	Botanical Name	Local Name	Nectar/Pollen	Flowering Season.
1	*Coffea arabica*	Coffee	N + P	Feb. - Mar.
2.	*Sapindus laurifolia*	Aantwala	N + P	April
3.	*Vitex negundi*	Lakki soppu	N + P	January
4.	*Citrus sinesis*	Sweet orange	N	October
5.	*Datura metel*	Visha ummathi	N + P	November
6.	*Ziziphus jambolomum*	Nerale gida	N + P	April

Table 13. Important Bee flora of Hassan

Sl. No	Botanical Name	Local Name	Nectar/Pollen	Flowering Season.
1.	Pongamia Pinnata	Honge	N	Feb. - Mar.
2.	Terminalia tomentosa	Mathi	N + P	March.
3.	Vitis vinifera	Grape	N + P	October.
4.	Gossypium species	Cotton	P	November
5.	Psidium guavja	Guava	N + P	Mar. – Apr.
6.	Ricinus communis	Castor	N + P	November
7.	Solanum melongena	Brinjal	N + P	April.

Recorded during 1990-1996.

4.5 BEEKEEPERS OF WESTERN GHATS

The number of beekeepers practising beekeeping in Western Ghats is comparatively higher than in plains (Fig. 1; Table 60). The total number of beekeepers of the study area during 1990 was 50,351 and their number steadily declined to 16,898 in 1996. In 1990 beekeepers were comparatively more in Kodagu study centre (10,790) than in other centres, followed by Dakshina Kannada (9,108), Chikmagalur (8,072), Hassan (7,108), Shimoga (6121) and Uttara Kannada (4,619) (Tables 14 - 19; Figs. 3 - 8). The number of beekeepers in each centre gradually declined and their number during 1996, was in descending order - Dakshina Kannada (5,5121), Kodagu (3,110), Shimoga (2,675), Uttara Kannada (2,674), Hassan (2,185) and Chikmagalur (1,907). The percentage of decline in the number of beekeepers during 1990-96 was 42.10% in Uttara Kannada, 39.48% in Dakshina Kannada 76.37% in Chikmagalur, 56.29% in Shimoga, 71.17% in Kodagu and 69.44% in Hassan respectively. The overall decline in the number of beekeepers of Western Ghats was 52.92%. Greater decline in the number of beekeepers was observed in Chikmagalur (76.37%) followed by Kodagu (71.17%) and Hassan (9.44%).

Beekeepers of Western Ghats in general are very passive and sluggish like any other beekeepers of our country. The most noticeable feature is that beekeepers may not possess bee colonies throughout the year but may keep one or two colonies during honey flow season. They may not keep colonies in non-honey season as they might incur loss by way of supplementary feeding of sugar syrup frequently. Further they have to know of bee management practices particularly colony management and prevention of absconding behaviour, for protection of colonies from pests, predators and brood diseases. Most, if not all, beekeepers are interested only in the income part of beekeeping but are not prepared to spend a little amount in the maintenance of bee colonies.

There has been a gradual decline in the number of beekeepers during 1990-96 (Figs. 3 - 8). The decline in the number of beekeepers could be either due to the loss of bee colonies as a result of the occurrence of deadly viral Thai sacbrood disease or non availability of bee colonies during the honey flow season coupled with high absconding. Most beekeepers start beekeeping by purchasing bee swarms from bee

tribes who only sell colonies which they capture from forest areas and also transitory swarms. Bee tribes and honey hunters are more skilled than beekeepers as they are highly specialised in the art of locating wild colonies in inhospitable and inaccessible places, capturing of colonies from natural wild hives and handling bees without any protective clothing. It is an irony that the bee tribes are well trained in locating, capturing and handling bee colonies, but do not keep bees either in traditional hives or in modern hives.

Beekeepers, by and large, are not at all interested in reaping maximum returns but are quite content with keeping one or two colonies, which may or may not yield honey eventually.

4.6 BEE COLONIES OF WESTERN GHATS

Beekeeping with Indian honeybee, *Apis cerana* is widely practised in most parts of Western Ghats. Beekeeping is a tradition rather than a profession. The method of enumeration consisted of receiving information not only from Government sources but also from practical beekeepers of the study area. The number of colonies of *Apis cerana* in the study area has been enumerated by means of information obtained from Department of Industries and Commerce, Khadi and Village Industries Commission and Khadi Village Industries Board. The number of colonies was cross-checked with beekeepers and the each number of existing bee colonies was recorded. The total number of bee colonies in the study area during 1990 was 1,83,362 and their number steadily decreased to 53,190 during 1996. The percentage of decline in the number of bee colonies from 1990 to 1996 was 70.99. The decline in bee colonies was maximum in Dakshina Kannada (66.56%) followed by Shimoga (30.27%).

The rate of decline in bee colonies is not uniform in different study centres. The number of bee colonies declined from 1990 to 1996 was 8520 in Uttara Kannada, 40,027 in Dakshina Kannada, 13,809 in Chikmagalur, 25,820 in Shimoga, 24,996 in Kodagu, 17,000 in Hassan study centres (Tables 14 - 19; Figs. 3 - 8). Results indicate that the decline in the number of bee colonies was maximum in Dakshina Kannada followed by Shimoga, Kodagu, Hassan, Chikmagalur and Uttara Kannada study centres. Greater decline in the number of bee colonies was primarily due to high incidence of Thai sacbrood disease. Generally, decline in the number of bee colonies was observed in all 6-study centres.

Several factors including the incidence of pests, parasites, and diseases were responsible for the decline in the number of bee colonies. Reduced rainfall, loss of colonies as a result of absconding and lack of knowledge of bee management practices coupled with untimely application of bee techniques also partly affected the apiary size.

Number of bee colonies per beekeeper varied from one study centre to another (Figs. 3 - 8). The average number of bee colonies per beekeeper was 4 to 8 Uttara Kannada, 4 to 7 in Dakshina Kannada, 2 to 3 Hassan study centres respectively. Results show that most beekeepers keep a few numbers of colonies but not more than 10 colonies. Beekeeping with 1 or 2 colonies is expensive and economically not viable.

4.7 HONEY PRODUCTION IN WESTERN GHATS

The honey potential of a given area is entirely related to its floral origin. Honey is essentially a condensed form of nectar. The quality of honey depends on the chemical composition of nectar. Quality of honey also depends on the floral source and the types of nectars collected by foraging bees such as unifloral or multifloral and also floral or extra-floral. Honey is also evaluated on the basis of colour, odour and aroma. Honey with light colour and aroma is most preferred. Honey with greater pollen count and more water has very short life and usually results in granulation and fermentation. The unique characteristic features of honey are destroyed if it is mixed with honeys gathered by different species of honeybees from different flower species of different geographic regions.

Results show that the study area is rich in honey potential. A total of 4,64,236 kg of honey was harvested in 1990. There was a progressive decline in the production of honey from 1990 onwards and eventually it declined to a mere 78,944 kg in 1996. The percentage of decline in honey production was 97.62% in Kodagu, 97.42% in Shimoga, 97.21% in Chikmagalur 87.42% in Hassan, 75.65% in Uttara Kannada, and 64.86% in Dakshina Kannada study centres. There was substantial reduction (as high as 89.99%) in the production of honey in the year 1996.

Honey yielding capacity of a colony is influenced by a plethora of factors. Two factors, viz., bee population size, quality and quantity of bee flora, play a vital role in honey production. Greater the size of bee population higher is the production of honey, and usually, greater the nectar flora, higher is the yield of honey. Evidently

greater proportions of foraging population switch to nectar gathering and carry significantly heavier load of nectar. Greater nectar flora, higher rate of nectar secretion throughout the day, more bee visitation increase in the frequency of bee foraging trips and carrying heavier load -- all are interrelated and ultimately result in high honey production. High honey hoarding is usually observed during honey flow season. Two major honey seasons were noticed in the study area: one during the winter and the other in summer.

Considering the existing quality and quantity of bee flora, high density of bee colonies and application of management skills, honey yield per colony per year is very low. Results show that the honey yield per colony per year varied from 1 to 6 kg as against the national average of 8 kg. During 1990 honey yield per colony per year was comparatively higher than in later years 1993-96 and it was as low as about 1 kg. It is not uncommon to obtain as high as 85 kg per colony per year particularly in the Western Ghats region. Honey yield less than 10 kg per colony per year is uneconomical and not at all profitable. It is interesting to note that *Apis cerana* is as good as, if not better than *Apis mellifera* it is well protected against pests, predators and diseases and can be managed skilfully.

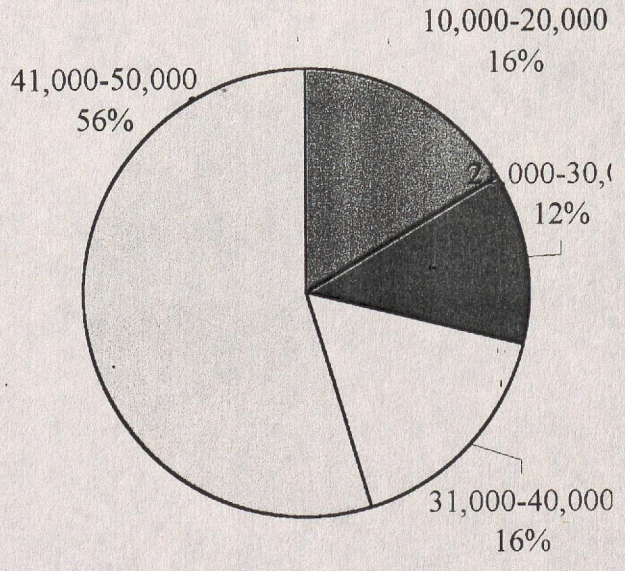
4.8 PERFORMANCE OF PROGRESSIVE BEEKEEPERS

Beekeeper is a general term, that includes a person, who actually keeps bees in a modern bee hive, one who lends his place for keeping bees, a member of beekeeper co-operative society, organisation or association, a beekeeping personnel of a private/government organisation involved/engaged either directly or indirectly and engaged in bee management including marketing of bees and their products. Even people involved in the manufacturing of bee tools and equipment are also called beekeepers. It is surprising that people who actually practice beekeeping are very small in number and generally are uneducated and ignorant of scientific and modern methods of beekeeping. In this context, the term progressive beekeeping is used and referred to those who actually practice beekeeping and are capable of demonstrating and / or practising all bee management skills. In the present study, as many as 362 progressive beekeepers, at least 60 from each study centre were identified and their performance including successes and failures were critically evaluated.

Generally, the performance of progressive beekeepers is terms of size of apiary,

number of colonies per beekeeper, honey production and honey yield per colony per year was better than the general beekeepers of the study area (Tables 37-42; Figs. 9 - 11). The number of bee colonies of different progressive beekeepers was relatively larger and varied between 20 and 40 during 1991 and subsequently significantly declined to 3 to 6 colonies. The decline in the number of colonies was primarily due to non-availability of colonies as a result of high incidence of Thai sacbrood disease. Similarly, the honey yield per colony per year was comparatively more than the other beekeepers of the area having more or less similar bee flora and climatic conditions. Honey yield per colony per year was high during 1991-92 (2 to 5 kg) and subsequently declined to 1 to 3 kg. The decline in the honey yield is more pronounced in Dakshina Kannada and Kodagu study centres. Decrease in the size of adult bee population was the major reason for the declining honey yield. Poor management practices coupled with non-migratory beekeeping were also greatly responsible for the decline in honey production.

Family Income of Beekeepers in Uttara Kannada



Income from beekeeping (P.A.)

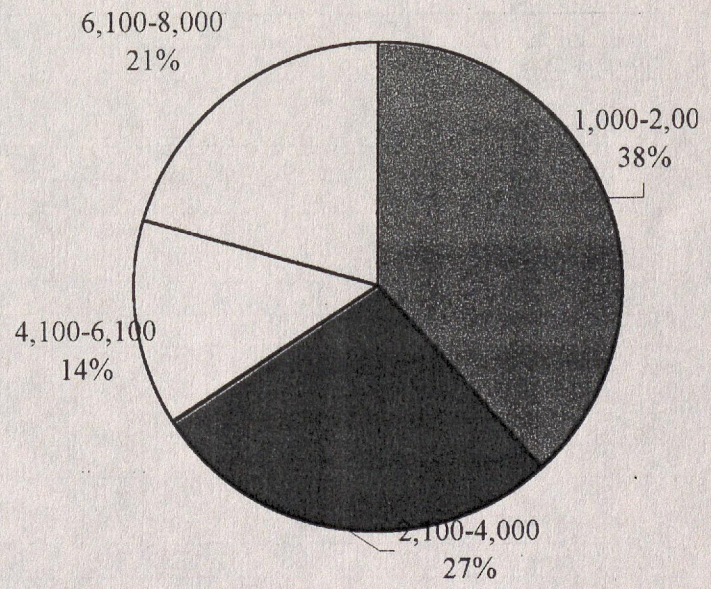


Table 31

Socio-Economic conditions of beekeepers of Uttara Kannada.

1. Beekeepers

No.of Men	No. of women	No. of Children	No.of Trained	No.of Un trained
73	0	0	39.14628297	28

2. Age

Age in years	15-25	26-35	36-45	46-55	56-65
No.of Beekeepers	2	17	26	14	14

3. Qualifications

Qualifications	Below S.S.L.C.	S.S.L.C.	P.U.C.	Graduate	Post Graduate	Un Educated
No.of Beekeepers	28	28	1	5	3	8

4. Occupation

Occupation	Agriculture	Business	Service	Landless Labourers
No.of Beekeepers	67	1	5	0

5. Caste

Caste	S.C.	S.T.	O.B.C.	General
No. of Beekeepers	0	0	24	49

6. Family Size

Family Size	2 to 3	3 to 6	6 and above
Family Members	11	29	33

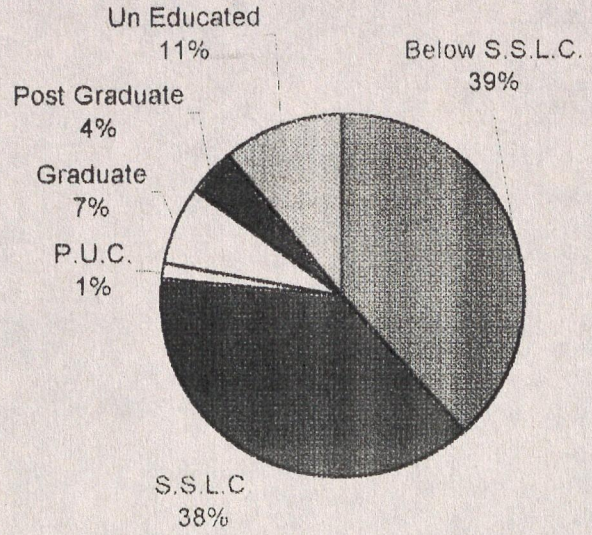
7. Family Income

Family Income	10,000-20,000	21,000-30,000	31,000-40,000	41,000-50,000
No.of Beekeepers	12	9	12	40

8. Income from beekeeping P.A.)

Beekeeping Income	1,000-2,000	2,100-4,000	4,100-6,100	6,100-8,000
No. of Beekeepers	28	20	10	15

Educational qualifications of Beekeepers of Uttara Kannada



Training

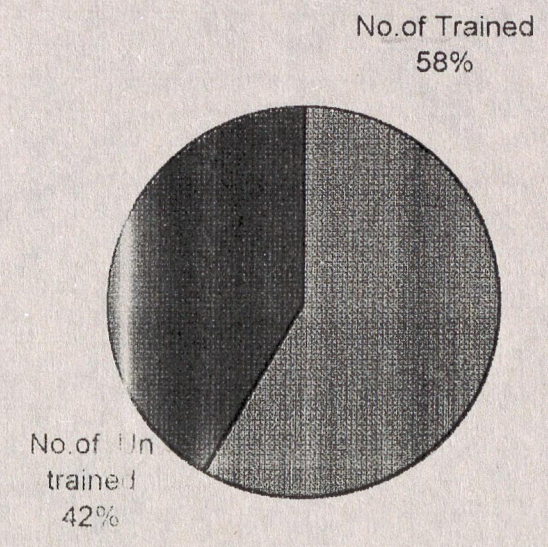


Table 32.

Socio-Economic conditions of beekeepers in Dakshina Kannada

Beekeepers

No. of Men	No. of Women	No. of Children	No. of Trained	No. of Un trained
53	7	0	39	21

2. Age

Age in years	15-25	26-35	36-45	46-55	56-65
No.of Beekeepers	1	26	28	4	1

3. Qualifications

Qualifications	Below S.S.L.C.	S.S.L.C.	P.U.C.	Graduate	Post Graduate	Un Educated
No. of Beekeepers	16	18	10	9	3	4

4. Occupation

Occupation	Agriculture	Business	Service	Landless Labourers
No. of Beekeepers	49	2	9	0

5. Caste

Caste	S.C.	S.T.	O.B.C.	General
No. of Beekeepers	3	9	19	29

6. Family Size

Family Size	2 to 4	4 to 6	6 and above
Family Members	1	11	48

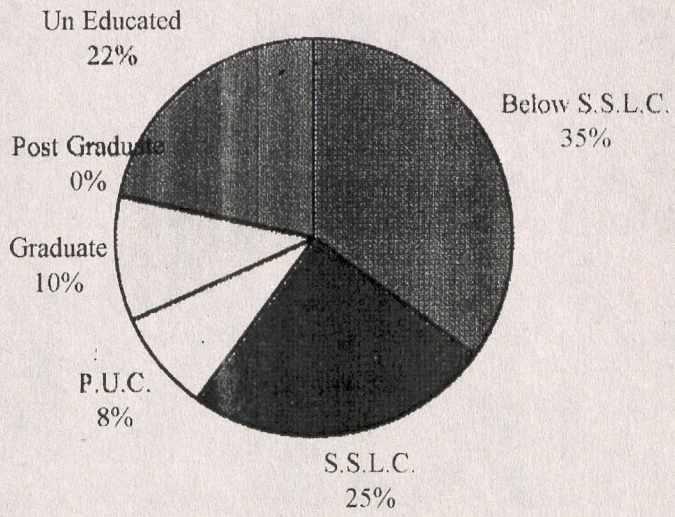
7. Family Income

Family Income	10,000-20,000	21,000-30,000	31,000-40,000	41,000-50,000
No.of Beekeepers	17	9	7	27

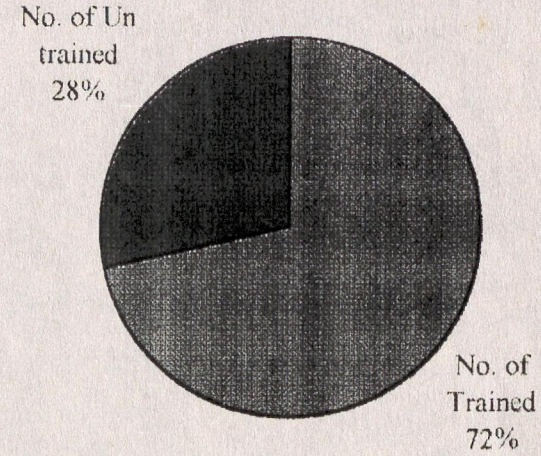
8. Income from beekeeping (P.A.)

Beekeeping Income	1,000-2,000	2,100-4,000	4,100-6,000	6,100-8,000
No. of Beekeepers	16	21	15	8

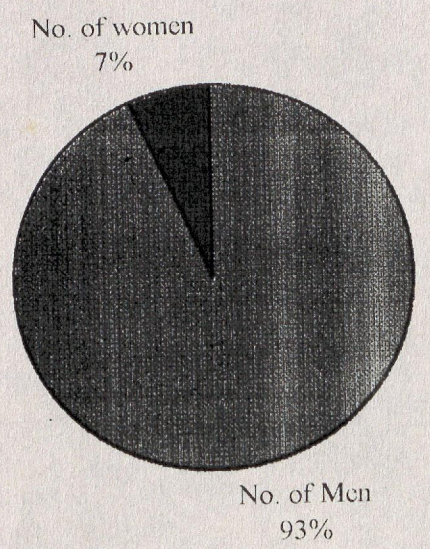
Educational Qualifications of Beekeepers of Shomoga



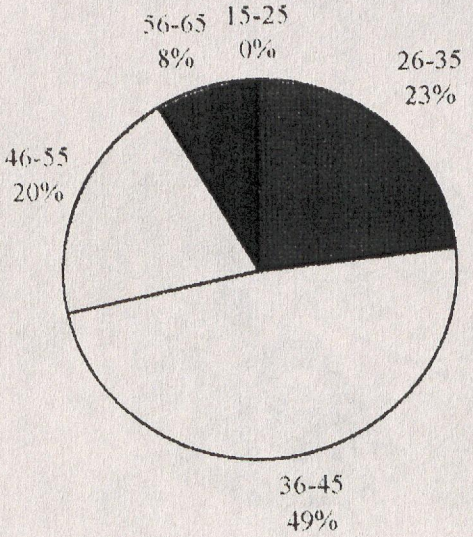
Training in Beekeeping



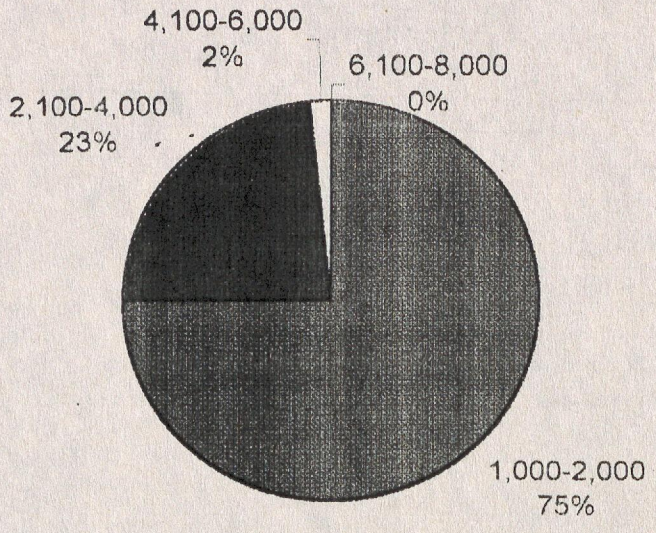
Socio-Economic conditions of beekeepers in Shimoga



Age in years



Income from Beekeeping



Shimoga district

Family income of beekeepers

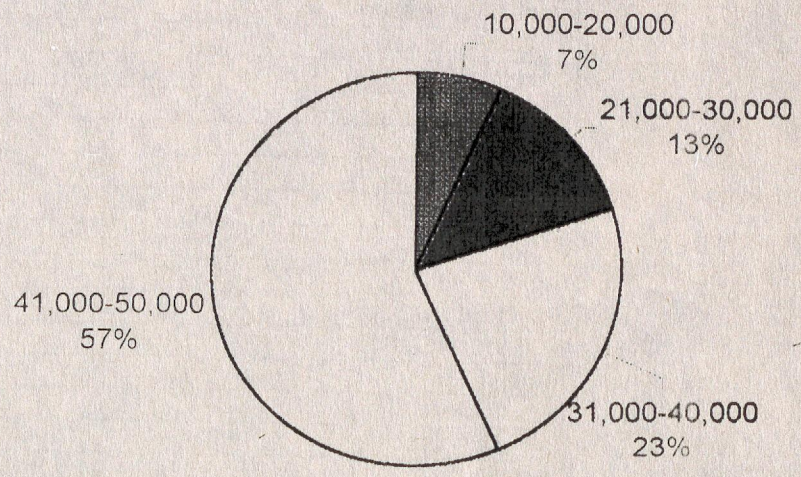


Table 33.

Socio-Economic conditions of beekeepers in Shimoga

1.Beekeepers

No. of Men	No. of women	No. of Children	No. of Trained	No. of Un trained
56	4	0	43	17

2. Age

Age in years	15-25	26-35	36-45	46-55	56-65
No. of Beekeepers	0	14	29	12	5

3. Qualifications

Qualifications	Below S.S.L.C.	S.S.L.C.	P.U.C.	Graduate	Post Graduate	Un Educated
No.of Beekeepers	21	15	5	6	0	13

4. Ocupation

Occupation	Agriculture	Business	Service	Landless Labourers
No. of Beekeepers	56	0	4	0

5. Caste

Caste	S.C.	S.T.	O.B.C.	General
No. of Beekeepers	0	0	33	27

6. Family Size

Family Size	2 to 4	4 to 6	6 and above
Family Members	14	24	22

7. Family Income

Family Income	10,000-20,000	21,000-30,000	31,000-40,000	41,000-50,000
No. of beekeepers	4	8	14	34

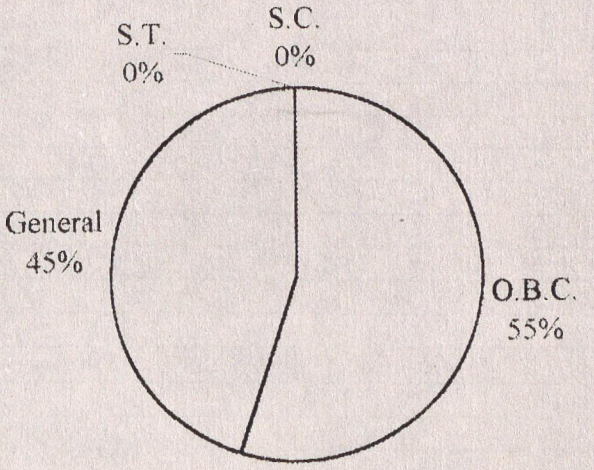
8. Income from beekeeping (P.A.)

Beekeeping Income	1,000-2,000	2,100-4,000	4,100-6,000	6,100-8,000
No. of Beekeepers	45	14	1	0

Occupation of Beekeepers of Shimoga



Caste



Family Size

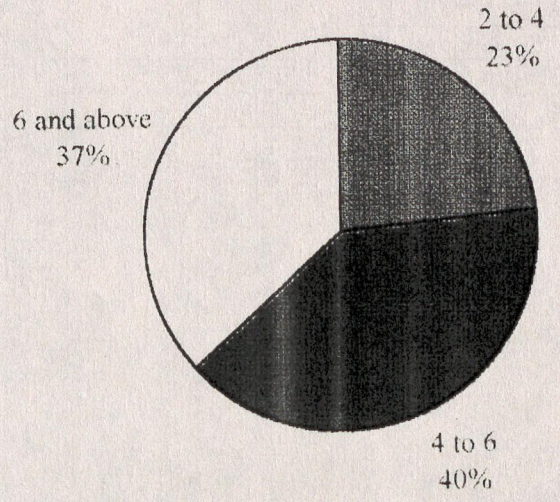


Table 34.
Socio-Economic conditions of beekeepers in Chikmagalur

1. Beekeepers

No. of Men	No. of Women	No. of Children	No. of Trained	No. of Un trained
61	0	0	47	14

2. Age

Age in years	15-25	26-35	36-45	46-55	56-65
No.of Beekeepers	0	14	30	13	4

3. Qualifications

Qualifications	Below S.S.L.C	S.S.L.C.	P.U.C.	Graduate	Post Graduate	Un Educated
No. of Beekeepers	20	16	7	4	1	13

4. Occupation

Occupation	Agriculture	Business	Service	Landless Labourers
No. of Beekeepers	59	0	2	0

5. Caste

Caste	S.C.	S.T.	O.B.C.	General
No. of Beekeepers	3	1	43	14

6. Family Size

Family Size	2 to 4	5 to 6	6 and above
Family Members	2	19	39

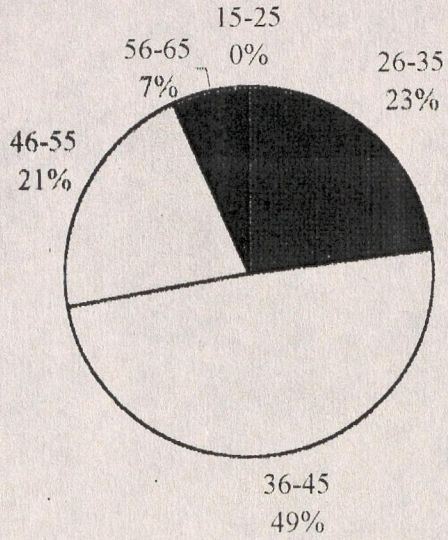
7. Family Income

Family Income	10,00-20,000	21,000-30,000	31,000-40,000	41,000-50,000
No. of Beekeepers	0	14	23	24

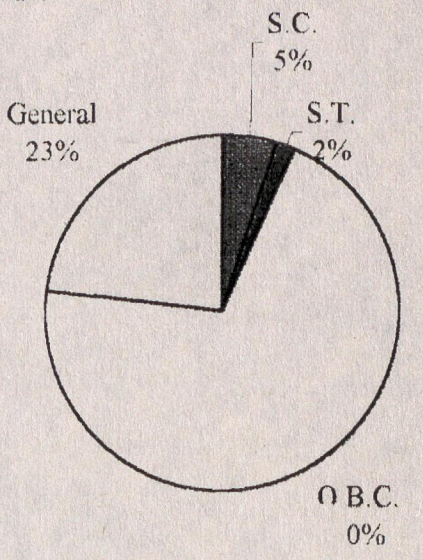
8. Income from beekeeping (P.A.)

Beekeeping Income	1,000-2,000	2,100-4,000	4,100-6,000	6,100-8,000
No. of Beekeepers	34	24	2	0

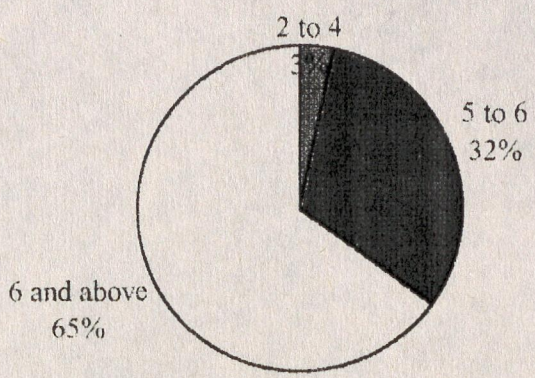
Socio-Economic conditions of beekeepers in Chikmagalur



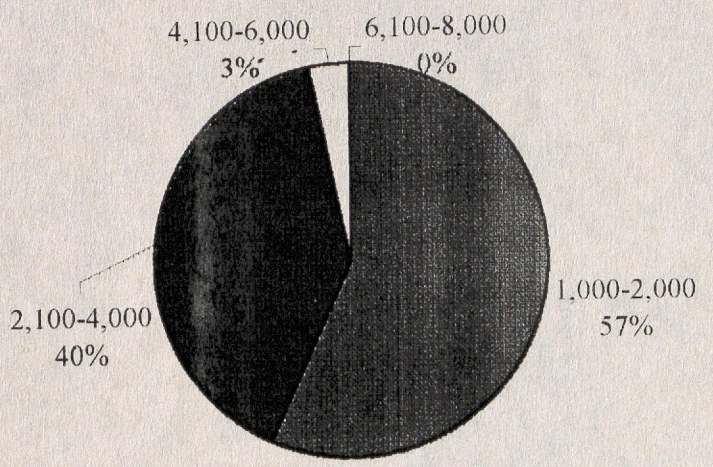
Caste



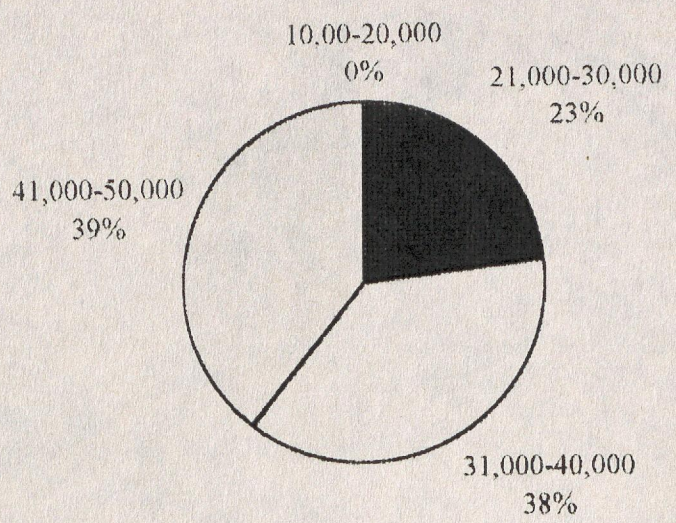
Family Members



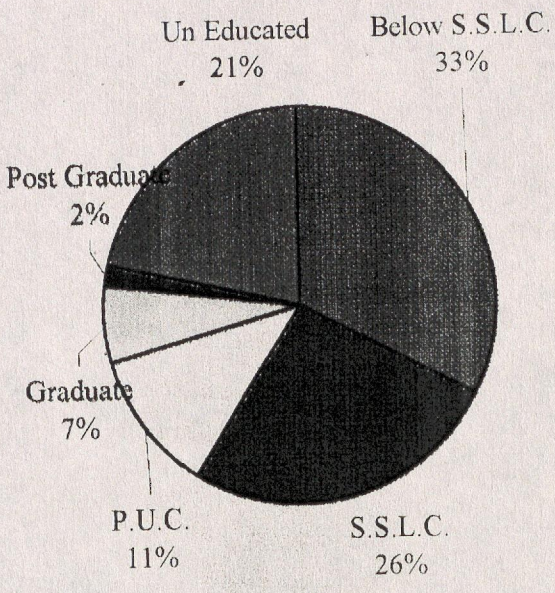
Income from beekeeping (P.A.) in Chikmagalur District



Family Income



Educatinal Qualifications of Beekeepers of Chikmagalur District



Training in Beekeeping

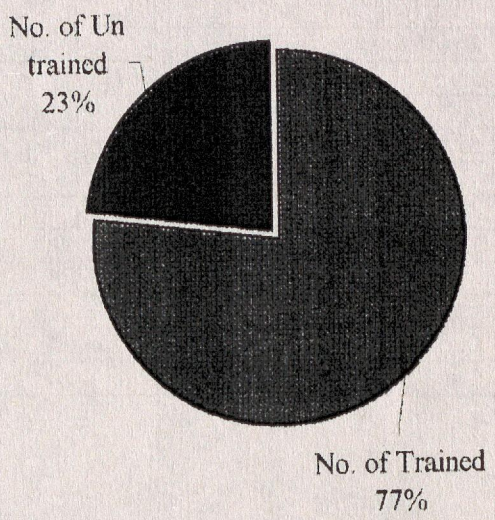


Table 35.
Socio-Economic conditions of beekeepers in Kodagu

1. Beekeepers

No. of Men	No.of Women	No. of Children	No. of Trained	No. of Un trained
60	0	0	40	20

2. Age

Age in years	15-25	26-35	36-45	46-55	56-65
No. of Beekeepers	6	8	27	18	1

3. Qualification

Qualifications	Below S.S.L.C.	S.S.L.C.	P.U.C.	Graduate	Post Graduate	Un Educated
No.of Beekeepers	26	20	11	1	0	3

4. Occupation

Occupation	Agriculture	Business	Service	Landless Labourers
No.of Beekeepers	56	3	1	0

5. Caste

Caste	S.C.	S.T.	O.B.C.	General
No.of Beekeepers	5	7	26	22

6. Family Size

Family Size	2 to 4	5 to 6	6 and above
family Members	1	22	37

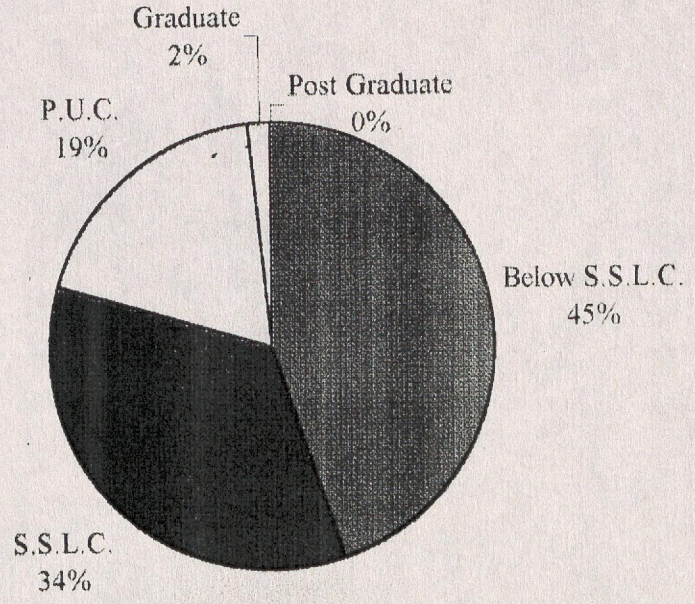
7. Family Income

Family Income	10,000-20,000	21,000-30,000	31,000-40,000	41,000-50,000
No. of Beekeepers	39	10	2	9

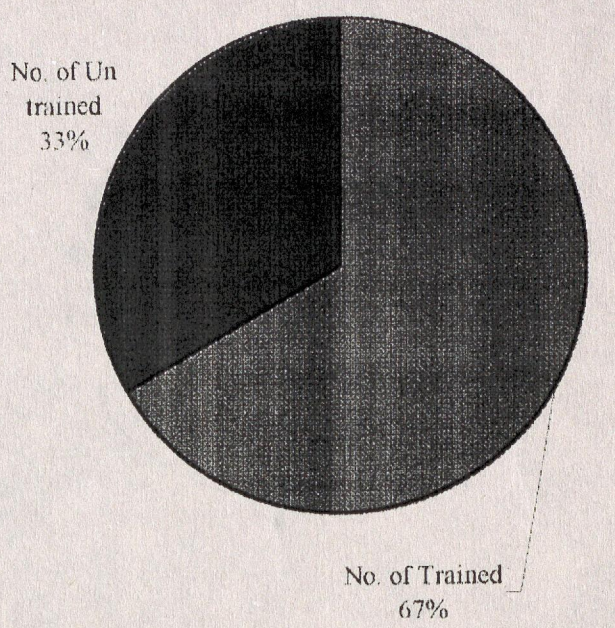
8. Income from Beekeeping (P.A.)

Beekeeping Income	1,000-2,000	2,100-4,000	4,100-6,000	6,100-8,000
No. of Beekeepers	45	11	4	0

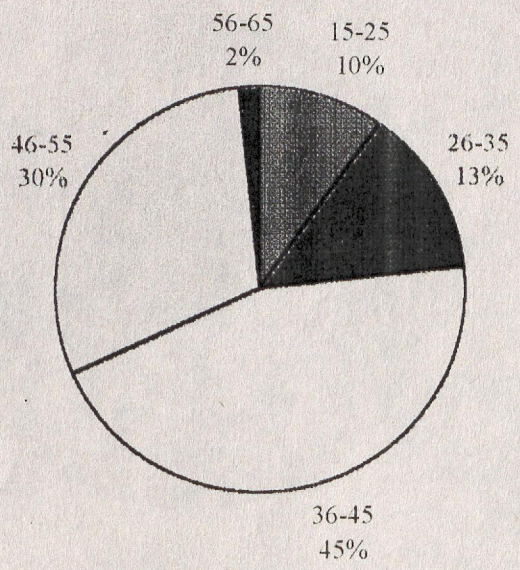
Educational Qualifications of Beekeepers of Kodagu District



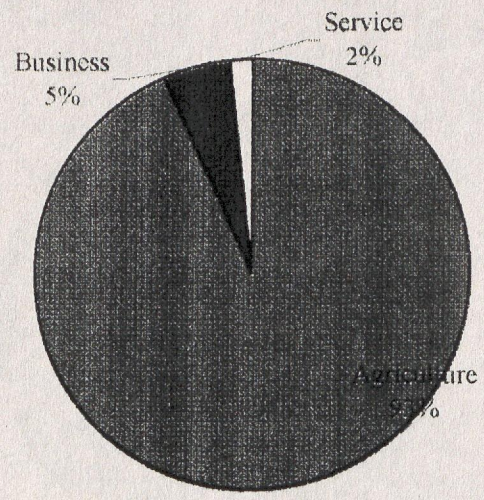
Training in Beekeeping



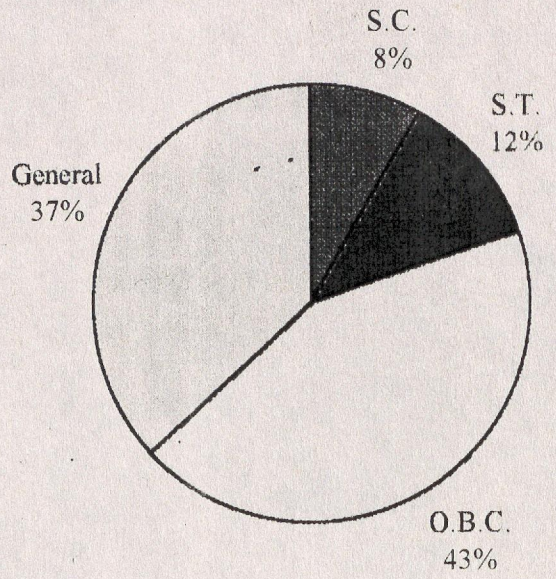
Socio-Economic conditions of beekeepers in Kodagu



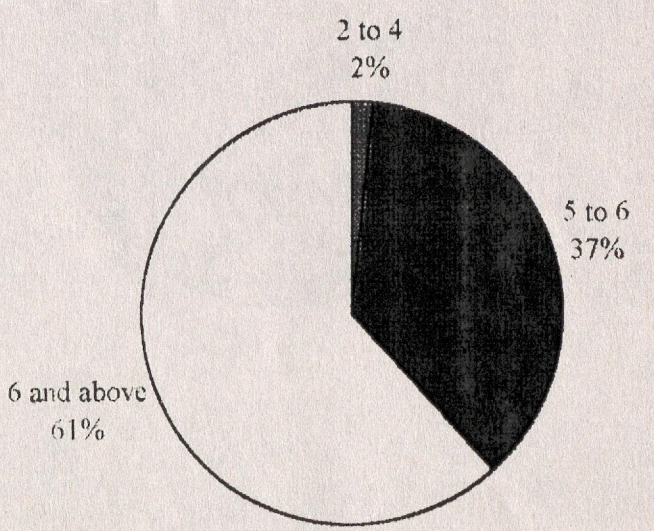
Occupation of Beekeepers in Kodagu District



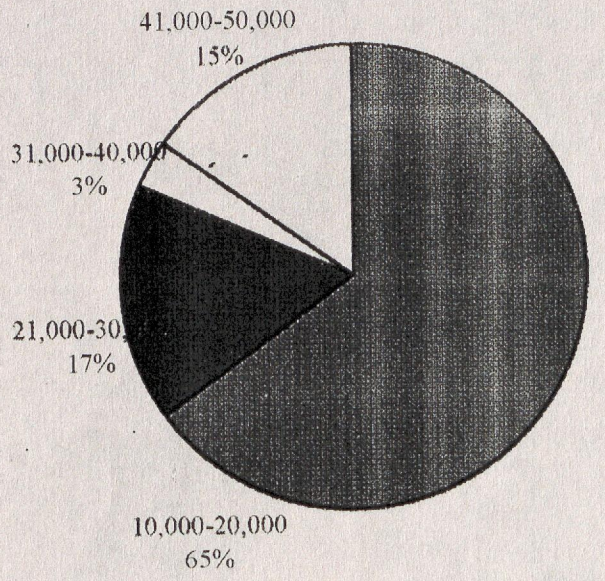
Caste of Beekeepers in Kodagu District



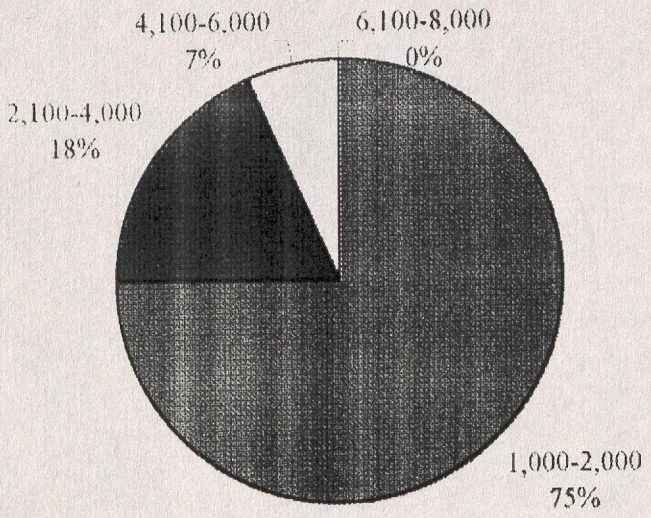
Family Size



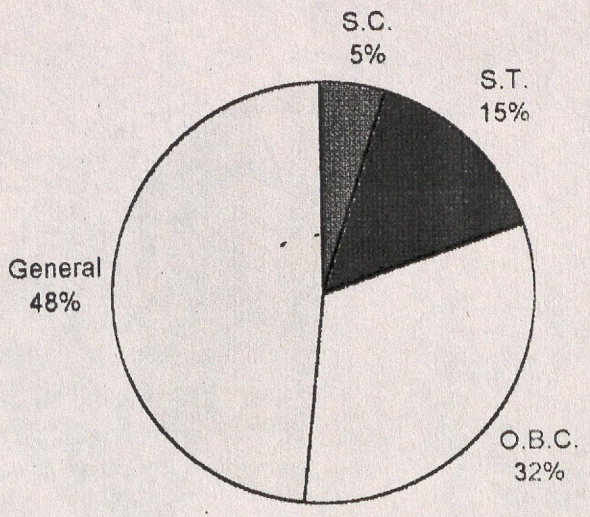
Family Income of Beekeepers in Kodagu District



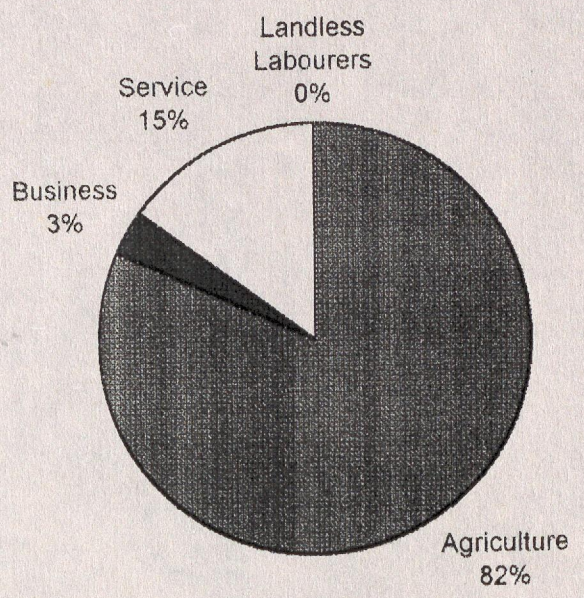
Income from Beekeeping (P.A.)



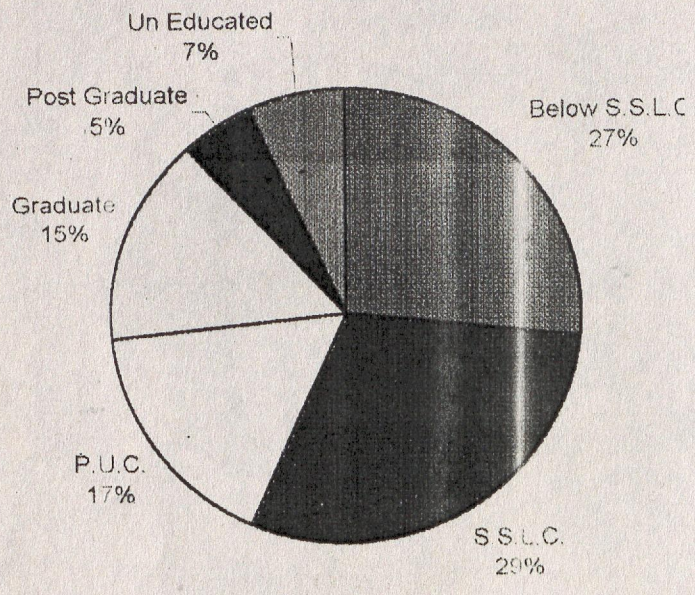
Caste of Beekeepers of Dakshina Kannada



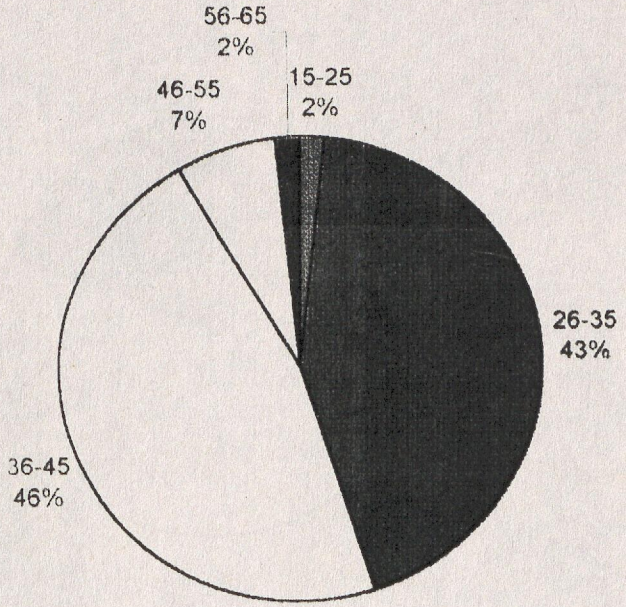
Occupation of Beekeepers



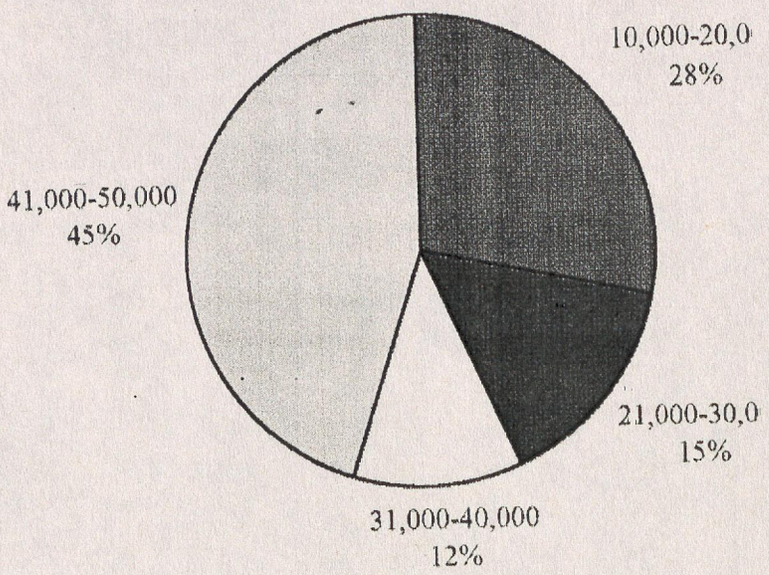
Education of Beekeepers of DakshinaKannada



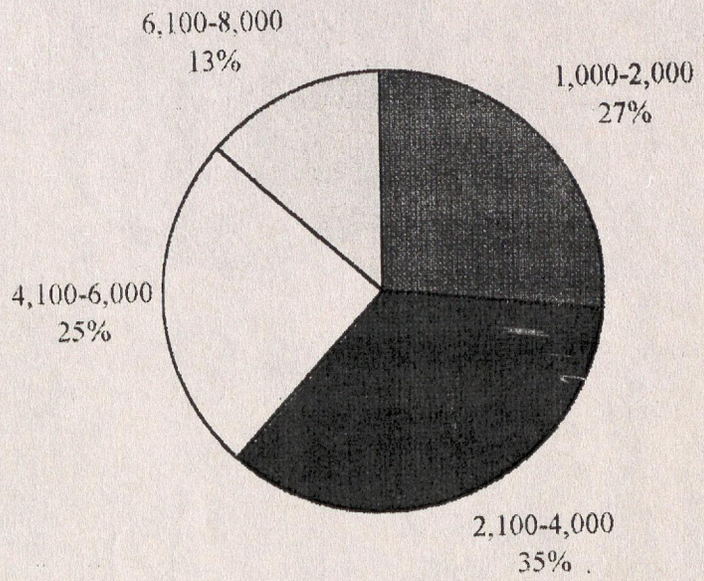
Age of Beekeepers



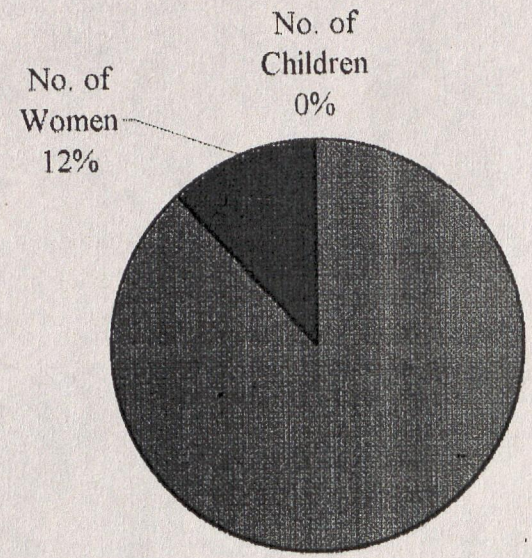
Family Income

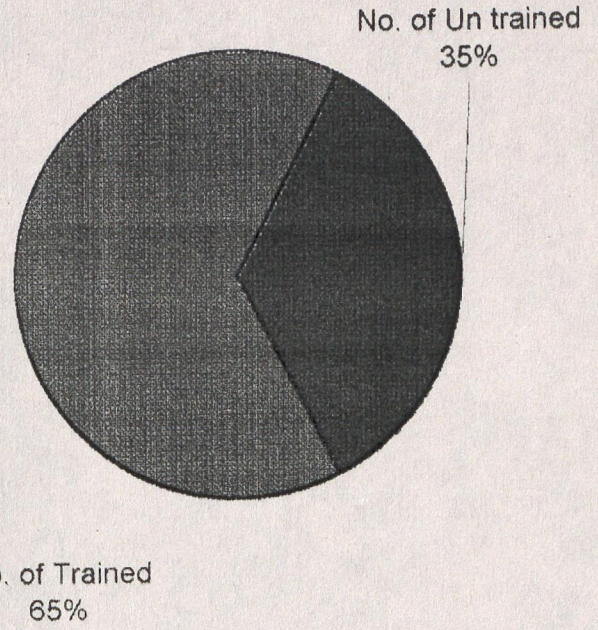


Income from beekeeping (P.A.) in Dakshina Kannada

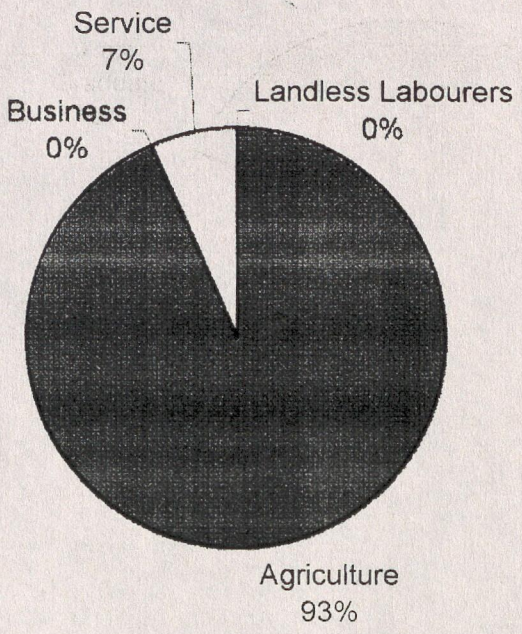


Socio economic conditions of
Beekeepers of Dakshina Kannada

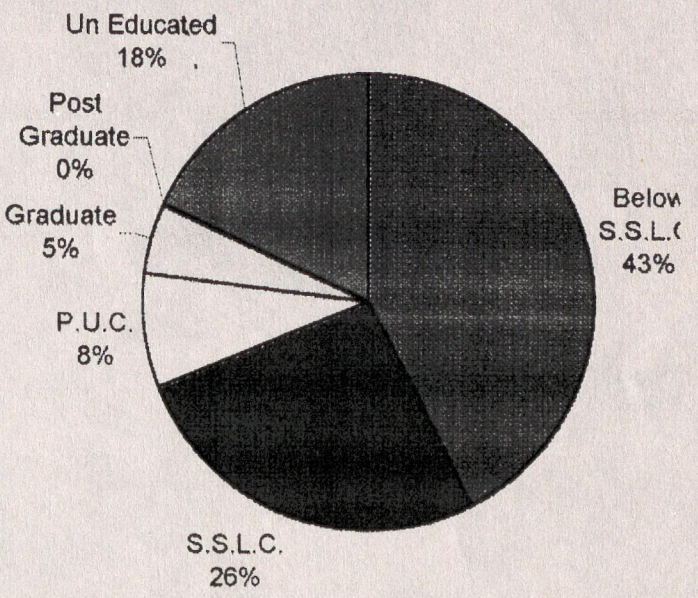




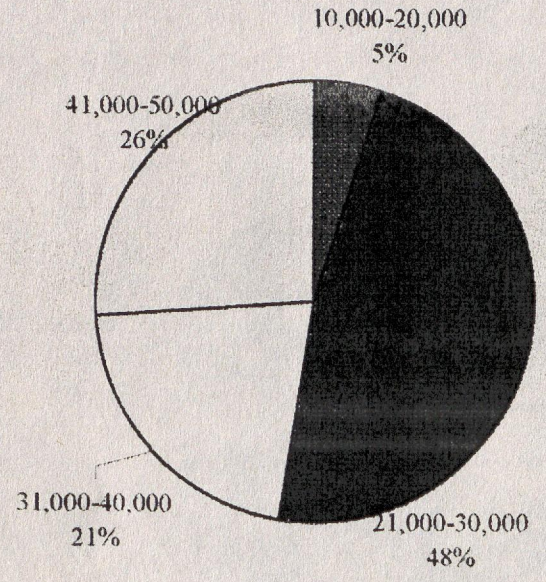
Occupation of Beekeepers in Hassan



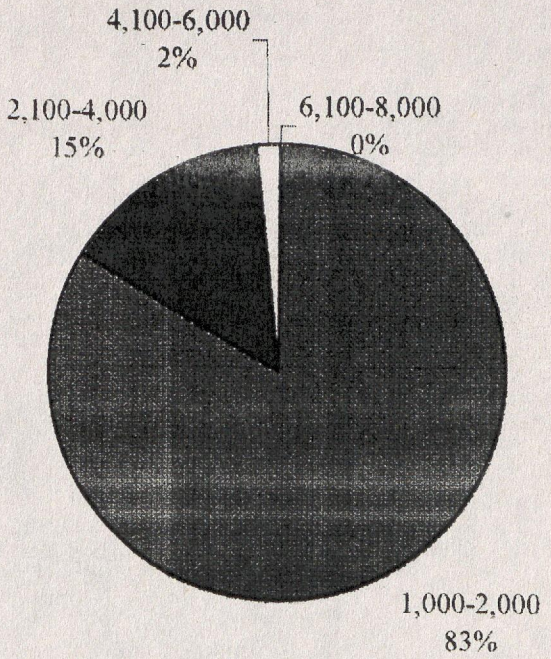
Educational qualificatiopns of Beekeepers



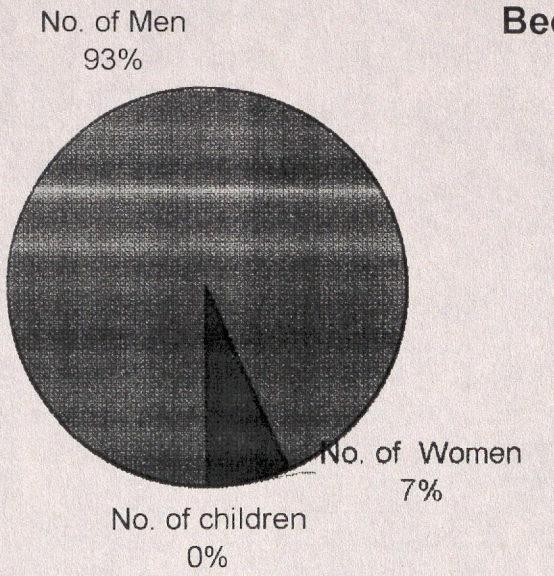
Family Income

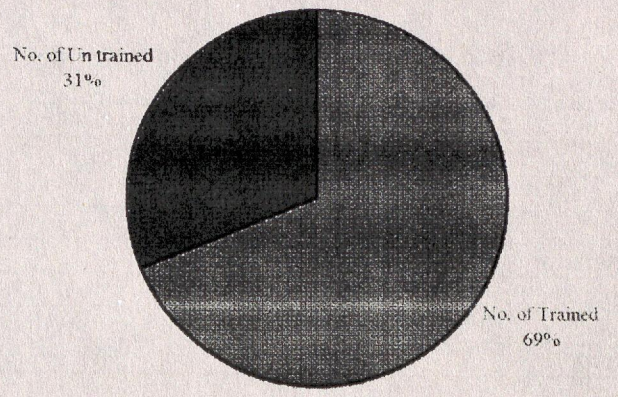


8. Income from beekeeping (P.A.)



Beekeepers of Hassan





Age of of Beekeepers in Hassan District

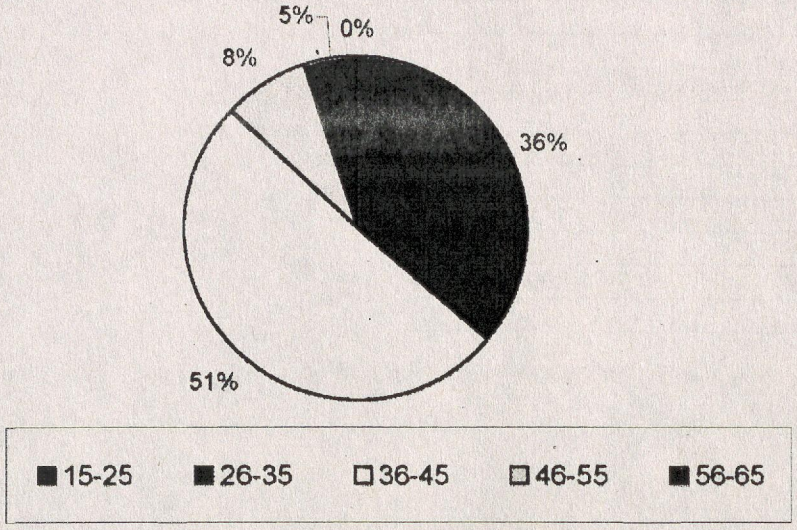


Table 36

Socio-Economic conditions of Beekeepers in Hassan.

1. Beekeepers

No. of Men	No. of Women	No. of children	No. of Trained	No. of Un trained
57	4	0	42	19

2. Age

Age in years	15-25	26-35	36-45	46-55	56-65
No. of Beekeepers	0	22	31	5	3

3. Qualifications

Qualifications	Below S.S.L.C.	S.S.L.C.	P.U.C.	Graduate	Post Graduate	Un Educated
No. of Beekeepers	26	16	5	3	0	11

4. Occupation

Occupation	Agriculture	Business	Service	Landless Labourers
No. of Beekeepers	57	0	4	0

5. Caste

Caste	S.C.	S.T.	O.B.C.	General
No. of Beekeepers	5	0	46	10

6. Family Size

Family Size	2 to 3	4 to 5	6 and above
Family Members	6	23	32

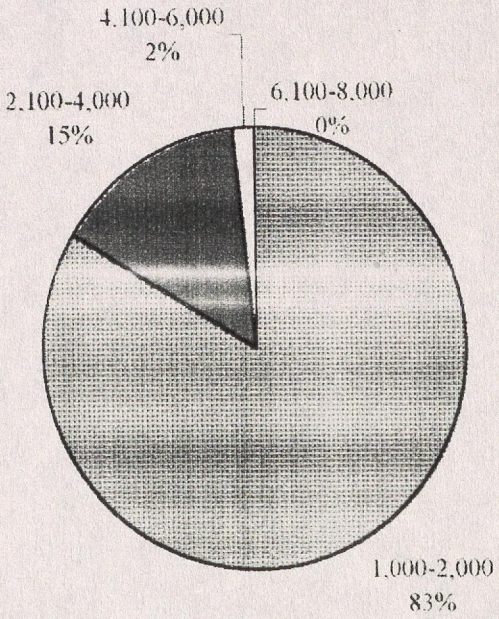
7. Family Income

Family Income	10,000-20,000	21,000-30,000	31,000-40,000	41,000-50,000
No. of Beekeepers	3	29	13	16

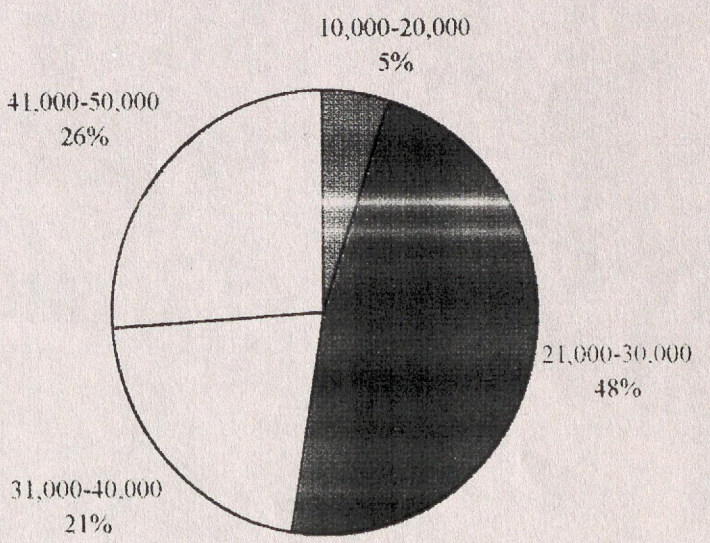
8. Income from beekeeping (P.A.)

Beekeeping Income	1,000-2,000	2,100-4,000	4,100-6,000	6,100-8,000
No. of Beekeepers	51	9	1	0

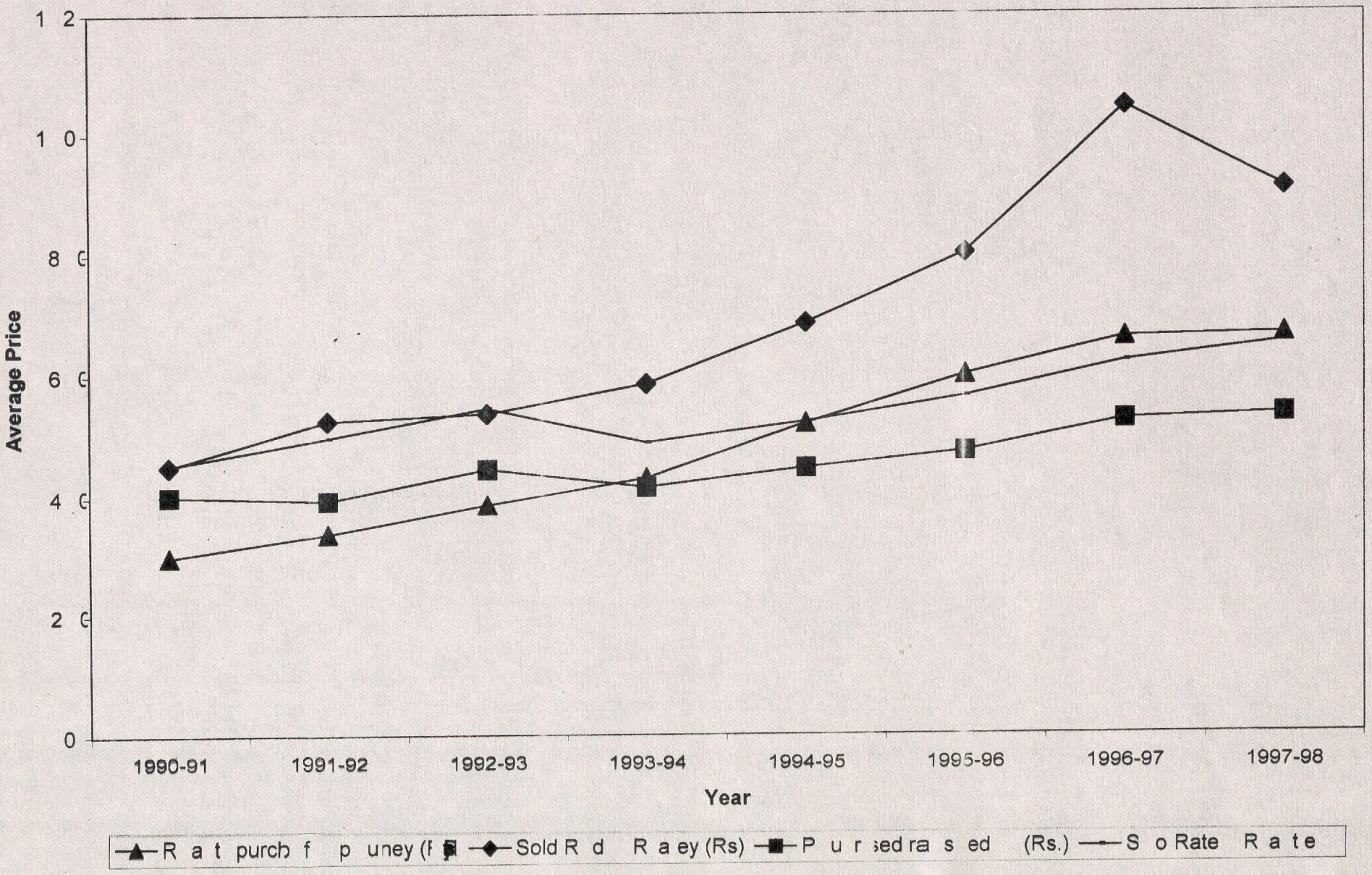
Income from beekeeping (P.A.) in Hassan District



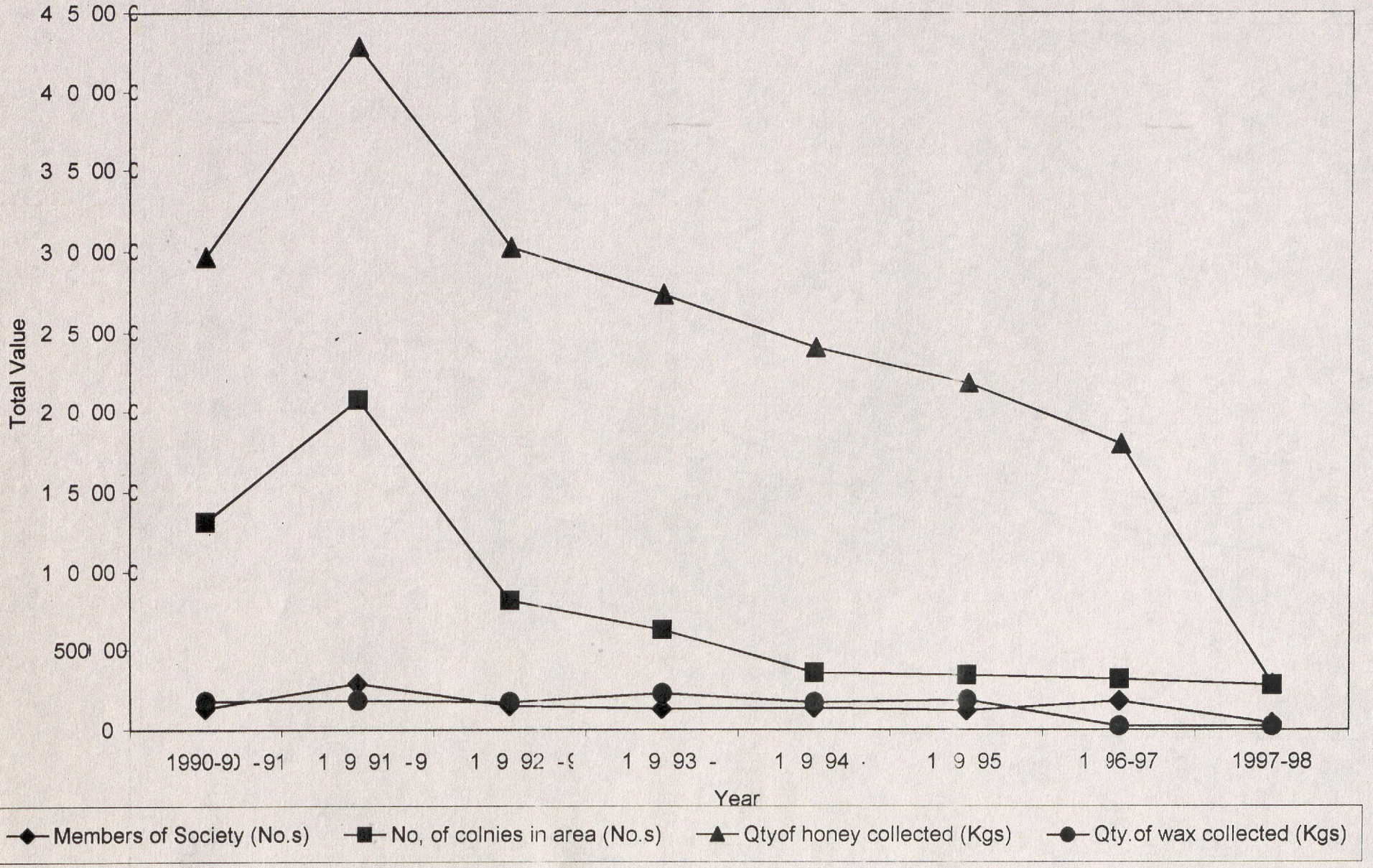
Family Income



Purchased and Sold Prices of Honey and Wax in Beekeepers Cooperative Societies of W.G.of Karnataka



Performance of Beekeepers Cooperative Societies in Western Ghats of Karnataka



Performance of Beekeepers Cooperative Societies in State

(Totals Values from 1990-91 to 1997-98)
Table -45

Particulars	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98
Members of Society (No.s)	13126	28794	14898	12867	13453	11870	17661	3771
No, of colnies in area (No.s)	131035	207594	81735	62850	35263	34069	31482	27725
Qtyof honey collected (Kgs)	296428	428300	302146	273512	240331	217541	179209	28576
Rate of purchase of Honey (Rs)	329	371	425	472	570	657	725	465
Sold Rate of Honey (Rs)	495	577	590	642	751	879	1146	636
Qty.of wax collected (Kgs)	17951.7	18602	17461.4	23084.4	17157	18826	2592	2525
Purchased rate of Wax (Rs.)	361	354	400	373	401	425	472	320
Sold Rate of Wax (Rs)	316	397	436	390	417	450	495	260

Performance of Beekeepers Cooperative Societies in State

(Avarage Values from 1990-91 to 1997-98

Particulars	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98
Members of Society (No.s)	1193.273	2617.64	1354.36	1169.73	1223	1079.09	1605.55	538.714
No, of colnies in area (No.s)	11912.27	20759.4	7430.45	5713.64	3205.73	3097.18	3148.2	3960.71
Qtyof honey collected (Kgs)	26948	38936.4	27467.8	24864.8	24033.1	19776.4	16291.7	4082.29
Rate of purchase of Honey (Rs)	29.90909	33.7273	38.6364	42.9091	51.8182	59.7273	65.9091	66.4286
Sold Rate of Honey (Rs)	45	52.4545	53.6364	58.3636	68.2727	79.9091	104.182	90.8571
Qty.of wax collected (Kgs)	1994.633	2066.89	1940.15	2564.93	1906.33	2091.78	288	420.833
Purchased rate of Wax (Rs.)	40.11111	39.3333	44.4444	41.4444	44.5556	47.2222	52.4444	53.3333
Sold Rate of Wax (Rs)	45.14286	49.625	54.5	48.75	52.125	56.25	61.875	65
Commission per KG of Honey	15.09091	18.7273	15	15.4545	16.4545	20.1818	38.2727	24.4286

Table - 46 Beeekeepers Cooperrative Society, Siddapur Uttara Kannada

Particulars	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98
Members of Society (No.s)	1228	1285	1253	1256	1314	211	227	227
No, of colnies in area (No.s)	15000		12000	11000	16000	18000	18000	18000
Qtyof honey collected (Kgs)	2788.7	1800	950.51	1153.47	1680	1600	800	91
Rate of purchase of Honey (Rs)	20	25	30	35	40	50	50	50
Sold Rate of Honey (Rs)	32	35	40	45	50	60	60	60
Qty.of wax collected (Kgs)	26.5	0	0	0	0	0	0	5
Purchased rate of Wax (Rs.)	30	0	0	0	0	0	0	55
Sold Rate of Wax (Rs)	36	0	0	0	0	0	0	
Commission per KG of Honey	12	10	10	10	10	10	10	10

Tble -47 Beeekeepers Cooperrative Society, Ankola, Uttara Kannada

Particulars	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98
Members of Society (No.s)	788	837	837	837	816	705	7087	708
No, of colnies in area (No.s)	2232	2617	2500	2117	1816	800	600	600
Qtyof honey collected (Kgs)	2175	3360	2200	3620	904	884	1026	300
Rate of purchase of Honey (Rs)	45	45	47	47	75	90	90	90
Sold Rate of Honey (Rs)	65	65	70	70	90	130	130	130
Qty.of wax collected (Kgs)	45	45	50	0	0	0	0	0
Purchased rate of Wax (Rs.)	45	45	50	0	0	0	0	0
Sold Rate of Wax (Rs)	65	65	70	0	0	0	0	0
Commission per KG of Honey	20	20	23	23	15	40	40	40

Table - 49 Beeekeepers Cooperrative Society, Honnavar, Uttara Kannada

Particulars	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98
Members of Society (No.s)	1753	1788	1895	562	647	755	788	NA
No, of colnies in area (No.s)	3726	3805	4047	4247	900	1029	NA	NA
Qtyof honey collected (Kgs)	4204.3	4084	9331	9459	3941	5906	1658	NA
Rate of purchase of Honey (Rs)	28	30	36	40	55	60	70	NA
Sold Rate of Honey (Rs)	36	40	48	54	65	78	80	NA
Qty.of wax collected (Kgs)	NA	NA	NA	NA	NA	NA	NA	NA
Purchased rate of Wax (Rs.)	NA	NA	NA	NA	NA	NA	NA	NA
Sold Rate of Wax (Rs)	NA	NA	NA	NA	NA	NA	NA	NA
Commission per KG of Honey	8	10	12	14	10	18	10	NA

Table -48 Beeekeepers Cooperrative Society, Kumta, Uttara Kannada

Particulars	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98
Members of Society (No.s)	220	333	344	359	368	375	380	NA
No, of colnies in area (No.s)	5786	4786	1024	848	300	200	324	NA
Qtyof honey collected (Kgs)	12000	11000	800	124	NA	30	396	NA
Rate of purchase of Honey (Rs)	40	45	50	55	68	85	90	NA
Sold Rate of Honey (Rs)	50	55	62	70	85	98	310	NA
Qty.of wax collected (Kgs)	120	110	80	60	30	20	40	NA
Purchased rate of Wax (Rs.)	30	45	48	52	56	60	65	NA
Sold Rate of Wax (Rs)	38	50	54	58	60	65	70	NA
Commission per KG of Honey	10	10	12	15	17	13	220	NA

Beeekeepers Cooperrative Society, Sirsi, Uttara Kannada

Particulars	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98
Members of Society (No.s)	530	556	560	562	571	571	571	571
No, of colnies in area (No.s)	1400	1500	400	450	500	700	700	700
Qtyof honey collected (Kgs)	996	1100	1892	425	1537	1233.85	1516	130
Rate of purchase of Honey (Rs)	20	30	35	40	45	50	65	70
Sold Rate of Honey (Rs)	35	48	50	55	65	75	80	90
Qty.of wax collected (Kgs)	28.2	35	35.35	32.4	77	60	44	20
Purchased rate of Wax (Rs.)	30	40	50	55	55	60	60	70
Sold Rate of Wax (Rs)	40	55	60	65	65	70	75	90
Commission per KG of Honey	15	18	15	15	20	25	15	20

Table -50 Beeekeepers Cooperrative Society, Puttur, D.Kannada

Particulars	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98
Members of Society (No.s)	4512	4763	4895	5064	5393	5658	5422	NA
No, of colnies in area (No.s)	33894	37167	20989	8423	4427	4885	5658	NA
Qtyof honey collected (Kgs)	181229	189993	97012	45587	20730	24520	5721	NA
Rate of purchase of Honey (Rs)	25	32	45	45	48	50	55	NA
Sold Rate of Honey (Rs)	36	43	53	53	60	63	68	NA
Qty.of wax collected (Kgs)	1249	1102	635	375	178	204	117	NA
Purchased rate of Wax (Rs.)	30	33	38	45	50	55	62	NA
Sold Rate of Wax (Rs)	39	39	46	52	58	65	70	NA
Commission per KG of Honey	11	11	8	8	12	13	13	NA

Beeekeepers Cooperrative Society, Londa, Belgaum

Particulars	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98
Members of Society (No.s)	56	50	45	40	50	60	80	80
No, of colnies in area (No.s)	60	40	35	30	10	25	50	25
Qtyof honey collected (Kgs)	1500	2000	1800	1725	1250	1100	950	1000
Rate of purchase of Honey (Rs)	25	25	30	35	40	40	45	45
Sold Rate of Honey (Rs)	40	90	50	55	65	65	70	70
Qty.of wax collected (Kgs)	1000	1100	1250	1400	1450	1500	1800	2000
Purchased rate of Wax (Rs.)	40	40	45	45	50	50	60	60
Sold Rate of Wax (Rs)	50	50	60	60	70	70	80	80
Commission per KG of Honey	15	65	20	20	25	25	25	25

Table -52 Beeekeepers Cooperrative Society, Virajpet, Coorg

Particulars	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98
Members of Society (No.s)	1097	1127	1103	1184	1220	1232	1102	1162
No, of colnies in area (No.s)	20600	112000	5000	3000	1000	300	300	400
Qtyof honey collected (Kgs)	70000	70000	7000	5000	4500	300	270	305
Rate of purchase of Honey (Rs)	24	30	34	45	52	63	65	65
Sold Rate of Honey (Rs)	36	40	45	50	60	70	80	90
Qty.of wax collected (Kgs)	602	688	533	191	289	93	111	0
Purchased rate of Wax (Rs.)	32	38	45	45	50	50	60	65
Sold Rate of Wax (Rs)	NA	NA	NA	NA	NA	NA	NA	NA
Commission per KG of Honey	12	10	11	5	8	7	15	25

Table -51 Beeekeepers Cooperrative Society, Bhagamandala, Coorg

Particulars	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98
Members of Society (No.s)	1086	1106	2085	1127	1160	1080	771	873
No, of colnies in area (No.s)	22300	20000	15000	12000	9000	7000	5000	8000
Qtyof honey collected (Kgs)	20000	25000	30000	40000	35000	30000	25000	26000
Rate of purchase of Honey (Rs)	30	35	40	45	50	60	65	65
Sold Rate of Honey (Rs)	65	70	75	82	86	90	93	96
Qty.of wax collected (Kgs)	450	600	550	520	610	440	480	500
Purchased rate of Wax (Rs.)	44	48	52	55	58	60	65	70
Sold Rate of Wax (Rs)	48	53	56	60	64	70	80	90
Commission per KG of Honey	35	35	35	37	36	30	28	31

Performance of Beekeepers Societies in Western Ghats of Karnataka

Table -53

Beeekeepers Cooperrative Society, Dharwad

Particulars	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98
Members of Society (No.s)	250	250	180	160	190	140	150	150
No, of colnies in area (No.s)	400	320	100	95	50	60	0	0
Qtyof honey collected (Kgs)	1500	1250	1100	1300	1800	800	700	750
Rate of purchase of Honey (Rs)	30	35	35	40	50	60	80	80
Sold Rate of Honey (Rs)	40	45	45	50	60	80	100	100
Qty.of wax collected (Kgs)	NA	NA	NA	NA	NA	NA	NA	NA
Purchased rate of Wax (Rs.)	NA	NA	NA	NA	NA	NA	NA	NA
Sold Rate of Wax (Rs)	NA	NA	NA	NA	NA	NA	NA	NA
Commission per KG of Honey	10	10	10	10	10	20	20	20

Beeekeepers Cooperrative Society, Sakaleshpur, Hassan

Particulars	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98
Members of Society (No.s)	1606	16699	1701	1716	1724	1083	1083	NA
No, of colnies in area (No.s)	25637	25359	20640	20640	1260	1070	850	NA
Qtyof honey collected (Kgs)	35	118713	150060	165119	168989	151167	141172	NA
Rate of purchase of Honey (Rs)	42	39	43	45	47	49	50	NA
Sold Rate of Honey (Rs)	60	46	52	58	65	70	75	NA
Qty.of wax collected (Kgs)	14431	14922	14328	20506	14523	16509	0	NA
Purchased rate of Wax (Rs.)	80	65	72	76	82	90	100	NA
Sold Rate of Wax (Rs)	NA	85	90	95	100	110	120	NA
Commission per KG of Honey	18	7	9	13	18	21	25	NA

4.9 Socio-Economic Conditions of Beekeepers of Western Ghats

The growth and development of beekeeping, though largely depending on the quality and quantity of bee flora, also relies on the status of the beekeeper including age, qualification, experience, family income, competence and confidence. The socio-economic conditions of beekeepers of study area particularly age, education, occupation, caste, family size, family income, and beekeeping income, were evaluated and the results are presented in Tables 31-36. Figs. 14 - 34 provide a graphic representation of these results.

All beekeepers are men with exception of Dakshina Kannada and Shimoga where 7 and 4 women, respectively, were involved in beekeeping. Generally young beekeepers below 25 years are not involved in beekeeping. A majority of beekeepers in all study centres are in the 36-45 years age group, followed by 26 – 35 years age group. Results show that young and old people were generally not involved beekeeping and its management. Most beekeepers know local language, both reading and writing, and had studied up to SSLC and PUC. Very few graduates and postgraduates practice bee keeping in the study area. Some beekeepers though not educated at least read local language. A majority of beekeepers are agriculturists and normally they keep bees in their own agriculture lands. Only a few persons doing business or in service kept bees primarily for honey for their own consumption. Interestingly persons without land and landless labourers were not practising beekeeping in any study centre. Persons belonging to SC (Schedule Caste), ST(Schedule Tribes), OBC (Other Backward Classes), and general, practised beekeeping but majority of them belong to general category and OBC. Only a very few people belonging to weaker section practice beekeeping. The family income of beekeepers varied from 10,000 to 50,000 per annum. Results indicate that very poor and rich persons were not involved in beekeeping. The income derived from beekeeping varied between 1,000 and 10,000 per annum. Beekeepers getting more than 2,000 and less than 5,000 per annum were comparatively more in number. Results show that beekeepers keeping one or two bee colonies were sure of getting at least Rs. 1,000 – 2,000. Results also indicate that there were no commercial beekeepers and large apiaries. Most beekeepers practise beekeeping as a part-time subsidiary activity for generating additional income and production of honey for family consumption. Both trained and untrained persons were involved in beekeeping.

The quality of training is limited to handling of bees and hives. Most trained beekeepers were not competent in bee management and generally did not apply the beekeeping techniques and skills. Most beekeepers lacked scientific knowledge and expertise and were unable to solve problems concerning with beekeeping. All beekeepers did not apply suitable measures to control pests, predators and diseases which cause considerable damage to bees and beekeeping and are more responsible for the loss of colonies and low yield of honey in many parts of the study area.

4.10 PERFORMANCE OF BEEKEEPERS SOCIETIES

Beekeepers societies in Western Ghats have the history as old as that of beekeeping in this region. Almost all co-operative societies started about fifty years ago. All societies except Dharwad and Londa have more than 500 members. In 1990-91 total members in all 11 Societies of this region was 13126 (Tables 45a,b). It was 17661 during 1996-97 while in 1997-98, it was very low, 3771. Table 46 gives the details of the Societies like the year of establishment, activities, financial assistance and training provided.

4.10.1 **Uttara Kannada**: This district has maximum number of beekeepers co-operative societies in the State. There are 5 societies in Sirsi, Siddapur, Honnavar, Kumta and Ankola (Tables 47 a - e).

The societies at Honnavar and Siddapur were leading in the number of members (1753 and 1228, respectively) during 1990-91. However the membership declined in later years. In terms of bee colonies, which also showed reduction over the years, the Siddapur Society was leading with 15,000 colonies in 1990-91, followed by the Societies in Kumta with 5786 colonies, Honnavar with 3726, Ankola with 2232, and Sirsi with 1400 colonies. The quality of honey collected varied much in different societies, the most significant variation being in the Kumta Society. This Society collected 12,000 kg in 1990-91 and 11,000 kg the next year. The collection went down abruptly to 800 kg in 1992-93 and further to 124 kg in 1993-94. In showed marginal improvement in 1996-97 with a collection of 396 kg. It is interesting to note that the rate of pruchase of honey varied within wide margins (Rs. 50 to 90 per kg) even within the district.

4.10.2 **Dharwad**: The district has one Society located in Dharwad. The membership has been declining from 250 in 1990-91 to 150 in 1997-98 (Table 48). Although the

honey collection was 1500 kg in 1990-91 and declined by about 50 per cent in 1997-98, the number of bee colonies went down drastically from 400 in 1990-91 to 60 in 1995-96. There were no bee colonies kept by beekeeper members at present.

4.10.3 **Hassan**: This oldest Beekeepers' Society in the State started in year 1940 in Sakaleshpur. This society does the work of collection, processing, and marketing of honey produced in Chikmagalur and Hassan Districts (Table 49). It has two subdivisions, one in Aldur and other in Mudigere; both these honey collection centres are in Chikmagalur District.

4.10.4 **Dakshina Kannada**: South Kanara (Dakshina Kannada) Beekeepers' Co-operative Society, is one of the famous bee societies in South India (Table 50). The Society started in 1940 and is working well with more than 5000 members.

The Society gets honey mainly from Sullia, Puttur, Belthangady, Karkala, and to some extent Udupi and Bantwal. It collected about 1,81,229 kg of honey in 1990-91, but the collection decreased to 5,721 kg in 1997-98. Sometimes, if the Society found procurement insufficient, they imported honey from Kerala, Bihar, Uttar Pradesh, and Punjab states. The Society has local supply of 15,000 to 16,000 kg of *Apis cerana* and nearly 40,000 to 50,000 kg of *Apis mellifera* honey is imported from northern states.

The Society had been publishing two periodicals, namely, *Madhu prapancha* (Honey World) and *Jenu Vyavasaya* (Apiculture). Besides these it publishes some of the souvenirs regularly. The Society undertakes processing of honey and sells honey in the commercial name "Madhuri" at a price Rs. 90/kg. The Society has a branch office at Sullia, to collect honey from beekeepers.

4.10.5 **Kodagu**: There are two beekeepers co-operative societies in the district; one in Bhagamandala and the other in Virajpet (Tables 51, 52). Both the Societies have members to the order of thousands, but in recent years their number is decreasing.

Though the amount of honey collected from the members is negligible, tribal people supply honey, collecting from the wild sources. They also import honey from northern states. Sources of society said that wax production is fairly good. There is 1 kg of production of wax for every 100 kg of honey.

4.10.6 **Belgaum**: There is one Beekeepers' Cooperative Society in Londa with membership ranging from 40 to 80 in different years (Table 53). The total number of bee colonies maintained by the members is quite small (10 to 60) with production

ranging from 950 to 2000 kg in different years. The high figures of honey and beeswax collected indicate that a large proportion of these was from *Apis dorsata*.

4.10.7 **Chikmagalur**: There is no record of beekeepers societies in the district. However, the Sakaleshpur Beekeepers Co-operative Society, which is working in Hassan District has its two branch offices in Mudigere and Aldur.

4.11 PESTS, PREDATOR AND DISEASE OF HONEY BEE SPECIES

Pests of bees:

Moths are the major pests of honeybees. Several species of moths are found as pests on honeybees and their products. Of all the species of moths, *Galleria mellonella*, greater wax moth, has been a serious threat to beehives (Dickman, 1933). It has been recognised as a serious pest in honeybees of all species, both in storage and in hives (Paddock, 1918, Dickman, 1988, Smith, 1967. Whitecomb, 1967, Alidtal 1973, Kapil & Shiag, 1983).

G.mellonella is a serious pest of *Apis dorsata* and *Apis cerana*. Majority of live colonies and cent percent deserted combs were infested by the pest and the damage caused to combs of *Apis dorsata* varied between 22% and 50%. In *Apis cerana* colonies the highest incidence of pest damage was recorded in Hassan (52%) followed by Shimoga (50%), Kodagu (41.11%), Chikmagalur (40.0%), Dakshina Kannada (33.33%) and Uttara Kannada (22.5%) (Table 29). The infestation is greater in winter and rainy seasons and was due to weak colonies. Less population coupled with greater exposure of empty comb facilitates faster growth of the pest. Good hygienic conditions and proper management greatly reduce pest population. Destruction of infected combs is an effective physical or preventive method. Fumigation of infested combs is also effective. The damage caused by the lesser wax moth is not significant even as its occurrence in wild and domesticated colonies is sporadic and seasonal.

Parasitic mites

Honeybees are also affected by many parasitic mites namely *Varroa jacobsoni* and *Tropilaelaps clareae*. Both these mites found in many tropical Asian countries (Morse, 1978). Both *Varroa jacobsoni* and *Tropilaelaps clareae* occurred in wild and domesticated colonies in the study area. Mite infestation was less in many bee colonies and did not cause severe damage to beekeeping. The mortality of adult bees

as a result of the mites was very low and beekeepers usually ignore the mite infestation. However, mite infestation might lead to incidence of viral diseases as indicated by our preliminary study (Table 28). More colonies with mite infestation had TSB virus infection than otherwise, in all the six districts studied (Fig. 35).

Bee Predators

Bee eaters and honey hunters are professional predators of honeybees. Pseudo scorpions, lizards, frogs, toads pick up bees at the hive entrance. The bee-eater, *Merops orientalis* is a serious predator of bees in the study area. The bee-eater caused damage to *Apis cerana* and *Apis mellifera*. The percentage damage to *Apis cerana* and *Apis mellifera* varied considerably between 14 to 71.60. The bird damage to *Apis cerana* was less than that in *Apis mellifera* (Table 30). The bird damage to bees was greater in Uttara and Dakshina Kannada study centres. No effective control measures are available to prevent the bird damage to bees.

Bee diseases

Of all known diseases, the brood diseases are the most serious diseases of honeybees all over the world. The most common brood diseases are American foulbrood, European foulbrood, sac brood and chalk brood (Morse, 1978, Kshirsagar, 1963, Nixon, 1983; Phadke, 1983). The American foulbrood is caused by a *Bacillus* and is most destructive. However, its occurrence in India is not so far reported. The European foulbrood is caused by *Streptococcus pluton*, which is known to infect the early larval stage of bees. Although it was reported in several parts of the country including Karnataka, it does not, fortunately, pose any serious threat to bee colonies. Thai sacbrood, the most virulent of all known brood diseases, is currently causing irreparable damage to beekeeping industry. A virus causes it and the disease spreads at a lightening speed. The occurrence of this disease was first recorded in some parts of Meghalaya and Assam in 1980 and subsequently in north Bihar in 1981, hilly tracts of Uttar Pradesh in 1982, Nepal and other parts of northern India during 1982 (Kshirsagar, 1982). The occurrence of this disease in some parts of tropical forests of Western Ghats and other parts of South India has been reported. The disease caused 100 percent mortality to bee larvae. No effective method of control is available.

Results obtained in the present study show that the Thai sacbrood disease (TSB) had infected the colonies of *Apis cerana* in all study centres (Table 54-58). Results also

indicate the occurrence of the disease throughout the year and the percent infection varied between 0 (rarely) and 84 (Table 58). The average percent colony infection for all the 8 beekeeping areas studied in 1996-97 varied from 7.88 in July to 56.05 in October. Fig. 36 shows that incidence of the TSBD was lowest in June-July and highest during September-October. The disease had disastrous effect on bee population, bee flower visitation, and honey gathering activity and bee pollination in several parts of the tropical forests in the study area. Apart from causing severe larval mortality, the disease had caused irreparable damage to beekeeper and beekeeping. There is significant reduction in the number of bee colonies and beekeepers during the period of occurrence of the disease. Many beekeepers even stopped beekeeping altogether and a few started beekeeping with the European honeybee, *Apis mellifera*. Efforts to control Thai sacbrood disease both by the state Government and beekeepers have not yielded desirable results so far. Even after six years of occurrence, the disease has not declined and continues to cause damage consistently.

The most disastrous impact is the spread of TSB to the wild colonies in the tropical forests. In these forests, *Apis cerana* is one of the major contributors of cash income to honey hunters and poorest forest dwellers. The TSB has led to destruction of wild *Apis cerana* colonies in the tropical forests of Western Ghats, causing hardship for honey hunters.

Nevertheless, the recent reports indicate that there are colonies of *Apis cerana* that have survived the onslaught of TSB. Thus, TSB resistant strains of *Apis cerana* are emerging in the tropical forests. The need of the hour is to identify such stock of resistant colonies and start a systematic breeding and multiplication programme.

Table 56

Intensity of T.S.B.V.disease in the colonies of Apis cerana in Karnataka during Jan-Feb 1997

Sl.No.	District	No. of colonies		% Colonies	Mean %	Range of Mean
		Observed	Infected	infected	Larval Infection	Larval Infection
1	Uttara Kannada	52	9	17.3	24.62	20.80-26.86
2	Dakshina Kannada	75	35	46.66	27.68	25.66-29.33
3	Kodagu	62	21	13.87	25.62	20.82-26.55
4	Shimoga	36	14	38.88	12.62	10.66-15.22
5	Chickmagalur	66	24	36.36	20.62	15.65-23.62
6	Hassan	42	17	40.47	18.26	15.55-26.44

Table 57

Intensity of T.S.B.V. disease in the colonies of Apis cerana in Karnataka during May-June 1997

		No. of colonies		% Colonies	Mean %	Range of Mean
Sl.No.	District	Observed	Infected	infected	Larval Infection	Larval Infection
1	Uttara Kannada	46	6	13.04	20.22	19.21-22.00
2	Dakshina Kannada	90	12	13.33	23.62	21.44-24.65
3	Kodagu	80	20	25	22.46	21.46-23.22
4	Shimoga	20	4	20	10.2	9.68-11.66
5	Chickmagalur	60	15	25	16.83	15.88-17.26
6	Hassan	52	14	26.92	15.42	14.68-16.22

Table 28

Comparative rate of infestation of *Varroa jacobsoni* in TSBV diseased and in healthy colonies of *Apis cerana F*

Location	No. of Colonies with mite infestation %	
	Healthy	Diseased
Uttara Kannada	4	8
Dakshina Kannada	3	9
Shimoga	4	7
Chikmagalur	2	7
Kodagu	3	5
Hassan	2	6

N= 10

Table 29

Incidence of wax moth *Galloria mellonella* in the colonies of *Apis cerana* F at study centers.

Sl.No.	Study Centers	No. of Colonies		% Infected Colonies
		Observed	Infected	
1	Uttara Kannada	80	18	22.5
2	Dakshina Kannada	60	20	33.33
3	Shimoga	50	25	50
4	Chickmagalur	75	30	40
5	Kodagu	85	35	41.11
6	Hassan	50	26	52

Table 30

Bird,Meropes orientalis damage to colonies of *Apis cerana* and *Apis mellifera* of Western Ghats

No. of Colonies					
Apis cerana		Apis mellifera		% Loss of Colonies	
Observed	Attack	Observed	Attack	Apis cerana	Apis mellifera
33	13	0	0	39.39	0
45	16	0	0	35.55	0
38	9	90	52	23.68	57.77
58	29	60	43	36.2	71.66
87	13	20	13	14.94	65
37	11	92	52	29.72	56.52

Table 54

Intensity of T.S.B.V. disease in the colonies of Apis cerana in Karnataka during May-June

Sl.No.	District	No. of colonies		% Colonies	Mean %	Range of Mean
		Observed	Infected	infected	Larval Infection	Larval Infection
2	Dakshina Kannada	200	140	70	23.52	22.62-24.50
3	Kodagu	150	110	73.33	30.24	28.50-32.60
4	Shimoga	65	52	80	28.62	25.63-29.82
5	Chickmagalur	85	72	87.8	42.32	38.60-43.20
6	Hassan	102	90	88.23	40.26	39.20-42.60

Table 55

Intensity of T.S.B.V. disease in the colonies of Apis cerana in Karnataka during Aug-sept 1996

Sl.No.	District	No. of colonies		% Colonies	Mean %	Range of Mean
		Observed	Infected	infected	Larval Infection	Larval Infection
2	Dakshina Kannada	120	75	62.5	21.33	19.42-23.46
3	Kodagu	96	57	59.37	22.64	18.64-23.26
4	Shimoga	35	6	17.14	18.66	16.66-21.52
5	Chickmagalur	76	49	64.47	36.26	33.33-38.22
6	Hassan	85	58	68.23	33.33	32.24-35.62

Percent infection of T.S.B.V. disease in a Apis cerana during 1996-97.

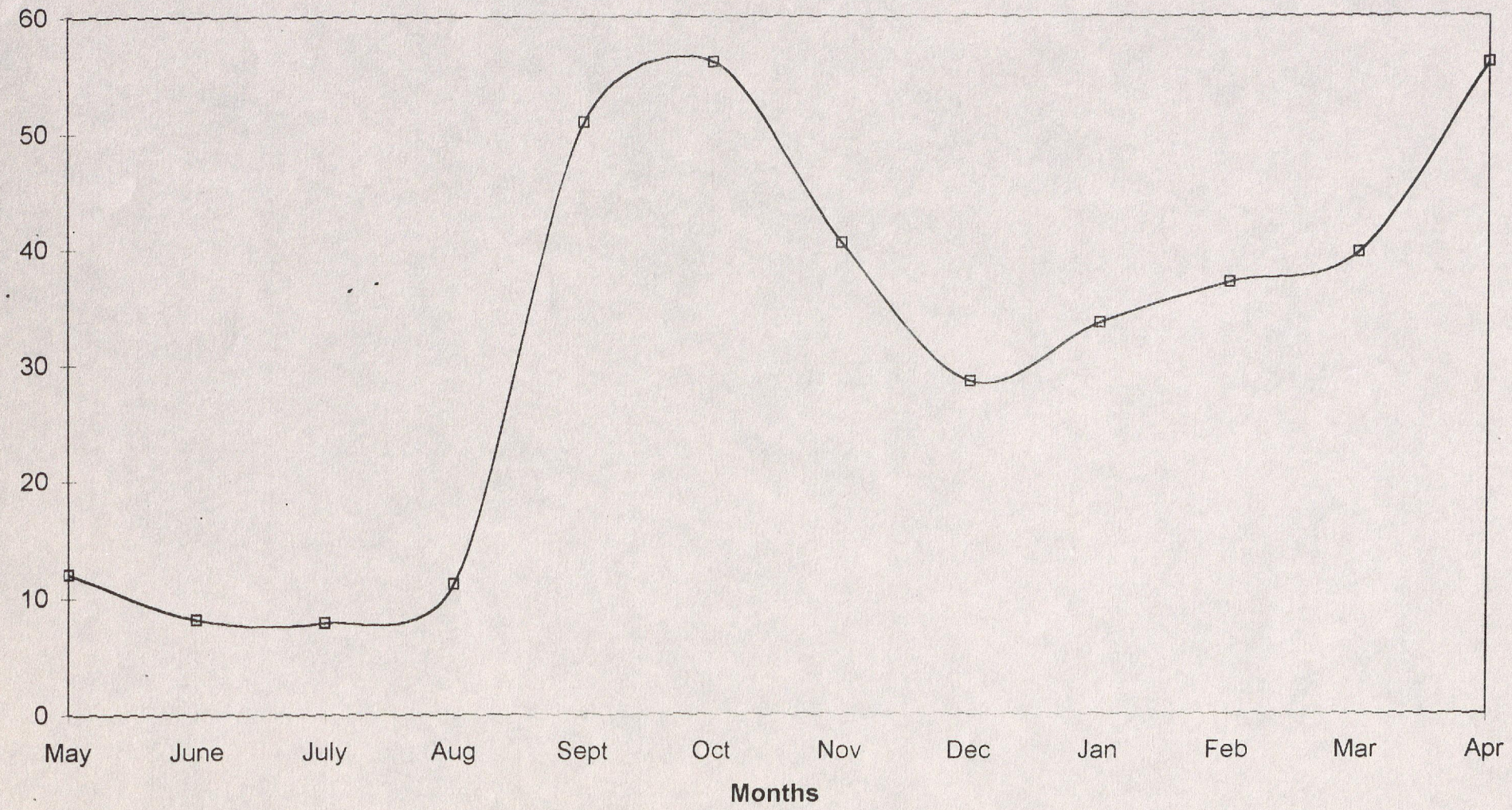


Table 26

Performance of Apis mellifera L in Karnataka during 1997

Sl.No.	Location of Apiary	Place of Original Apiary	Year of starting Apiary	Initial Size of Apiary	Present Size Apairy	% loss of Colonies
1	Dept.of Entomology UAS,Bangalore	West Bengal	1994	10	15	0
2	South Canara Beekeepers Co-op. Society	West Bengal	1994	80	11	86.25
3	Dept. of Industries & Commerce Govt.of Karnataka	Punjab	1995	90	40	55.55
4	Dept.of Industries & Commerce Zilla Panchayat, Hassan.	Punjab	1996	92	75	18.48
5	Dept.of Industries & Commerce Zilla Panchayat,Chikmagalur	Haryan	1996	60	30	50
6	Dept. of Industries & Commerce Zilla Panchayat, Shimoga	Punjab	1996	90	30	66.6
7	Agricultural College, Sirsi. Uttara Kannada	Punjab	1997	3	2	33.33

Table 27

Performance of *Apis mellifera L* in Karnataka during 1998

Sl.No.	Location of Apiary	Year of starting Apiary	Place of Original Apiary	Initial Size of Apairy	Present Size Apiary	% loss of Colonies.
1	Dept. of Enthology UAS, Bangalore	1994	West Bengal	10	10	100
2	South Canara Beekeepers Co-Op.Society Dakshina Kannada	1994	West Bengal	80	5	93.75
3	Department of Industries & Commerce Govt.of Karnataka Bangalore	1995	Punjab	90	30	66.67
4	Dept. of Industries & Commerce Zilla Panchayat Hassan.	1996	Punjab	92	40	56.25
5	Dept. of Industries & Commerce Zilla Panchayat Chikmagalur.					
6	Dept. of Industries & Commerce zilla Panchayat Shimoga.	1996	Punjab	90	20	77.78
7	Agricultural College, Sirsi. Uttara Kannada	1997	Punjab	3	0	100

Comparative rate of infestation of Varroa jacobsoni in TSBV diseased and in healthy colonies of Apis cerana F

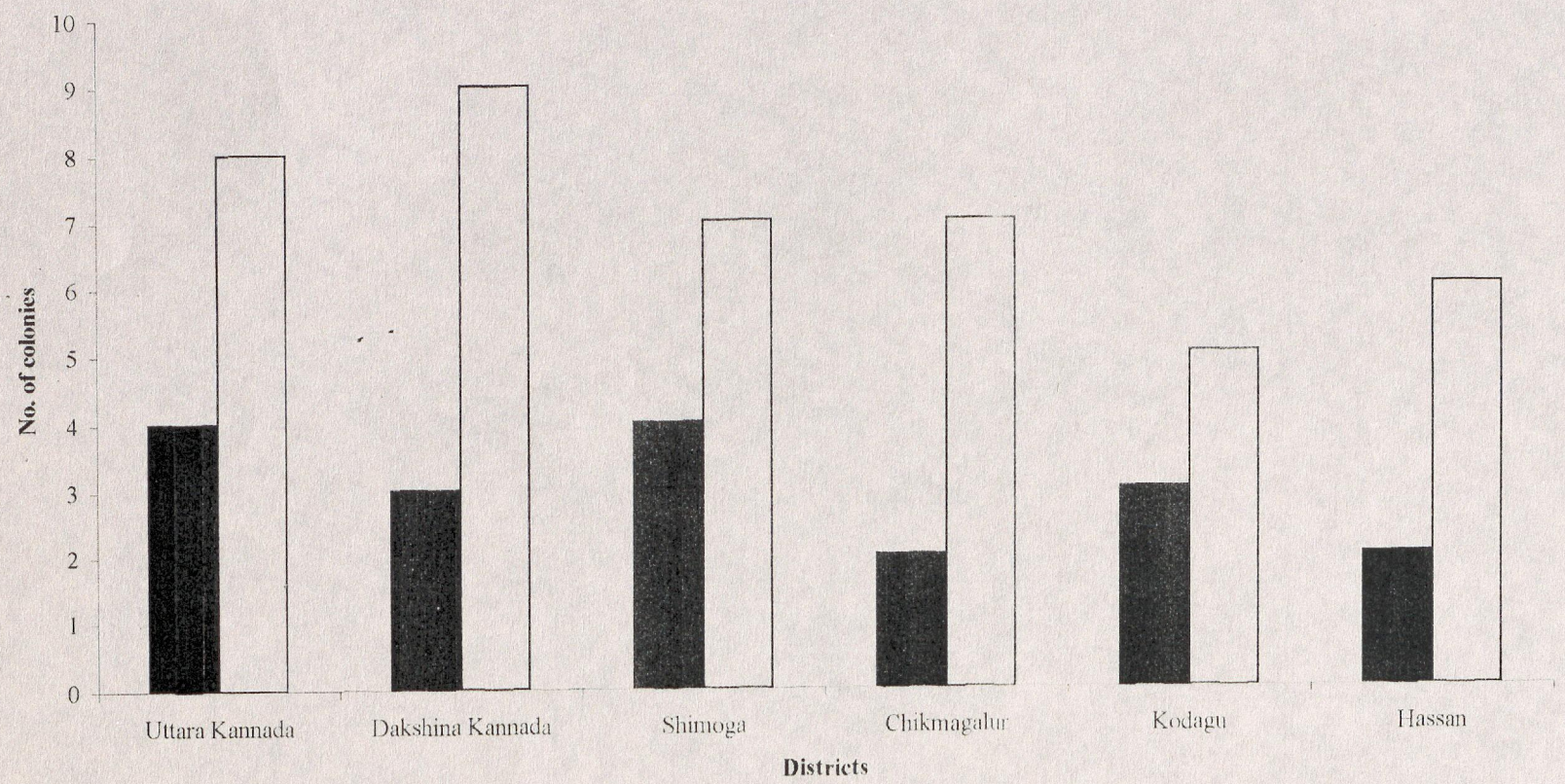


Table 44

Hive conditions of Apis mellifera during 1994-95				
Month	Brood (cm)	Pollen (cm)	Honey (cm2)	Bee Population (No.of frames)
Nov-94	912.31 ± 0.32	83.56 ± 0.61	1475 ± 0.63	6.00 ± 0.30
Dec	934.63 ± 0.43	87.32 ± 0.42	1563.61 ± 0.84	5.30 ± 0.70
Jan-95	1020.04 ± 0.52	108.61 ± 0.53	1375 ± 0.62	5.80 ± 0.02
Feb	1191.32± 0.54	124.74 ± 0.81	900.00± 0.83	6.00 ± 0.70
Mar	1172.43 ± 0.83	152.58 ± 0.54	672.61 ± 0.52	6.20 ± 0.30
Apr	1315.51 ± 0.52	161.40 ± 0.63	851.52 ± 0.64	7.50 ± 0.20
May	1002.41 ± 0.61	112.32 ± 0.83	620.06 ± 0.32	5.80 ± 0.70
Jun	936.32 ±0.38	110.51 ± 0.42	570.51 ± 0.43	5.30 ± 0.30
Jul	989.43 ± 0.54	97.64 ±0.54	530.21 ± 0.52	5.72 ± 0.90
Aug	1259.58 ± 0.52	92.62 ± 0.62	651.51 ± 0.81	5.81 ± 0.80
Sep		123.21 ± 0.31	786.91 ± 0.32	6.12 ± 0.20
Oct		135.76 ± 0.42	971.56 ± 0.41	6.31 ± 0.10
N = 5 ± S.D.				

Table 43

Hive conditions of Apis Cerana during 1994-95				
Month	Brood (cm)	Pollen (cm)	Honey (cm)	Bee Population(No. of frames)
Nov-94	483.32± 0.46	39.71± 0.63	532.72±0.53	6.76± 0.7
Dec	500.57 ± 0.01	40.35± 0.52	491.63±0.21	6.00±0.2
Jan-95	519.38 ± 0.61	42.43 ± 0.32	417.54 ± 0.62	6.10 ± 0.3
Feb	419.46 ± 0.86	45.41 ± 0.53	314.11 ± 0.50	7.60 ± 0.8
March	545.69± 0.91	49.53 ± 0.65	234.32 ± 0.99	8.00 ± 0.3
	614.03 ± 0.23	56.04 ± 0.72	310.41 ± 0.63	8.00 ± 0.3
	418.73 ± 0.83	39.32 ± 0.32	214.31 ± 0.53	6.32 ± 0.4
	462.42 ± 0.60	37.63 ± 0.86	222.54 ± 0.62	6.00 ± 0.2
	469.95 ± 0.81	30.54 ± 0.56	221.63 ± 0.15	6.10 ± 0.8
	479.23 ± 0.53	39.50 ± 0.31	300.00 ± 0.21	6.43 ± 0.2
	500.00 ± 0.32	45.63 ± 0.62	328.00 ± 0.29	7.00 ± 0.2
	527.73 ± 0.86	49.32 ± 0.32	330.00 ± 0.16	7.40 ± 0.5

Performance of *Apis Mellifera* in Western Ghats

5.0 EXOTIC BEES

Introduction

True honeybees of the genus *Apis* evolved some thirty million years ago (Culinary 1983), Probably originating in tropical Asia (Deodikar *et al.* 1959, 1961, Deodikar 1978, Michener, 1979). Of the four popular species of the genus, only the Western or European honeybees *Apis mellifera* L. is not indigenous to tropical Asia. This species is widely believed to have evolved in Africa. It is supposed to have moved northward to temperate Europe during the last glaciation of the Pleistocene (Depraw. 1965. Culinary, 1983). It has been from these European biotypes that man has recruited *Apis mellifera* colonies for introduction throughout the world over the past 350 years.

The European honeybees have been introduced in several Asian countries including India repeatedly over the past two hundred years. The introduction of *Apis mellifera* attempted many times during the past century (Akratanakal, 1976; Morse, 1983) but until recently this programme has met with failure resulting from a combination of biological and managerial problems. (Morse 1969, 1978, 1983, De Jong *et al.* 1982). In general the introductions were successful for one or two years at best, after which the hives died out.

Background

Apis mellifera is well adapted to temperate climates; however, its performance in tropical Asian countries is not well known. After a trial of 2 decades, in North India, only in recent times *Apis mellifera* is performing well. Even then the problems faced by beekeeping with *Apis mellifera* are multifold, and include lack of technical expertise, scarcity of beekeeping equipment, and lack of knowledge of this exotic bee among many beekeepers.

The introduction of European honeybee *Apis mellifera* in northern states of India was mainly due to two reasons: one because the impact of *Thai sacbrood* disease caused

by virus had divested 90-100% of *Apis cerana* colonies and the second reason was due to higher honey production of exotic honeybee species. The same holds good for Karnataka State. The indigenous honeybee species *Apis cerana* is threatened by TSB (Thai Sack Brood Virus) disease and it is on verge of extinction. The Asiatic bee *Apis cerana* is not only well adapted to tropical climates but is a better honey gatherer in diverse bee flora and good pollinator of crop plants, agricultural crops and horticultural crops (Mohana Rao & Suryanarayana 1983).

The European bees were introduced into India as early as 1860's. The introduction of exotic bees was of course clandestine and without any quarantine measures. Literature survey indicates that the *Apis mellifera* was introduced into Bengal in 1860, in Punjab 1882 and in the plains of Punjab and lower hills (Altitude 5000) of Himachal Pradesh after 1960. As on March 1995 the total number of *Apis mellifera* colonies in India was about 125,000 (Wakhle, 1998) and also perhaps equal number of colonies were kept by unknown individuals, in several unknown places.

Efforts to introduce *Apis mellifera* in Karnataka started way back in 1993, when some beekeepers' cooperative societies and the State Department of Industries & Commerce came forward to import exotic honey bee colonies from Punjab, Haryana and West Bengal to tropical forest regions in Karnataka and to study its performance, its adaptation to our environment, honey production, and to study pests, parasites and predators, if any.

OBJECTIVES:

The following objectives were also studied when this exotic honeybee was introduced in Western Ghats and plains of Karnataka.

- To determine the foraging frequency, foraging trip, foraging load and flower visitation.
- To determine the honey flow seasons and total honey productivity/bee colony/year.
- To evaluate the bee flora of *Apis mellifera* in Karnataka including nectar sources.
- To study pests, parasites, predators and diseases, if any.
- To determine to foraging range and its performance in monoculture and polyculture crops and also both agricultural crop and forest vegetation.

- To collect the opinion of beekeepers for failure of introduction in this region.

METHODOLOGY

Secondary data was collected from different sources including Department of Industries and Commerce, Khadi and Village Commission, University of Agricultural Sciences, Bangalore, Beekeepers' Cooperatives etc.

Also, information was collected from 31 persons who had experiences of keeping *Apis mellifera* covering all the districts in Western Ghats, so that we have experiences of about 320 colonies in this region (88.64%). Questionnaires and semi-structured interviews were used to collect the information.

Performance of *Apis mellifera* in Karnataka with special reference to Western Ghats

Like in several other Asian countries the European honeybee was introduced into Karnataka several times by Government and private agencies. The Department of Entomology of the University of Agricultural Sciences, Bangalore has the dubious distinction of first introduction of *Apis mellifera* into Karnataka during 1990 from Punjab. The performance of *Apis mellifera* including their hive conditions was satisfactory in the beginning probably due to unlimited feeding of sugar syrup. Later adult population in all 10 colonies steadily decreased, despite the availability of sufficient pollen and nectar floral sources near by the apiary. The decrease in population was due to the infestation by parasitic mites *Varroa jacobsoni* and *Tropilaelaps clareae*. By the end of 1990, all ten colonies were lost, nine colonies due to mite infestation and one colony absconded.

Again during 1994 the Department of Entomology imported 10 *Apis mellifera* colonies from West Bengal. As usual the performance was satisfactory initially but subsequently, performance was not satisfactory. However the colonies were sustained by scientific management including supplementary and mite control by competent scientific and expert bee personnel of the Department of Entomology (Tables 26, 27). The continued survival of colonies from 1994 was due to excess supplementary feeding, chemical control of mites periodically and practice of migratory beekeeping. Migration of colonies to excellent bee forage crops of both agricultural and horticultural had helped immensely not only for the survival of colonies but also sustaining the colonies.

The Department of Entomology of the University of Agricultural Sciences, Bangalore with the support from all India Co-ordinationed Research Project on Honeybees, Hissar launched this information service effectively and rapidly. Many beekeepers and even progressive beekeepers developed keen interest with *Apis mellifera*. As a result many beekeepers and associations imported as many as 331 colonies of *Apis mellifera* mostly from Punjab and Haryana between 1994 – 1996. Of 331 colonies, 201 colonies were kept in five locations at Western Ghats and the rest in 11 places in and around Bangalore (Tables 26, 27).

Hilly regions of Western Ghats, covered by the districts Uttara Kannada, Shimoga, Chikmagalur, Hassan, and Coorg is vast area with diverse eco system. In all these districts, *Apis mellifera* was tried but with failure. This is mainly promoted by District Idustries Centres or Department of Industries and Commerce under the financial support from ZillaPanchayats in each distract. Each DIC brought the colonies of *Apis mellifera* mainly from Ludhiana, Punjab in northern India (Table 27).

The Dakshina Kannada Beekeepers' Society, Puttur had kept totally 80 colonies at different locations since 1994. The Society brought *Apis melllifera* colonies from West Bengal in March 1994 and distributed 10 colonies each to different beekeepers. The Society itself kept 25 colonies -- 23 in Sulya and 2 in Puttur. The Society charged Rs. 1750 to its members and Rs. 2000/ colony to non members, including one box with five frames. Initially size of the colony was full in all the frames.

Surprisingly only 5 colonies (6.25%) survived until 1998. The reasons for the loss of 75 colonies from the date of starting until 1998 are not available. The loss of colonies could be due to the incidence of mite infestation and poor management practices. The next important place where *Apis mellifera* colonies were kept was at Javagal of Hassan District. This was managed by the Zilla Panchayat. Out of 92 colonies imported during 1996, only 40 colonies (43.48%) survived as on March 1998. The loss of 52 colonies during the period 1996 - 1998 was probably due to poor management practices, mite infestation and prolonged dearth period. The Shimoga Zilla Panchayat had brought about 10 colonies in 1996 and 50 in 1997 and kept them in different places. The Zilla Panchayat also imported 90 colonies during 1997 from Punjab and maintained these 90 colonies in several places of different agroclimatic conditions. Of these as many as 70 colonies (77.78%) were lost different reasons, which include poor management practices, mite infestation, wasp menace, bird

problem and non-availability of pollen.

They supplied boxes to individuals for Rs. 4000/ box. Later Rs. 2886.00/ were given to farmers as subsidy.

In Purappanamane area 20 colonies were supplied to farmers. Besides, they supplied 14, 8 and 14 colonies to Thirthahalli, Shimoga and Hosanagara areas, respectively. Out of these hardly 5-6 boxes are there in this region, that too in almost inactive condition, each with a small cluster of bees.

In Chikmagalur District, about 60 colonies were brought from Pathankot, Punjab, 30 each in October, 96 and July, 97. These were placed in different areas of the district. At present (May 1998), there are 14 boxes each in Mudigere (Karaemane) and Chikmagalur (Kengenahalli). In Hassan about 70 colonies were brought and kept in Javagal. In Kodagu also about 20 numbers were brought by Zillapanchayat. In all these districts, (except Shimoga) colonies were maintained by Department of Industries and Commerce only.

Besides, the Consolidated Coffee Works, brought about 10 colonies individually in Kodagu, under the guidance of Mr. Suresh Changappa, a well known beekeeper of this region.

It took about 6 days to carry these boxes from Ludhiana to Karnataka. Boxes were transported on lorries *(Canter)* in all these Districts. The condition of all the bees was good on arrival.

But success is the mirage in all the above cases. Even though the condition of the bee are good enough to survive in this region later they were found to be inactive.

Shortage of pollen was the main reason for failure. It is found that sunflower is the one of the suitable flora for *Apis mellifera*. All the success stories with *Apis mellifera* are with the sunflower growing areas only. Hosudi, Honnali taluk, where 6 kg of honey was extracted, was covered by the sunflower crop.

Though many organisations have come forward to introduce exotic honey bee species, *Apis mellifera*, in Karnataka, their success and performance rates were very poor. The following reasons may be attributed for future of exotic honeybee species (Fig. 37).

1. Climatic conditions – temperature, rainfall, and relative humidity, wind speed and many meteorological parameters.

2. *Bee Flora*: The performance of *Apis mellifera* in monoculture crops is far better than diverse polyculture crops like forest vegetation. The monoculture crops include sunflower, niger and coconut.

3. *Load carrying capacity*: Due to its heavy load carrying capacity the nectar/pollen available in Western Ghats is not upto its need.

4. *Foraging profile*: The foraging index of exotic bee is less than indigenous honeybee *Apis cerana*. *A. cerana* visits more flowers with less alighting period/flower, and load carrying capacity is nearly half that of the exotic honey bee species. *A. mellifera* requires heavy forage and alighting period/flower is normally more.

5. *Pests, parasites and diseases*: Of all the pests the most serious are wasps and birds. Wasps are active during winter season and they predate usually at hive entrance. It was recorded that one wasp killed on an average about 30 bees in 5-6 minutes.

Birds are usually dangerous when the bees alight on flowers for collection of food, i.e., pollen/nectar, and more observed in dense forests. Bird nuisance was more or less throughout the year, particularly more during dry seasons (Table 30).

RESULTS OF OPINION SURVEY

Possible reasons of for decrease of *Apis mellifera* in Western Ghats of Karnataka (An opinion survey of beekeepers)

Following are the aspects that resulted in the poor performance of *Apis mellifera* colonies, summarized from the data collected in the opinion survey involving beekeepers. Fig. 37 illustrates the level of importance given by the beekeepers to each aspect.

General opinion of beekeepers about *Apis mellifera* is that they are lazy and not adapted to the climate and flora of this area. Most of the beekeepers said that, even if the flower source is available in about more than two or three kilometres, they were not going for collecting the pollen. They are mono-floral in nature, and are adjusted with the flowers of this area. (40 %)

Shortage of flowers is another main reason for failure of *Apis mellifera* in Karnataka (16%). About 6% of beekeepers say that if migration was done most of the bee colonies could have succeeded. 16 %c respondents say that the climate of Karnataka Western Ghats is not suitable for *Apis mellifera*. Another 16% of respondents say that some other problems like sugar feeding, pests, location of apiary, diseases, and some unknown reasons were responsible for failure of *Apis mellifera*. One of the respondents says that old queens might be one of the reasons for failure (3%).

Shortage of pollen: Most of the respondents we met opined that shortage of pollen was the main reason for failure of *Apis mellifera* in Karnataka (19%). In regions of Western Ghats there are mainly crops like plantations crops and also these cover very less area of the total land area.

It is found that in regions of plains, sunflower is the main crop, *Apis mellifera* adapted well to the climate. About 6 and 30 kgs of honey was extracted in Shimoga and Hassan region respectively.

Inability to undertake migration: Migration is one of the crucial needs for success of *Apis mellifera* as it is told by most of the respondents. They say that, due to variation in the geographical and floral variation, it is essential to make migration from one region to another.

Administrative procedure in the Government departments is one of the major hurdles in success of *Apis mellifera*. As some of the respondents said it took about two months to distribute the boxes to individuals in Shimoga District due to administrative problems with the Zilla Panchayat, like inspecting, sanctioning, etc. In this period boxes were kept idle under administration with some minimum maintenance.

Pests/ diseases/ enemies: Most of the respondents did not feel that pests, predators and enemies were serious problems. However, they admitted that birds like small green bee-eater were predating upon the bees. Wax moth was only a slight problem, according to two beekeepers in Hosanagar region.

Not even a single colony of *Apis mellifera* out of 35 colonies could survive for two years in Puttur Region. Many beekeepers lost their colonies within 5 months of arrival from West Bengal. Bee-eaters, lizards, wasps and ants were the major enemies to *Apis*

mellifera. Beekeepers opine that the hot climate may not be suitable for *Apis mellifera*. The bees are quite dull and inactive compared to local *Apis cerana*. The bees cannot go far in search of pollen as the *Apis cerana* does. Although there was a need for pollen within the hive, they did not go out for pollen foraging if the pollen was not available near, say, more than 750 metres.

It was the experience of beekeepers that during May, the population of bees decreased and thereafter queen also died and within June the entire colony left the box. Some people saw that very few bees took rest in the shrubs for 3 to 4 days after they left the bee box and then they disappeared.

Lack of training and other management problems: It is found that most beekeepers were not given enough training before introducing *Apis mellifera* (56%). The high price of the colonies is one of the hurdles in keeping the bee colonies by regular and interested beekeepers. As it is found from our study, most of the beekeepers of this region were in the income range of Rs. 40000 to 50000; and for them the price of the colony of *Apis mellifera* was high. No beekeeper could afford an investment of about 10 % of his income on an *experiment.*

Bee equipment: Beekeepers by and large do not know this exotic honeybee species *Apis mellifera* in Karnataka, their management strategies, and equipment like, honey extractors. Majority of them had practically no training programme. Even then *Apis mellifera* was introduced under different projects in Karnataka.

Supplementary feeding: - The dearth period for these bees in the year is more than 7-8 months, since the forage is available hardly for 3-4 months. Hence it is very difficult to maintain the bee colonies without sufficient forage. Bee flora is one of the main limiting factors for development, survival, and existence of *Apis mellifera* in Karnataka.

Sugar water and sometimes *dorsata* honey was being used as supplementary feeding to the honeybees. Frequency of supplementary feeding was once in 4-5 days. And hence 4-5 kg of sugar or honey was required in a month to one bee colony. Supplementary feeding was given from March to December and even upto January, by some beekeepers. Comb foundation was supplied only once. Besides sugar water and honey some beekeepers provided soybean powder as supplementary feeding. Only one beekeeper was able to increase the population of bees and provided one

super to his bee hive.

Bee flora: The major bee forage sources for *Apis mellifera* included: Kuntu Neralu (*Syzigum caryopyllatum*), mango (*Mangifera indica),* soapnut *(Sapindus laurifolius*), Chara, guava, cashew, Seege (*Acacia concinna*), Blusurali, Elaichi (*Elattaria cardamomum*), Dhoopa, Nokate, and some parasitic climbers, coconut (*Cocos nucifera*), arecanut (*Acacia catechu*), and banana (*Musa* spp.).

Honey production: There are reports that UAS, GKVK, Bangalore had extracted nearly 30 kg of honey per *Apis mellifera* colony, but as far as the Western Ghats region is concerned the honey production with *Apis mellifera* is limited. Out of over 361 boxes brought to Karnataka, beekeepers were able to harvest honey from only 10 – 12 colonies which is less than 5 per cent. We could not calculate the actual percentage because most of the respondents and concerned officials were unable to recall actual numbers. Yield per colony was also very low. A maximum of 16 kg was obtained from the Industries Department Centre in Chikmagalur District, leaving most of the colonies without any yield.

T. Mahabaleshwar Bhat, Bangartadka, is the only beekeeper who was able to harvest honey from *Apis mellifera* in the Dakshina Kannada region. He harvested 15 kilograms of honey from two colonies of *Apis mellifera.*

Discussion

Generally, the performance of the European honey bee in Karnataka particularly Western Ghats has been unproductive and uneconomical. In most colonies, if a not all, honey was not extracted, despite supplementary feeding of sugar syrup. All beekeepers and institutions obviously incurred heavy losses. Except sugar feeding no other management technique was employed in the management of *Apis mellifera* colonies in all 16 centres where it was introduced.

The first ever introduction of *Apis mellifera* into Karnataka had generated lot of discussion and resentment both among the public and scientific community. A variety of causes was suggested ranging from predators to bad management. It now seems that the major problem was caused by the ecto-parasitic mites, *Varroa jacobsoni* and *Tropilaelaps clareae*. The parasitization of *Apis mellifera* resulted in infestation of the brood, feeding upon the pupae and killing them, stunting or causing malformation of emerging bees. The de-predation seems more severe on *Apis mellifera* than on their

natural hosts, *A. dorsata* and *A. cerana*. *A. Mellifera* is affected by both species of mites equally.

Control of mite pests on *Apis mellifera* is not easy and requires a mixture of chemical and management control. Mites are posing the most serious problems to beekeepers in Europe and America, where the very existence of beekeeping is threatened due to the mite menace. One of the effective methods of control is to break the brood rearing cycle of bees so that mites could not feed on immature bees. Deprivation if immature bees is achieved by caging queen bee for about three weeks and fumigating with phenyl thiazine. Alternatively, the removal of brood followed by the application of fine sulpur and napthalene as fumigants in the hive (Akratanakul, 1983). The intensity of these management techniques and their need for chemical agent for mite control suggest that newcomers to beekeeping with *Apis mellifera* in developing countries with large rural, uneducated and unsophisticated poor population in isolated areas may find themselves in difficulty. The practicality of developing beekeeping with *Apis mellifera* under different situations in various countries of tropical and sub-tropical countries of Asia leads to challenging and requires scientific management.

Generally it is much more difficult to keep this bee in tropical climates than in temperate climates due to the prevalence of pests and predators. The major problems with the European honeybee are the incidence of parasites. The chief parasitic mites are *Varroa jacobsoni* and *Tropilaelaps clarae*, which occur naturally in indigenous honeybees species, but are transferred to the European honeybees. The native bees are less affected by these mites than the European honeybees, which suffer greatly. Both the mite species have been observed in every *Apis mellifera* colony during the past several years. *T. clareae* appears to be the most destructive of the two mite species. The colonies of Europeans honeybee become infested with mites within a few months (9 - 10) after their introduction. Infestation of European honeybee colonies probably takes place through robbing as in this way the mites have transferred directly from colony to colony.

Very few people have formal training and interest in beekeeping with *Apis mellifera*. No research support is available to tackle technical problems associated with the introduction of *Apis mellifera*. It is obvious that there are still many constraints and unexplored areas as regards beekeeping with *Apis mellifera*.

Success in beekeeping depends on a variety of factors, the primary among these being in the development of seasonal management. The other important factor that ensures successful establishment of *Apis mellifera* is queen rearing and control of pests and diseases.

Due to the repeated failure of beekeeping with *Apis mellifera*, the local beekeepers tend to keep *Apis cerana,* which are abundant around the villages, towns and cities. Further beekeeping with *A. cerana* is simple and requires little time and effort. The management practices are inexpensive and the bees can be managed by women and even children. So, with little investment beekeepers are assured of a good harvest of honey. The recent failure with *Apis mellifera* remained as the native honeybee species can perform far better than *Apis mellifera*, either for honey production or for pollination. Though as many 331 colonies of *Apis mellifera* were introduced into different agro-climatic regions of Karnataka, as many as five times between 1990-1997, and was maintained and supervised by bee personnel of the Department of Industries and Commerce, only about 110 colonies are surviving and their performance is unsatisfactory. The bees remain unproductive.

Conclusions

- Lack of awareness of exotic honeybee *Apis mellifera.*
- No training in *Apis mellifera* management.
- Bee flora constraints;
- Problems of pests, predators and enemies.
- Bee equipment problem.

CASE STUDY OF HONEY HUNTERS: JENUKURUBAS

Names of persons who participated in discusson: Kencha, Mara, Raju, Madeva and Lingaraju

Village: Hoasahalli, N. Begur Panchayat, Heggada Devana Kote (H.D. Kote) Taluk, Mysore District

Background

Hosahalli is a village situated about 80 km from Mysore, the district headquarters. The village is surrounded by Gunde reserve forest area, bordered by Bandipur and Nagarhole National Parks. Tribal peoples locally known as *Jenukurubas* (literally meaning honey shepherds) and *Betta Kurubas* have been living in this area, and depend entirely on forest products for their livelihood. Food requirement is met either by agriculture or collectng wild food. They were collecting about 14 types of tubes as their food. According to their information, these tubers are: *noore*, *gunni*, *akki*, *nerige*, *eka*, *sala*, *vala*, *kirana*, etc. Meat requirement used to be met by hunting animals like wild boar, chital, hare, etc.

But presently the picture is changing. Tribals are living outside the forests, mostly on the forest fringes, being forced out by forest laws. In H. D. Kote taluk, tribals have been forced out twice because of the construction of the Kabini rservoir and Forest Conservation Act (Gunde Reserve Forest).

A number of NGOs and other social development forces have been working in this area for the upliftment of these tribals. As shifting cultivatio and hunting were banned, and tribals got pushed into searching for alternative ways of earning or in other words, *exchange economy*, the dependence on NTFP for income increased, even as their access to forest is denied. Traditional values are collapsing, new social values are constantly at work and have their impact on these traditions. The entire tribal group is changing. Thus all the traditional skills and knowledge about the tropical forest are disappearing from the whole tribal group.

Honeyhunting and tribal culture

As the name of the one of the tribal group, Jenukuruba, itself suggests, these tribes

were dependent on collection of honey and other wild food only. In earlier days only honey and the tubers were the sources of food for these groups.

Availability

The area covered by dry deciduous type of forests, supports a rich number of forest species. Honey is available considerably large quantities. All types of honey bee species available in Western Ghats of Karnataka, *viz.*, *Apis dorsata*, *Apis cerana*, *Apis florea* and *Trigona iridipennis*, are found in this region. Honeys from *Apis dorsata* and *Apis cerana* are available in much higher quantity and are mainly collected by tribal groups.

There are faily good numbers of *host trees* in the forests of the area. The host trees of *Apis dorsata* are called by tribals as '*Bare*' or '*Pademara*'. The major host trees are Tare (*Terminalia bellirica*) and Kadaba. These trees are spread in about 5 to 15 km range in the forests. The tribal people know each and every *bare* (host tree) and call each tree by its individual name given by them, e.g., *Balagere Kadaba*, *Doddavalli tare*, *Barekadaba*, etc.

Worshipping and tenurial security

In earlier days, if a honey hunter finds honey in a tree then he was making Pooja and putting some mark on the tree. Once some person marks it any other does not consider it for harvest. He who marked the tree can only marvest the honey. Usually he harvets the honey after it is completely ripe, whn maximum quantity of honey is available. As honeybees quit the trees in rainy season, the days just before the arrival of the rain (monsoon) is the best season for harvesting honey. Thus honey was harvested in a sustainable way.

But as the times change, such religious and social customs are disappearing from the tribal groups. Nowadays, there is no such restriction among them. One of the main reasons might be, as Kencha explains: earlier there was a religious fear among tribes, and wrong doers feared devine wrath and punishment. Such beliefs are disappearing now.

Collection

In this region, honey is available twice in a year, once in the month of November and

December and once at the end of May. Tribal people collect honey in both of these seasons. Usually, about 8 to 10 members form a group, before starting for collection, according to their convenience. In earlier days, each group was supposed to be headed by specific person of the village, and they even had to collect honey from some specific trees. But now such traditional rules and bondings are breaking down.

This group starts for searching honey hives in the forest. The tools they carry are simple: a knife, large rope and cans for storing. Other necessary tools like thread, *eni* (tool for climbing the tree), etc., are taken from the forest itself.

After identifying a tree, the wohole programme of collecing honey is planned and accordingly tools are prepared. *Eni* (climber) is prepared using bamboos. In some cases surrounding trees are used to climb the tree. In most of the cases about two to three *eni*s are tied to reach the branch of the tree from which the bee hive is hanging. If there are more than 10 colonies on a tree, more than one person, and sometimes, if necessary, four to five members climb the tree.

Usually leaves of *Udi soppu*, a shrub available in the forests, are used for making smoke to scatter the bees. If this particular species isnot available in that area, then green leaves of any other species are used formaking smoke. The branches with green leaves are tied with some combustible dry grass and burnt to get the smoke.

Honey collection is not carried out under moonlight. On the other days, when the sun sets the process of actual collection starts. One of the experienced among the group climbs the tree and ties the rope to a branch and puts down the other end to the others on the ground. A bundle of dry grass, covered by either *Udi soppu* or other green leaves, is sent above with the help of a rope to the person handling the colony.If there are more than 10 bee hives, as mentioned earlier, more than one person climb the tree. In such cases the entire work is shared. One person smoothly brushes the bees off the comb, with a broom of leaves, while the another collects the honey. Honey comb pieces are sent to the ground in baskets specially prepared of bamboo, leaves and coir rope. Nowadays, metal utensils are replacing these.

As the tribals say, *Apis dorsata* makes honey in central part of the comb. For harvesting honey in sustainable manner, tribals collect honey only from the central part of the hive, where honey is stored. Brood in the surrounding comb is left undisturbed. In the process of collection, minimum number of bees is destroyed.

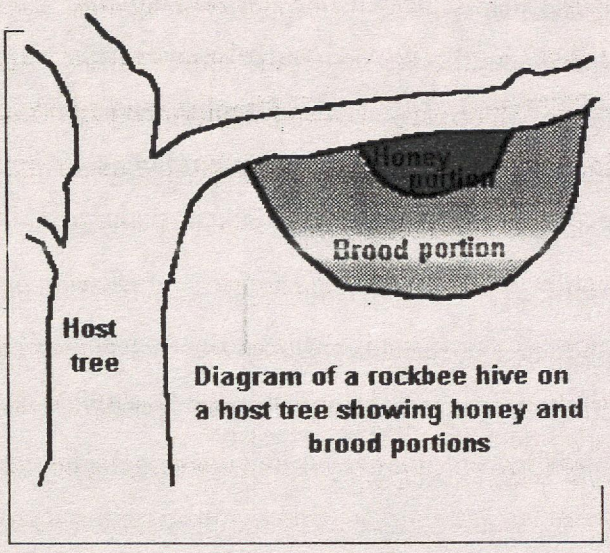


Diagram of a rockbee hive on a host tree showing honey and brood portions

As these people do not carry any of the materials for cooking, they live on the forest produce only during the whole period of collection. They eat bee brood, along with other tubers and honey. Usually, the honey harvesting processes continues for a week or two or in some years of high yield, even for months together. As mentioned earlier, there are two seasons of honey harvesting.

Marketing

The border of the adjoining Kerala State is only 10 km from here. Price of honey is higher in Kerala than in Karnataka. The tribals from this place sell honey in Kerala for Rs. 45/kg, whereas it is only Rs. 25 in Karnataka particularly in Heggada Devana Kote area. Tribals once going into the forest on a honey collection expedition, return to their village only aftaer marketing the honey.

After returning to the village, they share the money equally among all members who took part in collection. On an average, last year, each family member got an income of about Rs. 1500.

Reasons for decrease of honey bees

Most of the tribal members explained that the main reason for decrease in honey bee population is the decrease in density of forest and there by the reduction in flowering plants.They also felt that natural big trees that can support a large number of bee hives, are getting rare.

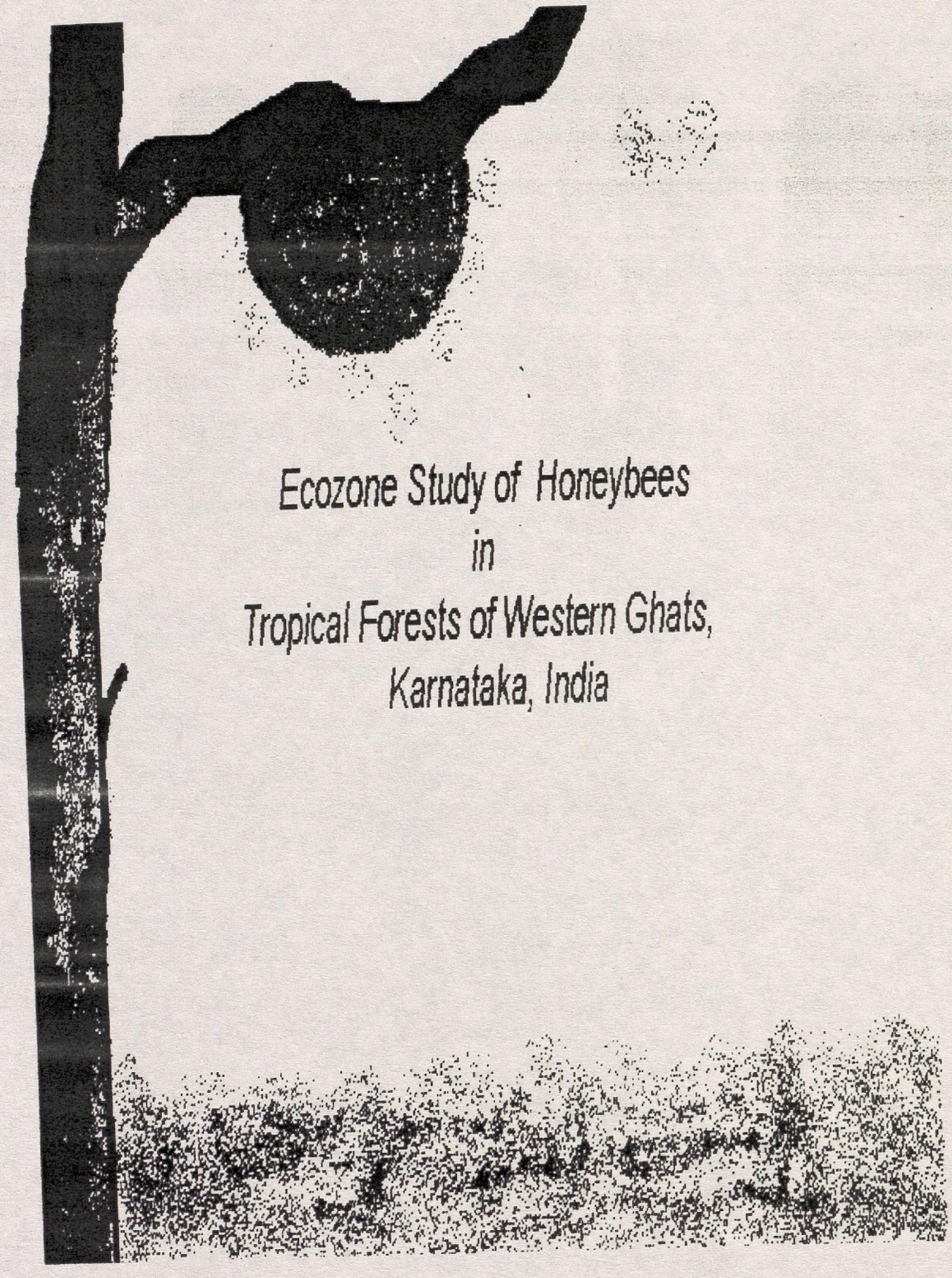
Kencha, an old Jenukuruba, who took active part in our dissussion, expresses his view about decrease of honey bee population in a different way. He say, in earlier days,

every year there was a forest fire. Such forest fires clear the undergrowth and promotes regeneration of some grass species, and plants like Gurige (*Strobilanthes* group of species), whose flowers are attractive to honey bees. Also, such forest fires clears the meshes woven by spiders in the forest which disturb the foraging bees. Further, a type of ant, locally known as *Kunuma*, is one of the major enemy of honey bees. If the forest fires occur every year, the population of these ants is kept under control.

However, the other young members who participated in the discussion do not agree with this. But, they agree that there was an increase in quantity of honey in the year of high forest fires.

Change in dependency

The dependency on the forest products like honey is decreasing rapidly among the tribes. The changing social and political factors affected the tribal society. As Mara says, "there has been no regular farm land for us, and also no permanent farming system with us. We have to seek wild food sources. Forest is rich enough to support the food habits of our small group. But now population density is high and besides, forest is degraded. Education and moral support are being given by a number of outside organizations."



Ecozone Study of Honeybees in Tropical Forests of Western Ghats, Karnataka, India

6.00 ECOZONE STUDY

ECOZONE STUDY OF HONEYBEES IN TROPICAL FORESTS OF WESTERN GHATS, KARNATAKA, INDIA

0.0 OBJECTIVES

Continuous depletion of precious natural forests has adversely affected forest ecology, including honeybee dynamics. Increase of monoculture plantations, deforestation, extraction of dead and fallen trees, use of Green Revolution pesticides, and pollution have affected both quantity and quality of honey production as well as honeybee population. Destruction of natural hives by collectors either by fire or widening holes natural nests has affected honeybee population in the wild. Bee keeping in India has been affected by the devastating disease, *Thai sacbrood* virus during the last two decades, which has had an impact on wild bees as well. This affected the both beekeeping and wild bees in the country severely.

Colonies of domestic bees are increased from dividing the existing stocks or collected from the wild. The latter practice serves to develop resistance to bee diseases. The density of wild varieties is also decreasing compared to earlier years; the decrease being in honeybee colonies as well as the quantity of honey available from each hive.

It is essential to analyse the reasons for decrease of honeybee colonies in the wild. Specifically our objectives, through this study were,

1. To study the population density of bee colonies of natural forest
2. To study the factors affecting the densities of bee colonies in the study area.
3. To study the status of honeybees in tropical forests.

1.0 METHODOLOGY

A high potential area of honeybees was identified with the help of local people /traditional bee hunters of area.

Population density and habitats requirements for nesting of honeybees were studied using:

1. Line transect method and
2. Random sample study of honeybee habitat/hives.

To determine the density of honeybees in the study area, eight areas of two hectares each were sampled, taking two sites in each eco zone (evergreen, foot hills, moist deciduous forest and dry deciduous forest), in the form of 1 km length and 20 metres wide linear transects. In each transect, all expected honey bee shelters were identified, with the help of wild honey collectors of that area. Both shelters with honeybees and disturbed shelters were studied. Possible reasons for destruction of shelter were also noted. GBH and approximate height, canopy cover, major forest species, status of forest etc were recorded.

'*Expected shelters*' are the shelters of honeybees which are used by honeybees for many years and satisfy the conditions of a good shelter and where a honey bee colony prefers to nest. In other words, these are the nest sites (hollows) that honeybees are regularly using to make nests. Usually honeybees come to such sites season after season until they are destroyed. An experienced wild honey hunter can readily identify these nest sites. The local people who had been collecting honey from the wild for a number of years and collected honey many times from the same shelter identified these expected shelters.

To study the habitat requirements, along the transects, some hives with honeybees were identified with the help of local people. Each hive was studied in detail. Factors like type of hives, *viz.*, nest site (hollow) of tree, anthill (former shelter of termites), dead and fallen tree, height from the ground level, area inside the hives, canopy cover of the area, sunlight falling on the hive, flowering plants, distance from a water source and from human settlement, etc., were studied. Also, a quadrant of 10X10 M., around each shelter was studied. For shrub level, a quadrant measuring 1 X 1 M. area was randomly laid.

We have also studied the effect of flowering plants and their seasonality and harvesting methods which are said to affect a big way the number of honey colonies in the wild.

Limitation and justification: Estimation of population density of the honeybees in the wild and identification of hives especially of *Apis cerana* and *Trigona* are difficult. Only experts can trace the hives of *Apis cerana* and *Trigona.*

Besides, the populations of these are not distributed evenly in the wild and a *representative site* as such cannot be selected. Hence we have selected the area of high potential of honeybees and studied the changes in density in that area and the habitat requirement of particular species of honeybee. Even though the results of this study may not be extrapolated in general to the other areas, it certainly reflects a general status of honeybees in the wild. The study was limited by the lack of scientists and paucity of time.

2.0 RESULTS

2.1 Study area

The study was carried out in the forests of Uttara Kannada District, (Karnataka) in Western Ghats. Eighty percent of its total geographical area, (*i.e.*, 10,24,679 ha), is under forest cover (8,29,153ha), as per the official records.

The district has four types of eco zones, *viz.*,

1. Coastal scrub and evergreen forests at foothills
2. Wet evergreen forests at crest line of Ghats
3. Moist deciduous forest and
4. Dry deciduous forest in the eastern side of the District.

Eight areas, (two sites in each eco zone), were selected. i.e., two each in coastal, crest-line, evergreen-moist deciduous forest belt and remaining two in dry deciduous forest areas.

2.2 Ecozone-1: Coastal scrub and evergreen forests at foothills

The coastal belt is mainly covered by scrub type of forest in the areas closer to the sea. Most of this has been converted into agriculture land, because of high human population density (164-persons/ sq. km). Near foothills, the forest type changes to evergreen type. Out of two study areas selected for the study, one is in coastal belt and the other one is near foothills.

2.2.1. Kavalakki is situated about 10 kilometres from Honnavar, taluk headquarters, in coastal belt of Uttara Kannada District. It is a hilly region, on the way to Gerusoppa, covered with forest species like Suragi (*Mammea suriga*), Hunalu (*Terminalia paniculata*), *etc.* The forest is highly disturbed, as there is high human

population density in the area. Beekeeping is being practised throughout the area with all the skills and technical knowledge.

Honeybee colonies in the wild are comparatively less, as there is no natural forest in the area. Honeybees also visit the pots placed inverted or slightly perpendicular to the ground, old hives in trees like Suragi (*Mammea suriga*), jackfruit (*Artocarpus integrifolius*), *etc*. The major flowering plants in this area are Antwal *(Sapindus laurifolius*), coconut (*Cocos nucifera*) and arecanut (*Areca catechu*) that are all planted species in the betelnut gardens or in the Betta lands. The honey prepared from the nectars of flowers of Antwal (Sapindus laurifolius) is supposed to be of high quality with yellowish color, longer shelf life, and fetches a higher commercial price.

2.2.2. Antaravalli is situated just below the Devimane Ghat, in Kumta taluk. It is about 15 kilometers from Kumta. The forest is evergreen type with high temperature and humidity. Beekeeping is being carried out by most of the villagers with a record of more than 35 colonies at a time. But nowadays the number of colonies has decreased to one or two or in some cases none at all, because of the Thai sacbrood disease.

The major flowering plants are coconut (*Cocos nucifera*), Antwal (*Sapindus laurifolius*), arecanut (*Areca catechu*) along with considerably more number of wild plants of evergreen forests like Ashoka (*Saraca asoka*), Holegere (*Holigarna arnottiana*) *etc*. Teak (*Tectona grandis*) is the introduced plant in plantations of surrounding area.

2.3 Ecozone-2. Evergreen type of forest at crestline

The edge of Western Ghats which bisects the district into coastal and Malnad area is covered by thick evergreen forests. Two areas from this ecozone were selected; one from south (Nilkund) and from another extreme north (Anshi) of the district.

2.3.1. Nilkund is at about 600 m. above the sea level. Thick forest cover of evergreen type surrounds the area with plants like *Garcinia* sp. and *Myristica* sp. Beekeeping is practised by some of the villagers not scientifically, but with traditional knowledge. There are some villagers who had upto fifteen bee colonies about four years back. Over last two years colonies have been completely destroyed by TSB disease. Karivokkaligas, a community residing in this area, are mainly involved in collection of honey from wild and Havyaks are more involved in beekeeping along with

collection from wild.

Flowering species in this area are Tengere (a climber which flowers during month of April), Babbi (*Calophyllum tomentosum*), Holegere (*Holigarna arnottiana*), Hunalu (*Terminalia paniculata*) *etc.*

2.3.2. Anshi is in Joida taluk on the crestline of Western Ghats. The area is surrounded by evergreen type of forest with cane (*Calamus* sp.), *Myristica* sp, *Garcinia* sp., *etc.* Beekeeping is hardly practised by villagers here. Honey from hives of *Apis dorsata* and *Apis cerana* has been harvested regularly by villagers. Kunbis residing in this area are mainly involved in collection of honey. They have some special religious rules and regulations to collect honey from the wild. Honey is harvested only after it is ripe, and after performing certain religious functions.

2. 4 Ecozone-3. Semi-evergreen and moist deciduous type of forest

The belt of evergreen and moist deciduous type of forests is the prominent type of ecozone in the district. The two areas from this zone were Magod and Vanalli.

2.4.1. Vanalli is situated about 25 kilometers from Sirsi. The area is covered with evergreen and partially moist deciduous type of forest. Major forest flowering species are Matti (*Terminalia arjuna*), Honne (*Calophyllum inophyllum*) Gurige (*Strobilanthes* type) and plantation crops like arecanut (*Areca catechu*), coconut (*Cocos nucifera*) *etc.* Villagers have been practising bee keeping as well as collection from wild since long. There is one tree having the record of supporting more than 300 hives of *Apis dorsata* about four years back.

2.4.2. Magod is about 15 kilometres from Yellapur with both evergreen and moist deciduous types of forests. Major flowering species are Matti (*Terminalia arjuna*), Gurige (*Strobilanthes* type) etc. Beekeeping is practised on a very small scale. But collection of honey from the wild, of both *Apis dorsata* and *Apis cerana*, is in practice among the villagers. Siddis, a tribal community residing in this area, are involved in collection of honey from the wild. They earn a considerable income from collection of honey from the wild.

2.5 Ecozone-4. Dry deciduous type

This forest type is found in eastern parts of the district. These commercially valuable forests support a number of deciduous species and the undergrowth consists mainly of

Eupatorium weed.

2.5.1. Chipgeri is about 35 kilometres from Sirsi. The forest type is mainly dry deciduous with species like Matti (*Terminalia arjuna*) and Sheege (*Acacia concinna*) and these are the major flowering species in this area. Villagers have been practising traditional and modern beekeeping. Collection of honey from the wild is also a common practice.

2.5.2. Borana gudda is about 20 kilometres from Sirsi on the road to Haveri. The forest type is dry deciduous with species like Matti (*Terminilia arjuna*) and Sheege (*Acacia concinna*). Beekeeping is hardly practised by the villagers. But collection of *Apis cerana* and *Apis dorsata* is a common practice among the villagers. There are six big trees, that have been attracting *Apis dorsata* for decades.

3.0 HONEY BEE SPECIES

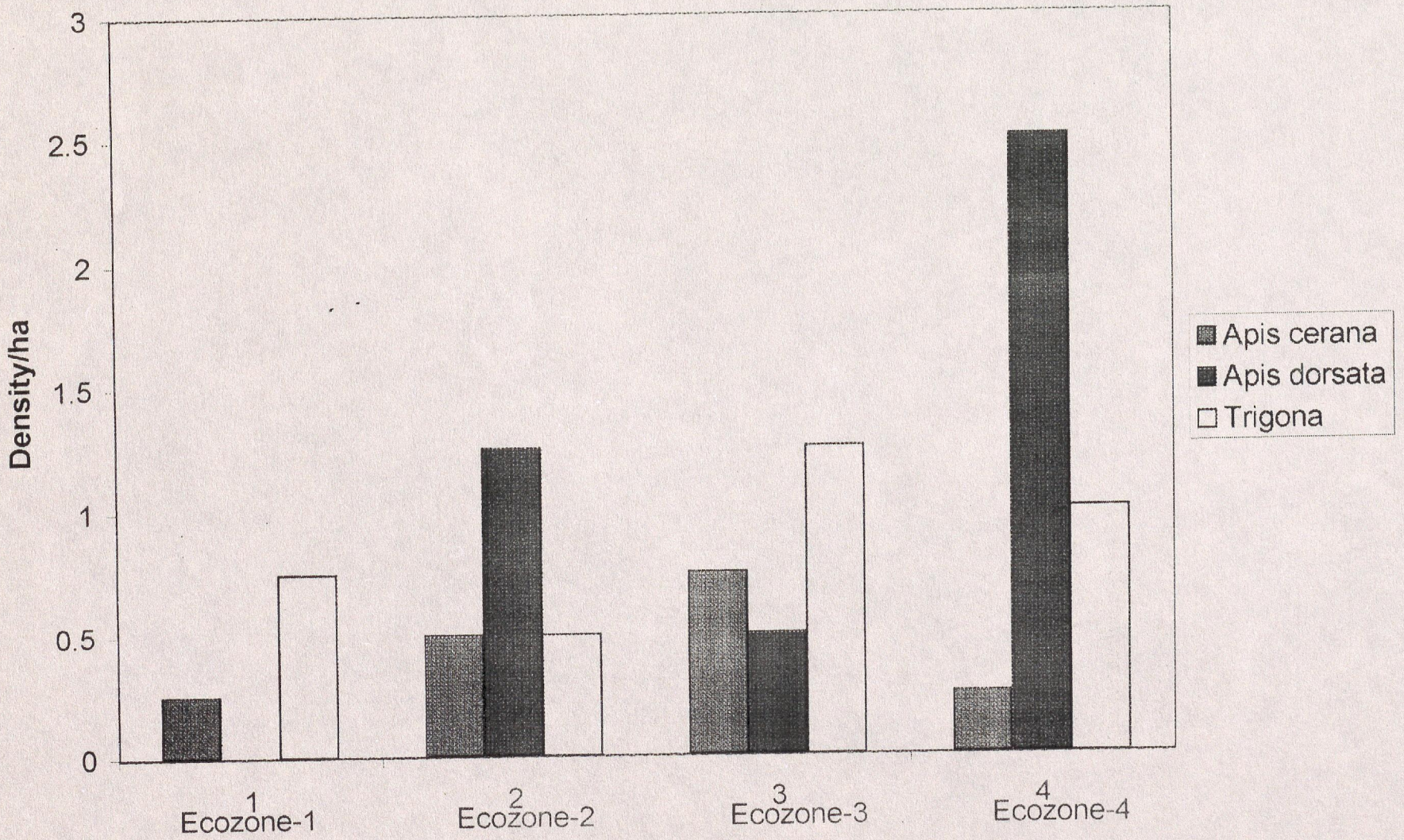
3.1 *Apis cerana* (Tudavi jenu)

3.1.1. General Description

Apis cerana is a widely distributed and common honeybee in all climatic and vegetation areas of Asian countries. The bees nest in cavities of trees, anthills, or other dark, enclosed places. They make several parallel combs hanging inside the cavities. Beekeeping is practised most commonly with *Apis cerana*. Three subspecies have so far been identified in India, *viz.*, *Apis cerana cerana* -- restricted to the Jammu and Kashmir and Himachal Pradesh, *Apis cerana himalaya* -- distributed in the northeastern Himalayan and adjacent Indo-Gangetic plains, and *Apis cerana indica* found in the central and peninsular parts of India. In Karnataka the subspecies, *Apis cerana indica* is found and has both the hill type and plains type forms.

These well-organised bees can adapt to climatic extremes. They migrate from place to place depending on the climatic conditions and availability of flowering species. Usually honeybees start to come to forests of hilly regions in search of nest sites only during the month of November and December and stay upto the onset of monsoon (1st week of June). In coastal areas they start making hives slightly earlier than in the hilly region, as there is comparatively warm climate and good sources of flowers. *Apis cerana* can be seen in all types of forests of Uttara Kannada district.

Density of Honeybee species in ecozones of Uttara Kannada



3.1.2. Habitat Requirements

3.1.2.1. Type of shelter: Out of 21 shelters studied, it was found that the dead and fallen trees are more attractive (42%) to *Apis cerana*. Next preference is found to be the standing trees (38%) followed by anthill (10%), inverted pot (5%) and others, in rare cases, like nest site (hollow) of wall, or any other place which fulfils requirements like proximity to flowering plants, water sources, no exposure to sunlight etc. (Table 62; Fig. 41) These are discussed later in this section.

3.1.2.2. Nesting details: Condition of nest site (hollow) is one of the important criteria for a colony to settle down. The present study focussed on all aspects of a suitable nest site (hollow). West is the preferred direction of entrance (47%) followed by east (28%), south (10%), north, south-east, and north-east (5% each) (Fig. 42). The mean diameter of entrance is found to be 7.02 cm with maximum of 25 cm and minimum of 2.5 cm. Mean height of nest site (hollow) from ground level is 2.62 m. In one case it was about 30 m on branches of an *Artocarpus* tree.

Even though there may not be specific reasons for the height of the hive from the ground level, one of them could be prevention from ground predators. Sunlight falling on the hive at ground level is low compared to higher strata of forest.

3.1.2.3. Water, sunlight and disturbance by human beings: Water and sunlight should not enter the hive. Most of the hives (80.95%, N=17) have their entrance below the actual nest site (hollow) so as to satisfy this condition. Exposure of hives to sunlight is avoided (95.23%, N=20) strictly. Average length of the hive was 1.11m and breadth of the hive was 0.25 m.

Canopy cover is an important factor for honeybees to select their shelter in the wild. Out of 21 honeybee shelters studied 12 had less than 80% of shade. The mean distance of water source from the hive was 271 m. Along with main streams, ponds, rivers, and *Apis cerana* are attracted to the places with small stagnant water bodies, like small ponds, pits for urine of cows etc. Distance from human settlement indirectly represents the disturbance of human beings to the natural forests. In other words the disturbance is higher in forests proximal to settlements. In case of honeybees the average distance of honeybees hives from the settlements is 974.76 m.

3.1.2.4. Type of forest: *Apis cerana* was found in all ecozones of Western Ghats including the coastal belt, where natural forest has almost disappeared. Density varies

with ecozones. Type of forest preferred by *Apis cerana* is the belt of moist deciduous forest with a maximum of 0.75 colonies/ ha followed by evergreen type with 0.5 colony/ ha, 0.25 colonies/ ha in coastal and dry deciduous type forest area (Table 66; Fig. 40). The Simpson's Diversity Index is calculated taking data around 0.1 ha of each hive. The average diversity index is 0.12 (max = 0.52, min = 0.75, median = 0.09). The average total number of species including shrubs are 150 (max = 477, min = 3, median = 127).

3.2 *Apis dorsata* (Hejjenu)

3.2.1. General description

Popularly known as rockbee, the name coming from its habit of nesting. *Apis dorsata*, the most common species of honeybees, makes single comb, hanging to the branches of big trees or stone walls, or even in some cases walls of big buildings. Nests are built in open but protected from direct sunlight and rain. Bees are bigger than the other species and hence are known as giant bee or *Hejjenu* in vernacular language. Honey extracted from these can be differentiated from the other type, as it is slightly bitter in taste.

3.3.2. Habitat requirements or nesting details

We have studied 16 **host trees** (*Pademara*) in the District. A **host tree** (*Pademara*) is tree used by *Apis dorsata*, to build its hives, in-group for years together. In case of such trees, they even neglect the security aspects, like close area of one side, which we can observe when they are in a single tree. The major characteristics (Table 63) observed in a host tree are:

1. It is the tallest among all other surrounding trees. Average approximate height of tree is calculated as 30.35 m.
2. The water sources must be near. Average distance of water sources from the all studied trees was found to be 218.8m with maximum of 500m and minimum of 10m.
3. Surrounding area should contain the floral sources.
4. In most of the cases, one side is covered or blocked. This might be to avoid the birds like honey eagle, which often attacks hives, and to protect the hives from wind and natural calamities (62%, N=49).

5. Clear ventilation and sunlight is preferred in most of the cases (90%, N=65).

6. Most of the trees are having more number of branches spread around with approximately 45° ± 10° angle of inclination to main tree. The maximum numbers of branches are 15, minimum is 4, and the average length is 3.52 m with a maximum of 5 m.

7. Average GBH of the tree was found to be 4.65 m with maximum of 11.70m at Donnekanu near Vanalli in evergreen type of forest and minimum of 2.20 at Savane, Chipgeri in dry deciduous forest.

3.3.3. Type of forest: Type of forest preferred by *Apis dorsata* was found to be dry deciduous type. The maximum density of *Apis dorsata* is 2.5/ ha in dry deciduous forests followed by evergreen (1.12/ha) and moist deciduous types (0.5/ha). There were no colonies in coastal forests (Table 66; Fig. 40).

3.3 *Apis florea* (Kolu jenu)

3.3.1. General description

A very rare species of *Apis* usually found in thickets of bamboo or other species in the forest of Western Ghats of Karnataka. These make single, small open combs, similar to those of *Apis dorsata*, but much smaller. Quantity of honey produced is also much less than other species.

3.3.2. Habitat

We were able to see only two hives during our study, one in a transect at Chipgeri and the other one on the banks of Aghanashini river near Golimakki. Type of forest in the former is dry deciduous and latter is evergreen type. But both the hives were found in thickets of bamboo. Length of comb was 8 cm and 12 cm, height from the ground level was 1.20m and 2.10 m and the diameter of the bamboo branches from which the hive was hanging was 12 cm.

3.4 *Trigona* (Dammar bees, Misari)

3.4.1. General description

A small, most common bee, usually known as *stingless bee*, *Trigona* is hardier than other species. The bees can be found in all parts of the Western Ghats. Unlike other

type of honeybees, they produce black wax. Honey is also slightly salty in nature. *Trigona* honey is believed to have medicinal properties. Usually these are not migrating and they make a tube like structure in front of the nest to avoid rainwater to enter into the hives in rainy season. They can even live in shelters of small area. Even though keeping in houses is not organised or popular, there are some persons who traditionally keep these in houses in bamboo hives and collect honey regularly.

3.4.2. Habitat

3.4.2.1. Nesting details: *Trigona* is adaptable to all type of natural habitats. Out of 22 shelters studied, two were in the walls of the house, one in old bamboo stick (Table 64). The preference of nest sites was found to be the standing trees 19 out of 22 shelters. The average height of the nest from the ground level is 3.97 m (sd =3.17, median = 4.50). The direction of entrance is towards west (N=12) followed by north (5), east (3) and south (2). The chamber position is above the entrance in 12 hives followed by below (8) and one each in perpendicular to ground level and covering both sides. Exposure to sunlight is avoided in most of the cases. Average length of the hive is 13.73 cm and breadth 10.18 cm, therefore area 146.41 sq. cm.

Distance from the water source is 556.64 m (median = 500) and average distance from human settlement is 566.64 m.

3.4.2.2. Type of forest: *Trigona* is found in all types of forests. The density of *Trigona* is maximum at moist deciduous forest with 1.25 / ha followed by 1/ha at dry deciduous forest, 0.76/ha in coastal and 0.5/ha in evergreen type of forests (Table 66; Fig. 40). The preferred canopy cover is between 1 and 2, or in other words, between 40% to 80 % of shade.

3.5 COMPARATIVE NESTING BEHAVIOUR

A comparative analysis of the nesting behaviour of the three honey bee species is presented in Table 65.

4.0 DENSITY OF HONEYBEES

4.1. *Apis cerana*: The density of *Apis cerana* colonies was highest in moist deciduous forests with 0.75 colonies/ha. It was higher in the evergreen type of forests with 0.5 colonies/ha than in the coastal type with 0.25 colonies/ ha (Table 66).

The number of expected shelters (Table 67) were more in evergreen type of forests

(28), followed by moist deciduous (22), dry deciduous (19), and coastal forests (13).

4.2. *Apis dorsata*: Density of *Apis dorsata* was higher in dry deciduous type (2.5 colonies/ha) of forest followed by moist deciduous (1.25 colonies/ha) and evergreen type (0.5colonies /ha) of forests (Table 67). We could not find even a single hive in coastal scrub forest.

4.3. *Trigona*: The density of *Trigona* was maximum in moist deciduous forests with 1.25/ha followed by 1/ha in dry deciduous forests, 0.76/ha in coastal and 0.5/ha in evergreen type of forests (Table 66; Fig. 40).

5.0 DISCUSSION

5.1. Type of forests and ecozones

The study clearly indicated that the type of the forest preferred by each type honey bee was different. We could not find even a single *Apis dorsata* colony in coastal areas whereas there were plenty of *Apis cerana* colonies even though there was no thick forest. As far as *Trigona* is concerned it seemed adaptable to all types of eco zones as well as situations of nest sites (Table 65).

The numbers of *Apis cerana* colonies were higher in the forests of semi-evergreen and moist deciduous types. As observed, it might be because of the availability of flowers throughout the year, either in evergreen or moist deciduous forests. As the calendar of major flowering plants in each ecozone shows (*cf.* Tables 8 - 13), it was the moist deciduous forest which had more number of flowering species than any other forest types. Even if we consider the other criteria, like availability of water sources, and suitable shelters, it was the mixed type of semi-evergreen and moist deciduous forests, which had more accessibility.

Number of colonies of *Apis dorsata* is more in the dry deciduous forests. The major reason for this might be, as was observed, the availability of suitable host trees (*Pademara*). Although the evergreen forests have the tallest trees, they do not satisfy the necessary conditions of a good host tree, as most of the trees surrounding the host tree prevent necessary ventilation and security.

5.1.2. Type of shelter: The type of shelters of *Apis cerana* and *Trigona* are comparable but the latter are smaller. The area inside the hive of *Apis cerana* is three times bigger than that of *Trigona*. *Trigona* prefers the hives in standing trees but *Apis*

cerana prefers the hives of dead and fallen trees. These usually provide the conditions preferred by them easily, as they might be having hollows (nest sites) made by woodpeckers or formed naturally. Trees like fallen Baine *(Caryota urens)* can provide these requirements readily. Besides these provide other conditions like low or no sunlight, protection from enemies, and space for upward movement of bees for making their nest.

5.1.3. Season of honey production: Optimum honey production is found to directly depend on the availability of the flowering plants. Honey production in Ghats region is maximum just before the arrival of the monsoon whereas in coastal areas it is minimum in that period. In crestline and upper Ghats region Matti *(Terminalia arjuna)* and Hunalu *(Terminalia paniculata)* are main sources of forage whereas in coastal areas Antwal *(Sapindus laurifolius)* is the major source. Besides flowers of coconut are available throughout the year.

5.2 STATUS HONEYBEES IN THE FORESTS OF WESTERN GHATS

5.2.2. Densities of honeybees hives are decreasing!

All the *expected shelters* taken into account in the study transect are the shelters, which were used by *Apis cerana* bees in earlier days. Honey hunters from whom we were able to identify these shelters have been collecting the honey from them for several years. Out of 82 *expected shelters,* only 7 (8.08%) were occupied by honeybees and remaining 28 shelters (35.52 %) were disturbed due to different reasons. But other 42 shelters (56.66%) were not occupied by any honeybee colony even though they were good enough to nest, satisfying all criteria of a good shelter (Figs. 44, 46). Also, collectors of honey from wild sources opined that, number of colonies in the wild was becoming less and quantity of honey available from wild was also decreasing considerably in recent years.

In case of *Apis dorsata*, out of 13 expected trees (host tree) two were destroyed (one fallen and in the other branches were broken); other 6 trees were without any *Apis dorsata* colony (Fig. 46). Even in the case of trees with *Apis dorsata* colonies, the number of colonies present this year (1998) was just 4.46%(17), which is much less than the maximum record (381) of honeybee colonies in earlier years.

5.3 REASONS FOR DECREASE OF HONEYBEES IN THE WILD

From the above discussion it is obvious that there is decrease in the number of honeybee colonies in the wild which clearly indicates that either the supporting habitats of this area or the density of honeybees must be decreasing. Major findings for decrease in honeybees in the wild are discussed below (*see* Fig. 43).

5.3.1.1. Shortage of flowers: In 1984, a *Pademara* in Donnekanu area near Vanalli supported more than 300 colonies of *Apis dorsata*. That was the year of *Gurige katte* (Gurige, belonging to the *Strobilanthes* group, has a life cycle of 8 years). For a honeybee colony, availability of flowers is a major criterion in building a hive. Some of our informants said that even if bees have occupied a hive and started making honey for months, if they find a shortage of flowers, they would leave the hive.

5.3.1.2. Seasonality of flowers also plays a major role in both quantity and quality of honey production. In coastal area, where, more flowers are observed for a large part of the year, flexibility in selection of shelter was observed. It was found that in this area *Apis cerana* make their hives in holes of walls and the pots put upside down on the trees.

It is observed that, quantity and quality of honey produced directly depends on the availability of flowers. But now-a-days, the available flowers are decreasing because of monocultured plantations *Acacia auriculiformis*, and weeds like *Eupatorium.*

5.3.1.3. Monoculture plantations like *Acacia auriculiformis* are a major threat/hazard to honeybees. These flower during November/December. Since more and more areas are being converted into *Acacia* plantations, it naturally resulted in decrease of diversity of plants like grasses, *Mimosa pudica*, and shrubs. Honeybees usually collect nectar from flowers of all these plants also. Hence although the flowers of *Acacia auriculiformis* attract honeybees, these can sustain only for a week or two, leaving the remaining days in a year without any flowers. To prepare the plantations all the existing ground vegetation is cleared eliminating the natural ***diversity of plants*** of that area.

Besides, *Acacia auriculiformis* trees start flowering only after 6-7 years of planting. But by this time, the existing vegetation would have been cleared. Hence these plantations can provide flowers only after six or seven years. Also as some of the experienced beekeepers said, honey prepared from nectars of these plants is not of

good quality compared with that from native plants. This indirectly results in low price for the produce.

5.3.1.4. Degradation of forest has resulted in decrease of natural forest area and species and indirectly resulted in **increase of weed species**. Weeds like *Eupatorium* are increasing because of this change of ecosystem. But flowers of *Eupatorium* do not attract the honeybees, as these do not have nectar in sufficient amounts. Besides, *Eupatorium* dominates over other flowering species in the undergrowth.

5.3.1.5. Seasons of flowering also affect honeybees. As disclosed by some of the honey hunters and beekeepers, it is in coastal belt of the district, honeybees produce comparatively higher quantity and good quality of honey uniformly throughout the year, as flowers like coconut are available for the whole year. Honey produced from flowers of Antwal *(Sapindus laurifolius)* is of good quality, lasts much longer, and hence fetches high price also. But production of honey decreases during the end of May whereas this is the peak time of honey harvesting for collectors in hilly region. Hence period of flowering is an important factor for both quantity and quality of honey.

5.3.2. Destruction of habitat and shelters/nest sites: Along with the decrease of natural forest, the natural habitat, which is essential to the very existence of honeybees in the wild, is itself decreasing rapidly. Each honey bee species prefers a. specific type of ecosystem. As discussed in the earlier sections, it is found that, even though the District has natural forests in all ecozones the population density of each type of honey bee is different in different ecozones.

The major reasons for depletion of natural forests as well as the natural habitat of honeybees are:

1. Extraction of dead and fallen trees
2. Fire
3. Unsustainable harvesting of honey
4. Logging and collection of other forest materials.

5.3.2.1. Extraction of dead and fallen trees: It is found from our study that dead and fallen trees are more attractive (42 per cent) shelters for *Apis cerana* than any other type of shelters (Fig. 41). More number of nest sites created is in dead and fallen trees

by either woodpecker in search of their food, or formed naturally. Honeybees use these shelters usually as their nest sites. In most of the cases, these dead and fallen trees are collected by villagers for fuel-wood or by contractors of Karnataka Forest Department (KFD). KFD gives contracts to contractors to extract dead and fallen trees. Contractors collect all dead and fallen trees from the forest. Hence, the most favourite shelters of *Apis cerana* are decreasing in the wild.

5.3.2.2. Logging: Logging by Forest department or others decreases the suitable nest sites for honeybees. Besides, in the process of logging, the canopy-cover decreases which affects the habitat of honeybee. About nine (32 per cent) of total disturbed shelters were caused by degradation of forests only.

5.3.2.3. Fire: As discussed earlier, and also found from our study, dead and fallen trees have more number of nest sites. The dry wood catches fire easily and hence the nest sites will be destroyed. Out of 28 disturbed shelters, in our study area, 4 (14.28 per cent) of them were destroyed by fire.

5.3.2.4. Unsustainable harvesting: Out of 28 disturbed nest sites 21.43 per cent were caused by unsustainable harvesting (N=6). Unsustainable harvesting includes cutting the entrances of nest site bigger, which allows water enter into it and exposes the colony to predators, or cutting down the whole tree, branches etc. Our study of habitats clearly indicated the requirements for each type of honey bee species. As discussed earlier, for *Apis cerana* a nest site must be having certain specific conditions. If such conditions are satisfied then only a colony can occupy the same nest site for several years. There are some nest sites which were occupied by *Apis cerana* for more than fifteen years. A good hunter of wild honey, takes care to retain the original condition of the nest after the harvest, so that water does not enter into it. Even if the canopy cover of the surrounding area changes, honeybees use that hive.

As nest sites are in thick forest, and are accessible for anyone, there is always a competition among collectors to collect as much as possible within minimum time. In some cases most of them don't know how to safeguard the hives after collecting the honey.

Use of fire to dislodge honeybees from the comb while collecting honey may kill many worker bees and in some case even the queen. But well-experienced honey hunters can collect honey with their bare hands without using fire at all. In case one

has to cut the entrance of the nest to make a bigger hole to collect the honey, he restores the original diameter of the nest entrance, by filling it with wood or stones.

In case of *Apis dorsata* the bigger trees which are essential for supporting nests are getting lost with increasing degradation of forest and changes in ecosystem. The branches of the barren and lonely trees are breaking down during heavy wind or as they are becoming old and no alternative trees are growing to replace the *host tree* (*Pademara*).

Collection of other non timber forest products (NTFP) like flowers of Suragi (*Mammea suriga*), Dalchinni (*Cinnamomum zeylanicum*) may affect honeybees as these are the among major flower sources of nectar for honeybees and collectors cut the branches of the trees, in most of the cases, to collect the product.

5.3.3. Change of ecosystem: As discussed earlier the whole ecology of the area itself is changing. The areas under monoculture plantations are increasing in the name of afforestation. *Acacia auriculiformis*, *Eucalyptus* and *Mangium* are good examples of the same. As more and more degradation of forest takes place, weed species like *Eupitorium* and *Parthenium* are increasing. Thus the natural diversity of the area is decreasing and worsening.

5.3.4. Diseases: We could not get any direct evidence of the effect of decrease of honeybees in the wild. However, there were indirect indicators like abrupt decrease of honeybees in the last two to three years and severity of diseases among domestic honey boxes, clearly indicating that diseases could be one of the reasons for decrease of honeybees in the wild.

5.3.5. Natural enemies or predators: Honey hunters informed that lizards, bee-eaters, and *bhandarmadike hulas* (wasps) often prey upon bees. However, this does not seem a severe problem.

5.4. Conclusions: There is a continuous decrease in density of honeybee colonies in the wild owing to reasons like depletion of natural forest and thereby decrease of flowering plants, disappearance of bee nest sites and spreading of virus diseases. Monoculture plantations, increases of weeds, change of agriculture cropping pattern are changing the ecosystem of the area itself. These are affecting adversely the habitats of honeybees.

10.0 RECOMMENDATIONS

Avoid:

1. monoculture plantations
2. cutting of undergrowth while making plantations
3. forest fire
4. logging and lopping
5. Extraction of dead and fallen trees; alternatively provide additional nest sites like clay pots.

Promote:

1. multipurpose plantations with native species
2. natural regeneration
3. More flowering species in plantations so as to supply flowers around the year.

For beekeepers:

1. Develop and promote disease resistant varieties of honeybees.
2. Develop proper marketing channels.
3. Training.

For wild bee hunters:

1. Develop sustainable harvesting methods; maintain harvesting level for sustainable colony development
2. Sustainable maintenance of nest sites after collecting honey
3. Introduce appropriate technology for tools and techniques for harvesting honey
4. Organise honey hunters and beekeepers to

    a) share the knowledge among them

    b) develop proper marketing channels

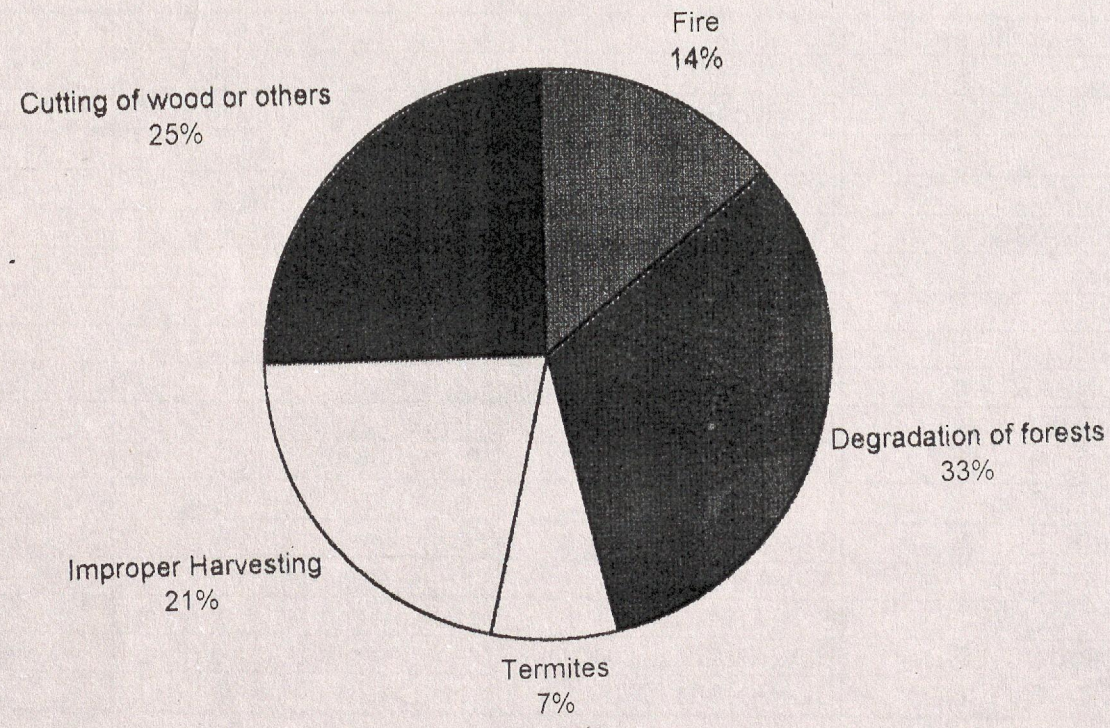
Protect:

1. Natural forest
2. Host trees (pademara)
3. Trees like Baine *(Caryota urens)*, *Terminalia paniculata* etc, and other flowering species.

Further areas of study:

1. attraction of flowers or pollination mechanisms
2. effect of traditional methods of harvesting on honeybees
3. seasons of flowers and quality of honey produced

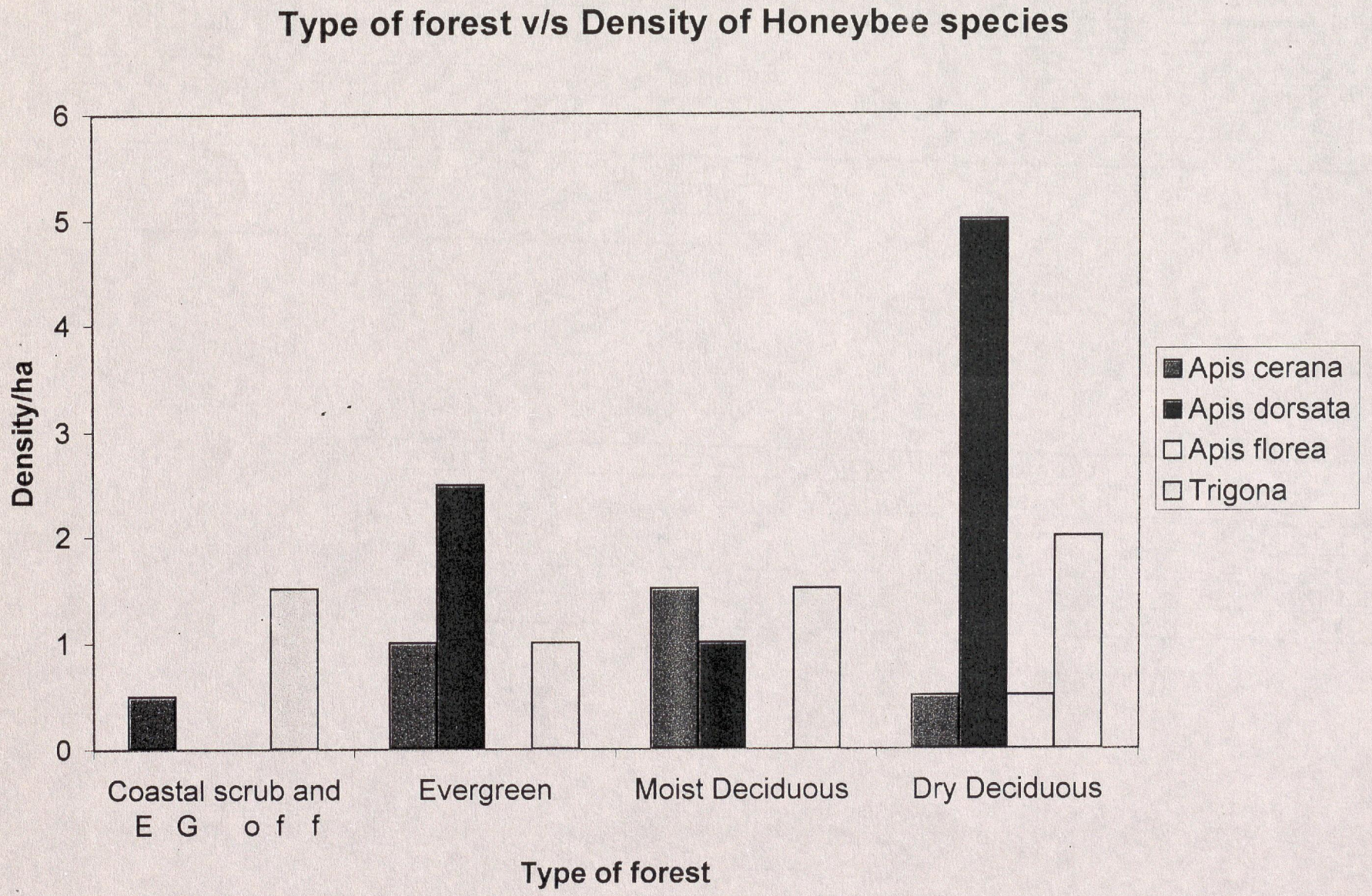
Reasons for Destruction of nesting sites of Apis cerena



Charicteristics of Apis dorsata hives in study areas

Continued to..

Type of ecozone	Name of the area	Location	Name of the tree	No of colonies		
				at present(1998)	Maximum	Year
Ecozone - 1 Coastal scrub		No colonies of Apis dorsata were found in this zone				
Evergreen forest Ecozone -2	KAKKALLI	DONNEKANU	Bilisari (local name)	9	300	1984
	KUDRAGOD	KELASE	*Terminilia paniculita*	5	75	1992
	ANSHI	ANSHI	Not identified	16	150	1996
Moist deciduous forest Ecozone -3	MUREGAR	SANMANEGADDE	*Terminilia tomentosa*	3	29	1984
	GONSAR	TULSI KUMBRI	*Terminilia paniculita*	2	15	1984
	GONSAR	TULSI KUMBRI	*Lianceolata*	1	20	1984
	HALLIBAIL	HALLIBAIL	*Alstonia scholaris*	9	150	1984
	MAGOD	JENAKALLU GUDDA	(Stone wall)	16	NA	NA
	MAGOD	HARIMANE	Caralia sp	1	2	1996
Dry deciduous forest Ecozone -4	CHIPGERI	SAVANE	Terminilia paniculita	1	2	1996
	CHIPGERI	SAVANE	Terminilia paniculita	1	4	1996
	BORANAGUDDA	BORANAGUDDA	Madivala mara (local name)	2	15	1996
	BORANAGUDDA	BORANAGUDDA	Madivala mara (local name)	8	200	1996
	BORANAGUDDA	BORANAGUDDA	Heddi mara (local name)	2	25	1996
			Average=	5.43	75.92	


Type of forest v/s Density of Honeybee species
Density/ha
6
5
4
3
2
1
0
Coastal scrub and E G o f f
Evergreen
Moist Deciduous
Dry Deciduous
Type of forest
Apis cerana
Apis dorsata
Apis florea
Trigona

Densities of Honey bees in different Ecozones

Name of ecozone	No. of colonies of honey bee species			Density of honeybee species/ha		
	Apis cerana	Apis dorsata	Trigona	Apis cerana	Apis dorsata	Trigona
Ecozone-1, Coastal-scrub	1	0	3	0.25	0	0.75
Ecozone-2, Evergreen	2	5	2	0.5	1.25	0.5
Ecozone-3, MDF	3	2	5	0.75	0.5	1.25
Ecozone-4, DDF	1	10	4	0.25	2.5	1
			Average=	0.4375	1.0625	0.875
			sd =	0.239356777	1.087332363	0.322749
			Median=	0.375	0.875	0.875

Status of hives of Apis cerana in study transects

Name of ecozone	Total no of holl	Hollows with	Disturbed	Hollows without
	in transect	Honey Bees	Hollows	Honey Bees
Ecozone-1, Coastal-scrub	13	1	7	5
Ecozone-2, Evergreen	28	2	8	18
Ecozone-3, MDF	22	3	5	14
Ecozone-4, DDF	19	1	8	10

Charicteristics of Apis dorsata hives in study areas

Continued from..

GBH OF tree in mts	Height of the tree (mts)	Branching		Distance from water source (in mts)	Distance from Human settlement (in mts)
		Numbers	length in mts		
11.7	46.8	14	4	100	200
8.5	35	9	4	150	500
2.6	30	8	3	500	100
2.69	36	13	3.5	10	50
2.39	20	7	2.5	20	200
2.41	32	10	3	20	200
2.72	34	15	4	50	350
NA	NA	NA	NA	NA	NA
2.99	15	5	5	200	300
2.4	25	4	3.5	200	350
2.2	34	4	2.75	350	200
3.1	30	5	4	500	300
7	26	10	4	500	300
6	25	11	3	500	300
4.36	29.91	8.85	3.56	238.46	257.69

Table-65

Comparitive analysis of charecteristics of honey bee species

		Apis cerana	Apis Dorsata	Trigona
1	GBHof the tree in mts	1.0741	4.36	0.17158
2	Distance from water source (m)	271.9	238.46	418.4
3	Distance from human settlement(m)	974.76	257.69	566.636
4	Canopy cover of the forest	2 or 80%	3 or 80%	1.13 or 40 to 80%
5	Height of the hive from the ground level (m)	2.62	29.906	3.972
6	Direction of entrance of the hive	West (47%)	NA	West
7	Length of the hive (m)	1.114	NA	0.13
8	Breadth of the hive (m)	0.245	NA	0.101
9	Total area inside the hive (sq.mts)	0.2786	NA	0.01313
10	Diameter of entrance of hive	0.0702	NA	0.01682
11	Preferred hive type	Dead and fallen tree(	NA	Standing tree
12	Chamber position: below/above entrance	Above the entrance	NA	Above the entrance
13	Maximum no. of years,honey collected from sam	15 years	NA	15
14	Average no of branches of tree with honeybee	NA	8.84	NA
15	Average maximum length of branches (m)	NA	3.558	NA
16	No of colonies in one tree: maximum	NA	300	NA
17	No of colonies in one tree: minimum	NA	1	NA
18	Approx. angle of inclination of branches	NA	45+_ 10 deg	NA

DETAILS OF HABITATS OF TRIGONA IN STUDY AREA

Continued to 2

Hive No.	Name of the area	Type of hive	Name of the tree	Botanical name	GBH of tree	Entrance Direction	Chamber Position
1	Kvalakki	Standing tree	Challe	Not known	76	WEST	Both side
2	Kvalakki	Standing tree	Suragi	*Ochracarpus longifolis*	45	EAST	Below
3	Karki	Wall of a house	NA	NA	NA	NORTH	Above
4	Antravalli	Standing tree	Nandi	*Cedrala toona*	58	SOUTH	Above
5	Antravalli	Standing tree	Mullusampige	Not known	59	WEST	Below
6	Nilkund	Standing tree	Haiga	*Hopea*	65	WEST	Below
7	Nilkund	Standing tree	Nandi	*Cedrala toona*	80	WEST	Above
8	Anshi	Standing tree	Haiga	*Hopea*	56	WEST	Below
9	Anshi	Standing tree	Bilibasari	Not known	145	NORTH	Below
10	Vanalli	Standing tree	Matti	*Terminilia arjuna*	120	WEST	Above
11	Vanalli	Standing tree	Matti	*Terminilia arjuna*	80	NORTH	Above
12	Magod	Wall of a house	NA	NA	NA	WEST	Above
13	Magod	Standing tree	Matti	*Terminilia arjuna*	86	Eeast	Above
14	Magod	Standing tree	Kaulu	Not known	110	WEST	Below
15	Magod	Standing tree	Hebbalasu	*Artocarpus sp.*	120	NORTH	Below
16	Magod	Old bamboo	Bamboo		125	SOUTH	Perpe
17	Magod	Brink of stone	NA	NA	NA	WEST	Above
18	Chipgeri	Standing tree	Matti	*Terminilia arjuna*	130	WEST	Below
19	Chipgeri	Standing tree	Matti	Terminilia arjuna	105	WEST	Above
20	Boranagudda	Standing tree	Bilibasari	Not known	600	WEST	Above
21	Boranagudda	Standing tree	Bilibasari	Not known	600	EAST	Above
22	Boranagudda	Standing tree	Bilibasari	Not known	600	NORTH	Above

171.5789

Continued from.1

DETAILS OF HABITATS OF TRIGONA IN STUDY AREA

Height from ground level	Diameter of entrance(cms)	Length of the hive(cm)	Breadth of hive in cms	Total area inside hallow sq. cms	Canopy cover	Distance from waterbody in mts	Distance from human settlement in mts
670	2	16	6	96	0	100	15
700	1	10	5	50	1	200	150
650	1	8	6	48	0	5	1
15	2	12	7	84	2	500	1000
450	2	10	5	50	2	600	2000
750	1	12	8	96	1	50	60
500	2	16	9	144	0	100	150
200	1	11	6	66	2	200	50
100	2	15	25	375	3	600	140
150	1	20	10	200	2	500	600
100	2	10	10	100	1	250	600
750	2	10	6	60	0	100	50
1200	1	15	10	150	2	500	1500
450	2	20	6	120	2	100	300
600	2	14	9	126	2	800	450
200	1	15	9	135	2	300	1200
500	2	25	19	475	1	300	600
500	2	15	10	150	1	500	600
10	2	12	13	156	1	500	1500
100	2	12	15	180	0	1000	500
120	2	12	15	180	0	1000	500
25	2	12	15	180	0	1000	500
397.2727273	1.681818182	13.72727273	10.18181818	146.4090909	1.13636	418.4090909	566.6363636

Characteristics of Apis cerana hives in study areas

Continued to ...

Hive.No.	Name of the Ecozone	Name of the area	Type of hive	Name of the tree	Botanical name	GBH of tree	Entrance Direction	Chamber position
1	Ecozone-1	Kvalakki	Standing tree	Gerejalu	Not known	103	WEST	Below
2	Coastal scrub	Karki	Inverted pot	NA	NA	NA	EAST	Above
3	and evergreen		Dead/Fallen tree	Baine	*Caryota urens*	90	SE	Above
4	of foothills	Antravalli	Standing tree	Challe	Not known	80	EAST	Above
5			Dead/Fallen tree	NA	NA	86	WEST	Above
6	Ecozone-2	Anshi	Standing tree	Nandi	Cedrala toona	60	WEST	Below
7			Dead/Fallen tree	Baine	*Caryota urens*	95	South	Above
8		Nilkund-	Dead/Fallen tree	Baine	*Caryota urens*	90	WEST	Above
9	Evergreen		Standing tree	Nandi	Cedrala toona	120	South	Above
10	forest		Dead/Fallen tree	Haiga	Hopea	85	EAST	Above
11			Standing tree	Nandi	Cedrala toona	110	WEST	Below
12			Hutta(Termite)	NA	NA	NA	WEST	Above
13			Standing tree	Matti	Terminilia arjuna	135	EAST	Above
14	Ecozone -3	Vanalli	Dead/Fallen tree	Baine	*Caryota urens*	90	North	Above
15			Anthill	NA	NA	NA	WEST	Above
16	Moist	Magod	Dead/Fallen tree	Kaulu	Not known	112	WEST	Above
17	Deciduous		Standing tree	Hebbalasu	Artocarpus sp.	225	EAST	Below
18	Forest		Standing tree	Honalu	Terminila paniculita	110	EAST	Above
19			Dead/Fallen tree	Nandi	Cedrala toona	115	WEST	Above
20	Ecozone-4,	Boranagudda	Dead/Fallen tree	Nandi	Cedrala toona	120	NE	Above

107.4118

Characteristics of Apis cerana hives in study areas

Continued from ...

Height from the ground level	Diameter of entrance	Length of the hive cms	Breadth of hive cms	Total area inside hallow sq. mts	Canopy cover	Distance from waterbody	Distance from human settlement
900	4	100	20	0.20	1	300	300
600	8	140	25	0.35	1	50	10
45	3	120	21	0.25	2	200	500
50	4	150	22	0.33	3	200	100
15	6	60	27	0.16	3	800	1800
60	8	70	26	0.18	2	500	1000
40	15	90	15	0.14	3	600	1000
45	14	70	14	0.10	2	150	1500
49	5	60	21	0.13	3	100	2000
20	3	125	18	0.23	2	200	300
90	5	145	20	0.29	3	10	3000
5	10	125	24	0.30	2	500	4000
60	5	70	28	0.20	1	200	300
45	10	70	26	0.18	2	150	1500
45	3	140	22	0.31	2	100	200
48	3	90	28	0.25	2	200	300
3000	4	150	30	0.45	2	250	300
120	2.5	135	31	0.42	2	100	250
125	4	140	22	0.31	2	500	600
110	6	145	30	0.44	2	500	1500
Average= 273.6	6.125	109.75	23.5	0.259975	2.1	280.5	1023

CASE STUDIES OF HONEY HUNTERS

Case study 1:

Name: Gappu. Dyava. Gowda
Village: Mulgund
Taluk: Siddapur, Dist: Uttara Kannada

A tall dark looking man, Gappu is constantly watching the sky for the last one hour, oblivious to the blazing noon sun profuse sweat on his chest. When we ask him about the unseen object he is looking for in the sky, he replies, without turning his face to us: "Honeybees".

He is looking for *Apis cerana* hives in the forest.

The paths of honeybees on the way to collect pollen can be identified in the sunlight of mid day. That is why he is looking at the sky concentrating on the unseen object.

Gappu, a peasant from the karivokkaliga community is an expert in honey hunting from *Apis cerana*. He has been collecting honey from his childhood. Every year he used to collect about 50 to 60 kg of honey from the wild only of *Apis cerana* small quantity of *Apis florea and Trigona,* but not *Apis dorsata*.

Honey Harvesting Techniques: Usually he never uses any smoke to scatter the honeybees. He can sense the mood of the bees by looking at them, and judge if they sting heavily or not. According to him black bees are more aggressive than the lighter ones. He just widens the entrance of the hive so as to put his hands in it to collect combs of honey. Most of the time as he has been collecting honey from the same area and same shelter for a number of years, the entrance is quite often big enough to put his hands in, just after removing the stone which he put last year. He does this after collecting the honey to maintain the original diameter of the hive entrance.

The tools he uses for collecting honey are very simple. Only a Katti (knife) and a rope (if the hive is higher from the ground level).

He never collects honey on Monday, as it is the day of lord Shiva.

Experiences Of Honey Harvesting: He is worried about the decrease of honey bee colonies and also the quantity of honey available from each hive. As he analyses, the reasons are decrease of flowering species and unsustainable harvesting. He correlates the climatic variations like low rain, short winter with flowering of plants like mango, uppage and others.

Collection of Marketing of Honey: During the last season (May 1996) he collected about 35 kgs of honey from *Apis cerana*. He sold about 30 kg at the price of Rs 55 per kg to local people and consumed the rest at home. The beekeepers' co-operative society, according to him, pays less and they complain about the quality of wild honey. He does not use any machine or filter while extracting honey from the comb.

He also collects colonies from the wild and sells them to the beekeepers who have boxes at home at Rs 50 per colony from them. He collects only the queen in his hand, and rest of the workers and males will group around her and he brings the colony to village to fill in the boxes.

Nowadays number of honeybee colonies he can identify in the wild is low compared to earlier days.

CASE STUDIES OF HONEY HUNTERS

Case study 2:

Name: Seena Siddi
Village:Hiresara
Taluk: Yellapur, Dist: Uttara Kannada

A dark looking old man with swirled hair, Seena Siddi, has been wandering in the forests of Bedthi Valley, from forty years. He knows every knock and corner of this forest. When we decided to spend a day with him in the forest, it was one of the hottest days May.

Siddis are the Negroid communities residing in the forest region of Yellapur and Sirsi taluk, of Karnataka. They can be identified with their swirled hair.

Seena, a peasant from the siddi community is an expert in honey hunting from *Apis cerana*. He took us to deep inside the forest. He has been collecting honey from forty years. Every year he used to collect about 40 to 50 kg of honey from the wild only of *Apis cerana,* but not *Apis dorsata*.

Honey Harvesting Techniques: He just widens the entrance of the hive so as to put his hands in it to collect combs of honey. Most of the time as he has been collecting honey from the same area and same shelter for a number of years, the entrance is quite often big enough to put his hands in, just after removing the stone, which he put last year. He does this after collecting the honey to maintain the original diameter of the hive entrance.

He showed us the sustanable harvesting technique by harvesting from one of such old shelter. He removed the pieces of stone heput last year and collected only honey bearing combs from the nest.

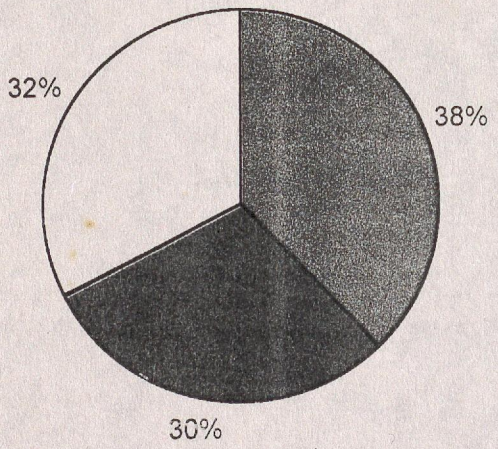
The tools he uses one Katti (knife) for collecting honey.

Experiences Of Honey Harvesting: He is worried about the decrease of honeybee colonies and also the quantity of honey available from each hive. He shared the experience of seeing dead bees inside the shelter itself.

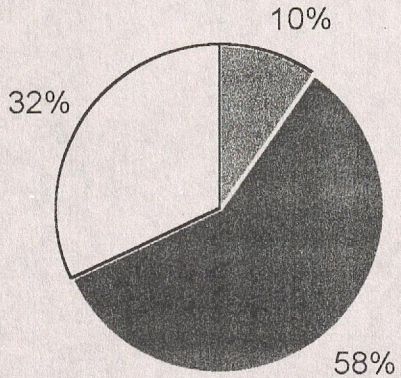
Collection of Marketing of Honey: During this season (May 1997) he collected about 30 kgs of honey from Apis cerana. He sold at the price of Rs 60 per kg to local people. He also collects colonies from the wild and sells them to the beekeepers who have boxes at home.

Nowadays number of honeybee colonies he can identify in the wild is low compared to earlier days. He is worried about the shortage honey colonies in the wild, as his depends on them.

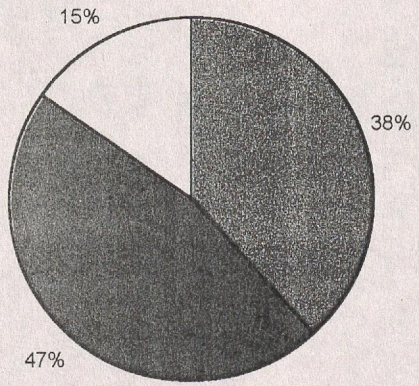
Status of hives of Trigona



Status of hives of Apis cerana



Apis dorsata (trees)



Sheletrs with honeybees Shelters without honeybees Disturbed shelters

Case study –3

Name of informants: Ananth, Yasoovanth, Mahadeva, Shaba, Datta, Sairu

Village: Anshi

Taluk: Joida

District: Uttara Kannada, Karnataka, India

Anshi is a village situated on the crestline of Western Ghats, surrounded by evergreen forests. Recently areas of about 275 ha have declared as Anshi National park. Communities like Kunbis and Desai's have been living in the area. Kunbis are tribes still living with primitive conditions. They have been collecting honey from *Apis dorsata* and beekeeping is not practiced by tribal group.

Availability: As the area is surrounded by rich natural forest, there are number of *host trees* for *Apis dorsata*. There are eight host trees in surrounding forest viz., Matti (*Terminalia arjuna*).

Harvesting - Honey is harvested by the similar procedure as explained in other case studies.

Worshipping and tenurial security: Each and every tree is allotted for particular family in the natural forest traditionally. Those particular family members only can harvest the honey from the tree.

Honey is harvested after making poojas (Worshipping). Poona will be performed using coconut, incense sticks, oil, flowers, etc. After the Poona two chickens will be cut before the tree.

Usually pooja will be performed in a single place and later honey will be collected. Advantage of such Pooja is that, only ripe honey can be harvested. Day of Pooja will be selected so as to get only ripe honey. Honey is becoming ripe, just before the arrival of Monsoon.

Marketing: Marketing is not organised. Some of the dealers from Dndeli, a nearest city, have been coming for purchasing honey. But they give very less price compared to other market. Last year, a NGO working in this area tried to help these tribes for marketing. But some of the assured dealers/ processors failed to purchase the honey. Thus there is about more than 250 KGs of honey left behind with them even after a year of collection. Since this is not processed, there is every chance of getting wasted.

Unlike tribes op Heggada Devana Kote taluk, in Mysore, these tribes have authority over a particular tree inside the forest traditionally. But Jenukurubas have to identify each year

7.0 TROPICAL FORESTS AND HONEYBEES

Tropical forests are warehouses of diversity of flora and fauna. The evolution of plant and insect diversity is closely interlined in this region. In comparison to temperate forest ecosystem, the tropical rain forests has helped to evolve diversity honey bee spices like *Apis dorsata, Apis cerana* and *Apis florea*. There is vast scope to study new species of stingless bees in the tropical forests of Western Ghats.

Honeybees have evolved with the plant diversity. Recently the studies conducted on pollination of cardamom have shown the major role played by *Apis cerana* in pollination of cardamom as well as other agricultural and horticultural crops. Nevertheless the data on the role of honeybees in conserving the plant diversity, especially the linkage in pollination is very crucial from the view point of conservation of biodiversity.

While contributing towards enhancement of biodiversity, honeybees constitute a resource to provide employment and cash income to forest dwelling tribes. Through it is very risky and tough job, the linkage of honey hunters to overall tropical forest ecosystem is harmonious in nature. This harmony is reinforced through practice of tradition and rituals.

The recent trends in tropical deforestation have caused irreparable damage to the biodiversity of the region and specifically in reduction of honeybees in the tropical forests.

The following are the main factors affecting honeybees tropical forest.

Destruction of natural tropical rain forests

The trend in destruction of natural forests has increased over last 200 years. Initially the natural tropical rain forests were replaced to grow plantation crops like tea and coffee. The process of conversion of land-use from natural forests into commercial plantations reduces the diversity of plant spices. This has direct impact on honeybees as the availability of diverse foraging base gets reduced. The coffee estates do provide foraging opportunity during flowering season. However in comparison to natural tropical forest, the foraging in coffee plantation is limited and lasts for a shorter period.

Monoculture plantation

The process of clear felling of natural forests, and replacing by monoculture with teak, *Eucalyptus* or other exotic species has been a major factor in reduction of biodiversity and specifically for destruction of the habitat of honey bee species. In the tropical forests of Western Ghats, the natural forests provide ideal nesting site for *Apis dorsata*, *Apis cerana* and *Apis florea* colonies. The narration of the history of the area selected from elderly people in the region indicate the reduction of nesting sites (due to clear felling) and an overall reduction of honey bee species in the tropical forests of Western Ghats.

The forest policy and timber concessions

The commercial orientation of the forest policy is geared towards the sole objective of earning revenue from timber. The large scale logging activities and allowing timber concessions to forest based industries has led to destruction of large trees that were the ideal habitat for *Apis dorsata* colonies. The destruction of these large tree species has destroyed the nesting sites of honey bee species.

Due to the pressure from environmental movements the government has changed its forest policy. The clear felling of natural forests for monoculture plantations, and timber concessions is abandoned. Nevertheless, the present policy of removal of dead and dry trees from the tropical forests of Western Ghats is causing further destruction of the nesting sites of the honeybees, *Apis cerana* and *Apis florea*. Dead logs and dry trees provide an ideal nesting sites for honeybees. Unfortunately, the honey bee populations suffer adversely as they are removed.

Destruction of tropical rain forests and honey hunters

The deforestation of tropical forests has had negative impact on honey hunters. The dwindling resources of these forests make it very difficult for the honey hunters to get adequate cash income from collecting wild honey. As the nesting sites are destroyed and foraging plants are felled, the population of honeybees in the wild gets reduced, effecting the lives of forest dwelling tribes/indigenous people.

The above factors are some indicators to roughly assess the impact of tropical deforestation in Western Ghats on honeybees and honey hunters. Nevertheless, the loss of biodiversity is irreversible and there is an urgent need to establish a scientific

linkage between the honey hunters and enhancement of biodiversity.

8.0 MARKETING

A. Local sales and Consumption

In most cases, the beekeepers sell their honey locally at a premium. They get higher price than the price offered by beekeepers societies. Most consumers buy locally because they are assured of the quality. In tropical forests of Western Ghats, the honey produced by the beekeeper is less and it is not able to meet the demand. Many beekeepers who keep one or two colonies use the honey for household consumption.

B. Beekeepers societies

Beekeepers' societies are one of the main players in marketing of honey and beeswax (Figs. 12, 13). These co-operative societies were established with one of their main objective as collection of honey from beekeepers at reasonable price and marketing of honey. The recent trends indicate that there is great demand for quality honey harvested from boxes. However, the supply is short of meeting the ever-increasing demand. Making use of this opportunity, many beekeepers are opting out of co-operatives. At present these societies purchase honey in bulk from various sources. The major source in Western Ghats is:

a) honey from *Apis dorsata* colonies

b) Honey brought from northern and eastern parts of India, basically *Apis mellifera* honey.

The societies are purchasing the honey as mentioned above and after processing they label the honey as locally produced; obviously this is a fraud on the consumers, who buy the honey assuming that is of good quality and locally produced.

After the appearance of TSB the production figures of honey for all societies (from 1992) shows a declining trend (Fig. 13).

This shows that there is no locally produced honey. But in order to survive these societies manage to purchase honey from outside.

Beekeepers' societies have lost their relevance in marketing the honey. Besides, it is also learnt from the study that the profit earned by beekeepers co-operative societies

is not same; in some cases it is as high as Rs., 35 to 45, which is more than 60% of the buying rate from the beekeepers (Table 45 b; Fig. 38). Some of the beekeepers complained about the services offered by the Societies. Even though most of the Societies claimed that they were giving training to beekeepers, it is evident that such a training was not regular and was inadequate in meeting the needs of an ordinary beekeeper.

C. Apis dorsata Honey

Fig. 47 shows the production of honey and beeswax from forests in the State during 1993 - 1997. Most of it was from *Apis dorsata*. Honey production was over 50 tonnes in 1995-96; but declined in the following year. The case study of honey hunters explains some reasons for the declining honey output.

Almost 75 per cent of the honey produced in India and coming into market is honey harvested from *Apis dorsata* colonies. This provides income to poorest forest dwelling tribes. However the price variance between the honey hunter and the consumer varies; it enhances in upto 100 per cent. Thus, the price the hunter gets after risking his life is not even 10% of the money paid by consumer. This shows the exploitation of honey hunters by the middleman. Some large scales *Apis mellifera* honey producers in the northern part of India have given a call to ban the sale of *Apis dorsata* honey. This is not only impractical, but it will have negative impact on the forest dwelling groups who are engaged in honey hunting. On the other side, in India the honey supply in the market is satisfied by *Apis dorsata* honey. The role of *Apis dorsata* honey can not be undermined.

D. Honey Market

India is facing a paradoxical situation. There is an increasing demand for good quality of honey for religious and consumption purpose. However there is no supply of honey to meet the increasing demand for honey. Indian drug companies (e.g., Dabur) or even Indian multinational (e.g. TATA) have entered into the honey market, to capture the sales. Their final product is almost 100% costlier than the local market rate. Inspite of this high cost, people prefer to buy this honey linking it to the established brand names. In reality these companies collect, *Apis dorsata* or *mellifera* honey and process them. For this, they extract heavy price, making it difficult for ordinary Indian to by honey, as the price is high.

There is higher production of honey in northern parts of India. This is basically *Apis mellifera* honey. They do not have the market and due to the glut in honey production, it fetches low price. As there is shortage of honey in southern India (due to TSB) the honey flows from North India to South India.

Nevertheless, there exists the practice of adulteration of honey in the Indian market. People have evolved various ways to adulterate honey making it difficult for even the experts to detect the adulteration.

In this situation we can conclude that through there is great demand for honey in India, the present trend of adulteration of honey products would threaten the goodwill of beekeeping industry.

9.00 TRAINING AND EXTENSION NEEDS

The state government as well as Khadi and village Industries Board claim to provide training to people in beekeeping. Unfortunately, most of these training programmes provide only an exposure rather than imparting practical skills. Training syllabus does not include practical aspects. It is not conducted when the beekeeping activity is going on. Thus, there is no hands on training to trainees. Government provides capital and equipment after this training. Nevertheless, the trained people are incapable of practical beekeeping.

The training at present is an eyewash to meet the targets laid down by the officials. Thus target-oriented approach is a hindrance towards inspiring genuine interest among prospective beekeepers.

The answer lies in proper identification of people and imparting practical aspects of handling bee colonies. This is crucial to enthuse the trainees and evoke sustained interest. The training given should be precisely during the bee activity season. By this the trainees learn a lot.

The Central Bee Research and Training Institute (CBTRI) has excellent experience in training people on the practical aspects of beekeeping. It is essential to utilise this expertise of CBRTI.

10.0 CONCLUSIONS

10.1 BEEKEEPERS' COOPERATIVE SOCIETIES

- Beekeepers co-operative is an important institution to assist beekeepers and in developing apiculture.
- Though there is large membership in societies, the members are not practical beekeepers.
- There is discrepancy in the data in which the number of colonies kept by members own does not correlate with the reality; though there are bee boxes, actual colonies kept is low.
- The equipment supplied by societies is of low standard.
- The quality of honey sold by societies is not reliable.
- The societies are functioning as middleman to market honey. Their extension activity is not effective.
- The training giving does not make a person capable of beekeeping

10.2 BEEKEEPERS

- Beekeepers are mostly from middle age group and are educated on an average the honey yield is 5 kg per colony per year. The number of bee colonies kept by beekeepers is decreasing. They follow some management practice. However this is not sufficient to manage the migratory beekeeping.
- Beekeepers sell *Apis dorsata* honey as *Apis carana* honey to beekeeper society.
- Most of the beekeepers bring wild colonies and try to keep them in boxes.
- As the beekeepers are not given technical know how/skills to manage the bees, the colonies frequently migrate causing problems in beekeeping.
- The arrival of TSB has destroyed beekeeping in the region.

10.3 EXOTIC BEES

- The performance of *Apis mellifera* has been dismal. They have neither produced honey nor have they established themselves in tropical rain forests of Western Ghats.

- It is costly and, unlike *Apis cerana* it is not available locally. It needs to be purchased from outside paying cash.
- It requires large area of, for foraging. The diversity of tropical forests is a deterrent factor for *Apis mellifera* in Western Ghats.
- It is threatened by mites, pests and disease; needs constant management and frequent medication. Thus it is beyond the comprehension of the ordinary beekeeper.
- High input of supplementary feeding (sugar) is required during lean season.
- *Apis mellifera* colonies can not survive in the wild.

10.4 ECOZONE STUDY

- Removal of dead logs by KFD threatens destruction of nesting sites.
- Honey hunting techniques destroyed nesting sites.
- Fire: Accidental fire results in destruction of nesting sites.
- Monoculture plantations: monoculture plantations reduced the flowering species and changed the calendar of availability of flowers in region.

10.5 PESTS, PREDATORS AND PESTICIDES

- Indiscriminate use of pesticides is a great threat to beekeeping in the tropical forest.

10.5 TROPICAL FOREST AND HONEYBEES

- Honeybees enhance the diversity of Tropical Rain Forests
- Forest policy has adversely affected honeybees.
- Monoculture plantations have destroyed honeybee nesting sites and foraging resources.
- Tropical Rain Forests can provide sustainable base to develop beekeeping and provide employment for forest dwellers without felling trees. Beekeeping as sustainable harnessing or use to Tropical Rain Forests needs to be strengthened.

10.7 MARKETING

- The demand exceeds supply. This leads to adulteration of honey.
- The honey hunters get low price and middleman exploits them.

10.8 TRAINING

Training is impractical; it does not equip trainees towards practical beekeeping.

It is only a target oriented government programme.

11.0 RECOMMENDATIONS

- There is an urgent need to reorient beekeeping development in Tropical Rain Forests regions.
- To establish demonstration Apiaries to train the practical aspects of beekeeping.
- There should be more emphasis an evolving management technique to control the absconding behavior and to control nest/parasites in *Apis cerana.*
- In order to control TSB and to revive *Apis cerana* the TSB resistant strains of colonies in the wild should be identified and a systematic breeding programme of *Apis cerana* should be launched.
- Introduction of *Apis mellifera* should be stopped in Tropical Rain Forests of Western Ghats. Experience has show that it is not suitable to the region.
- The forest policy should change to be towards conservation that helps in enhancement of beekeeping in Tropical Rain Forests; mainly change of natural forests into monoculture plantations should be stopped immediately. The nesting sites of honeybees should be protected.
- Beekeepers must be educated and trained intensively so as to be in a position to look after the bees themselves and should be in a position to apply all modern management practices to obtain maximum returns from beekeeping. He must be able to demonstrate that beekeeping is not only feasible but economically viable too. He also should be able to generate income by way of production of apiary by-products such as beeswax, pollen, royal jelly and venom. Beekeepers must also learn the skills of bee management for multiplying the colonies from existing colonies and should at any cost restrain from buying bee colonies from other

sources.

- As women can manage bees more efficiently than men, beekeeping development programmes should adopt a strategy to involve more and more women into beekeeping. This also encourages economic self-reliance and resepctability in them.
- Beekeeping training programmes should be adopted to specific needs and target groups like, women and youth. A majority of the beekeepers in our survey was in the age group of 26 - 45. If proper beekeeping training is given to young people below 25 years of age, they can readily take up beekeeping as an enterprise and an dignified means of livelihood.
- Young people who have higher educational qualifications (SSLC / PUC) should be encouraged to take up higher responsibilities of organization and implementation of beekeeping development programmes. Training such people in aquiring initiative and leadership qualities, should be taken up on a priority basis.
- The campaign to create awareness on honeybees and its reliance to Tropical Rain Forests needs to be strengthened.

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