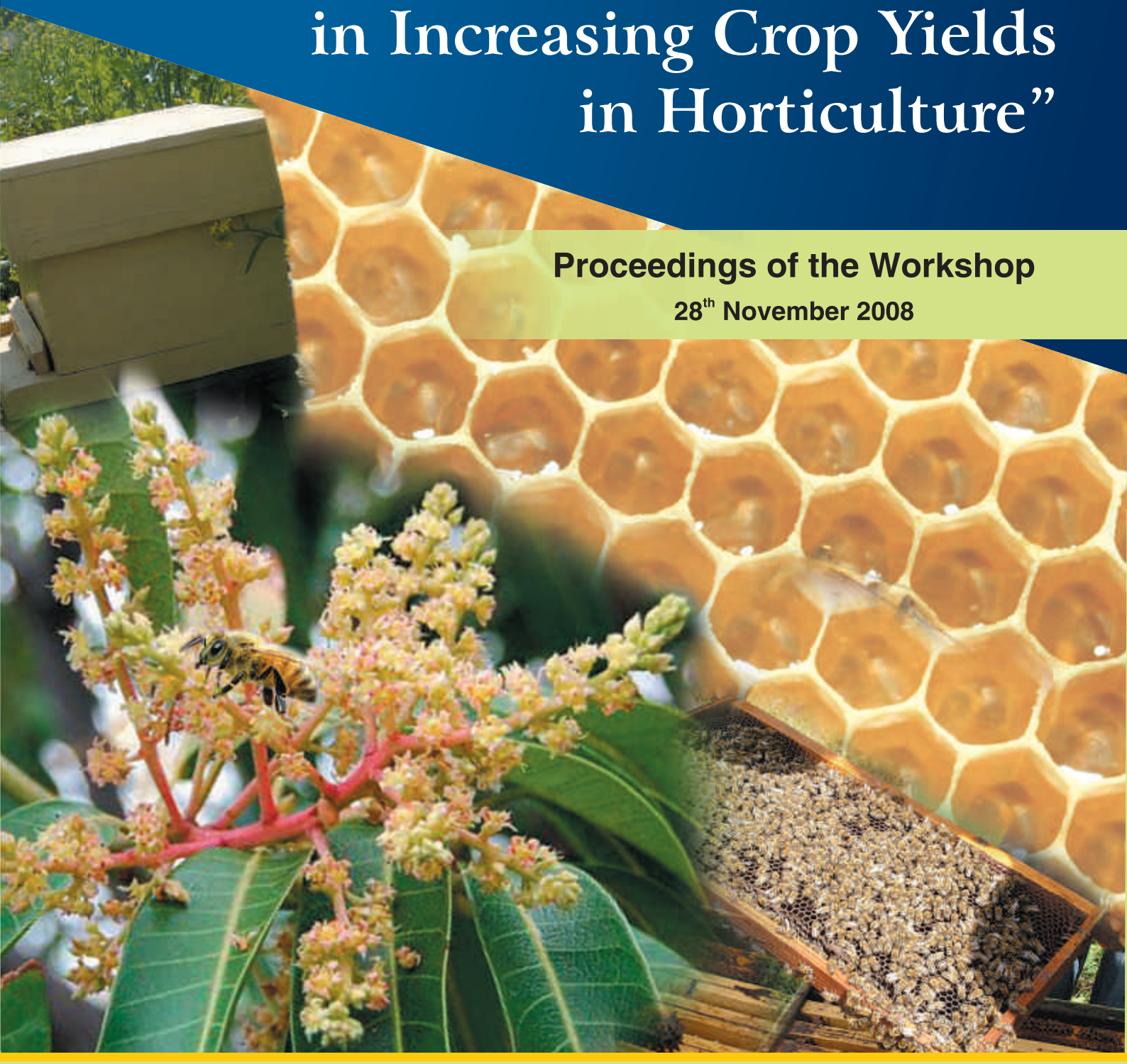
"Role of Apiculture in Increasing Crop Yields in Horticulture"

Proceedings of the Workshop

28th November 2008



Workshop Organized by

Maharashtra State Horticulture and Medicinal Plants Board

Pune - 4110 05

(Ministry of Agriculture, Government of Maharashtra)

PROCEEDINGS OF THE WORKSHOP ON "ROLE OF APICULTURE IN INCREASING CROP YIELDS IN HORTICULTURE"

HELD ON 28TH NOVEMBER 2008,
AT
SAKHAR SANKUL, SHIVAJINAGAR, PUNE 411 005

Workshop Organized by
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PART - I

Historical Background and Pre-workshop Arrangements

1) Objectives of the Workshop:

Honeybees are best known for the honey they produce. But the principal economic role of honeybees in nature is to pollinate hundreds and thousands of flowering plants and ensure seed set in quantity and quality. Both flowering plants and honeybees are interdependent for their biology and life cycle. Flowering plants offer nectar and pollen to honeybees and honeybees reciprocate their obligation by bringing about pollination, maintaining genetic diversity and continuation of the plant species.

Honeybees are of great importance to the beekeepers for the honey they produce. But honeybees are still of greater importance to farmers for the pollination service they offer and increase crop yields both qualitatively and quantitatively through pollination. Agricultural scientists in United States have estimated that the value of the increased crop yields through bee pollination is several times more than the value of the honey and beeswax the honeybees produce.

Warnings, however, are coming from the environmentalists and scientists from all over the world that indiscriminate use of insecticides, monoculture, changes in cropping patterns, pollutions etc. resulting into depletion of population of useful pollinating insects, is threatening for world food production. Considering the severity of the problem, the Global Environment Facility (GEF), launched in August 2008, a Project on “Conservation and Management of Pollinators for Sustainable Agriculture through Ecosystem Approach”. The United Nations Environment Programme (UNEP) is implementing this Project. As honeybees are the most efficient and reliable crop-pollinators, Apiculture has to be integrated with Agriculture and Horticulture for mutual benefits and development.

According to the scientists at the Indian Council of Agricultural Research, India needs minimum 70 lakh bee colonies (and Maharashtra 5 lakh bee colonies) just to pollinate 12 major crops that are entomophilous and are dependent on insects like honeybees for pollination. As against this bare urgent need we have about 12 lakh bee colonies in India and 8000 bee colonies in Maharashtra.

To increase the agricultural growth rate at 4 per cent, in addition to four traditional inputs, use of honeybee colonies as fifth input to pollinate self-sterile crops has no substitute and is indispensable. In United States 80 per cent of the

bee colonies are used for planned pollination of various crops. The beekeepers prefer to provide bee colonies on rental basis for pollination service to farmers and orchardists rather than to take honey production.

In view of the importance of Apiculture as an agro-based industry and its role in increasing crop yields through bee pollination, National Horticultural Mission has formulated pattern of assistance for utilizing honeybee colonies for pollination of various fruit crops. Shri. Gopal Reddy, Managing Director, Maharashtra State Horticultural and Medicinal Plants Board (MSH&MPB) took keen interest in the subject and convened a meeting of concerned officers and desired that someone should prepare Master Plan / Road Map for the development of Beekeeping Industry in Maharashtra. Dr. R.P.Phadke, Retired Director, Central Bee Research and Training Institute and Member, Managing Committee, National Bee Board, offered to write such document. Dr. Phadke later submitted to MSH&MPB a "**Plan for the Development of Beekeeping Industry in Maharashtra"**. Shri. Gopal Reddy, further perused the matter with Hon'ble Shri. Nanasaheb Patil, Principal Secretary (Agriculture- M.S.) who kindly accepted the proposal of MSH&MPB to organize a Workshop on Beekeeping. Accordingly a Workshop on 'Role of Honeybees in Increasing Yields in Horticulture" was organized on 28th November 2008 at Sakhar Sankul, Shivajinagar, Pune 411 005.

As beekeeping is a new subject for the Department, assistance and guidance of Dr. R.P.Phadke (Retd. Dirtector, Central Bee Research and Training Institute and Member of the Managing Committee, National Bee Board, Ministry of Agriculture, Govt. of India) was sought in organizing and conduct of the workshop.

Beekeeping is a forest and agro-based industry. Officers from Departments of Agriculture, Forest, Social Forestry, Agricultural Universities, Krishi Vigyan Kendras, Maharashtra State Khadi and Village Industries Board, Khadi and Village Industries Commission etc. were, therefore, invited to participate in the Workshop.

Why Beekeeping?

Apiculture and Agriculture -

1. Introduction:

Beekeeping is a very fascinating occupation. It can be practiced equally by men, women, grown up children and even by physically handicapped and old persons. The investment required is low, and the economic returns are comparatively very high. Beekeeping does not bring any pressure on agriculture land. It produces honey, beeswax, pollen, propolis from the flowers which otherwise dry up in nature and go waste. Beekeeping is a decentralized industry and does not displace persons from their villages. If conditions are favourable, level of beekeeping can be increased to semi-commercial or commercial level.

Though the honeybees are best known for the honey they produce, their economic role in nature is to pollinate hundreds and thousands of flowering plants and assure seed or fruit set. Honeybees thus play very important role in cross pollinating various agricultural and horticultural crops and increase their yield per unit area and improve their quality. Agricultural scientists in America and Europe have estimated that value of the increased crop yields due to honeybee pollination is several times more than the value of the honey and beeswax the honeybees produce

2. Present Status And Need of Bee colonies in Maharashtra:

About 35 lakh hectares of land in Maharashtra is under cultivation of crops which are dependent on insects for pollination. About 14 lakh ha. of land in Maharashtra is under fruit crops. More and more land is being brought under agricultural and horticultural crops under “Mission 2007” and “National Horticulture Mission”. **The present need of bee colonies in Maharashtra can be estimated at about 5 lakh. As against this need there are about eight thousand bee colonies in Maharashtra.**

3. Honeybees and Forests:

Honeybees and forests have been associated with each other for several million years. Honeybees are an integral part of forests and their ecology. A healthy bee fauna is an indication of healthy forest and its natural balance. This is so because bees and flowering plants have evolved together as one biological unit over past million years. Hills and adjacent transitional belts and hills and surrounding agricultural belts having mixture of forests and agriculture are of the unique biological wealth that could be converted into economic wealth and can offer livelihood on a substantial basis. These are the best areas for promotion of beekeeping industry.

Various development projects in the country, however, affected beekeeping industry adversely due to deforestation, increasing land-use for agriculture, urbanization, tourism development etc. All these factors reduce significantly the bee forage potential.

It is necessary to check this deterioration trend of the industry if this important income resource to the rural and tribal population depending upon forests for their livelihood has to be maintained. This is all the more necessary in view of the importance of honeybees as cross pollinators of various agricultural and horticultural crops. This is possible by taking up extensive afforestation programme in which multipurpose tree species useful to honeybees during their flowering and having other economic utility should be included. *Jamun, Soap nut, Shikekai, Amala, Harad, Karanj, Neem, Drumstick, Eucalyptus* are a few plant species to mention which have duel utility. The plant species should be such selected that there is a staggered flowering and flora is available to the bees almost round the year. This will support insect population, resulting into vibrant, lively and dynamic nature of the forests.

4. Role of Honeybees in Agriculture and Horticulture:

Until mid-20th century, honeybees were equated with the production of honey and beeswax. But since past 3-4 decades, utilizing honeybees to pollinate large number of agricultural and horticultural crops to increase per acre yield has become a routine practice in many developed countries. Many commercial beekeepers in America prefer to provide honeybee colonies on rental basis for pollination service rather than to take honey production. Beekeepers in California earn about $150 per bee colony per month as a rental for providing bee colonies for pollination service. According to Agricultural Scientists in U.S.A., value of increased crop yields due to honeybee pollination is 10 to 15 times more than the value of honey and beeswax the honeybees produce.

5. Crops Benefited by Bee Pollination:

Experiments on effect of bee pollination on various crops were conducted by Central Bee Research and Training Institute and various Agricultural Universities under All India Coordinated Project on Honeybee Research and Training (ICAR). There is a good data available on this subject from abroad also. A cross section of the cross fertile crops, self sterile crops with different degree of self-sterility and even self fertile crops benefited by bee pollination is summarized below.

Oilseed: White mustard, Rape, Toria, Sarsoo, Lahi, Safflower, Sunflower, Linseed, Niger, Gingelly, etc.

Orchard Crops: Apple varieties, pears, plums, cherry, strawberry, raspberry, Litchi, citrus varieties, grapes, cucumbers, squashes, melons**,** Almond, peach, guava, gooseberry**.**

Legume seeds: Alfalfa, berseem and other clovers, vetches, broad beans, dwarf beans.
Vegetable seeds: radish, cabbage, turnip, carrot, onion, cauliflower, gourds.

6. Integration of Apiculture and Agriculture- Horticulture:

Nearly 70 percent of the cultivated crops all over the world are cross-fertile and depend on insects like honeybees for pollination. Dwindling of population of useful pollinating insects has become a global problem. This is due to pollution of water, air and indiscriminate use of insecticides. Of all the pollinating insects, honeybees are considered as the most efficient and reliable crop pollinators. Honeybees and flowering plants are interdependent for their biology and life cycle. Thus Apiculture and Agriculture are interdependent for mutual benefits and cannot develop in isolation.

The enormous benefit that honeybees silently offer to Agricultural and Horticultural crop productivity and to national economy goes unnoticed. The beekeeping industry has rarely put itself forward as a Key Factor in agricultural production. We know role of honeybees in pollinating large number of crops. But the public and what is more painful is the planners are unaware of this cheap, but essential and eco-friendly input. The input, which has quadruple benefits viz. 1) employment generation among rural and tribal population, 2) providing supplementary income to marginal farmer, landless labours etc. 3) Producing honey, beeswax from the nectar of the flowers which otherwise dries up in nature and goes waste and finally the most important 4) increasing crop productivity and crop production through bee-pollination. Ministry of Agriculture is planning for the Second Green Revolution. It may not be an exaggeration to say that second green revolution may not yield desired results without honeybees. As honeybees and agricultural crops are interdependent for their life cycle, Apiculture and Agriculture has to be integrated for mutual benefits.

7. Beekeeping A Multidisciplinary Subject:

In case of other domestic animals i.e. in dairy, poultry, piggary etc. the animals are confined to shed and are fed with stored food as per their requirement. Contrary to this, honeybees themselves go out in search of their food which is a live material that is flowers. Thus beekeeping is very peculiar industry in the sense that there is an interaction of two living materials i.e. honeybees at one side and the flowering plants on the other side. The matter is more complex because flowering of the plants and secretion of nectar and production of pollen in the flowers, the sole food of honeybees, is influenced by various climatic factors, like, soil texture, soil moisture, humidity, ambient temperature, wind velocity etc. Beekeeping industry therefore involves different biological sciences like Bee-botany, entomology, bee-behaviour, bee-management, bee-pathology, bee-genetics, bee-breeding and quality control and handling of bee-products. In addition to this designing of beekeeping equipment (Apiculture engineering) and providing graded training facilities in this non-

traditional new industry is also essential. An integrated approach and simultaneous attention to all these aspects of beekeeping is required to be given for qualitative and quantitative development in the industry. An over-view of the above aspect may be necessary to understand the industry in depth and to formulate comprehensive perspective plan for the development of the beekeeping industry.

8. World and Asian Scenario:

About 5 crore bee colonies, mostly ***Apis mellifera,*** are maintained all over the world. According to UNCTAD (1986) Report, world production of honey was estimated at about 10 lakh M.Tons. There are 15 countries in the world which account for the 90 per cent of the world honey production. China is the only Asian country, among these, producing nearly 1.6 lakh M. Tons of honey. China produces 12800 M.Tons of beeswax as against 43400 M.Tons of world production. China also produces 1000 M.Tons of pollen and 800 M.Tons of royal jelly and is the biggest exporter of honey, beeswax and other bee products. China like India has indigenous ***A. cerana*** bee colonies and like India has introduced Western ***A. mellifera*** bees. There are about 70 lakh ***A.mellifera*** bee colonies and 30 lakh ***A. cerana*** bee colonies in China and they have a plan to increase this number to 5 crore during next few decades. India has about 10 lakh ***Apis cerana*** and 2 lakh ***Apis mellifera*** bee colonies.

By adopting a strategy to increase the colony number on one side and increasing the productive efficiency of bee colonies on the other, India can also become a major producer and exporter of bee-products, besides utilizing large number of bee colonies for pollination of agricultural and horticultural crops..

9. Future challenges:

It is estimated by statisticians that the population of India will be about 140 crores by 2030 AD. India will have to face two formidable challenges from coming decade i. e. to provide 1) employment to large number of youths and 2) enough and nutritive food to all people. According to the agricultural scientists, India needs minimum 75 lakh bee colonies just to pollinate and increase productivity of 12 major crops which are self-sterile and need insect pollination.. Beekeeping industry can play its own humble role in addressing both these challenges.

10. Action Plan, Thrust Areas:

Existing 2000 beekeepers and 8000 bee colonies are the assets of the industry in Maharashtra created during past few decades. 1) Census of existing beekeepers and bee colonies, 2) upgrading technical skills of the existing beekeepers, 3) conservation and maintenance of the existing bee colonies, 4) rapid multiplication of bee colonies and 5) increasing productivity of bee colonies should be the strategy for the next decade. Considering these facts, Action Plan on following priorities and thrust areas has been worked out. The ***modus operandi*** of the Action Plan is also suggested.

11. Financial Outlay:

Forests are permanent abodes of honeybee colonies. Beekeeping industry has to be developed on agricultural plains for pollination service i.e. the last and 5th eco-friendly input, particularly for self-sterile and cross-fertile crops which are insect dependent for pollination. It is proposed to establish 1.0 lakh bee colonies in forest areas and 1.0 lakh bee colonies on agricultural plains. Estimated cost will be Rs. 100 crores for 10 years i.e. for XI the and XII the Five Year Plan.

12. Conclusion and Formation of Various Committees:

From many view points viz. employment generation among rural youths and tribal population, producing valuable products like, honey, beeswax, pollen, propolis, venom and royal jelly and above all increasing the yields qualitatively and quantitatively, of various agricultural and horticultural crops, beekeeping has to be developed on priority basis. Apiculture and Agriculture are interdependent and cannot develop in isolation. Integration between Apiculture and Agriculture is therefore essential for mutual benefits and development.

Because of the peculiar nature of beekeeping industry, simultaneous attention is required to be given to different disciplines of biological sciences. For implementing extension, research, training and marketing programmes, KVIC, State K.V.I. Boards, Beekeepers' Cooperatives, Departments of Forest, Agriculture, Horticulture and Agriculture Universities and NGOs should work in close co-ordination. Such integrated approach alone will result into rapid development of this important agro- and forest based industry. Different Committees may have to be formed, drawing representatives from above mentioned Departments for planning, preparation of Road Map, monitoring and reviewing etc.

A BACKGROUND PAPER ON BEEKEEPING EXTENSION

- Dr. R. P.Phadke
(Retd. Director, Beekeeping Industry - Khadi & V. I. Commission)

1. Effects of Industrial and Agricultural Development Programmes:

After independence India launched a massive programme of rapid industrialization. The economists believed that, like European countries, industrialization was essential for long term development and the benefits accrued would percolate from cities to villages and from upper strata to lower strata of the population. In reality this percolation theory did not prove completely correct. Though the industrialization created a tempo of modernization and made the country self sufficient in many fields, there had been no equitable distribution of wealth generated. In general, this programme benefited the elite section of the people coming from the cities and the poorest section of the rural population remained by- passed. The benefits of the programmes reached the villages last or not at all. This resulted in an inflow of large number of unemployed rural population from villages to cities, creating problems both in the villages, like shortage of agricultural labour and in the cities like housing, transport, hygiene etc.

As 70 per cent of the population live in rural India and depend on agriculture, in the second phase of developmental programmes more emphasis was placed on agriculture. Huge investments were made in agricultural research and extension in order to boost-up production of crops like cereals, oilseeds, pulses, tea, coffee, sugar etc. and India became self-sufficient in food production ranking World's fourth largest food grain producer. Special efforts were also made to develop various agro-based industries like dairy, poultry, fish farming, sericulture and beekeeping**. Out of these, Beekeeping industry received inadequate attention resulting in its stagnation.**

2. Beekeeping as a Part of Integrated Rural Development:

Honey harvesting by smoking away the honeybees and squeezing out their combs for honey has been traditional in India for last several thousand years. But the development of **Apiculture (beekeeping)** on modern scientific lines has lagged behind than in temperate regions. In India where flora and fauna are rich and varied, there is considerable scope for harnessing these naturally available resources by promoting **'Modern' beekeeping** or **Apiculture.** Besides prolific honey gatherers, honeybees are most efficient and reliable crop-pollinators. This in turn would help to improve productivity of agricultural and horticultural crops and the quality of life of rural people.

3. Role of Women in Beekeeping:

In employment, education, training and status, women constitute the most neglected group in India. But the women's share of agricultural work often exceeds that of men. Women also play very important role in traditional

activities such as food production and processing and in crafts like spinning, weaving and other domestic works. In India, nearly half of the population leave below poverty line. Poverty could be eradicated if these people could be involved in productive activities and if both men and women contributed to integrated rural development programme.

During economic and social development, many activities traditionally performed by women in their homes are superseded by mass-produced goods. Such development has adversely affected families in general and women in particular. The traditional work of women is often replaced by men and machine and so women are deprived of the opportunity to earn money. Women need occupations which are not physically demanding and will not interfere with their family obligations but which will provide a monetary return on a small investment.

In beekeeping industry, much of the work in a fixed apiary or stationary type of beekeeping, can be done by women. For heavier jobs like honey extraction, migration, moving bee colonies for pollination, other members of the family can help. In India there is no loss of social standing for being a beekeeper; instead it is an important occupation that produces valuable product like honey and those involved in this industry can be proud of this occupation.

3.1 Extension -

As beekeeping was newly introduced industry, various incentives were required to be given to Institutions, farmers, tribals etc. to attract them to this new industry. The Beekeeping Directorate under the leadership of first Director Shri. S.K.Kallapur formulated various patterns of assistance in which about 50 per cent subsidy and 50 per cent loan was provided for buying bee-hives and other beekeeping equipment. In addition to this, training at the doors of the prospective beekeepers, stocking of beekeeping equipment, construction of honey houses was also arranged. Following are some of the most important patterns of assistance, which made rapid progress in the development of beekeeping industry in the country. These patterns have undergone revisions and additions depending upon the changing needs of the industry.

3.1.1 Sub-stations -

After surveying and confirming the utility of the area for introducing beekeeping, a sub-station was established there. One senior fieldman and one junior fieldman were posted at the sub-station. The area of operation of the sub-station was about 15 Kms. radius. The fieldmen were supposed to capture bee colonies from nature and maintain a small apiary of bee colonies for the supply of colonies to the prospective beekeepers. The colonies were installed at the beekeeper’s backyard and were inspected periodically. Colony inspection and other bee management operations were done in the presence of the beekeepers, thus giving practical training to the beekeeper and members of his family at their doors. The fieldmen

were expected to establish about 200 to 300 bee colonies in a period of three years in the area. The life of a sub-station at a particular place was of five years. Within five years beekeepers were supposed to be self-reliant. After five years the fieldmen were shifted to nearby area to start a new sub-station there. At one time there were about 500 sub-stations working all over the country.

3.1.2 Circle- stations -

After five years of existence of a sub-station on sixth year financial assistance was stopped as per the pattern of the sub-station. Then about five of such closed sub-stations were clubbed to form a Circle-Station and further assistance of one fieldman was provided for two years. With this pattern of assistance, Beekeeping Directorate continued to get feed-back from the closed sub-stations, besides helping beekeepers. In due course of time, the beekeepers in the area were encouraged to form a Beekeepers' co-operative Society or enroll themselves with the registered Institutions in their area to get further financial assistance and technical guidance.

3.1.3 Other Patterns of Assistance -

In addition to above two pivotal patterns of assistance, there were about 8 different patterns like, Model Apiary-cum-nursery, Beekeeping in Schools, purchasing of honey processing unit and comb foundation mill, migration, pollination service etc.

Initially, during the first year of establishment of KVIC, 232 beekeepers were enrolled as beekeepers maintaining about 800 bee colonies and producing about 1200 Kg. of honey. With KVIC's efforts and due to above mentioned patterns of assistance, by 1990 there were 2.5 lakh beekeepers spread over 1.5 lakh villages all over the country, maintaining about a million bee colonies and producing about 10 million Kg. of honey annually. After 1990 the above achievements were marred by the spread of some never known bee diseases.

3.1.4 Introduction of Western Honeybees in India

KVIC right from the begining concentrated its efforts on popularizing indigenous honeybees Apis cerana and reached a landmark of target of 1 million bee colonies and 10 million Kg. of honey production by 1990.

Punjab Agricultural University (PAU) made efforts to popularise beekeeping as an agro-industry with Indian honeybees. Their efforts did not meet with success. The PAU then concentrated their efforts on conducting experiments on acclimatizing European honeybees in Ludhiana. Though initial experiments were not successful, changes in

the cropping pattern, development of horticulture coupled with social forestry, farm forestry etc., provided congenial conditions for successful introduction of European honeybees in Punjab. By the end of 1980 there were sizable number of European honeybee colonies in Punjab, producing good quantity of honey every year, giving substantial supplementary income to farmers. There are about 2 lakh European honeybees in Northern states. In Maharashtra also European honeybees have been introduced in some areas.

Existing beekeepers and existing bee colonies are the assets of the Nation. Serving the beekeepers to save and develop beekeeping, should be the theme of developmental plan. Beekeepers should be considered a target persons and they should be provided with financial assistance, timely supply of beekeeping equipment and his technical skills should be constantly upgraded. Such encouragement alone will give incentive to beekeepers and ensure qualitative and quantitative development of beekeeping industry.

In view of above following items should be attended to immediately:

1) Manufacturing and stocking of beekeeping equipment,
2) Qualitative improvement in worked out areas,
3) Survey of new potential areas,
4) Formulating Patterns of Assistance,
5) Establishing Demonstration-cum-Training-cum-Nursery Units,
6) Census of Beekeepers, bee colonies, honey and wax production etc.,
7) Establish contacts between beekeepers and farmers for pollination service,
8) Conservation of existing bee colonies and their rapid multiplication,
9) Improving technical competence of beekeepers
10) Creating new beekeepers and new class of Farmer-beekeepers.

By bringing all the **available** bee species and their rapid multiplication, honey and beeswax production can be increased manifold and crop production can also be significantly increased. **We have seen Green Revolution, we have seen White Revolution (Milk production), let us now see Golden Revolution (Honey Production). A Revolution in Beekeeping, which is complementary to "Mission 2007 for Hunger Free India".**

A BACKGROUND PAPER ON BEE RESEARCH PROGRAMME

- Dr. R. P.Phadke
(Retd. Director, Beekeeping Industry – Khadi & V. I. Commission)

Extensive research has been done on European honeybees. The foreign bee-scientist have now developed interest in Asian honeybee species. Same is the case in honey handling technology. The International Bee Research Association, U.K. and FAO have recently taken interest and are planning to implement collaborative project.

Research needs and priorities:

Starting with only three Departments in 1962 viz. Botany, Apiculture and Chemistry, the Institute has gradually added many more Departments. Since bee-research is an interdisciplinary subject, all the departments in their own way contribute to the development of the industry. However considering the present status of the industry and changing needs of the industry, CBRTI will have to identify and fix some priorities. Research on such practical problems will help in qualitative and quantitative improvement in the industry. Some of the research priorities could be as under:

i) Genetic improvement in Indian hive bee Apis cerana

Dr. K.K.Kshirsagar (Retd. Sr. Sci. Officer, CBRTI), in his studies, has identified six different races of Apis cerana in India. Within each ecotype of Indian hive bees, there is a wide genetic variation. Some of the genetic characters like honey gathering capacity, resistance to diseases, high egg laying capacity of the queen, low absconding tendency are economically important characters of the honeybees. These characters of individual bee colony should be studied. Then programme of improving the strains of honeybees within a given ecotype and then by inter-ecotypic crossing should be undertaken. This section which is an important branch of bee science is rather neglected. For Indian beekeeper, who is generally a tribal or landless labourer, low cost industry with comparatively high returns, like beekeeping with Indian honeybees, is the basic need.

ii) Rapid multiplication of hive bee colonies

The hived honeybee colony number of Apis cerana has come down to 7 lakhs from 10 lakhs during last couple of years mainly due to sac-brood disease. The major toll of losses was from the leading southern states. Rapid colony multiplication programme from the existing disease-free stock should be given top priority to quickly restore the original number and further increase it according to the potential of the area. About 20 years back such centre was started at Bhadwar (Himachal Pradesh) after large number of bee colonies were lost due to Acarine disease in Himachal Pradesh. Such colony multiplication centres or nurseries should be established in each state to quickly increase the colony number as per the target.

iii) Standardizing Bee-disease Control Methods

About 30 years back Indian honeybees were considered to be free from known bee diseases. However there are now incidences of Acarine, European Foul Brood and Sac Brood disease and also other problems of pests and predators. The Indian beekeepers are completely ignorant about the preventive and curative methods of controlling the bee diseases. Bee pathology section of CBRTI should be strengthened to take nation-wide survey of bee diseases, pests and enemies of honeybees in India and standardize methods to control them.

iv) Management of European Honeybees

European honeybees are now well established in the Tarai region of sub-Himalayan belt. These honeybees are very prolific honey gatherers and possess non-absconding character. To improve the productive efficiency of these bee colonies, seasonal management practices should be standardized and this technology should be passed on to beekeepers. This will enable increasing bee colony number and have higher honey production per bee colony.

v) Zonation for European and Indian hive bees

There were nearly 10 lakh Indian hive bee colonies in India few years back. Some of these bee colonies in some areas have produced honey quite comparable to European honeybees. In some areas Indian hive bees have proved superior to European hive bees. Indiscriminate movement of European honeybee colonies from one state to another, particularly where beekeeping with Indian hive bees already exists in sizable proportion, should be discouraged. Zonation for development of beekeeping with Indian hive bees and European hive bees is essential to avoid extinction of indigenous species of honeybees. There are some areas e.g. agricultural plains of northern states where natural colonies of Indian hive bees are not available but the area has the potential for beekeeping. Such areas should be first identified for introduction of European hive bees. China has nearly 70 lakh indigenous hive bee colonies and about 30 lakh European hive bee colonies. The indigenous bee colonies are developed in southern china while the European bee colonies in northern china.

vi) Processing and quality control of bee-products

At present beekeeping is equated with honey production alone. In order to increase the income of beekeeper, hygienic collection of other bee-products namely beeswax, bee collected pollen, propolis, bee venom, should be encouraged. Bee-products and Apithearpy is a new branch of beekeeping industry being developed in many countries. There is a great potential for export market for Indian honeybee products.

vii) Studies on crops useful to honeybees and vice-versa

About 70 to 80 per cent of our crops are dependent on insects like honeybees for pollination. Studies on degree of utility of each of the crop to honeybees as provider of nectar and pollen and degree of utility of honeybees for pollination of these crops is very essential. Such basic data will enable to

decide number of bee colonies required per hectar of the crop for pollination and optimization of crop productivity.

viii)Fellowships

About 8 to 10 well qualified (At least M.Sc.) candidates may be taken up on fellowship basis for a period of three years In first six months they should be trained in Apiarist course. Afterwards they should be assigned some research project under beekeeping. For this purpose they may be permitted to register themselves for Ph. D. of any University. CBRTI is already recognised by University of Poona for conducting post-graduate studies. Performance, aptitude, devotion etc. of these candidates should be periodically reviewed by the competent committee. At the end of their fellowship period, the competent committee may prepare a pannel of fellows according to their merits for absorption in Beekeeping Directorate in extension or research programme. In this procedure, KVIC gets some research project executed at a very low cost and at the same time there is every possibility that KVIC gets trained and tested persons for its future expansion programme.

A BACKGROUND PAPER ON TRAINING PROGRAMME

- Dr. R. P.Phadke
(Retd. Director, Beekeeping Industry – Khadi & V. I. Commission)

Beekeeping is not a traditional industry in India and hence trained artisans are not readily available. To achieve the target of establishing additional 15 lakh bee colonies during coming ten years and further 30 lakh bee colonies during next fifteen years, a short-term and long term strategy for training in beekeeping will have to be formulated in addition to the current regular and specialised training courses. Short-term strategy should aim at (a) upgrading the technical competence of the existing beekeepers (b) creating new beekeepers and (c) creating general awareness among agriculturists and planners. The long-term strategy should aim at creating 2nd and 3rd front of bee-scientists, research workers, technicians, extension workers, teachers, marketing experts etc. to shoulder the responsibility of implementing II phase of development of the industry.

A) Short-term Measures

i) Existing Beekeepers:

There are about 2.5 lakh beekeepers in India maintaining 10 lakh bee colonies. Existing beekeepers and bee colonies should be considered as a great asset of beekeeping industry and existing beekeepers should be considered as target group of first priority in the developmental programme. Increasing technical competence of existing beekeepers for (a) conservation and maintenance of existing bee colonies (b) rapid multiplication of bee colonies (c) supply of bee colonies (d) providing pollination service and (e) diversification of bee-products should be the theme of training for this target group. In India a beekeeper on an average maintains four bee colonies. Even if the holding of number of bee colonies per beekeeper is doubled, the colony number will increase to 18 to 20 lakhs.

ii) Creating New Beekeepers:

Considering the potential and also the requirement of bee colonies, large number of marginal farmers, tribals, landless labourers etc. will have to be roped in beekeeping industry as prospective beekeepers. Considering the decentralised nature of the beekeeping industry this is all the more necessary. At least two lakh new beekeepers will have to be created each maintaining about five bee colonies. This is a very formidable, rather impossible target with the existing facilities and infrastructure available in men and material with the KVI sector. But this problem can be addressed in the following manner.

There are about 80 Agricultural Schools in Maharashtra run by State Government and Krishi Vigyan Kendras (KVKs) run by Union Ministry of Agriculture. Agricultural Schools conduct two years Certificates course for

farmers' sons. KVKs are mainly concerned with transfer of technology to farmers. All the teachers of Agricultural Schools and KVKs may be given one months training in beekeeping with special reference to bee-pollination. Simultaneously, syllabus of Agricultural Schools may be suitably revised to include topics on Apiculture. With this strategy thousands of youths-farmers' sons, will be trained in beekeeping every year and great awareness will be created about bees and beekeeping among farmers' community. Even if 25 per cent of the trained students take up to beekeeping, it will be a great achievement. KVIC and State Khadi and Village Industries Board will have to tie-up with Departments of Agriculture, Horticulture and Forest to work out *modus operandi* of this strategy. Initially such of the Districts may be selected where beekeeping already exists or where there is a potential for the industry.

iii) Bank Managers'- Government Officers' Training:

A short, two hours training course for Bank Managers, Government Officers from Agriculture, Forest and Irrigation Departments etc. is very essential to create awareness about the importance of beekeeping industry. In Pune there are two National Training Institutions (a) College of Agricultural Banking (Reserve Bank of India) and (b) Vaikunth Mehta National Institute of Co-operative Management and c) National Institute of Bank Management. All these Training Institutes are indirectly related to beekeeping and Beekeeping Cooperatives. Two to three weeks training courses are conducted round the year at these Institutes for Bank Officers from all over the country. For these Bank Officers and other Government Officers two hours Orientation Training Course in Beekeeping with Film show may be arranged and a Folder and literature on beekeeping may be distributed to these Officers.

B) Long-Term Measures:

The existing extension, research and training programmes under Khadi and Village Industries Commission should continue for a long period until the gap between the potential and actual is reduced to a large extent. For this, creation of second and third front of bee-scientists, research workers, technicians, extension workers and marketing experts is very essential. These young trained personnel will, in future, shoulder the responsibilities and face the challenges of the industry. Futuristic planning will provide well-qualified and experienced personnel to main various Departments of the Industry. This will also gradually give CBRTI a National and International status.

i) Research Fellowships:

For any developmental activity, one of the basic needs is availability of technically qualified and experienced persons. In the current trend of Voluntary Retirement and freezing the recruitment in Government Departments, getting additional staff is almost impossible. The only way out to overcome this impasse is appointment of Research Fellows for a

stipulated period of two to three years. About ten M. Sc. students with 1st Class in Botany, Entomology, Genetics, Bio-chemistry, Pathology, Agriculture and even M.A. with Economics may be appointed as Research Fellows. First two months they may be given orientation training in all aspects of bees and beekeeping including field visits. Later they may be given research projects on honeybees, beekeeping and allied subjects and also permitted to register for M.Phill or Ph.D. All these students should be paid Fellowships as per the norms of University Grants Commission or Indian Council of Agricultural Research (ICAR) etc. Appointment of Pool-Officers on the list of ICAR may also be considered. In this system the students after stipulated period get their Degrees and the Institute gets some of its field-oriented projects implemented. There is no obligation on either side after the tenure of the Fellowship is over. All the four Agricultural Universities in Maharashtra should be involved in this programme.

C) Quality and uniformity of Training courses

At present various beekeeping courses are conducted by different organizations. In order to maintain uniformity and quality of training, it is necessary to prepare syllabus for each course along with notes, technical bulletins, audio- videocassettes, films, transparencies and other teaching aids. Such courses should be coordinated and controlled by CBRTI.

To make a beginning in this direction, introductory training courses and then courses for teaching staff and officers of the agricultural schools, colleges and universities, forest officers college may be conducted at CBRTI, Pune. The things would gradually take shape in couple of years. This will enable the students and staff of these Departments to have basic knowledge of bees and bee keeping and would initiate some of them to take up bee keeping

i) To prepare syllabi for graded training courses
ii) Syllabi for Agricultural Schools, Colleges etc. may be suitably revised
iii) Strengthen Training Wings of Central Bee Research and Training Institute, Pune of Khadi & Village Industries Commission and that of Beekeeping Centre, Mahabaleshwar of Maharashtra, State Khadi and Village Industries Board
iv) Conduct graded training courses at different places with uniform syllabi
v) To bring out Technical Bulletins, audio-visual aids, Manuals, Films etc.

A BACKGROUND PAPER ON HONEYBEE PRODUCTS

- Dr. R. P.Phadke
(Retd. Director, Beekeeping Industry – Khadi & V. I. Commission)

In India, honeybees are generally equated with honey production. Even beeswax is considered as a by-product and much attention is not given for its collection and processing, leave aside collection of other bee products namely, bee collected pollen and propolis, royal jelly and bee venom.

In the present global market, quality and competitive prices alone will govern the market and the future of the industry. A beekeeper will therefore have to tap not only all the above bee products but also provide his colonies on rental basis for pollination service and augment his income. Such strategy alone can make the beekeeper self reliant and beekeeping a viable industry in the competitive market.

It may however be remembered that all the bee products are used either as food or in pharmaceutical and cosmetic industries. For this reason, hygienic collection, handling, processing, storage etc. and maintaining National and International purity standards are of prime importance.

India is endowed with presence of three species of the genera ***Apis,*** namely, ***A.dorsata, A.cerana, and A.florea*** and stingless honeybees of ***Trigona/Mellipona sp.*** Successful introduction of European honeybees ***A. mellifera,*** in India**,** has given a new dimension to the beekeeping industry in India.

Though large quantities of honey and beeswax are collected in India and methods of their collection, processing etc. have been fairly standardized, methods of production of other bee products are yet to be standardized for commercial use. Standardization of methods of collection and development of market for these products and for their value added products will have to be simultaneously looked into.

1. Honey

In a single honeybee colony there are about ten thousand worker honeybees. Being social bees, there is an highly evolved division of labour among these bees. Few scout bees, survey the area within a radius of one Km. and collect the information about the direction, distance and quality of food – nectar and pollen, available. By performing some dances, this information is passed on to other honeybees. The honeybees then take a straight flight and land on the crop for collecting nectar and pollen. The honeybees continue to visit this particular crop until its flowering withers away. This peculiar behavior or the floral fidelity of honeybees makes it possible to get honeys from predominantly a single plant source and thus we get unifloral honeys like, Jamun honey, Mustard honey, Litchi honey etc. When density of a single plant source is sparse in a particular

area, then honeybees switch over to another plant species for gathering nectar. Under these circumstances we get multi-floral honey.

Each floral honey has a peculiar colour, taste and flavour specific to the plant source. Except for these sensory tests, unifloral and multifloral honeys have the same gross chemical composition

2. Bees Wax:

In the process of evolution, honeybees appeared on the earth millions of years before man made his appearance on this planet. As honey is said to be the first sweet substance known to man, beeswax is said to be the first natural plastic known to man. The Egyptians in 4200 B.C. found numerous uses of beeswax. They used to preserve mummies, to seal the coffins etc. Ship building industry was also a great consumer of Beeswax. Beeswax was used for waterproofing the bottoms of the ships. The most important property of beeswax, is its stable composition. Thousand year old beeswax cakes were recovered from the sunken ships. The composition and properties of these wax cakes were unchanged over centuries.

3. Bee Collected Pollen

Honeybees collect nectar, convert it into honey and store it as their carbohydrate food. Similarly a single bee colony collects 25 to 40 Kg of pollen grains every year as a source of proteins, vitamins, minerals, oils and fats etc. Pollen grains contains all types of nutrients required for the growth young once in a bee colony and hence considered by many as a 'Complete food'. Pollen tablet are prepared as "food supplement" by some Pharmaceutical Firms

4. Propolis

Honeybees collect gummy material secreted by leaf or flower buds of some plants such as poplars, conifers. This substance is known as propolis. Propolis is collected by European honeybees and not by Indian honeybees. Honeybees use this resinous material to fill up cracks, crevices, and holes in the hive. The hive entrance is reduced using propolis to protect the colony from intruders like wasps, lizards etc. Propolis has anti-bacterial and anti-fungal properties and it also acts as a repellent for many bee enemies. Propolis is used in some pharmaceutical preparations.

5. Royal Jelly

Queen bee lays two types of eggs, unfertilized and fertilized. From unfertilized eggs drones or male bees develop. From fertilized eggs, either worker bee (sterile female) or queen bee develops. After hatching of the fertilized egg, for the first three days uniform and same food is given to all the larvae. After three days, larvae to be developed into worker bees are given courser type of food and the larvae to be developed into queen bee are given abundant quantity of special food. This food brings miraculous changes in the body of the queen bee and her life.

The bigger size of the queen, which is developed in short period, her the egg laying capacity and the extended life span is attributed to the special food secreted from the hypopharyngeal glands of the young worker bees. This food is more popularly known as "Royal jelly" or "Miracle food" Royal jelly is used in many pharmaceutical preparations.

6. Bee Venom

Most of the people know honeybees for the honey they produce so also they know that honeybees are armed with sting which they use for the defense of the colony. Bee venom is now known to have some medicinal properties. Methods have been standardized to collect bee-venom

7. Apitherapy

From ancient times, man has exploited honeybees throughout the world, first for their sweet honey and then for their protein rich brood and pollen. The use of beeswax came later and followed by other bee products propolis, royal jelly and venom.

In early 20^{th} century, cane sugar was produced commercially. Technology of commercial production of glucose was also developed. Since recently, fructose rich syrup from corn, using enzymatic process, is being manufactured. All these developments have replaced honey as world's main sweetener. Similarly, with the development of petro-chemical industry, variety of waxes, lubricants and other synthetic products have replaced beeswax from many uses.

In order to keep pace with changing times, beekeepers and their organizations started looking for other avenues to augment their income. As a result, traditional old therapy of using other bee products was revived and from 1960 onwards methods were developed for commercial collection of pollen, propolis and venom and production of royal jelly from bee colonies. Followed by these achievements, extensive research was done on all the six bee products for their food and medicinal values and came into existence a new branch of medicine 'Apitherapy' i.e. use of bee products for treating various ailments.

8. World and Asian Scenario

About 5 crore bee colonies, mostly ***Apis mellifera,*** are maintained all over the world. According to UNCTAD (1986) Report, world production of honey was estimated at about 10 lakh M.Tons. There are 15 countries in the world which account for the 90 per cent of the world honey production. China is the only Asian country, among these, producing nearly 1.6 lakh M. Tons of honey. China produces 12800 M.Tons of beeswax as against 43400 M.Tons of world production. China also produces 1000 M.Tons of pollen and 800 M.Tons of royal jelly and is the biggest exporter of honey, beeswax and other bee products. China like India has indigenous ***A. cerana*** bee colonies and like India has introduced Western ***A. mellifera*** bees. There are about 70 lakh ***A.mellifera*** bee colonies and 30 lakh ***A. cerana*** bee colonies in China and they have a plan to

increase this number to 5 crore during next few decades. India has about 10 lakh ***Apis cerana*** and 2 lakh ***Apis mellifera*** bee colonies.

By adopting a strategy to increase the colony number on one side and increasing the productive efficiency of bee colonies on the other, India can also become a major producer and exporter of bee-products, besides utilizing large number of bee colonies for pollination of agricultural and horticultural crops.

A BACKGROUND PAPER ON MARKETING OF BEE PRODUCTS

- Dr. R. P.Phadke
(Retd. Director, Beekeeping Industry - Khadi & V. I. Commission)

The Beekeeping Directorate concentrated its efforts on extension, research and training aspects alone. Marketing of honey was looked after by the Beekeepers' cooperatives themselves. The Beekeeping Directorate undertook marketing activity as a departmental activity since 1971 following a glut in honey market. After successful introduction of European honeybees in northern belts of India, large quantity of honey produced by the European honeybees is also available for sale. In addition to above apiary honeys, large quantities of forest or wild honey mainly produced from Apis dorsata honeybees, is also available in the market. It is estimated that wild honey contributes to nearly 70 per cent of the total Indian honey production.

Honey Production in India

In India we have two indigenous species of honeybees producing large quantities of honey. These are Apis dorsata or the wild honeybees and Apis cerana the domesticable hive bee. In addition to these Indian honeybees, European honeybees Apis mellifera have been introduced in India.

a) **Apis dorsata Honey**: This honey is traditionally collected from the wild honey bee colonies Apis dorsata, by smoking away the bees and squeezing out their combs for honey. Because of the crude method of collection of honey, this honey contains lot of foreign matter, is turbid in appearance and invariably contains large percentage of moisture. About 2.5 to 3 crore kgs of honey as annually collected from these wild honeybee colonies.

b) **Apis cerana honey**: Colonies of this domesticable hive bee Apis cerana are maintained in modern wooden hives and honey is extracted by scientific methods without killing the honeybees or destroying their honey combs. Honey extracted from these bee colonies is therefore clean, transparent and free from extraneous material. About 80 to 90 lakh Kg of honey is annually produced from these bees.

c) **Apis mellifera honey**: The Italian race of Apis mellifera honeybees was introduced in Punjab about three decades back. These honeybees are now spreading in Haryana,Uttar Pradesh, Bihar, West Bengal and Assam. There are now about 1 lakh European honeybees colonies in northern states producing nearly 10 lakh Kg of honey annually. The rate at which these honeybees are spreading in the agricultural plains of north India, shows the new trend of development of beekeeping in India.

Honey Market

All tropical honeys including Indian honeys contain high moisture content (20 to 25 %), low enzymatic value and high Hydroxy-methyl-furfurol (HMF) content, compared to European honeys. Honeys with higher moisture content are liable to ferment quickly. Low enzyme and high HMF contents are indicative of over-heating during processing or long storage. The European, FAO and WHO standards give special emphasis on values of above contents and India honeys generally fail in these standards. Special care will have to be taken to collect, process and pack Indian honeys to conform to International specifications.

a) Internal market: Compared to traditional wild honey, production of apiary honey is less and price-wise it is more costly than wild honey. Apiary honey has therefore market in big cities and in pharmaceutical industries, while wild honey finds market in small cities, villages, Aurvedic preparations etc.

b) International market: During 19th century hundreds of European honeybee colonies were migrated to North America, South America, Australia, New Zealand etc. These European honeybees are well established in these countries and are being harnessed for production of honey, beeswax, royal jelly, pollen, propolis and bee-venom. There are about 2 crore European honeybee colonies all over the world, producing nearly 12 lakh Tons of honey annually. As against this, in India, we have 8 lakh bee colonies producing about 8000 tons of apiary honey. FAO, WHO and European Common Market have laid down purity specifications for honey based on the composition of Apis mellifera honeys. In developed countries honey is mainly used as food, in food products, in bakery products and in breweries.

Legal Aspect of Honey Marketing

Prevention of Food Adulteration (PFA) Act is in force since 1937 and honey is one of the commodities covered under this Act. Any food commodity not conforming to the standards, laid down under this Act, is considered as adulterated. Even a genuine product, not adulterated but sub-standard, not conforming to the standards is termed as adulterated. Earlier, as per the Act, imprisonment OR fine was the punishment. In 1978 the Act was amended and the convicted person has to undergo both punishments i.e. imprisonment AND fine.

PFA Rules are mandatory and Food inspectors have the authority to draw any honey sample, even AGMARK graded, from any sale counter. The only solace is that, there is an understanding between AGMARK and PFA authorities that before any procecution proceedings are initiated by PFA authorities, AGMARK authorities are consulted and the particular Lot if declared as adulterated is permitted to withdraw from the market.

Technical Aspect of Honey Marketing

Marketing under KVIC is mainly of traditional village industries products, like pottery, leather, hand made paper etc. Cereals, pulses and oil-seeds are considered as primary agricultural products and hence are not covered under PFA Rules. Only the edible oil after crushing the oil-seeds is covered under PFA. The oil seeds can be well dried and crushed whenever required. With simple precautions, maintaining the quality of oil is very easy. In case of honey the story is altogether different. Honey, the final food product is produced by the honeybees. Sugars in honey have the property of absorbing atmospheric moisture. On storage the composition of honey changes slightly. Ours being a tropical country, this change is at times very fast. Further, honey is mostly collected by tribals and illiterates who hardly realise the importance of quality control and hygiene. Collection, storage, processing, handling and quality control of this thick sugary syrup is a technique by itself. This requires lot of care right from the stage of production at beekeepers' level to storage, processing, packing etc. at packers' level.

Recommendations

Considering the various aspects of honey marketing as above and KVIC's experience in this line for the last three decades, we may decide our honey marketing strategy on following lines;

a) Honey produced by Indian honeybees should be processed with the processing unit having moisture reduction attachment to improve quality of honey.
b) Indian honeys should be sold in Indian market alone, preferably in respective states to avoid unnecessary expenditure on transport, breakage, leakage and losses in transit.
c) Wild forest honey may be procured by Societies and Institutions and properly filtered and processed to improve the quality of honey. At present the village traders are paying just Rs. 15 to 20 per Kg. to the tribals. The societies should purchase this honey at higher rates. With proper filtration, processing and moisture reduction, this honey can be sold at higher rates.
d) CBRTI, may take up standardization of techniques of collection, filtration, and processing of wild honeys so that in future both producers and consumers are benefited.
e) CBRTI may provide full facilities to train technicians from cooperatives, Institutions in all aspects of quality control of honey. The existing honey processing unit installed at CBRTI can be used for demonstration- cum – training purpose.
f) Honey produced from European honeybees in northern states is mainly from agricultural crops, just like that of in Europe and America. This honey compares well with European and American honeys and conforms to FAO, WHO, and European Common Market standards. With little more care in collection and processing and improvement in packing, this honey can be exported. This would further pave way for exporting Indian honeys and other bee-products.
g) Tropical honeys are mostly produced from forest areas. These honeys are free from pesticides unlike European or American honeys. There is therefore

growing demand in western countries for tropical forest honeys. After establishing market for honey produced in India from European honeybees, honey produced from Indian honeybees can be exported in a second stage by improving the quality of honey and by proper publicity and propaganda.

h) Other bee-products: Beeswax, bee-collected pollen, propolis, bee-venom and royal jelly are the other bee-products. These are much more costlier than the honey. These products are extensively used in pharmaceuticals and 'Apithearpy' in foreign countries. CBRTI should standardize methods of hygienic collection of these products for export. This will augment the income of the beekeepers manifold.

Rock Bee or Wild Honey

Honey collection from wild honeybee colonies is a traditional industry in India. It is estimated that 70 to 80 per cent of the total honey production of India comes from wild honeybees. Thus about 100 million Kg. of honey worth about Rs. 200 croer is annually collected from wild honeybee colonies. All this honey is mostly collected by tribal. Thus from socio-economic considerations this is a very important industry. Another advantage of KVIC entering into wild honey field is to-days tribals involved in wild honey collection will also be tomorrow's modern beekeeper.

Just like village oil, Khadi, silk and Kattha, collection of wild honey from honey hunters and processing it is post harvest tecnology. A separate wing may be established under Beekeeping Directorate or Central Bee research and Training Institute (KVIC) for standardising methods of collection, processing and marketing of wild honey. With latest technologies available, wild honey can be made as transparent and clear as that of apiary extracted honey.

Unlike domesticated hive bees, Apis dorsata the wild honeybees are spread all over the country and each state therefore produces wild honey. Honey collected in a state from these colonies may be processed and as far as possible marketed in the same state. Long distance transporting of liquid honey may be avoided. This will avoid not only leakage, breakage, contamination and spoilage of honey but also transportation cost and pollution of highways. Excess of honey in a state can be converted into dry-honey or honey drops/candy and marketed on all India basis.

PART - II

Proceedings of the Workshop

1) Inaugural Session

i) Welcome by Shri. A.K.Haral
ii) Special Address by Dr. P.V.Phirke
iii) Inaugural Address by Shri. V. M. Kokane

2) Main Session

i) Lead Paper By Dr. R.P.Phadke
"Beekeeping as an Industry and Its Role in Forestry, Agriculture and Horticulture"
ii) Presentation by Shri. Vijay Ghavate
"Pollination Support Through Beekeeping Under NHM
iii) Presentation by Shri. M.N.Darade
"Beekeeping Development- A Field Experience"

3)Formation of Four Technical Groups

i) Extension
ii) Research
iii) Training
iv)Marketing

1. Inaugural Session

i) Welcome Address by Shri. A.K. Haral, Proj. Coordinator

Shri. A.K.Haral, Project Coordinator, Maharashtra State Horticulture and Medicinal Plants Board, welcomed the participants and narrated about the background of holding the Workshop and need of integration of Apiculture and Agriculture to increase the crop productivity.

ii) Special Address by Dr. P.V. Phirke, Director –Horticulture (M.S.)

Dr. Phirke, Director, Horticulture, M.S. in his special address, stressed the importance of honeybees as a fifth eco-friendly input in agriculture to boost-up crop productivity. He suggested formation of Technical Groups and requested the Members of the Technical groups to make specific recommendations with financial requirements for the development of beekeeping industry in Maharshrtra.

iii) Inaugural Address by Shri. V. M. Kokane - Jt. Secretary - Agri. (M.S.)

Shri. V. M. Kokane, in his inaugural speech stressed the need of protection of environment with special reference to flora and fauna of Maharashtra. He assured the participants that adequate funds will be made available for the development of beekeeping industry in Maharashtra.

Beekeeping as an Industry and it's role in Forestry, Agriculture and Horticulture

Summary of the Paper

Dr. R.P. Phadke
Retd. Director, Beekeeping Industry and Central Bee Research and Training Institute
(Khadi and Village Industries Commission)

The increasing population of India has posed two formidable challenges before the planners. 1) Employment generation for about 35 crore people of the age group between 20 to 40 years, and 2) Provision of sufficient and nutritious food to all.

Agriculture is the biggest private enterprise in our country. As 60 per cent of the population live in rural area and depend on agriculture, Agriculture Sector alone can address this uphill task. Beekeeping Industry, in its own humble way can contribute to this endeavour by providing part-time employment to about a million people, producing valuable food like honey worth crores of Rupees and the most important, increasing the crops yields substantially through bee-pollination of various agricultural and horticultural crops that are dependent on insects for pollination.

Agricultural Scientists at the Indian Council of Agricultural Research have estimated that India needs minimum 70 lakh bee colonies to pollinate 12 major crops which are dependent on insects like honeybees for pollination. As against this bare need we have just 15 lakh bee colonies. Minimum need of Maharashtra is 5 lakh bee colonies and there are only 8 thousand bee colonies in Maharashtra.

The enormous benefit that honeybees silently offer to Agricultural and Horticultural crop productivity and to national income goes unnoticed. The beekeeping industry also has rarely put forth itself as a Key-Factor (Input) in Agricultural production. Honeybees and flowering plants are interdependent for their life cycle. In other words, Apiculture and Agriculture / Horticulture are interdependent and cannot develop in isolation. Integration of Apiculture and Agriculture is necessary for mutual benefits of both beekeeper and the farmer. Warnings have been, however, coming from Environmentalists and Scientists from all over the world that excessive use of insecticides, monoculture, pollution etc., resulting into depletion of useful pollinating insects, is threatening to reduce our food production by $^{1}/_{3}$.

Beekeeping industry has quadruple benefits 1) Generating self-employment for about a million rural and tribal population of India 2) Producing valuable bee-products worth crores of Rupees from the nectar and pollen which otherwise dry up and go waste in nature, 3) Providing employment to educated unemployed and the most important 4) increasing yields per unit area of cross fertile crops through bee-pollination.

Beekeeping industry has to be developed as an integral part of Agriculture. For this, close coordination between Departments of Forest, Agriculture, Horticulture, Irrigation, Khadi and Village Industries Commission and Maharshtra State Khadi and Village Industries Board is essential.

BEEKEEPING AS AN INDUSTRY AND ITS ROLE IN FORESTRY, AGRICULTURE AND HORTICULTURE

- Dr. R. P. Phadke
Retd. Director, Beekeeping industry and
Central Bee Research and Training Institute
(Khadi and Village Industries Commission)

1. Introduction:

The increasing population of India has posed two formidable challenges before the planners. 1) Employment generation for about 35 crore people of the age group between 20 to 40 years, and 2) Provision of sufficient and nutritious food to all.

Agriculture is the biggest private enterprise in our country. As 60 per cent of the population lives in rural area and depend on agriculture and agro- forest based industries, agriculture sector alone can address this uphill task. Beekeeping Industry, in its own humble way can contribute in this endeavour by providing part-time employment to about a million people, producing valuable food like honey worth crores of rupees and the most important, increasing the crops yields substantially, through bee-pollination of various agricultural and horticultural crops.

2. Industrial Development:

The industrial revolution in Europe brought prosperity in most of the European countries. Seeing the example of European countries, after independence, India launched a massive programme of rapid industrialization. The economists believed that industrialization was essential for long term development and the benefits accrued would percolate from cities to villages and from upper strata to lower strata of the population. In reality this percolation theory did not prove completely correct. Though the industrialization created a tempo of modernization and made the country self sufficient in many fields, there had been no equitable distribution of wealth generated. In general, this programme benefited the elite section of the people coming from the cities and the poorest section of the rural population remained by- passed. The benefits of the programmes reached the villages last or not at all. This resulted in an inflow of large number of unemployed rural population from villages to cities, creating problems both in the villages, like shortage of agricultural labour and in the cities like housing, transport, hygiene etc.

3. Agricultural Development:

As 60 per cent of the population lives in rural India and depend on agriculture and forest-based village industries, in the second phase of developmental programmes more emphasis was given on agriculture. Huge investments were made in agricultural research, extension and training in order to boost-up production of crops like cereals, oilseeds, pulses, tea, coffee, sugar etc. In 1980s India witnessed first Green Revolution and became self-sufficient

in food production, ranking world's fourth largest food grain producer. Special efforts were also made to develop various agro-based industries like dairy, poultry, fish farming, sericulture and beekeeping and the results achieved were spectacular. Out of these, Beekeeping Industry, however, received inadequate attention resulting into stagnation.

4. Present Status:

Beekeeping Industry in India is mainly a forest based industry, unlike Western countries where it is mainly agriculture based. Forest population and tribals are the main beneficiaries of this industry in India. Considering the decentralized nature of this forest-based non-traditional industry and educational level of beekeepers, KVIC has done commendable work. Starting with about 200 beekeepers in 1956, maintaining 800 bee colonies and producing about 1200 kg of honey, there are now under KVIC Sector, about 3 lakh beekeepers maintaining 15 lakh bee colonies and producing about 10.00 million kg of honey annually**. In Maharashtra there are about 2500 beekeepers maintaining 10, 000 bee colonies.** Scientists have estimated that bee forage available in forests and on agricultural farms in India can support more than 1 crore bee colonies. **The potential of Maharashtra is estimated at about 5 lakh bee colonies**. Thus there is huge gap between the actual and potential. However, the rate of growth of apiary industry appears to have slowed down. Deforestation, wild fires, pollution of water and air, torrential rains in forest areas and stationary type of beekeeping are the constraints for the development of beekeeping industry.

5. Peculiarities of Beekeeping Industry:

Beekeeping is a peculiar industry, in the sense that in this industry there is an interaction of two living materials, the honeybees on one side and the flowering plants on the other. The matter becomes more complex as secretion of nectar and production of pollen, the sole food of honeybees, depends on climatic factors like, rainfall, humidity, soil moisture, ambient temperatures, wind velocity etc. Thus beekeeping is a multidisciplinary subject and simultaneous attention to sciences like entomology, bee-behaviour, bee-flora, bee-diseases, bee-genetics, bee-breeding and quality control and marketing of bee products is necessary for rapid and qualitative and quantitative development of the industry.

6. Swot Analysis:

Before actually recommending any Action Plan for the integrated development of this important industry, it is necessary to take stock of the past experience and know the Strengths, Weaknesses, Opportunities and the Threats of the industry so that the Planners have the basic information to finalise future strategy and prepare developmental Plan for the industry.

6.1 Strong points:

Beekeeping is one of the most fascinating and desirable occupation. There are many strong points in favour of beekeeping. They are :

i) In relation to industry -

a) There is practically no expenditure on raw material, labour, work-shed, accommodation etc.
b) Capital investments on bee hives and other equipment is very meager
c) In addition to honey, other bee-products like, beeswax, bee collected pollen, royal jelly, bee venom and propolis can be collected from honeybees to augment the income of a beekeeper

ii) In relation to agriculture and horticulture -

a) In this industry there is no pressure on agricultural land for raw material. Bees collect nectar and pollen from the available flora.
b) Honeybees are the best pollinators and they improve the crops both, qualitatively and quantitatively. Beekeeping is therefore one of the most important inputs in agriculture and horticulture.

iii) In relation to socio-economic aspects -

a) Beekeeping can be practiced equally by men, women and grown up children in rural and tribal areas.
b) Local carpenters, blacksmiths get additional job work.
c) Being a forest- and agro-based industry beekeepers are not displaced from their villages.
d) Beekeeping can be practiced by artisans without affecting their main occupation.
e) Beekeeping can be practiced without losing any social status.

6.2 Weak points:

Beekeeping is a very peculiar industry that poses some intrinsic constraints as under:

a) This is a non-traditional newly introduced industry.
b) Tribals and illiterates from forests and remote rural areas generally practice this industry.
c) In this industry there is an interaction of two living materials - honeybees and living plants
d) Flowering of plants and secretion of nectar and production of pollen - sole food of honeybees, is influenced by climatic conditions.
e) The behaviour and life cycle of honeybees depend completely on climatic and floristic conditions, which vary from place to place.

6.3 0pportunities:

Beeekeeping industry does not need any sophisticated technology, high capital investment or infrastructure. Compared to the potential not even a fringe of it in terms of honeybee colony number is achieved. There is a

great potential opportunity for the development of this industry. Beekeeping industry has a great Self-help potential for the rural people, small and marginal farmers, landless labourers, forest labourers etc as under:

a) Honey has a great food value and provides cash income
b) Beeswax which is twice as much costly as honey is in great demand
c) Other products, viz. bee-collected pollen, propolis, venom and royal jelly are several times costly than honey and beeswax
d) About one million people in India and 50000 in Maharashtra can get part-time employment without displacing them from their homes and without sacrifying their main occupation
e) Providing services to farmers for increasing crop-productivity and honey production
f) Processing of value added bee-products.

6.4 Threats:

a) De-forestation
b) Indiscriminate use of insecticides, pesticides, weedicides etc.
c) Wild fires
d) Mono-culture
e) Pollution of water and air.
f) Steady decline of trained research and extension workers

7. Honeybees and Forests:

Honeybees are presumed to have evolved from their wasp-like ancestors shortly after the appearance of flowering plants on the earth. Thus honeybees and forests have been associated with each other for several million years. Honeybees are an integral part of forests and their ecology. A healthy bee fauna is an indication of healthy forest and its natural balance. This is so because bees and flowering plants have co-evolved as one biological unit over past million years. Both, honeybees and flowering plants are interdependent for their life cycle and biology. Flowering plants- arboreal, shrubs, herbs, climbers, bushes, weeds etc. provide nectar and pollen the sole food of honeybees. The forests also provide shelter to honeybees. Forests are therefore permanent natural abodes of the honeybees. The honeybees reciprocate their obligation by offering pollination service to the flowering plants, assuring formation of large quantity of good quality seed and thus maintaining genetic diversity and continuation of the plant species.

Hills and mountains in India are distributed all over the country with major areas located in Himalayas extending 2500 Kms. in length and 150 to 400 Kms. in breadth. The Western Ghats, Eastern Ghats, Vindhyadri, Satpuda, Nilgiri, Palni Hills constitute other major hill agro-forest ecosystem in the country. These systems cover nearly 50 percent of the total National Geographic area and occur in almost all the agro-ecological zones of the

country. Hills and adjacent transitional belts and hills and surrounding agricultural belts having mixture of forests and agriculture, are of the unique biological wealth that could be converted into economic wealth and can offer livelihood on a substantial basis. These are the best areas for promotion of beekeeping industry.

8. Apiculture, Agriculture and Horticulture:

It is estimated that with the improved techniques, 50 per cent of the India's total land can be made available for agriculture. This coupled with forests and plantation lands provides huge opportunities to small and marginal farmers, landless agricultural labourers, tribals and educated unemployed to take up this fascinating industry and improve their economic conditions while producing a valuable food material like honey and other bee-products. Thus a new class of farmer-beekeeper can also be created. It is worth noting here that beekeeping industry does not compete with agriculture or animal husbandry or bring any pressure on agricultural or forest lands but produces many precious products from natural resources which are not otherwise utilized. In fact honeybees play very important role in cross pollination of various agricultural and horticultural crops increasing their yields substantially and also improving the quality of the crop. In the insect-pollinated crops, improved variety of seed, timely irrigation, doses of fertilizers, plant protection and similar agricultural inputs have no meaning if insect pollinators like honeybees are not provided during their flowering. With the increased use of pesticides the population of useful pollinating agents on agricultural lands is depleting fast and honeybees have become almost indispensable pollinators of agricultural and horticultural crops.

In tropical countries with traditional system of agriculture, pollination by wild and innumerable types of insects was generally sufficient. However, intensive agricultural methods are now-a-days adopted for higher agricultural yields. More and more land is being brought under irrigation system every year to step up agricultural production. This also involves and sometimes excessive use of insecticides, destroying useful pollinating insects along with harmful insects. In irrigated areas mono cultivated crops are taken twice or thrice in a year. Non cultivated flowering plants and weeds which are useful to bees are destroyed. This reduces food supply to useful insects and their population is drastically reduced. Further the natural insects are not adapted to the changed system of cropping patterns and flowering of the crops. Thus their population may not be available in adequate numbers when needed most, because of their hibernation or inactive phase of their life cycle. As honeybees are available throughout the year, use of honeybees as an essential input in cross-pollinated crops becomes inevitable under such conditions

9. Green Revolution:

About three decades back, India has achieved amazing results in increasing productivity of cereals like wheat, paddy, jower, bajara etc., which are either self-pollinated or wind pollinated crops. But similar results have not been

achieved in crops like oil-seeds, pulses, legumes, fodder crops, fruits, vegetables and condiment crops. Ministry of Agriculture, therefore, launched various Missions like "Oil-seed Technology Mission"(1985), "Technology Mission on Pulses"(1990), "National Horticulture Mission"(1995), etc. to boost up production of these crops. Despite last twenty years of efforts, production of these crops per hectare has been stagnated and in case of some crops there is reduction in yields per hectare. The statistical information given by Dr. M.S.Swaminathan in his article 'Towards Hunger-Free India" (Manorama 2006), needs serious thinking. He says;

"Technology Mission in Pulses: This Mission has been in existence since early1990s. Pulse yields have been stagnated. A sharp increase in imports has further reduced incentives for home production.

Oilseed Technology Mission: This Mission was started in 1986. There was substantial expansion of area, yields and production till mid 1990s. The production went up 24.4 million tons in 1996. The production was 25.1 million tons in 2003-04 but the growth continued to be negligible.

Imports of edible oil was less than 10 % of domestic production till 1994-95. Now the volume of imports equals domestic production.

National Horticulture Mission: In fruits and vegetables, there has been no increase in yields. Vegetable yields are declining. Out-put increase is entirely through area expansion. The National Horticulture Mission will have to concentrate on increasing yields and quality."

It is worth noting that most of these crops are self-sterile and cross-fertile and hence depend completely on insects like honeybees for pollination. Use of hybrid seed, adequate doses of fertilizers, timely irrigation and plant protection alone will not give desirable yields, if last but important input i.e. insect-pollinators in adequate numbers at the time of flowering of these crop is not provided. Depletion of pollinating insects due to indiscriminate use of insecticides is a global problem and stagnation in production or reduction in yields is a result of this situation. Development of beekeeping industry and using honeybee colonies for planned pollination of various cross fertile crops is the only solution.

10. Honeybees - The most efficient pollinators:

In a single honeybee colony there are about ten thousand worker honeybees. Being social bees, there is an highly evolved division of labour among these bees. Few scout bees, survey the area within a radius of one Km. and collect the information about the direction, distance and quality of food – nectar and pollen, available. By performing some dances, this information is passed on to other honeybees. The honeybees then take a straight flight and land on the crop for collecting nectar and pollen. The honeybees continue to visit this particular crop

until its flowering withers away. This peculiar behaviour or the floral fidelity of honeybees brings about assured fertilization of flowers. This floral fidelity is not found in other insects. Moreover other insects hibernate during some months of the year and are not available for pollination. The floral fidelity of honeybees, large number of hair on their body, presence of a force of about ten thousand bees in a single colony and their behaviour to work for the whole day and for the whole year for collection and storage of their food makes the honeybees the most efficient and reliable crop-pollinators. The modern beekeeping, further makes it possible to move large number of bee colonies from one place to another for planned bee-pollination of various crops.

In some of the agricultural zones useful insects are on the verge of extinction. In USA, farmers and orchardists are now-a-days solely dependent on honeybees for pollinating many crops. In California, about 2.5 lakh acres of land is under almond cultivation. According to statistics three bee colonies are required per acre to pollinate all the flowers of almond. California State has only about 3 lakh honeybee colonies. About four lakh honeybee colonies are brought to California from adjacent States during the flowering of almond. The orchardists pay to the beekeepers about $ 150 per bee colony per month towards pollination service. There are about 50 lakh bee colonies in USA, 55 lakh in USSR and 1 crore in China and 25ooo in Israel. All these bee colonies, besides honey production are regularly used for pollination of various crops.

11. World Scenario:

There are about four crore bee colonies in the world. The United States have about 50 Lakh bee colonies, The USSR have about 55 lakh and China has 1 crore bee colonies. Few decades back China had 60 lakh bee colonies. Now they have one crore bee colonies and have a plan to increase this number to 5 crores in next few decades. To achieve this target China has taken on a big scale afforestation, road-side plantation and other programmes to increase bee-flora and have a timber for manufacturing large number of bee-boxes to hive bee colonies. All these bee colonies, besides honey production, are regularly used for planned bee-pollination of various cross-fertile crops, thereby improving the crop yields both, qualitatively and quantitatively. With different types of forests and variety of agricultural and horticultural crops, India can also come on the world map of Beekeeping.

12. Role of honeybees in agriculture and horticulture:

Until mid-20th century, honeybees were equated with the production of honey and beeswax. But since past 3-4 decades, utilizing honeybees to pollinate large number of agricultural and horticultural crops to increase per acre yield has become a routine practice in many developed countries. Many commercial beekeepers in America prefer to provide honeybee colonies on rental basis for pollination service rather than to take honey production. According to Agricultural Scientists in U.S.A., value of increased crop yield due to honeybee

pollination is 10 to 15 times more than the value of honey and beeswax the honeybees produce.

Dependence of some crops on insects for pollination is as under;

Oil seeds Fruits Vegetables and seeds

Sunflower	100 %	Grape Fruit	80 %	Pumpkin	90 %
Safflower	100 %	Lemon	20 %	Water Melon	70 %
Rape seed	100 %	Lime	30%	Vegetable seed	100 %
Niger	100%	Strawberry	40 %		

- (American Bee journal 1989 (2) page 80)

Experiments on effect of bee pollination on various crops were conducted by Central Bee Research and Training Institute, Pune of KVIC and various Agricultural Universities under All India Cordinated Project on Honeybee Research and Training (ICAR). There is a good data available on this subject from abroad also. A cross section of the cross fertile crops, self sterile crops with different degree of self-sterility and even self fertile crops, benefited by bee pollination is summarized below;

Oilseeds: Mustard, rape, toria, sarsoo, lahi, safflower, sunflower, linseed, niger, gingelly, etc.

Orchard Crops: Apples, pears, plums, cherry, strawberry, raspberry, persimmon, Litchi, citrus verities, grapes, cucumbers, squashes, melons**,** Almond, peach, guava, gooseberry**.**

Legume seeds: Alfalfa, berseem and other clovers, vetches, broad beans, dwarf beans etc.

Vegetable seeds: radish, cabbage, turnip, carrot, onion, cauliflower, gourds etc.

Condiment crops: cardamom, nutmeg, pepper, corriander etc.

Misc. crops: American cotton, Egyptian cotton, coffee etc.

13. Minimum need of honeybee colonies:

According to the scientists at the Indian Council of Agricultural Research, we urgently require minimum 70 lakh bee colonies for optimum pollination of just 12 important crops of India which are dependent on insects for pollination. . Only 15 lakh bee colonies for pollination of these 12 major crops are available at present. Therefore there is a great scope for development of beekeeping in rural areas to generate additional income by way of honey sale and an additional advantage of pollination of crops.

About 35 lakh hectares of land in Maharashtra is under cultivation of crops that need insect pollination. The number of bee colonies needed for effective pollination, ranges from 3 to 7 colonies per hectare depending upon floral density and floral biology of a particular crop. Taking even the minimum requirement of 3 colonies per ha., the total number of bee colonies required for pollination will be 1.0 million. Considering the fact that the same colonies can be used in different seasons and that there are some other natural pollinating insect available, the total need could be safely estimated at 5 lakh bee colonies.

In Maharshtra the minimum need of bee colonies is 5 to 7 lakhs. As against this need, we have just 10,000 bee colonies.

14. Conservation and maintenance of natural bee fauna:

According to International code of conduct regarding honeybees, the endemic races in any country should not be replaced with exotic races, before thoroughly investigating their biological values. Local honeybees, through several thousand years, have evolved themselves and are the best adapted to specific local environmental conditions. The honeybees and the other pollinating insects are the integral part of forests and agriculture. A healthy bee-fauna is an indication of healthy forest and healthy crop yields. Therefore not only domesticable hive bee, but also all other species of honeybees should be conserved. Besides the Indian hive bee and the newly introduced European hive bee, honey is also produced in India by the 'Rock bee' the 'Little bee' and the sting-less the 'Dammer' bee. All these honeybee species can be utilized for pollination of agricultural crops without destroying or replacing them. By bringing all these honeybee species in to service, honey production can be doubled and crop production can be significantly increased.

15. Constraints in the development of bekeeping on agricultural plains:

1. **Absence of forage to honeybees for a long period**. Forage is available to the bees during flowering of Kharif and Rabi crops. Absence of forage during other months coupled with excessive heat of summer posses problems to maintain honeybees on agricultural plains throughout the year.

2. **Excessive use of pesticides:** Beekeeping and pesticides are both essential inputs of modern agriculture management technology. By ignoring either of the two, food production would be seriously impaired. But the pollination of our agricultural crops is seriously affected by indiscriminate use of insecticides and pesticides. This has reduced or even destroyed the population of useful insects including honeybees and has indirectly affected our farm production, as crop yields per hectare are poor.

16. Overcoming constraints:

Agricultural plains provide huge potential for the development of beekeeping industry. This potential has to be fully tapped for mutual benefits of

both, beekeeping industry and agriculture. Constraints in the development of beekeeping on agricultural plains can be overcome as under:

16.1 Inter-migration of colonies from forests to Farms:

Different forests and hills in India show different floristic and climatic conditions. Fortunately, it so happens that when there is acute floral dearth in forests in Monsoon or winter, there are Kharif or Rabi crops in bloom in adjacent agricultural plains. And when there is dearth of bee forage on agricultural plains, there is abundant flora in forest areas. Thus bee forage seasons in forests and agricultural plains alternate. Advantage of this fact can be taken by intermigration of bee colonies between farms and forests. This management practice enables not only colony survival but colony multiplication, honey production and pollination of various cross fertile crops, a triple benefit.

16.2 Agro-forestry and Social-forestry:

Viability of beekeeping industry depends on the density, distribution and composition of local bee flora. However, as the urbanization and other developmental activities increase, large scale deforestation results. These affect apiculture. The main constraints in developing beekeeping in farming areas are absence of food to the honeybees throughout the year and use of pesticides. A long-term measure to develop beekeeping is to introduce bee plants of economic utility. While planning for afforestation, social forestry, farm forestry, road-side avenues, canal-side avenues etc. due attention should be given to inclusion of bee forage plants in addition to economic or aesthetic requirements. When we are planning to increase the bee colony number in India from existing 15 lakh to 70 lakhs in coming decades, such bee plant propagation and change in cropping pattern is all the more essential. List of economic trees, shrubs, herbs etc. useful to honeybees can be prepared and supplied to concerned Departments for inclusion in their forestry programme. If these annuals and perennial plants have staggering flowering periods continuity of bee forage and development of beekeeping industry can be assured. The cropping patterns and afforestation programmes should be so formulated that while fulfilling their own objectives, they support apiculture also. This in the interest of all, the beekeeping industry, the agriculture and the forestry.

Great emphasis is now given on agro-forestry, farm-forestry, road-side forestry, canal-side forestry, social forestry etc. All these projects can have mixed plant species useful for fuel, food, fodder, shelter, medicines etc. and also useful to honeybees during their flowering. Drumstick, Amala, Karanj, Soapnut, Shikekai, Harad, Neem, Jamun etc, for example, are the multipurpose tree species which flower in different months and provide nectar and pollen to honeybees continuously.

16.3 Farmers' Training and Education:

(i) There are over 500 Agricultural Schools all over the country. The syllabi of these schools should be suitably revised to include beekeeping with special reference to practical aspects of beekeeping, (ii) There are over 500 Krishi Vidgyan Kendras (KVK) all over the country. These should serve as centers for transfer of technology in beekeeping and (iii) Under "Mission 2007", each village is to be developed as 'Knowledge Centre'. Awareness about importance of beekeeping can be created through these centers. (iv) low cost 'Janata' bee hives may be made available to new beekeepers.

As beekeeping is a non-traditional industry, above four –pronged approach is necessary to create a new class of farmer-beekeepers.

16.4 Introducing European honeybees:

The European honeybees have adapted to work on agricultural plains and have been successfully introduced in the Indo-Gangatic plains of North India. These honeybees can be first introduced in irrigated agricultural plains with migratory type of Beekeeping.

17. Integration of Apiculure and Agriculture for mutual benefits:

Beekeeping industry is generally equated with honey production and honeybees are, therefore, best known for the honey they produce. But the principal economic role of honeybees in nature is to pollinate hundreds and thousands of flowering plants (including agricultural and horticultural crops) and assure fruit or seed set.

Beekeeping industry has quadruple benefits viz. 1) employment generation for small and marginal farmers, tribals etc., 2) producing honey, beeswax worth crores of rupees from the nectar of the flowers which otherwise dries up in nature and goes waste, 3) providing self-employment to educated unemployed in collection, processing and marketing of bee products and their value added products and finally the most important 4) increasing crop yields of agricultural and horticultural crops through bee-pollination.

18. Future challenges:

Existing 10 thousand bee colonies are the assets of the industry created in Maharashtra during past few decades. Conservation and maintenance of these colonies their rapid multiplication and increasing the productive efficiency of the bee colonies should be strategy of the next decade. Action plan on following points may be worked out.

1) Conservation and maintenance of the existing bee colonies
2) Manufacturing and supply of standard bee keeping equipment
3) Improvement in bee forage
4) Increasing bee colony number and their productivity

5) Technology development
6) Control over diseases, pests and enemies of honeybees
7) Breeding better strains of honeybees
8) Transfer of technology and upgrading skills of beekeepers
9) Diversification of bee products
10) Training in Schools and Colleges of Departments of Agriculture and Forests
11) Quality control and marketing of bee products
12) Co-ordination between KVIC, MSKVIB, Depts. of Agri., Horticulture, Forest, Irrigation, Agricultural Universities etc.

The population of India has already touched a figure of 110 crore. Scientists predict that by 2030, the population of India will stabilize at 140 crores. India therefore will have to face two formidable tasks in the coming decades namely (a) to generate employment for about 40 crore people and (b) to provide nutritious and sufficient food for all.

As 70 per cent of our population lives in villages and depend on agriculture and agro-based industries, agriculture sector alone can address this challenge. Beekeeping industry can play its own role in partially fulfilling both the above objectives. It can provide self - employment to a large segment of rural and forest based population in production and processing various bee products and it can help farmers and fruit growers to boost-up their crop yields through bee-pollination. This is possible through combined efforts of the experts from different concerned Departments.

19. Concluding remarks:

The enormous benefit the honeybees silently offer to agriculture, horticulture and forestry in increasing crop productivity and national income goes unnoticed. The beekeeping industry also, all these years, has rarely put-forth itself as a Key factor, the fifth eco-friendly input in agriculture. But the public and the planners are unaware of this cheap, but essential and eco-friendly input. Warnings have been coming from environmentalists and scientists from all over the world that excessive use of insecticides, monoculture, changes in cropping pattern and pollution, resulting into depletion of population of useful pollinating insects, is threatening to reduce our total supply of food by 1/3. This is a global problem. Apiculture industry has therefore to be developed at any cost.

Beekeeping industry and agriculture / horticulture are interdependent and cannot develop in isolation. There has to integration of all these, for mutual benefits and quick development. KVIC and State Village Industries Board have been playing a leading role in the development of beekeeping industry. KVIC, Maharashtra State Village Industries Board, Beekeepers' Cooperatives and Public Institute, State Departments of Forest, Agriculture, Horticulture, Agricultural Universities should work in close coordination for a common cause. We have seen Green Revolution. We have seen White Revolution. Let us now see Golden Revolution through Beekeeping Industry.

POLLINATION SUPPORT THROUGH BEE KEEPING UNDER NHM

- Shri. Vijay Ghawate

Subcomponents

1. Distribution of Bee Colonies, hives & equipments –
   a) Bee Colonies - 50% max. Rs. 350 per Colony
   b) Bee Hives / Equipments - 50% max. Rs. 450 per set max. 20 Hives
2. Development & multiplication of Nucleus Stock - Project based activity up to Rs. 3.00 lakh
3. Assistance to Bee breeders for strengthening of infrastructure - 50% of project cost max. Rs. 2.5 lakh

Status of Implementation of Honeybee Program under NHM

Sr. No.	Name of Project	Sanctioned Amount (Rs. in Lakh)
1	Establishment of bee nursery Cum demonstration at Rajgurunagar	1.45
2	Demonstration on farmers field – Nashik, Pune, Amravati & Nagpur	6.68
3	Technology Dissemination of pollination support through Bee Keeping	10.51

Programme approved under NHM during 2009-10

Sr. No.	Name of activity	Sanctioned Amount (Rs. in Lakh)
1	Distribution of Bee colony with hives	8.76

Issues for Consideration -

- To identify state designated agency (SDA)
- Identification institutes in public and corporate sector for Development & multiplication of Nucleus Stock
- Identification of bee breeders from corporate / private sector
- Identification of crop clusters, mapping, flowering season
- Selection of bee keepers
- Training of bee breeders, bee keepers
- Selection of Bee species
- Formation of groups for development of strategy & preparation of action plan

BEEKEEPING DEVELOPMENT – FIELD EXPERIENCE

- Shri. M.N. Darade

Shri. M.N. Darade, Development Officer, Maharashtra State Khadi and Village Industries Board, rated his experience in developing beekeeping centre at Latur. There are about 500 bee colonies in Latur District. With available flora, he said, it is possible to increase the colony number to about 10,000. To achieve this target, he said, administrative support, introduction of patterns of assistance, supply of beekeeping equipment is necessary.

Formation of Technical Groups

Following four technical groups were formed to study the status and make recommendations;

1) Extension:-

a) Shri. M.N.Darade, Dev.Officer (MSKVIB) Latur
b) Dist. Suptd. Agri. Opfficer, Raigad
c) Shri. A.Y.Munj, Konkan Krishi Vidyapeth, Dapoli
d) Shri. P.B. Bhalekar, Dept. of Social Forestry (M.S.)
e) Shri. Milind Joshi, Sillod, Aurangabad
f) Dr. R.P.Phadke, Ex-Director, Central Bee Research and Training Institute, Pune 411 016

2) Research:-

a) Shri. A.P. Mhase, Assistant Director, Social Forestry
b) Dr. Gajannan Lande, PDKV, Akola
c) Dr. M.C. Suryanarayana, Ex SSO, CBRTI, Pune
d) Dr. R.P. Phadke, Ex Director, CBRTI, Pune

3) Training:-

a) Shri. D.R. Patil, Director, I/c. Beekeeping Centre Mahabaleshwar, MSKVI Board.
b) Shri. M.Y. Mundhe, T.O. Jt. Dir. Agri. Kolhapur
c) Shri. S.B.Sawant, Central Bee Res. & Trg. Inst. Pune
d) Shri. P.S.Masurkar, Pragati Bahuuddyshiya Sanstha, Pulgao, Dist. Wardha
e) Dr. Daisy Thomas, Asst. Director, Central Bee Research and Training Institute, KVIC, Pune
f) Shri. S.K. Deshmukh, Proj. Coordinator, Krishi Vidyana Kendra, Washim
g) Shri. Bharat Dawane, SMP (PP) KVK, Bhabaleshwar, Dist. Ahmednagar
h) Dr. K.K.Kshirsagar, Ex-Sr. Sci. Officer, Cen. Bee Res. & Trg. Inst. Pune
i) Dr. R.P.Phadke, Ex-Director, Central Bee Res. & Trg. Inst. KVIC, Pune

4) Marketing:-

a) Shri. S.L.Baviskar, DSAO, Nagpur
b) Shri. S.R.Patil, DSAO, Thane
c) Shri. Shevakari, T.O. Directorate of Horticulture, (M.S.)Pune
d) Shri. S.R.Warale T.O. National Horticulture Mission, (MSH&MPB), Pune
e) Shri. S.B.Sawant, Central Bee Res. & Trg, Inst. (KVIC) Pune
f) Dr. R.P.Phadke, Ex-Director, Central Bee Research & Training Institute (KVIC), Pune

The Heads of the Technical Groups presented their recommendations in the Plenary Session as under

Recommendations made by Group - 1

Expansion of Beekeeping Industry

Following were the Members of the Group-1;

1) Shri. M.N.Darade, Dev.Officer (MSKVIB) Latur
2) Dist. Suptd. Agri. Opfficer, Raigad
3) Shri. A.Y.Munj, Konkan Krishi Vidyapeth, Dapoli
4) Shri. P.B. Bhalekar, Dept. of Social Forestry (M.S.)
5) Shri. Milind Joshi, Sillod, Aurangabad
6) Dr. R.P.Phadke, Ex-Dir., Central Bee Research and Training Institute, Pune 16

For our discussions and recommendations, a Note on "Beekeeping Extension Prograsmme" written by Dr. R.P.Phadke, which was circulated to all participants, was taken as a base.

It is estimated that bee-flora available in forests and on agricultural belts can support more than 12 lakh bee colonies. However, considering the fact that there are only 2300 beekeepers and 8000 bee colonies in Maharashtra, the District-wise targets recommended by Maharashtra State Horticulture and Medicinal Plants Board was found reasonable. Thus we have a target to establish 80,000 bee colonies during XI Five Year Plan and another 1.2 lakh bee colonies by the end of XIIth F.Y.P. in Maharashtra. In our discussions and recommendations we have tried to identify priorities and ways and means to achieve the above targets. Following are few important areas where extension work has to be taken on priority basis:

1) **Manufacturing, Stocking and Supply of Bee Hives and other beekeeping equipment:**

   Basic need of beekeeping industry is bee hives and nucleus boxes for hiving the bee colonies and honey and wax extractors. (a) At present Bee hives are being manufactured at MSKVIB's workshop at Gokul Shirgaon (Dist. Kolhapur) and KVIC's workshop at Dahanu (Dist. Thane). In addition to these there are a few small individuals at Kolhapur, Puner and Bordi (Thane), manufacturing bee hives. (b) Some of the Bee hive parts, such as, brood and super frames, queen cages, entrance gates etc. cab be manufactured out of waste timber from Saw Mills/ Jooinery Mills of Forest Department located in different zones of Maharashtra. Four cnetres in four zones of Maharashtra, viz. Kokan (Thane), Western Maharashtra, (Kolhapur) Marathwada, (Nanded) and Vidarbbha (Chandrapur-Gadchiroli) may be established in collaboration with the Department of Forest.

2) Qualitative Improvement in Worked out Areas:

Existing beekeepers and bee colonies are the assets of the beekeeping industry. The average holding of a beekeeper is just 4 bee colonies. The existing beekeeper may be encouraged to increase their holding to 8-10 bee colonies. This will double the number of bee colonies in a year or two. For this, providing bee hives on subsidized rates and encouraging them to migrate bee colonies for survival / honey production /colony multiplication / bee-pollination is essential. Some pattern of assistance may be evolved for this.

3) Census of Beekeepers, bee colonies etc:

The beekeepers should be considered as target persons for the development of the industry. A data-base of beekeepers, their holdings, honey and wax production, Beekeepers' cooperatives, their members etc. should be created so as to enable the planners to get feed-back and serve the beekeepers to develop the industry.

4) Improving Technical Competence of Existing Beekeepers:

Management of bee colonies round the year is the most important aspect of beekeeping for conservation of existing bee colonies, their rapid multiplication, increasing their productive efficiency etc. In addition to production of honey, production of beeswax, bee collected pollen, propolis and royal jelly should also be considered to make the beekeeping sustainable, viable and self-reliant industry. This will attract large number of farmers to become beekeepers. The latest technologies developed at the Central Bee Research and Training Institute (KVIC) Pune and Beekeeping Centre (MSKVIB) Mahabaleshwar may be passed on to beekeepers.

5) Crash Programme in four districts of four zones of Maharashtra:

Four District in four Zones of Maharashtra Viz. Thane (Konkan), Pune (Western Maharashtra), Latur (Marathwada) and Chandrapur or Yavatmal (Vidharbha) may be selected for Crash Programme. Concentrated efforts may be made in these Districts for the development of beekeeping industry. The success story will then automatically spread in adjacent Districts.

6) Strengthening Beekeepers' Cooperative Societies and NGOs:

There are six Beekeepers' Cooperatives in Maharashtra. Similarly there are many NGOs doing good work in rural and tribal areas. The Beekeepers Societies should be strengthened and NGOs should be identified and involved in Beekeeping Developmental Programme.

7) Financial Aspect:

The main items of expenditure in beekeeping industry are Bee hives, nucleus boxes and honey extractors.

For establishing 1 lakh bee colonies of **Apis cerana** and 1 lakh Bee colonies of **Apis mellifera**, following will be financial requirement;

	A.cerana	A.mellifera
Non-recurring:		
5 Bee hives	7500=00	5000=00
3 Nuclei	2000=00	2500=00
5 Stands	1000=00	1500=00
1 Honey extractor	1000=00	2000=00
Misc. equipments	1000=00	1500=00
Total N.R.	**10,000=00**	**15,000=00**

Recurring:		
5 Bee colonies	1500=00	7000=00
Foundation Sheets	200=00	1000=00
Sugar feeding	350=00	1000=00
Medicines	250=00	500=00
Transport	200=00	500=00
Total Recurring	**2500=00**	**10,000=00**

Grant Total Non-recurring + Recurring Rs 12,500=00 Rs.25,000=00 (**For a Unit of 5 Bee colonies)**

Summary of Estimated Financial Requirement (Rs. in crore)

	A.cerana	A.mellifera	Total
Non Recurring	20=00	30=00	50=00*
Recurring	5=00	20=00	25=00*
Over Heads	1=00	1=00	2=00
(Coordinating cell)			
	26=00	51=00	77=00

(***** Out of this 40.00 crores as subsidy and 35.00 as Capital & working Loan)

Recommendations made by Group - 2

Identification of Research Areas in Honey bee rearing and allied activities

Following were the members of the Group - 2;
1. Shri. A.P. Mhase, Assistant Director, Social Forestry
2. Dr. Gajannan Lande, PDKV, Akola
3. Dr. M.C. Suryanarayana, Ex SSO, CBRTI, Pune
4. Dr. R.P. Phadke, Ex. Director, CBRTI, Pune

In our discussion we took as the basis, the various points detailed in the note 'Bee Research Programme' prepared by Dr. R.P. Phadke, Ex Director, CBRTI, Pune, and circulated to all the participants of the Workshop.

At the outset it was pointed out that Maharashtra has been fortunate to have a basic resource of bee research information, particularly on the indigenous honey bee, *Apis cerana*. The Apiculture Laboratory, Maharashtra KVI Board, Mahabaleshwar and the Central Bee Research and Training Institute, KVIC, Pune did pioneering work on various aspects of bee research and technology. This valuable resource at the research centres can be utilized initially in implementing the beekeeping development programme.

Under the changing conditions of agriculture, floral and faunal resources, however, investigations are necessary in the management of the existing floral and faunal resources and formulate technologies both in the rearing and management of honey bees and in the post harvest treatment of bee products. This will help in the implementation of the beekeeping development program now being envisaged under the National Horticulture Mission in Maharashtra.

In our discussions and formulation of recommendations, we tried to identify priority areas where immediate research inputs are necessary. Following are the few areas where we felt research and development work has to be taken up on a priority basis.

1. Assessment of bee forage availability and vegetation mapping: Considering the various aspects that affected the natural and cultivated vegetation in the State, a detailed district-wise assessment of bee forage availability has to be undertaken. This should include species-wise enumeration of the floral resources, their approximate numbers, season of forage availability and utility for *Apis cerana* and/or *Apis mellifera*. This is necessary in view of the fact that the two bee species differ in their floral preferences and foraging behaviour.

   Vegetation maps have to be prepared depicting the density and distribution of major forage sources.

We suggest that the four State Agricultural Universities may take up this work. Survey teams may consist of persons with botany, entomology and forestry background. CBRTI may provide technical assistance.

2. The next task in the assessment of bee forage potential in each of the (a) forest areas and (b) cultivated areas. Each area or zone in the State may be classified as A, B, C or D area depending upon the estimated bee forage potential - 'A' being the best and 'D' the least useful. This will help in estimating the number of bee colonies that can be profitably kept in the area and in formulating further development plans in the area.

3. Optimal utilization and management of the available floral resources involves formulation of floral calendars for each zone giving the flowering period and forage availability. This will help in formulating migration schedules, bee colony multiplication and other seasonal operations of bee colonies.

4. A long-term strategy to improve bee forage is to include sources of bee forage in various plant propagation programs like agricultural forestry, social forestry and afforestation. Among the plant species recommended for this purpose are: bor (*Ziziphus mauritiana*), shevga (*Moringa oleifera*), hadga (*Sesbania grandiflora*), kavath (*Feronia elephantum*), jambhul (*Syzygium cumini*), ain (*Terminalia elliptica*), jangli badam (*Terminalia catappa*), hirda (*Terminalia chebula*), chinch (*Tamarindus indica*), shami (*Prosopis cineraria*), kadunimb (*Azadirachta indica*), gulmohr (*Delonix regia*), copperpod tree (*Peltophorum pterocarpum*), etc. Candidate species suitable for each zone may be identified and included in the afforestation programs.

   Another equally important strategy for agricultural areas is to introduce new crops and attempt crop rotation method to include bee forage during periods of its scarcity. Crops like coriander (*Coriandrum sativum*), maize (*Zea mays*), niger (*Guizotia abyssinica*), Lucerne (*Medicago sativa*), berseem (*Trifolium alexandrinum*), sunflower (*Helianthus annuus*), safflower (*Carthamus tinctorius*), sesame (*Sesamum orientalis*), and different vegetables if included in the crop rotation will assist in improving the bee forage potential in the area. Crop species suitable to each agro-climatic zone of the State have to be identified for this purpose.

5. Optimal utilization of bee faunal resources: The State has a wealth of bee species. Besides the hive bee species, *Apis cerana*, *A. mellifera*, there are the rockbees, *A. dorsata*, the dwarf or little bee, *A. florea* and the stingless bees belonging to *Trigona*. A major share of commercial honey in State is provided by the rockbees. CBRTI has evolved sustainable and eco-friendly methods of harvesting of honey and beeswax from this species. Several tribal groups in the State were trained in the scientific harvesting of honey. Similarly there are good populations of the little bees and the stingless bees. Honeys from the little bees and stingless bees are considered to be medicinal. We recommend a detailed survey of the distribution and taxonomy of these wild bee species, as well as investigations on their biology and utilization for production of honey and other

valuable products. Their contribution of pollination of crops is also known to be valuable. Evaluation of the utility of individual species to different crops has to be undertaken.

6. Zonation of the State for beekeeping: Field level experiments have to be undertaken to assess the bee species and variety suitable for each agro-climatic zone. It is generally believed that *A. cerana* is suitable for rearing in the forest regions. However, the ideal strain or variety of this species for each forest or vegetation type needs to be identified and the beekeepers advised accordingly.

   A. mellifera is considered the best in irrigated agricultural areas. While the indigenous bees do not prefer to forage on tur (*Cajanus cajan*) and sunflower, the European bees do and produce significant quantities of honey. The trials during the last about 20 years by the Apiculture Laboratory, MSKVI Board at Latur and adjacent areas showed that this species is ideal for honey production in the area. It is suggested that while importing colonies of this species from outside the State, consideration should be given to the strain of the bees kept in a State like Punjab with agro-climatic conditions similar to Maharashtra.

   We feel that A. cerana beekeeping as of now has to remain as a subsidiary occupation. A bee farmer may be able to keep an apiary of about 25 bee colonies. A. mellifera on the other hand will be profitably adopted as a commercial, full-time, occupation. Under this venture each beekeeper has to maintain a minimum of 50 bee colonies.

   We suggest that about a third of bee colonies proposed to be established in the State (about 30,000 in the first 5 years and about 40,000 in the next five years) may be of *A. cerana* and the remaining may be of *A. mellifera*.

7. Rapid multiplication of bee colonies: Both CBRTI and the Apiculture Laboratory, Mahabaleshwar have the technologies for rapid multiplication of bee colonies. These can be adapted to the different agro-climatic regions of the State. It is suggested that for A. mellifera production of mated queen bees in addition to bee colonies may be taken up. The former (queen bees) are required for requeening of bee colonies once in every two years and the bee farmer can improve colony productivity by adopting this management method.

   In view of the large number of colonies proposed to be established, it is considered necessary to identify experienced beekeepers and train them in the queen rearing and colony multiplication technologies. Such trained beekeepers may be encouraged to take up colony multiplication, queen bee production and supply.

   The State Agricultural Universities (SAUs) may establish one bee breeding centre. This centre will produce stocks of colonies from selected breed of bees. These selected colonies are given to bee colony multipliers for further increase in colonies. Each SAU will identify at least 50 beekeepers for colony multiplication. Each of the trained beekeepers will produce and supply at least 100 bee colonies each year.

8. Standardization of seasonal management of bee colonies: Investigations have to be undertaken to prepare standard bee management schedules for each agro-

climatic zone of the State for optimal utilization of available resources. This information should be passed on to beekeepers. They also need to be regularly advised on the new technologies developed.

It is suggested that an experimental apiary of about 25 bee colonies of *A. cerana* and/or 50 colonies of *A. mellifera* be established at each SAU.

9. Control of bee diseases and pests: A. cerana bee colonies in the State have one serious problem in the form of sacbrood disease. Being a viral disease there are no chemical control methods. The only course of action is to breed resistant strains of bees. Fortunately, during the past few years a large proportion of natural bee colonies found in the State is disease-tolerant. Such disease-tolerant bee colonies have to identified and kept in the experimental apiary. After careful observation and ensuring their disease-resistant nature, the colonies may be multiplied and supplied to trained beekeepers for further multiplication and distribution in the field. CBRTI and Apiculture Laboratory, Mahabaleshwar have developed technologies to prevent and control pests and diseases of *A. cerana*. These have to be passed on to beekeepers during their initial training.

   A. mellifera has two major problems – *Varroa* mite infestation and *Nosema*, a protozoan parasite causing debilitating disease in adult bees. Though the latter is not yet reported from India, there is a potential threat of infection in the Indian A. mellifera colonies. There are two species of *Nosema – N. apis* and *N. ceranae*. The former is found in *A. mellifera*, but *N. ceranae* commonly found in *A. cerana*, is recently found to infect *A. mellifera* in several South Asian countries.

   Both the diseases are at present controlled by chemicals. The chemical treatment is costly and the chemicals are not available in the Indian market. It is therefore advisable to develop alternative methods of control including hygienic management of bee colonies.

   A. mellifera colonies are also affected by the green bee eaters, found in large numbers in several parts of the State during the bee colony growth season starting in October. Methods have to be evolved to prevent scare the birds away from the apiary locations. One of the methods can be use of ultra-sound that is harmless to humans and bees.

10. In the proposed plan to develop beekeeping for improving horticulture crops, about 80,000 colonies are suggested to be established in the first 5-year plan and another 120,000 in the next 5-year plan. This naturally involves provision of a similar number of bee boxes, as well as a proportionate number of beekeeping implements. Supply of Bureau of Indian Standards (BIS) ‘A’ type bee boxes for *A. cerana* is at present made by the carpentry workshops of the MSKVI Board, at Dahanu and Kolhapur. These sources may prove inadequate. For *A. mellifera* bee colonies Langstroth boxes are necessary. At present these are imported from northern States entailing high costs. Considering the large demand for these bee boxes it may be economical to manufacture them at facilities within the State. We propose that at least five carpentry workshops be established at suitable locations where bee boxes for both species of bees can be manufactured.

We further suggest taking up steps to develop of bee boxes using cheaper timber available within the State, to evaluate other material like cement – for stationary type of beekeeping with *A. cerana*, bamboo strips or reeds woven into mats and plastered with clay and dung. Expertise already exists with the MSKVI Board centre at Latur.

Trials may also be undertaken on use of Top bar hives (TBH), which can reduce the cost of the bee box substantially. TBHs are successfully used in the Nilgiri and Palni hill areas. Novice beekeepers may like to use these cheaper types of hives initially and switch over to the standard boxes after they get sufficient experience in handling bees and are confident of taking up profitable beekeeping.

11. Common Facility Centres for Post-Harvest Activities and Production and Supply of Bee boxes and related Equipment: We suggest establishment of Common Facility Centres (CFCs) in different agro-climatic zones to be entrusted to cooperatives, self-help groups and other development agencies. The CFCs will establish facilities for processing, storage, packing and marketing of honey and other bee products. They can also take up manufacture of bee boxes, comb foundation sheets and other equipment and supply these to beekeepers. Honey and beeswax from wild bee colonies can be procured by the CFCs and after processing, etc. can be marketed. They can also function as service centres for beekeepers.

    The CFCs may take up production and supply of bee feeding materials like pollen supplements, simple chemicals for control of bee diseases and pests, and value-added products from honey, beeswax, etc.

    Government of India has launched in 2005-2006 the Scheme of Fund for Regeneration of Traditional Industries (SFURTI) for development of ‘clusters’ for village industries sector as well as for Khadi and Coir sectors. It is learnt that the Pragati Bahu-Uddeshiya Sanstha, Wardha has recently been entrusted with one ‘Cluster’ – Amaravati Beekeeping Cluster – for development of beekeeping and rockbee honey in the Melghat region of the State. Proposals for cluster development can include establishment of CFCs and can be forwarded by the State Government to any Nodal Agency under the SFURTI.

    Production and post-harvest technologies already exist within the State for honey and beeswax. For the development of Pollen and Royal Jelly, obtained mainly from *A. mellifera* colonies, however, experienced beekeepers from potential areas need to be given training in the production techniques. Post-harvest handling and treatment of the two products is highly technical and needs to be undertaken by a well-equipped centre. CFCs may be upgraded to take up these tasks in addition to the above noted activities.

12. Bee Pollination: There are several agricultural and horticultural crops in the State which are known to be benefited by bee pollination. Experiences of private and public institutions expressed in the Workshop indicate that sunflower, melon and onion seed crop are benefited by honey bees kept near these crops. CBRTI had earlier undertaken experiments on several crops in

Maharashtra and demonstrated the use of honey bees in increasing both the crop yields and quality. It is however important to note that the utility of the bees to different crops depends upon the variety of the crop, agro-climatic conditions and the foraging behavior of the bees. Experiments will have to be undertaken, firstly, to assess the need for bee pollination to the specific variety of the crop, secondly, to identify the bee species which can be most efficient in this task and thirdly, to formulate specific management practices for pollination including prevention of damage to pests and agro-chemicals.

In this context we would also like to point out that world-wide there is an increased perception of threat to pollinator populations, of which honey bees are the main. In the U.S.A. and in the countries of Europe honey bee populations are diminishing at alarming rates, which can adversely affect not only honey production, but more importantly pollination of almonds, fruits, vegetables, oilseeds and other major food crops. This can result in severe shortage of world food production. Considering the severity of the loss of pollinator populations, the Global Environment Facility (GEF) launched in August 2008, a 5-year project on 'Conservation and Management of Pollinators for Sustainable Agriculture through an Ecosystem Approach" to ensure food security through protection of key pollinator species. The United National Environment Programme (UNEP) is implementing the project through partnerships with the Governments of Brazil, Ghana, India, Kenya, Nepal, Pakistan and South Africa in collaboration with stakeholders from different environment and agricultural communities at national and international level. It is suggested that suitable projects may be formulated under this program on conservation and management of the honey bee species available in Maharashtra.

13. Bee Research through Fellowships: In addition to the efforts by established bee research centres in the State, different bee research problems can be taken up for study by research fellows who can use the results of their research for M.Sc. or Ph.D. degrees. Candidates taken up for these Fellowships should be B.Sc. or B.Sc. (Agri.) with basic forestry, horticulture and Apiculture as elective subjects. They may also be given 6-month Apiculture Diploma Course training imparted by the CBRTI, Pune. The aptitude and performance of the Fellows may be periodically reviewed and evaluated. Successful Fellows can be taken up to lead or execute bee research projects in the Department of Entomology, Forestry, Agriculture or Horticulture.

    It is suggested that each State Agriculture University may award 2 Fellowships to undertake bee research leading to the M.Sc. degree and 1 Fellowship for Ph.D. degree.

14. We made tentative financial requirements for the above research and development program. This is purely of indicative value. According to these tentative estimates about Rs. 18 crores will be required for the two plan periods, as shown in the attached Statement.

Recommendations made by Group - 3

"Training Needs in Beekeeping Industry"

Following were the Members of the Group - 3;

1) Shri. D.R. Patil, Director, I/c. Beekeeping Centre Mahabaleshwar, MSKVI Board.
2) Shri. M.Y. Mundhe, T.O. Jt. Dir. Agri. Kolhapur
3) Shri. S.B.Sawant, Central Bee Res. & Trg. Inst. Pune
4) Shri. P.S.Masurkar, Pragati Bahuuddyshiya Sanstha, Pulgao, Dist. Wardha
5) Dr. Daisy Thomas, Asst. Director, Central Bee Res. & Trg. Inst. KVIC, Pune
6) Shri. S.K.Deshmukh, Proj. Coordinator, Krishi Vidyana Kendra, Wasdhim
7) Shri. Bharat Dawane, SMP (PP) KVK, Bhabaleshwar, Dist. Ahmednagar
8) Dr. K.K.Kshirsagar, Ex-Sr. Sci. Officer, Cen. Bee Res. & Trg. Inst. Pune
9) Dr. R.P.Phadke, Ex-Director, Central Bee Res. & Trg. Inst. KVIC, Pune

There are 2300 Beekeepers and 8000 bee colonies in Maharashtra. It is proposed to add 80,000 bee colonies during XI th Five Year Plan and another 1.2 lakh Bee colonies by the end of XII th F.Y.Plan. As beekeeping is a non-traditional industry, a new class of beekeepers i.e. Farmer-beekeepers will have to be create in each District of Maharashtra to achieve the targets, fixed for each District.

A short-term and long-term measures will have to be taken for (1) Upgrading technical skills of the existing beekeepers, (2) rapid multiplication of bee colonies, (3) increasing productivity of bee colonies, (4)creating large number of new beekeepers, (5) increasing the number of bee colonies per beekeeper and (6) creating scientists, research workers, teachers, technicians, extension experts etc. to achieve the target and shoulder the future responsibility of establishing 5 lakh bee colonies during XIIIth and XIVth F.Y.P. To achieve these targets, the existing training facilities available with Khadi and V.I. Commission, State Khadi Board, Agricultural Universities, Agricultural Colleges, Agricultural Schools, Forest Guards and Rangers Training Centres and KVK should be utilized. Following are the recommendations

a) Existing Beekeepers: Technical skills of the existing beekeepers should be upgraded to bring about qualitative and quantitative improvement in the industry. Summer Camps may be organized for existing beekeepers for transfer of technology. Various technologies like rapid multiplication of bee colonies, queen rearing, local and distant migration, disease control, health and hygiene, diversification of bee products etc. have been developed at the Central Bee Research and Training Institute, (KVIC) Pune and Bee Keeping Centre, Mahabaleshwar (State Khadi Board). Summer Camps, through Beekeepers' Cooperatives may be organized. A set of literature on these important topics should be prepared and distributed to beekeepers.

b) Creating New Beekeepers: To establish 2 Lakh bee colonies by the end of XIIth F.Y.P. and 5 Lakh bee colonies by the end of XIV th F.Y.P. about 40,000 new beekeepers will have to be created. This can be done by utilizing existing facilities available with Agricultural Schools and KVKs in Maharashtra. Two teachers from each of the Agri. School and KVK should be trained in Beekeeping at Central Bee Research and Training Institute, Pune (CBRTI). This can be two week's Teachers Training Programme. Special syllabus should be prepared for this training programme. This programme can be completed in one year in 5-6 Batches. Details will have to be worked out in consultation with CBRTI.

c) Revision of Syllabi: Revision of syllabi of Agri. Colleges, Agri. Schools, Horti. Colleges etc. giving emphasis on bee-biology, bee-behaviour and honeybees as an essential input in pollinating cross-fertile crops.

d) Demonstration-cum-Training-cum Nursery Units in State Agricultural Universities: Each Agricultural University should have on their Campus a Demonstration Unit-cum-Training-cum Nursery Unit for both, Apis cerana and Apis mellifera bee colonies. Thousands of progressive farmers visit Universities every year. This will help bring awareness among farmers importance of honeybees in increasing criop productivity and encourage them to become beekeepers.

e) Apiculture as a subject for M.Sc. M.Phill, Ph.D. : B.Sc.(Agri.) students may be encouraged to opt for Apiculture as a subject for Post-Graduate studied. Bee-biology, Bee-behaviour, Bee-botany, Mellissopalunology, Bee-genetics, Bee-breeding, Bee-pathology, Bee-pollination etc. can be the subjects of M.Sc.(Partly by papers and partly by thesis), M.Phill or Ph.D. degrees. This will fulfill the requirement of scientists, research workers, extension officers etc. in coming decades.

In view of above following are the recommendations;

a) A half-day Workshop on "Honeybees as an Input in Agriculture" may be organized for the District level Agricultural, Horticultural and Forest Officers. This can be arranged at the Central Bee Research and Training Institute, (Khadi and V.I.Commission) Pune 411 016.

b) One week training in beekeeping for Taluka and Circle level staff of the Dept. of Agriculture and for staff of the Nurseries of the Horticulture Dept. may be organized. This can be arranged at the Beekeeping Centre, Maharashtra State Khadi and V.I.Board, Govt. Bungalow No. 5, Mahabaleshwar (Dist. Satara)

c) Two weeks training in beekeeping for Teachers of Agricultural Colleges, Agricultural Schools, Forest Guard's and Ranger's Schools and In-charges of Krishi Vidyan Kendras. This can be arranged at Central Bee Research and Training Institute, Pune 411 016.

d) Some NGOs with good track record and from the areas suitable for introducing beekeeping, may be selected and candidates selected by these NGOs may undergo one months training in beekeeping. This can be arranged at Beekeeping Centre, Govt. Bungalow No. 5, Mahabaleshwar.

e) Technical skills of existing beekeepers should be constantly upgraded by conducting 'Summer Courses" for them and by transferring technologies developed to the beekeepers.

f) Syllabi of Agricultural Colleges and Agricultural Schools should be suitably revised including important topics on bees and beekeeping. CBRTI, Pune can help in preparing the syllabi.

g) All State Agricultural Universities should have on their Campus "Beekeeping Demonstration-cum-Training-cum-Nursery Unit functioning under Entomology Department.

h) B.Sc.(Agri.) students may be encouraged to opt for Apiculture as subject for Post-graduate studies. Bee biology, Bee behaviour, bee-botany, mellissopalynology, bee-genetics, bee-pathology, bee-pollination etc. can be the subjects for M.Sc. (partly by papers and partly by thesis), M.Phill and Ph.D. degrees. This will fulfill the requirements of scientists, research workers, extension officers etc. during coming decades.

Estimated Financial Requirements for the suggestions of the Training Group

(In Rs. Lakh)

Sr. No.	Type of Training	2009-10	2010-11	2011-12	2012-13	2013-14	Total	Who will conduct
1	Dist. level officers' orientation	0.5	0.5	-	-	-	1.0	CBRTI, Pune
2	Two weeks teachers training Agril. College, School etc.	4.5	4.5	-	-	-	9.0	CBRTI, Pune
3	One week training Dist., Tahsil, Circle level Agri. and other staff	9.0	9.0	9.0	9.0	9.0	45.0	Beekeeping Centre, Mahabaleshwar, (Dist. Satara)
4	Agri. Univ. Demo Training Nursery	8.0	6.0	4.0	2.0	-	20.0	4 Agriculture Universities
5	Fellowships 4 Univ. M.Sc. & Ph.D.	5.0	5.0	5.0	5.0	5.0	25.0	4 Agriculture Universities
Total		**27.00**	**25.00**	**18.00**	**16.00**	**14.00**	**100.00**	

Note:

1. Dist.Level Officers 100 Nos. (2 Batches of 25 each in one year) Fees + TA.DA Rs. 3000=00 each.
2. Teachers Training 300 Nos. (Six Batches of 25 each per year) - DO
3. Dist.-Taluk-Circle 1500 Nos. (Six Batches of 50 each per year) -

Recommendations made by Group - 4

"Marketing of Honeybee Products"

Following were the Members of Group - 4;

1. Shri. S.L.Baviskar, DSAO, Nagpur
2. Shri. S.R.Patil, DSAO, Thane
3. Shri. Shevakari, T.O. Directorate of Horticulture, (M.S.)Pune
4. Shri. S.R.Warale T.O. National Horticulture Mission,(MSH&MPB), Pune
5. Shri. S.B.Sawant, Central Bee Res. & Trg, Inst.(KVIC) Pune
6. Dr. R.P. Phadke, Ex-Director, Central Bee Research & Training Institute (KVIC), Pune

Though honeybees are best known for the honey they produce, other important bee-products are 1) Wax, 2) Bee-collected pollen, 3) Bee-collected Propolis, 4) Bee venom and 5) Royal jelly. All the products have applications in Pharmaceutical and cosmetics industry. Thus methods of hygienic collection, processing and maintaining purity standards, both Indian and FAO standards is very essential.

At present honey production in Maharshtra is about 50,000 Kg. per year and there is problem of marketing honey. But the production of honey and other bee-products is expected to increase year by year and it is necessary to take precautionary measures right from beekeepers level to processing, packing and marketing level. This is in the interest of all, the producer, the packer and the consumer. Following are the recommendations of the Group- 4 on marketing of bee products

1. Beekeepers should be well informed about hygienic collection of all be products.
2. Diversification of bee-products and developing value added products may be considered
3. Quality and type of containers for collection and storage should be standardized.
4. Spraying schedule on crops should be so arranged that not only honeybees but the nectar and pollen of the flowers are not contaminated with insecticides.
5. Folders and Technical Bulletins on all bee-products should be prepared for the benefit of producer, packer, seller and buyer.
6. Development of Testing Laboratory for maintaining quality of bee products as per National and International standards

Financial Requirements for publishing literature, publicity and propaganda and testing facilities:
Rs. 2.00 Crores for 10 years

Summary of Total Financial Requirements for Beekeeping Industry for 10 years
For Extension, Research, Training and Marketing

(Rs. in Crore)

		Total
1) Extension Programme	35=00 + 40=00 as subsidy	75=00
2) Research Programme	18=00	18=00
3) Training Programme	10=00	10=00
4) Marketing Programme	2=00	2=00
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Total 65=00 + 40=00 (Subsidy)		105=00

PART - III

PLENARY SESSION

1. Observation by Chairman

2. Vote of Thanks by Project Coordinator

OBSERVATIONS

Dr. P.V. Phirke,
Director,
Horticulture (M.S.)

Dr. P.V. Phirke, kindly made it convenient to attend the Workshop throughout the day. After going through the presentations by the Heads of the Technical Committees, he made valuable suggestions and suggested that Proceeding of the Workshop may be prepared as early as possible. He observed that based on the recommendations of the Technical Committees, a “Core Committee” may be formed to implement the recommendations of the Technical Committees and for the development of this important agro-based industry to boost up crop productivity.

VOTE OF THANKS

Project Coordinator,
MSH & MPB

Shri. A.K. Haral, proposed vote of thanks to Dr. P.V. Phirke for making it convenient to attend the Workshop for the whole day and making valuable suggestions. Shri. Haral thanked Dr. Phadke for his valuable guidance and participation in deliberations of all Technical Committees. Shri. Haral thanked all Participants for their active participation in the workshop and the staff of the MSH & MPB for making the workshop a grand success. Shri. Haral thanked Sakhar Sankul for making available Hall and other facilities for the workshop.

ACTION PLAN

Based on the recommendations of the Technical Groups and as suggested by Director, Horticulture (M.S.) following tentative Action Plan is prepared and formation of Committees is recommended.

Introduction:

In Maharashtra there are about 10,000 bee colonies, mostly located in Western Ghats i.e. in the Districts of Kolhapur, Sangli, Satara, Pune, Ahmednagar, and Nashik. There are some colonies in the Districts of Thane, Amaravati, Chandrapur, Gadchiroli and Bhandara.

In Maharashtra, 35 lakh hectares of land is under cultivation of crops which are entomophilous and hence depend on insects like honeybees for pollination. Minimum of 5 to 7 lakh bee colonies is a bare need for pollination of all these crops. The forests of Maharashtra also have the potential to support minimum 5 lakh bee colonies. With our existing basic stock of 10,000 bee cololonies, addition of another 80,000 bee colonies during 11th Five Year Plan and 1.2 lakh bee colonies by the end of 12th Five Year Plan can be a reasonable target. Out of these, 1.0 lakh Indian honeybee colonies should be established in forests and adjacent mixed vegetation, i.e mix of .forest and agricultural crops and 1.0 lakh bee colonies mostly European honeybees, in agricultural belts. To achieve this target about 40,000 new beekeepers, farmer-beekeepers will have to created.

Extension, Research, Training and Diversification of bee-products, their quality control, processing etc. should be simultaneously attended. Beekeeping is a newly introduced, non-traditional industry and trained artisans are not available in this industry. Therefore, special emphasis on training programme will have to be given. Action Plan for training, extension, research may be on following lines as per the recommendations of the Technical Groups formed during the Workshop.

A) Training:

1. A half-a-day workshop on “Honeybees as an Input in Agriculture and Protection of honeybees from pesticides” may be organized for District-level Agricultural and Horticultural Officers. This can be arranged at the Central Bee Research and Training Institute, (CBRTI) Pune.
2. A Five Day training programme for Taluka and Circle level staff of the depts. of Agriculture and Horticulture may be organized. This can be arranged at CBRTI, Pune and Beekeeping Centre, Mahabaleshwar, Dist. Satara (M.S.)
3. Teachers’ Training: Teachers of Agricultural Colleges, Schools, Forest Guards and Rangers’ Schools, In-charges of Krishi Vigyan Kendras should undergo Two Week’s short training course in Beekeeping.
4. Syllabi of Agricultural Colleges and Schools should be suitably revised to include ‘Honeybees and Beekeeping”. CBRTI can help in preparing the syllabi.

5. Some NGOs with good track record and from areas suitable for introducing beekeeping, may be selected and candidates selected by these NGOs may be given one month's training in beekeeping.
6. Technical skills of the beekeepers should be constantly upgraded by conducting "Summer Camps"
7. All Agricultural Universities should have on their campus a "Beekeeping Demonstration-cum-Training-Cum-Nursery Unit" functioning under Dept. of Entomology.

B) Extension:

1. Census of Beekeepers and creating data-base
2. Manufacturing and stocking of beekeeping equipment
3. Formulation of new Patterns of assistance
4. Strengthening of existing Beekeepers' Cooperatives
5. Promoting new Beekeepers' Cooperatives
6. Conservation of existing bee colonies and their rapid multiplication
7. Survey of new potential areas
8. Participation of NGOs
9. Promoting migratory beekeeping
10. Establishing Bee Nursery Units
11. Coordination between Beekeepers and Farmers
12. Organising summer camps, Seminars etc.

C) Research:

1. Standardisation and designing of beekeeping equipment
2. Standardisation of Bee-management methods for different regions
3. Standardisation of methods for protection of bee colonies from pesticides
4. Bee genetics and Bee breeding – Improving strains of honeybees
5. Studies on Bee-flora, degree of utility of crops to honeybees and vice-a-versa
6. Introduction of Multipurpose bee-plants in afforestation, social forestry, road-side forestry, agro-forestry etc.
7. Studies on European honeybees
8. Diversification of Bee-products, their quality control, development of value added products
9. Development of quarantine control procedures
10. Studies on diseases, pests and enemies of honeybees, preventive and control measures etc.

D) Formation of Beekeeping Cells and a Committee:

1. A special Cell may be created exclusively for beekeeping under (i) Dept. of Agriculture, (ii) Dept. of Horticulture and (iii) Dept. of Forest and iv) Social Forestry.
2. A core Committee may be formed, drawing officers from above Departments, Central Bee Research and Training Institute (KVIC), State Khadi and Village Industries Board and some Experts in the field for; (i) Planning and preparation of Road Map, (ii) Co-ordination, (iii) Review and (iv) Monitoring

Annexure-I

List of Invitees:

1. Principal Secretary (Agri. & Hort.) & President, MSHMPB, Mantralaya, Mumbai
2. Commissioner – Agriculture (M.S.), Commissionerate of Agriculture, Central Building, Pune -1
3. Director – Horticulture (M.S.), Commissionerate of Agriculture, Shivajinagar, Pune-5
4. Director – Agriculture (Inputs), Commissionerate of Agriculture, Central Building, Pune-1
5. Director – Agriculture (Soil conservation), Commissionerate of Agriculture, Central Building, Pune-1
6. Director – Agriculture (Extension), Sakhar Sankul, Shivajinagar, Pune-5
7. Director – Agriculture (Processing), Sakhar Sankul, Shivajinagar, Pune-5
8. Director General – Maharashtra Council of Agri. Education and Research, 132-B, Bhamburda, Bhosalenagar, Pune-7
9. Divisional Joint Director of Agriculture, Pune Division, Pune
10. Divisional Joint Director of Agriculture, Nashik Division, Nashik
11. Divisional Joint Director of Agriculture, Aurangabad Division, Aurangabad
12. Divisional Joint Director of Agriculture, Kolhapur Division, Kolhapur
13. Divisional Joint Director of Agriculture, Latur Division, Latur
14. Divisional Joint Director of Agriculture, Amaravati Division, Amaravati
15. Divisional Joint Director of Agriculture, Thane Division, Thane
16. Principal Chief Conservator of Forests, Maharashtra State, Vanbhavan, Civil line, Nagpur, Dist-Nagpur
17. Chief Conservator of Forests – (Teritorial) Old PMT Building, Shankarseth Raod, Behind Janki Hall, Pune -37
18. Chief Conservator of Forests – Research & Education, New PMT Building, 4th Floor, Swargate, Pune
19. Chief Conservator of Forests – Education, New PMT Building, 4th Floor, Swargate, Pune
20. Director – Social Forestry (M.S.), Central Building, Pune
21. Chief Exe. Officer, Khadi and Village Industries Commission, IRNA Road, Vileparle Mumbai 400 056
22. Dy. Director, Central Bee Research and Training Institute (KVIC) Pune 411 016
23. Director, Beekeeping Centre, Govt. Bungalow No 5, Mahabaleshwar (Dist. Satara)
24. Managing Director, Tribal Development Corporation
25. Managing Director, Wasteland Development Corporation,
26. Managing Director, Command Area Development Agency, Shinchan Bhavan, Manalwar Peth, Pune
27. Shri. Sopanrao Kanchan – Grape Growers' Association, Market yard, Pune
28. Dr. Sohoni Bharatiya Agri. Industries Foundation (BAIF), Dr. Manibhai Desai Nagar, Warje, Pune-58

29. Mr. Vijay Paranjpe, Gomukh, Durga 92/2, Gangote Path, Opp. Kamala Nehru Park, Erandavane, Pune-4
30. Shri. Milind Bhide, Surya Shibir , Plot No. 11, Kaka Halwai industrial Estate, Near City Pride, Satara Road, Pune-9
31. Oil seed specialists, Mahatma Phule Krushi Vidyapeeth, Rahuri
32. Head, Entomology dept., Mahatma Phule Krushi Vidyapeeth, Rahuri & Dr. Panjabrao Deshmukh Krushi Vidyapeeth, Akola
33. Pulse Breeder, Marathawada Krushi Vidyapeeth, Parbhani
34. Seed Officers -1
35. Head, Horticulture Dept, Dr. Panjabrao Deshmukh Krushi Vidyapeeth, Akola & Dr. Balasaheb Sawant Kokan Krushi Vidyapeeth, Dapoli, Dist-Ratnagiri
36. Director, National Centre for Garlic and Onion, Rajgurunagar
37. National Research Centre for orange ICAR – Nagpur
38. Dr. D.R. Bapat, Honorary Secretary, Maharashtra Association for the Cultivation of sciences and Retd. Director of Research, MPKV, Rahuri.
39. Mr. Rajabhau Limaye, President, Coconut Board, Tilak ali, Ratnangiri.
40. Shri. S.S. Patil, Nirdhar Grammodhog Vikas Sanstha, Alandi, Tal-Khed, Dist. Pune
41. Shri. Darade, Development Officer, District Industries Board, M.S., Khadi Village Industry, Latur, Dist- Latur
42. Shri. Dhanraj Koche, Pragati Bahu-Uddeshiy Sanstha, Athvadi Bajar, At post-Pulgaon, Tal-Devli, Dist-Vardha
43. Dr. Tukaram Nikam, Principal, Bitco College, Nashik
44. District Superintendent Agriculture Officer, Thane, Dist. Thane
45. District Superintendent Agriculture Officer, Raigad, Dist. Raigad
46. District Superintendent Agriculture Officer, Satara, Dist. Satara
47. District Superintendent Agriculture Officer, Kolhapur, Dist. Kolhapur
48. District Superintendent Agriculture Officer, Ahmednangar, Dist. Ahmednagar
49. District Superintendent Agriculture Officer, Nanded, Dist. Nanded
50. District Superintendent Agriculture Officer, Amaravati, Dist. Amaravati
51. District Superintendent Agriculture Officer, Jalgaon, Dist. Jalgaon
52. District Superintendent Agriculture Officer, Pune, Dist. Pune
53. Dr. Bhaskar Gaikwad, Programme Coordinator, KVK, Rahata, Dist-Ahmednagar
54. Mr. K.A. Dhapke, Programme Coordinator, KVK, Badnera (Durgapur), Dist-Amaravati
55. Mr. S.V. Sonune, Programme Coordinator, KVK, Kharpudi, Dist-Jalna
56. Dr. R.B. Patil, Programme Coordinator, KVK, YCMOU, Dnyanagangotri, Near Gangapur Dam, Goverdhan, Dist-Nashik-22
57. Dr. (Mrs.) T.A. Kadarbai, Programme Coordinator, KVK, Baramati, Tal-Baramati, Dist-Pune
58. Mr. J.B. Jagtap, Programme Coordinator, KVK, Karada, Dist- Satara
59. Mr. P.P. Shelke, Programme Coordinator, KVK, RisodLoni Road, Dist-Washim

60. Managing Director, Maharashtra Agro Industries Development Corporation, Krushi Udyog Bhavan, Are Dugdha Vasahat, Goregaon (East), Mumbai 400065
61. Dr. Kshirsagar, 1294 Subhash nagar, Galli No.7, Pune-2
62. Dr. M.C. Suryanarayan, D-3-10, Suryaprabha garden, Survey 572/8, Bibvewadi Kondwa Rd, Pune 411 037
63. Shri. Kadu Vitthal Birari, Kandhane, Tal Satana, Dist- Nashik M-9860222511
64. Shri. Milind Joshi, C/o, Uday Tahuje, Sathri Colony, Vice President, Swami Vivekand Samaj Prabodhan Sanstha, Sillod, Dist-Aurangabad M-9881880844

Annexure-II

दिनांक २८/११/२००८ रोजी झालेल्या फलोत्पादन वाढीमध्ये मधुमक्षिका पालन उदयोग व्यवसायाचे महत्व या कार्यशाळेस उपस्थित असलेल्या अधिका-यांची यादी

अ.नं.	अधिका-यांचे नाव	हुददा व कार्यालयाचा पत्ता
१	श्री. नानासाहेब पाटील, भाप्रसे	प्रधान सचिव, कृषि व फलोत्पादन , मंत्रालय, मुंबई तथा अध्यक्ष मराफऔवमं. पुणे
२	श्री. व्ही.एम. कोकणे	सहसचिव, फलोत्पादन, मंत्रालय, मुंबई-३
३	डॉ. पी.व्ही.फिरके	संचालक,फलोत्पादन, कृषि आयुक्तालय पुणे
४	श्री. अे.पी. म्हसे	सहा. संचालक, सामाजिक वनीकरण, पुणे
५	श्री. मं.चि. सूर्यनारायण	निवृत्त एस.एस.ओ. सीबीआरटीआय, पुणे
६	डॉ. क.कृ. क्षिरसागर	निवृत्त वरिष्ट संशोधन अधिकारी, मधमाश्या, शुक्रवार पेठ, पुणे
७.	डॉ.आर.पी.फडके	निवृत्त संचालक, रिसर्च ॲन्ड ट्रेनिंग, ३३३ शुक्रवार पेठ पुणे
८	श्री. एस.एम. पोकरे	A.D.V.(FBI) CBRTI
९	श्री. एस.बी. सावंत	CBRTI, पुणे
१०	श्री. दिलीप झेंडे	अ.कृ.अ. (विकृससं) पुणे
११	श्री प्रशांत हरीभाऊ मसूरकर	प्रगती बहुउदेशीय संस्था, आठवडी बाजार, पुलगांव, जिल्हा वर्धा
१२	श्री. पी.बी. भालेकर	सहा. संचालक,सातारा
१३	डॉ. गजानन कि. लांडे	Dept. of Entomology, Dr. PDKV Akola
१४	श्री. डी.आर. पाटील	I/c Director M.S.K. & V.I.B. Mahabaleshwar
१५	श्री. एम.एम. जोशी	स्वामी विवेकानंद एस.पी.बी. संस्था सिल्लोड, औरंगाबाद
१६	श्री. गजानन आस्वले	दिनदयाळ प्रसारक मंडळ, यवत
१७	श्री. अमित डी. ननावरे	कृषि सहायक
१८	श्री. गुलाबराव सखाराम शेवकरी	तंत्र अधिकारी (तफअ)
१९	श्री. एस.के. देशमुख	Programme Co-ordinatar, IVK Karda
२०	डॉ. गजानन आर. लोळगे	Assist. Prof. Ento Agril. College Pune
२१	श्री. एम.जी. शेवकरी	Agril. Officer, Commissionerate of Agriculture.
२२	प्रा.अे.व्ही.मुंज	Jr. Entomologist Regional Fruit Research Centre, Vengurle

२३.	श्री. विकास पाटील	जिल्हा अधिक्षक कृषि अधिकारी अहमदनगर
२४	श्री. भारत दावनगे	SMS(Plant protection) KVK Babhaleshwar
२५	श्री. अशोक लोखंडे	D.S.A.O. Raigad Alibag
२६	श्री. बसवराज मस्ताल	SDAO Karvir Kolhapur
२७	श्री. एस.आर.पाटील	D.S.A.O., Thane
२८	श्री. एस.एल. बाविसकर	S.A.O, office of the D JDA, Nagpur
२९	श्री. एम.एन. दराडे	विकास अधिकारी (मध) म.रा. खादी व ग्रामो. मंडळ लातूर
३०	श्री. के.एस.मुळे	जिल्हा अधिक्षक कषि अधिकारी अमरावती
३१	श्री.एम.वाय. मुंढे	तंत्र अधिकारी,विकृस.सं. कोल्हापूर
३२	श्री. बी.एस.देशमुख	उपसंचालक
३३	डॉ. डेअरी थॉमस	ॲसि. डायरेक्टर
३४	श्री. डी.आर. पाटील,	प्र. संचालक मध संचालनालय, महाबळेश्वर
३५	श्री. जी.एस. शेवकरी	तंत्र अधिकारी (एनएचएम)
३६	श्री. अे.डी. ननावरे	कृषि सहायक
३७	श्री.एस.बी. सावंत	सीबीआरटीआय/११५३/पुणे १६
३८	श्री. एस.आर. वराळे	तंत्र अधिकारी, एनएचएम पुणे
३९	श्री. आर.बी. गोसावी	तंत्र अधिकारी, एनएचएम पुणे
४०	श्री. एस.ए. कुलकर्णी	तंत्र सहायक

Annexure- III
Programme of the Workshop

कार्यक्रम पत्रिका

एक दिवसीय कार्यशाळा - 'फलोत्पादन वाढीमध्ये मधुमक्षिका पालन उद्योग व्यवसायाचे महत्व' दि. २८/११/२००८

स्थळ : समिती सभागृह पहिला मजला, साखर संकुल, शिवाजीनगर, पुणे

वेळ	कार्यक्रम	सादरकर्ते
१०.०० ते १०.१०	स्वागत	श्री. आबासाहेब हराळ प्रकल्प समन्वयक, मराफऔवम
१०.१० ते १०.२५	प्रस्तावना व संकल्पना	डॉ. पी.व्ही. फिरके संचालक, फलोत्पादन
१०.२५ ते ११.००	मधुमक्षिकापालन उद्योगाचे सादरीकरण व पुर्वपिठिका	डॉ. आर. पी. फडके निवृत्त संचालक, केंद्रिय मधुक्षिका संशोधन आणि प्रशिक्षण संस्था, पुणे
११.०० ते ११.२०	अनुभव कथन	श्री. एस.एस. पाटील श्री. दराडे
११.२० ते ११.३० चहा		
११.३० ते ११.५०	कृति आराखडा- सादरीकरण/ तांत्रिक गटनिवड	श्री. विजय घावटे प्रकल्प व्यवस्थापक, मराफऔवमं
११.५० ते १३.००	गटचर्चा ● गट-१ मधुमक्षिका पालन उद्योगाचा विस्तार ● गट-२ मधुमक्षिका पालन संशोधन ● गट-३ मधुमक्षिका पालन प्रशिक्षण ● गट-४ मधुमक्षिका पालन उत्पादन, गुणवत्ता आणि पणन	
१३.०० ते १४.०० दुपारचे जेवण		
१४.०० ते १५.२०	मधुमक्षिकापालन उद्योग व त्याचे कृषि व फलोद्यान उत्पादन वाढीमध्ये योगदान	
१५.२० ते १५.३० चहा		
१५.३० ते १६.४०	**कार्यशाळा नियोजन व निष्कर्ष** **(**Plenary/ Concluding session**)** ● पुढील दिशा ठरविण्यासाठी कृति गट स्थापन करणे शिफारशी ● नियोजन, समन्वय व सनियंत्रण कार्यक्रम	
१६.४०	आभार	श्री. आबासाहेब हराळ प्रकल्प समन्वयक, मराफऔवम.

Annexure- IV
Marathi Translation of Lead Paper

मधमाश्यापालनाचे फायदे

स्वयंरोजगार, मधोत्पादन आणि कृषी उत्पादनात वाढ

- डॉ. र.पु. फडके
निवृत्त संचालक,
मधमाश्यापालन उद्योग आणि
सेन्ट्रल बी रिसर्च ॲण्ड ट्रेनिंग इन्स्टिट्यूट, पुणे
(खादी ग्रामोद्योग आयोग, मुंबई ४०००५६)

अनुक्रमणिका

मधमाश्यापालन विषयावर चर्चासत्र

दिनांक : २८/११/२००८

प्रायोजक : महाराष्ट्र राज्य फलोत्पादन आणि औषधी वनस्पती मंडळ, पुणे-४११००५

स्थळ :साखर संकुल, शिवाजीनगर, पुणे-४११००५

प्रास्तविक:

भारताची लोकसंख्या आजमितीला ११० कोटी आहे. संख्याशास्त्रज्ञांच्या अंदाजाप्रमाणे २०३० पर्यंत भारताची लोकसंख्या १४० कोटींपर्यंत पोहोचेल. यामुळे भारतीय योजना तज्ञांपुढे येत्या दशकांत दोन आव्हाने असतील. १) २० ते ४० वयोगटातील सुमारे ३५ कोटी तरुणांसाठी रोजगार निर्माण करणे. आणि २) सर्वांना पोटभर आणि सकस अन्न पुरविणे.

भारत हा कृषीप्रधान देश असून सुमारे ७० टक्के लोक ग्रामीण भागात राहतात आणि त्यातील बहुसंख्य लोक कृषी आणि कृषी आधारीत उद्योगांवर अवलंबून आहेत. रोजगारनिर्मिती आणि अन्नधान्य उत्पन्नाच्या वाढीतून स्वयंपूर्तता ह्या दोनही गोष्टी केवळ कृषी व्यवसायच साध्य करु शकतो. परपरागसिंचनाद्वारे पिकांचे हेक्टरी उत्पादनांत वाढ आणि त्याचबरोबर स्वयंरोजगार या दोन्ही बाबतीत मधमाश्यापालन व्यवसाय कृषी व्यवसायात महत्वाची भूमिका बजावू शकतो.

१) भारताची औद्योगिक प्रगती:

युरोपमध्ये औद्योगिक क्रांती होऊन, औद्योगिकरणाने युरोपात समृध्दी आणि संपत्ती निर्माण झाली. हि गोष्ट नजरेसमोर ठेवून स्वातंत्र्यानंतर भारताने औद्योगिकरणाची कास धरुन पंचवार्षिक योजना सुरु केल्या. योजनाकर्त्यांची अशी अटकळ होती, कि या योजनांमुळे होणारा लाभ झिरपत-झिरपत (Percolation Theory) तळागाळातील दुर्बल घटकांपर्यंत आपोआप पोहोचेल. या योजनांमुळे भारतात औद्योगिकरणाचा पाया जरुर घातला गेला आणि त्याची फळे आज आपणांस मिळत आहेत. परंतू औद्योगिकरणामुळे होणारे फायदे गरिबांपर्यंत आपोआप झिरपत पोहोचतील हि आशा फोल ठरली. उद्योजक अधिक श्रीमंत होत गेले आणि अल्पभूधारक शेतकरी, भूमीहिन शेतमजूर आणि इतर दुर्बल घटक अधिकच गरीब होत गेले.

२) कृषी क्षेत्रातील प्रगती :

अन्नधान्याच्या तुटवड्यामुळे परदेशातून अन्नधान्याची आयात, शेतकऱ्यांची दुरावस्था आणि भारतातील ७० टक्के जनता ग्रामीण भागांत रहात असून ते मुख्यत्वेकरुन शेती व्यवसायावर अवलंबून असल्याने नंतरच्या पंचवार्षिक योजनांमध्ये कृषी संशोधन, विस्तार, शिक्षण इ. बाबींवर जास्त भर देवून भरघोस आर्थिक तरतूद करण्यांत आली. नोबेल पारीतोषिक विजेते डॉ. नॉर्मन बोरलॉग, डॉ. एम्. एस्, स्वामिनाथन आणि डॉ. ए. बी. जोशी यांच्या प्रयत्नांतून भारतात पहिली हरीत क्रांती झाली. गहू, ज्वारी, बाजरी, भात या तृणधान्यांचे उत्पादनांत भारताने स्वयंपूर्तता गाठली येवढेच नव्हे तर भरपूर

धान्यसाठाही झाला. याचबरोबर कृषी आधारीत पशुपालनावरही विशेष कार्यक्रम राबवून कुक्कुटपालन, दुग्धव्यवसाय, रेशीम उद्योग, मत्स्यपालन, मधमाश्यापालन या व्यवसायांचीही प्रगती झाली. परंतू मधमाश्यापालन व्यवसायास जेवढे महत्व द्यावयास हवे होते तेवढे न दिल्याने या व्यवसायाची प्रगती धीम्या गतीने झाली.

३) दुर्बल घटक - फायद्यापासून वंचित:

औद्योगिकरण आणि कृषी उत्पादनात वाढ यांचे फायदे सुशिक्षित आणि ज्यांचेकडे साधन-सामुग्री होती त्यांनाच मिळाले. परंतु अल्पभूधारक, छोटे शेतकरी, भूमिहीन शेतमजूर आणि पारंपारिक ग्रामोद्योगातील बहुसंख्य ग्रामीण जनता या फायद्यापासून वंचित राहिली आणि त्यामुळे सुमारे ४० टक्के ग्रामीण जनता दारिद्र रेषेखाली आहे.

४) एकात्मिक ग्रामीण विकास योजना:

वरील परिस्थिती पक्षात घेता वन आणि कृषी आधारित खालील ग्रामोद्योगांना ग्रामविकास कार्यक्रमात महत्वाचे स्थान आहे. १) बायोगॅस २) रेषाउद्योग ३) वेत आणि बांबू ४) फळ-प्रक्रिया ५) अन्न धान्य प्रक्रिया ६) औषधी वनस्पती ७) डिंक राळ इ. वनातील पदार्थाचे संकला ८) रेशीम उद्योग ९) सामाजिक वनीकरण १०) मधमाश्यापालन, हे सर्व उद्योग विकेंद्रित आणि दूरवर पसरत असल्याने कुटुंबाचे विस्थापन होत नाही. शिवाय शेतातील हंगामी कामात नांगरणी, पेरणी, मशागत इ. मदत करुन कुटुंबियास रोजगार मिळू शकतो.

५) एकात्मिक ग्रामीण विकास योजनेत मधमाश्यापालनाचे महत्व:

भारतात आणि महाराष्ट्रातही मधमाश्यांचे चार प्रकार उपलब्ध आहेत. यातील आग्या माश्या सर्वांच्या परिचयाच्या आहेत. जगातील सर्वात मोठ्या आकाराच्या भरपूर मध गोळा करणाऱ्या या मधमाश्या. सातेरी हा दुसरा पाळता येण्यासारखा मधमाश्या प्रकार. तिसरी काटेरी आणि चौथी घुघुरटी. याशिवाय भारतात युरोपिय सातेरी मधमाश्याच्या वसाहतींचा प्रसार होत आहे. भारतीय सातेरी आणि युरोपिय सातेरी मधमाश्या आधुनिक पध्दतीने पेट्यातूंन पाळता येतात.

भारतात मधमाश्यांचे विविध प्रकार आणि त्यांना उपयुक्त अशा विविध वनस्पती असून देखील शास्त्रीय मधमाश्यापालनांत चीन तसेंच युरोप अमेरिका, ऑस्ट्रेलिया, दक्षिण अमेरिका इ. देशांच्या तुलनेत भारत फारच मागासलेला आहे. महाराष्ट्रात वन व शेती विभागांत मधमाश्यापालन व्यवसायास भरपूर वाव असून रोजगार निर्मिती आणि मध-मेण-पराग या मूल्यवान पदार्थांची निर्मिती असा दुहेरी फायदा आहे.

६) मधमाश्या आणि वने:

इतर कोठल्याही प्राणी कीटकांप्रमाणे मधमाश्यांनाही अन्न आणि निवाऱ्याची गरज असते. फुलांत स्त्रवणारा मकरंद आणि फुलातील परागकोषात निर्माण होणारे पराग हेच केवळ मधमाश्यांचे अन्न असते. मकरंदाचे रुपांतर मधात करुन तो साठविला जातो. त्याचप्रमाणे परागही साठविला जातो. मध हे

मधमाश्यांचे उष्मांक पुरविणारे अन्न. तर पराग हे प्रथिने, स्निग्ध पदार्थ, खनिजे, जीनवसत्व पुरविणारे अन्न अशा प्रकारचे मध आणि पराग मिळून मधमाश्यांचे पूर्ण अन्न होते. मोठ्यामोठ्या झाडांतील ढोल्यांमध्ये मधमाश्या आपले घर बांधतात. मधमाश्यांना त्यांचे अन्न, वन विभागात आणि वने-शेती अशा मिश्र भागात मिळते. सह्याद्रीचे जंगलातून पिसा, कावळा, अंबूळकी, जांभूळ, हिरडा, गेळा, तवसा, बेहडा, आवळा, खेर, ऐन, नाणा, सावर इ. अनेक वृक्षांपासून, तसेच चिमट, चिल्लर, शिकेकाई, पांगळ इ. झुडुपांपासून आणि तेरडा. सोनकी, सहदेवी इ. तणे आणि गवतांपासून मधमाश्यांना अन्न मिळते. एकापाठोपाठ एक अशा फुलणाऱ्या आणि भरपुर मकरंद आणि पराग देणाऱ्या वनस्पती, निवाऱ्यासाठी सुरक्षित जागा, स्वच्छ हवामान, योग्य तापमान-आर्द्रता अशा जागा म्हणजे मधमाश्यांच्या वाढीसाठी नंदनवनेच होत. सह्याद्रीच्या कुशीत आणि गडचिरोली, चंद्रपूर येथील वनात अशी अनेक स्थाने आहेत. अशाप्रकारे वने आणि मधमाश्यांचा संबंध अतूट आहे.

७) महाराष्ट्रातील मधमाश्यापालनाचा इतिहास आणि सद्य:स्थिती:

महाराष्ट्रात कोल्हापूर संस्थानात स्वातंत्र्य प्राप्तीपूर्वी छत्रपती शाहू महाराज यांच्या प्रोत्साहानाने मधमाश्यापालन व्यवसायास सुरुवात झाली होती. स्वातंत्र्यप्राप्तीनंतर महाबळेश्वर (जि.सातारा) येथे मधमाश्यापालन व्यवसाय सुरु होणे हा एक अपघात होता. ब्रिटीश आमदनीत महाबळेश्वरचा परिसर राखीव जंगल म्हणून जाहीर केलेला होता. मुंबई प्रांताची एप्रिल-मे महिन्यात उन्हाळी राजधानी महाबळेश्वर येथे असायची. या काळात गव्हर्नर, अनेक सरकारी अधिकारी, संस्थानिक, मुंबई येथील उद्योगपती महाबळेश्वर येथे यायचे. त्यामुळे महाबळेश्वर व परिसरातील हजारो शेतकरी, सुतार, गवंडी, रंगारी, सफाई कामगार, माळी इ. अनेकांची वर्षभराची कमाई २-३ महिन्यात व्हायची. स्वातंत्र्य प्राप्तीनंतर १९४८ मध्ये मुंबई प्रांताची उन्हाळी राजधानी महाबळेश्वर येथे न हलविण्याचा निर्णय पहिल्या मंत्रीमंडळाने घेतला. या निर्णयामुळे महाबळेश्वर परिसरातील रहिवाश्यांची अर्थव्यवस्था पूर्णपणे कोलमडली. त्यांनी जंगले तोडून, लाकूड विक्री करुन वनखात्याची जमीन लागवडीखाली आणण्यासाठी जंगलतोड सत्याग्रह सुरु केला.

श्री. वैकुंठभाई मेहता मुंबई प्रांताच्या मंत्रीमंडळात होते. वरील समस्या बळाने न सोडविता मतपरिवर्तनाने सोडवावी म्हणून त्यांनी जिल्हा अधिकारी (सातारा), मुख्य वनसंरक्षक (पुणे) आणि त्यांचे एक सहकारी-स्वातंत्र्यसैनिक श्री. बापूसाहेब शेंडे यांची एक समिती नेमली. श्री. शेंडे जावळी तालुक्यात हिंडून याबाबत प्रचार करु लागले. हे कार्य करीत असताना त्यांनी आग्या मधमाश्यांच्या वसाहती जाळून मध काढला जात असल्याचे पाहिले. स्थानिक लोकांना मधमाश्यापालनासारखा वनांवर आधारित असलेला व्यवसाय शिकवला तर त्यांना एक वर्षभराचा जोडधंदा मिळेल आणि त्यांना जंगल तोडीपासून परावृत्त करता येईल या विचाराने त्यांनी योजना आखण्यास सुरुवात केली. काही कार्यकर्त्यांना या व्यवसायाचे शिक्षणासाठी कर्नाटक राज्यात पाठविले, वनसंरक्षकांकडून सागवानी लाकुड मिळवून वाई येथे एक हजार मधुपेट्यांचे उत्पादन केले. महाबळेश्वर येथील रिकामे पडलेले ५ सरकारी बंगले मिळविले आणि मधमाश्यापालन केंद्र सुरु करुन मधमाश्यापालनाच्या विस्ताराचे काम सुरु केले आणि स्थानिक, गिरीजन, आदिवासी यांना एक स्वयंरोजगार मिळवून दिला. सुरुवातीस हे

कार्य मुंबई ग्रामोद्योग समितीतर्फे झाले. पुढे याच समितिचे मुंबई राज्य खादी ग्रामोद्योग मंडळ आणि नंतर महाराष्ट्र राज्य खादी ग्रामोद्योग मंडळात रुपांतर झाले.

मधमाश्यापालन हा एक अपारंपारिक उद्योग असून त्यांत किटकशास्त्र, वनस्पतीशास्त्र, रोगशास्त्र इ. अनेक शास्त्रशाखांचा संबंध येत असल्याने या उद्योगास संशोधन आणि प्रशिक्षण याची जोड दिल्याशिवाय या व्यवसायाची गुणात्मक वाढ होणार नाही याची जाणीव झाली. १९५४ साली महाबळेश्वर येथील एका बंगल्यात मधुमक्षिका संशोधन प्रयोगशाळेची सुरुवात झाली. या प्रयोगशाळेचे उद्घाटन त्यावेळेचे मुख्यमंत्री श्री. मोरारजी देसाई यांच्या हस्ते झाले. श्री. ठकार या प्रयोगशाळेचे प्रमुख होते. प्रस्तुत लेखकाने याच प्रयोगशाळेत १९५४ मध्ये कनिष्ट संशोधक सहाय्यक म्हणून कामास सुरुवात केली.

डॉ. देवडिकर, मानद सल्लगार यांचे मार्गदर्शनाखाली महाराष्ट्रात आणि भारतांत मधमाश्यापालन व्यवसायातील विस्तार, संशोधन आणि प्रशिक्षण यांचा पाया महाराष्ट्र राज्य खादी ग्रामोद्योग मंडळाचे या प्रयोगशाळेत घातला गेला.

८) मधमाश्यांपासून मिळणारे पदार्थ:

मधमाश्या म्हणजे मध हे समीकरण बहुतेक सर्वांना माहित आहे. तसेच मधमाश्यांपासून मिळणाऱ्या मेणाचा उपयोग, चर्मोद्योग, ओतकाम, लाकडी वस्तुंना संरक्षक लेप देणे यासाठी होत असल्याने काही कारागीरांना मेणाचीही माहिती होती.

२० व्या शतकांत उसापासून दाणेदार साखर निर्मिती सुरु झाली. पिष्टमय पदार्थांवर आम्लक्रिया करुन द्राक्षशर्करा (Glucose) निर्मितीचे तंत्र उदयास आले. अलीकडे मक्याच्या पीठावर एन्झाईम प्रक्रीयेने साखरेच्या दुप्पट गोड अशा फल शर्करेचा (Frutose) पाक तयार करण्याचे तंत्र विकसीत झाले आहे. सॅकरीन सारख्या अतिगोड पर्दाथांचेही शोध लागले. या निरनिराळ्या शोधांमुळे साखर, द्राक्षशर्करा, फलशर्करा इ. गोड पर्दाथांनी, अन्नपदार्थातील मधाची जागा घेतली. दुसरीकडे खनिज तेलाचा शोध लागला आणि त्यापासून मिळणारी तेले, ग्रीस, व्हॅसलीन, मेण इ. पदार्थामुळे उद्योग क्षेत्रातील मधमाश्यांच्या मेणाला पर्याय निर्माण झाले.

या घटनांचा मधपाळांच्या व्यवसायांवर परिणाम होऊ लागला. या परिस्थितीतून मार्ग काढून उत्पन्न वाढविण्यासाठी मधपाळांनी मधमाश्यांपासून मिळणाऱ्या इतर पदार्थांची निर्मिती सुरु करण्याचे प्रयोग सुरु केले आणि त्यात ते यशस्वी झाले. हे पदार्थ युरोपमध्ये पारंपारिक औषध पध्दतीत (Folk Medicine) वापरले जात असतच. आता मध आणि मेणाशिवाय, मधमाश्यांनी गोळा केलेला पराग आणि प्रॉपॉलिस, मधमाश्यांचे विष आणि मधमाश्यांनी राणी माशीसाठी बनविलेले खास अन्न (Royal Jelly) यांचे उत्पादन आणि विक्री प्रगत देशांत सुरु झाली आहे. औषधे बनविणाऱ्या कंपन्यांनी या पदार्थापासून मुल्यवर्धित

पदार्थांची निर्मिती सुरु केली आहे. यातूनच औषधोपचाराची नवी शाखा Api-therapy निर्माण होऊ घातली आहे. इस्त्रांइलसारख्या छोटा वाळवंटी देशसुध्दा या क्षेत्रात अग्रेसर बनू पहात आहे.

१ किलो परागाची किंमत कमीत कमी एक हजार रुपये आहे. मध-मेण-पराग, प्रॉपॉलिस विष आणि राणी अन्न हे एकापेक्षा एक मूल्यवान पदार्थ आहेत. अमेरिकेत ५-१० सी.सी., राणी-अन्नाची कुपी १०-१५ हजार रुपयांस विकली जाते. महाराष्ट्रात सर्वच पदार्थ नाही तरी मध-मेण, पराग या तीन पदार्थांपासून मधपाळास त्वरीत आर्थिक लाभ होऊ शकतो.

९) भारतातील हरित क्रांती:

भारतात हरितक्रांती झाली, गव्हाची आयात थांबली आणि अन्नधान्याचे उत्पादन करणाऱ्या जगातील पहिल्या पाच देशात भारताने स्थान मिळविले. पण ही स्वयंपूर्णता फक्त तृणधान्याचे बाबतीतच झाली. परंतु गळीताची धान्ये, कडधान्ये फलोत्पादन यांचे हेक्टरी उत्पादन अनेक वर्षे स्थिर होते. या पिकांच्या उत्पादनात भारत जगाच्या तुलनेत फारच मागे होता. आणि खाद्यतेलाची आयात करावी लागत होती.

वरील गोष्टीची दखल घेऊन १९८६ मध्ये "तेलबिया मिशन्स १९९० मध्ये" कडधान्ये मिशन्स आणि १९९२ मध्ये "फलोत्पादन मिशन्स सुरु करण्यात आले. १५ ते २० वर्षे ही मिशन्स अस्तित्वात आहेत आणि हेक्टरी उत्पादन वाढीचे प्रयत्न चालू आहेत. परंतु या मिशनबाबत डॉ. स्वामीनाथन यांनी "Towards Hunger Free India" या २००६ मध्ये लिहीलेल्या लेखांत उधृत केलेली केलेली माहिती निराशाजनक आहे. १९९६ मध्ये आपण आपल्या तेलाच्या उत्पादनाच्या (२४ लाख टन) केवळ १० टक्के खाद्यतेल आयात केले होते. सन २००४ मध्ये आपण घरगुती तेलाच्या उत्पादना इतके म्हणजे २५ लाख टन खाद्य तेल आयात केले. फलोत्पादनांतही इतर देशांच्या तुलनेत हेक्टरी उत्पादन निम्यापेक्षा कमी आहे. गेली १५-२० वर्षे ही मिशन्स अस्तित्वात असून हेक्टरी उत्पादनात वाढ नाही. आणि आयातीवर दरवर्षी वाढता खर्च होत आहे. असे का?

१०)मधमाश्या आणि सपुष्प वनस्पती :

पृथ्वीवरील सजीवांच्या उत्क्रांती प्रक्रीयेत, पृथ्वीवर प्राणी जीवन निर्माण होण्यापूर्वी लाखो वर्षे आधी फुलाणाऱ्या वनस्पती आणि फुलणाऱ्या वनस्पतीवर खाद्यासाठी पूर्णपणे अवलंबून असणाऱ्या मधमाश्यांची निर्मिती झाली. मधमाश्या त्यांच्या खाद्यासाठी फुलणाऱ्या वनस्पतीवर संपुर्णपणे अवलंबून असतात आणि ७० टक्के फुलणाऱ्या वनस्पती परागसिंचनासाठी म्हणजे बीज-फल धारणेसाठी मधमाश्यासारख्या कीटकांवर अवलंबून असतात. फुलणाऱ्या वनस्पती आणि मधमाश्या यांचे हे परस्परावलंबित्व गेली लाखो वर्षे चालत आले आहे. एकाचे अभावी दुसऱ्याचे अस्तित्वच अशक्य आहे असे म्हटल्यास अतिशयोक्ति होणार नाही.

शेतीपिकांपैकी गहू, भात, ज्वारी, बाजरी इ. तृणधान्ये स्वपरागफलित किंवा वाऱ्यामार्फत परपरागफलित आहेत. हि पिके परागभवनासाठी आणि बीजधारणेसाठी किटकांवर अवलंबून नसतात. परंतू गळिताची धान्ये, कडधान्ये, चाऱ्याची पिके, मसाल्याची पिके, फळभाज्या, बियाणाची पिके,

फळफळावळ हि पिके परागीभवनासाठी मधमाश्यासारख्या कीटकांवर अवलंबून असतात. हि पिके स्वपरागसिंचित वांझ (Self-Sterile) पर-परागसिंचित सफल (Cross-Fertile) आहेत. मधमाश्यांच्या फुलांतील मकरंद – पराग गोळा करण्याच्या प्रक्रियेत एका फुलातील पूबीज आणि दुसऱ्या फुलांतील स्त्री बीज यांचे मीलन होऊन बीज-फल धारणा होते आणि बीयाणाची प्रतही सुधारते.

परपरागफलित (Cross-Fertile) पिकांमध्ये उत्तम बियाणे, खता-पाण्याच्या योग्य मात्रा आणि पिक-संरक्षण ह्या निविष्ठा वापरल्यानंतर हि पिके जेव्हा फुलांत येतात तेंव्हा मधमाश्यांसारखे उपयुक्त कीटक पुरेशा संख्येने उपलब्ध नसतील तर पहिल्या चारही निविष्ठा वाया जाऊन अपेक्षित कमाल पीक - उत्पादन मिळणार नाही.

११)परागीभवनासाठी मधमाश्याच कां?

शेती आणि बागायती क्षेत्रांत निसर्गात उपलब्ध असलेले अनेक कीटक आहेत. परंतु मधमाश्या व्यतिरीक्त इतर कीटकांमध्ये एकाच जातीच्या पिकावर सातत्याने मकरंद-पराग गोळा करण्याची प्रवृत्ती नसते. या उलट मधमाश्या एकदा एका पिकांच्या फुलोऱ्यावरुन मकरंद-पराग गोळा करु लागल्या कि त्या पिकाचा फुलोरा संपेपर्यंत एकनिष्ठेने त्याच फुलोऱ्याचा मकरंद-पराग गोळा करतांत. या त्यांच्या स्वभाव-वैशिष्टयामुळे (Floral Fidelity) इतर कोठल्याही कीटकांपेक्षा मधमाश्या जास्त कार्यक्षम आणि भरवशाच्या परागसिंचक समजल्या जातात. मधमाश्या या जास्त कार्यक्षम परागसिंचक असल्यामागे इतर अनेक कारणे खालीलप्रमाणे आहेत.

१) एका वसाहतीत ५ ते १० हजार मधमाश्या असतांत. इतक्या मोठ्या संख्येने परागसिंचक इतर दुसऱ्या किटकांत नसतात.

२) मधमाश्यांच्या शरीरावर असंख्य केस असतात. या केसांत अनेक परागकण अडकतांत आणि दुसऱ्या फुलांवर पडून परपरागसिंचन होते.

३) मधमाश्यामध्ये मध आणि पराग साठविण्याची वृत्ती असते. त्यामुळे मधमाश्या मकरंद-पराग गोळा करण्यासाठी एखाद्या पिकावर दिवसभर फेऱ्या करतांत. यामुळे परागीभवनांचे काम खात्रीपूर्वक आणि मोठ्या प्रमाणांत होते.

४) मधमाश्या दिवसभर कार्यरत असल्याने, परागकोष फुटुन परागकण बाहेर येण्याची दिवसातील कोठलीही वेळ असली तरी मधमाश्यांच्या पराग गोळा करण्याच्या प्रक्रियेत परागीभवन हमखास होते.

५) काही कीटक ऋतुमानानुसार सुप्तावस्थेत जातात. मधमाश्यांच्यात सुप्तावस्था नसते. त्या परागीभवनासाठी वर्षभर उपलब्ध असतात.

६) मधमाश्यापालनात अनेक तंत्रे उपलब्ध झाली आहेत. पाळीव मधमाश्यांच्या वसाहतींचे रातोरात १००-२०० किलोमीटर स्थलांतर करुन हुकमी परागसिंचन करता येते.

१२)मधमाश्यापालन एक अनिवार्य गरज:

आजकाल शेती बागायती पध्दतीमध्ये पिक संरक्षणासाठी कीटकनाशकांचा वापर होऊ लागला आहे. उपद्रवी कीटकांचा नाश करणे जरुरीचे आहे. परंतु अति तीव्र कीटकनाशकांचा अनिर्बंध वापर

पर्यावरणास घातक ठरत आहे. उपद्रवी कीटकांबरोबर सर्व जातीच्या मधमाश्या, कुंभारीण माश्या, भुंगे इ. उपयुक्त कीटकांच्या जाती शेतीविभागातून नामशेष होणाऱ्या मार्गावर आहेत. परिणामी परागीभवनासाठी कीटकांवर अवलंबून असलेल्या पिकांच्या हेक्टरी उत्पादनात घट होत आहे. अशा परिस्थितीत आधुनिक पध्दतीच्या मधमाश्यापालन व्यवसायाला पर्याय नाही. अमेरिकेत अनेक व्यवसायिक मधपाळ मधाचे उत्पन्न घेण्यापेक्षा मधमाश्यांतर्फे परागीभवनाची सेवा देण्यास पसंती देवून बागाईतदारांकडून एका वसाहतींसाठी एक महिन्याचे १५० डॉलर्स भाडे मिळवतात. हिमाचल प्रदेशातही ही पध्दत सुरु झाली आहे. सफरचंदाचे बागाईतदार एका मधमाश्याच्या वसाहतींसाठी २५ ते ४० रुपये प्रति महिना भाडे देवून परपरागसिंचनाची सोय करतात आणि भरघोस उत्पादन मिळवतात. चारा पिकांच्या परागिभवनासाठीही मधमाश्यांचा उपयोग केला जातो. यात बियाणाचे हेक्टरी उत्पादन वाढते आणि बियाणांची उगवण क्षमता खूप असते. या बियाणांपासून तयार होणारा चारा जास्त पौष्टीक असतो. उत्तम बियाणे, खते, जलसिंचन आणि पिक संरक्षण या नंतर पिके फुलात आली असता मधमाश्यातर्फे परपरागसिंचन या पाचव्या आणि महत्वाच्या निविष्ठेस पर्याय नाही.

भारतीय कृषी अनुसंधान संस्थान येथील कृषी शास्त्रज्ञांच्या अहवालानुसार परागीभवनासाठी कीटकांवर पूर्णपणे अवलंबून आहेत अशी भारतांत बारा महत्वाची पिके आहेत. या बारा पिकांखालील क्षेत्रफळ लक्षांत घेता या पिकांचे संपूर्ण परागीभवन करण्यासाठी कमीतकमी ७० लाख मधमाश्यांच्या वसाहतींची गरज आहे आणि भारतांत फक्त १५ लाख मधमाश्यांच्या वसाहती आहेत.

१३)मधमाश्या आणि परागीभवन:

मधमाश्यांमुळे ज्या पिकांमध्ये परपरागीभवन होऊन पिकांचे एकरी उत्पादनात वाढ होते अशा कांही पिकांची यादी पुढीलप्रमाणे:

तेलबिया : सुर्यफूल, करडई, सोयाबीन, तीळ, कारळा, जवस
डाळी : तूर, मूग, उडीद, मटकी
फळपिके : सफरचंद, संत्री, मोसंबी, लिंबू, पेरु, कलिंगड, डाळींब इ.
फळभाज्या : वांगी, भेंडी, मिरची, काकडी, भोपळे, पडवळ, कारली इ.
भाज्याची बियाणे : कोबी, कॉलिफ्लॉवर, मुळा, कांदा, लसूण इ.
चारा पिके : लसूण घास, बरसीम इ.

अमेरिकेतील कृषी शास्त्रज्ञांच्या अहवालाप्रमाणे मधमाश्यांतर्फे परागीभवन होऊन मिळालेल्या वाढीव कृषी उत्पादनाचे मुल्य हे मधमाश्यांनी तयार केलेल्या मधा-मेणाच्या मुल्याच्या १५ ते २० पट जास्त असते.

१४)मधमाश्यांच्या वसाहतींची महाराष्ट्राची गरज:

महाराष्ट्रात सुमारे २१० लाख हेक्टर क्षेत्र निरनिराळ्या पिकांच्या लागवडीखाली आहे. ज्वारी, बाजरी, मका या तृणधान्याच्या फुलोऱ्यापासून मधमाश्यांना त्यांचे खाद्य मिळते. मात्र ही पिके परागीभवनासाठी कीटकांवर अवलंबून नाहीत. परंतु भुईमुग वगळता बाकीची गळीताची पिके, कडधान्ये आणि इतर पिके परपरागीभवनासाठी मधमाश्यासारख्या कीटकांवर अवलंबून असतात.

महाराष्ट्रात अशा तेलबियांखाली सुमारे ३० लाख हेक्टर क्षेत्रफळ आहे. कडधान्याखालील क्षेत्र १० लाख हेक्टर आणि फळफळावळ ८ ते १० लाख हेक्टर ही सर्व पिके फुलांत आली असता, परागीभवन करुन पिकांचे उत्पादनात वाढ आणि पिकांचे प्रतीत सुधारणा असे दोन्ही फायदे मिळविण्यासाठी मधमाश्यांच्या वसाहतींची गरज आहे. मधमाश्यांच्या वसाहती स्थलांतर करुन खरीप, रबी पिकांसाठी वापरल्या आणि निर्सगात उपलब्ध असलेल्या उपयुक्त कीटकांची संख्या लक्षात घेतली तरी महाराष्ट्राची किमान ५ ते ७ लाख मधमाश्यांच्या वसाहतींची गरज आहे. आज महाराष्ट्रांत २५०० मधपाळ आणि १० हजार मधमाश्यांच्या वसाहती आहेत.

१५)मधमाश्यापालन व्यवसायात कृषी क्षेत्रातील अडचणी:

कृषीक्षेत्रात मधमाश्यापालन व्यवसाय रुजविण्यात दोन मुख्य अडचणी आहेत.

अ) दीर्घ मुदतीचा दुष्काळी काळ: कृषी क्षेत्रांत मधमाश्यांना खरिप आणि रबी पिकांचे फुलोऱ्याच्या हंगामात खाद्य मिळते. बाकीच्या महिन्यांत त्यांना पुरेसे खाद्य मिळत नाही.

ब) कीटकनाशकांचा वापर: आधुनिक शेती पध्दतीत कीड-रोगांपासून पिकांचे संरक्षण करण्यासाठी कीटकनाशकांचा वापर करणे जरुरीचे आहे. परंतु तीव्र कीटकनाशकांच्या अतिवापरामुळे उपद्रवी कीटकांबरोबर मधमाश्यासारख्या उपयुक्त कीटकांचाही संहार होत आहे. परिणामी परागीभवनासाठी कीटकांवर अवलंबून असलेल्या पिकांचे (तेलबिया-डाळी) हेक्टरी उत्पादन घटत आहे.

१६)अडचणीवर उपाय योजना:

वनविभागातील मधमाश्यापालना बरोबर कृषी विभागातील मधमाश्यापालनावरही विशेष लक्ष द्यावयास हवे. यामुळे मधमाश्यापालन व्यवसाय वृध्दी आणि पिकांचे उत्पादनात मधमाश्यांतर्फे होणाऱ्या परागीभवनामुळे वाढ असा दुहेरी फायदा आहे. सर्व अडचणीवर मात करण्यात खालील महत्वाचे उपाय आहेत.

अ) वनविभागातील **वसाहतींचे पावसाळी स्थलांतर:** वनविभागांत मधमाश्यांना दीर्घकाळ खाद्य मिळत असते. तरी पावसाळ्यातील तीन महिने दुष्काळी असतात. त्यातच मेणकिडे, बुरशी, प्रतिकुल बाह्य वातावरण यामुळे अनेक वसाहती पावसाळ्यात नाश पावतांत. सुदैवाने याचवेळी नजीकच्या शेतीविभागांत खरिप पिके, गुलमोहोरासारखे वृक्ष, चाऱ्याचा मका फुलांत येतांत आणि मधमाश्यांना भरपूर खाद्य मिळते. शेतीविभागातील फुलोरा सप्टेंबर अखेर संपल्यानंतर वनविभागीत, गवते, तणे, तेरडा, सोनकी, जंगली आस्टर आणि त्या पाठोपाठ इतर वृक्ष फुलांत येतात. या गोष्टीचा फायदा घेऊन वनविभाग आणि नजीकचा कृषीविभाग यांत वार्षिक स्थलांतर करुन, मधमाश्याच्या वसाहतींचे संरक्षण, त्यांची संख्या वाढविणे आणि परागीभवनातर्फे पिकांचे उत्पादनांत वाढ असा तिहेरी फायदा होऊ शकतो.

ब) सामजिक वनीकरण आणि मधु वनस्पती प्रसार: मधमाश्यांमुळे मध-मेण-पराग यांचे उत्पन्न मिळतेच आणि परागीभवन होऊन पिकांचे एकरी उत्पादन वाढते यांची जाणीव होऊन शेतकऱ्यांना

देखील आपण मधमाश्या पाळून एक जोडधंदा करावा आणि मधमाश्यांतर्फे परागसिंचन करुन घेऊन पिकाचे उत्पादन वाढवावे असे वाटते. परंतू शेतीस उपयुक्त असा हा व्यवसाय करण्यात एक अडचण येते, ती म्हणजे शेती विभागातील दीर्घ मुदतीचे दुष्काळी महिने. पिकांच्या वाढीसाठी मधमाश्यांचा उपयोग होत असल्याने शेतकऱ्यांनी मधमाश्यांना वर्षभर काहीतरी फुलोरा मिळत राहील अशा प्रकारे शेतीचे व्यवस्थापन केले पाहिजे. बांधावर मधमाश्यांना उपयुक्त अशी झाडे लावावीत. पडिक जमीनीत वनशेती करतांना बोर, शेवगा, हादगा, कवठ, जांभूळ, ऐन, हिरडा, चिंच, जंगली बदाम, शमी, कडुनिंब, गुलमोहर, पेण्टाफोरम अशी बहुउद्देशीय झाडे लावावीत. त्याचबरोबर कोथंबिर, मका, कारळा तिळ, लसुण घास, बरसीम, सुर्यफुल, करडई, तीळ, फळभाज्या अशी मिश्र पिके घेतल्यास वर्षभर मधमाश्यांच्या वसाहती पाळता येतील. वनीकरण, सामाजिक वनीकरण, वनशेती, कॅनॉल व रस्त्यालगतचे सुशोभिकरण इत्यादी कार्यक्रम मोठ्या प्रमाणात हाती घेण्यात येत आहेत. त्यांच्या ध्येय-धोरणांना बाधा न आणता अशी झाडे-झुडपे, औषधी वनस्पती, शोभिवंत फुले, निवडता येतील की त्यामुळे मधमाश्यांना वर्षभर कोठल्यातरी झाडांच्या फुलांपासून खाद्य मिळेल आणि शेतकऱ्याला या वनस्पतींच्या फळापासून, पानापासून आर्थिक लाभ मिळेल.

वनविभागातही असा मधु-वनस्पतींचा प्रसार करुन वसाहतींची संख्या वाढविणे शक्य आहे. सह्याद्रीचे वनांतून फेब्रुवारी – मार्च महिन्यात फुलाणाऱ्या जांभळाच्या झाडांपासून मधपाळास मधाचे मुख्य उत्पादन मिळते. जांभळाची झाडे फुलण्याचे आधी फुलाणाऱ्या उदा. पिसा, तवसा, अंबुळकी, आक्रा इ. वनस्पतींचा प्रसार केल्यास वसाहतींची संख्या वाढविणे आणि जास्तीचे मधोत्पादन करणे शक्य आहे.

१७)महाराष्ट्रातील शेती आणि शेतकरी:

महाराष्ट्रातील सुमारे ३१० लाख हेक्टर भौगोलिक क्षेत्रापैकी २१० लाख हेक्टर क्षेत्र लागवडीखाली आहे. १५ टक्के क्षेत्र वनांखाली आहे आणि फक्त १५ टक्के क्षेत्र सिंचनाखाली आहे. खात्रीशीर पर्जन्याचे क्षेत्र वगळता सुमारे ५० टक्के क्षेत्र अवर्षणप्रवण आहे.

महाराष्ट्रात सुमारे ९५ लाख भूधारक खातेदार असून एक हेक्टरपेक्षा कमी जमीन असलेले ३४ लाख आणि एक ते दोन हेक्टर जमीन असलेले २९ लाख खातेदार आहेत म्हणजेच सुमारे ६३ लाख शेतकरी हे अल्प भूधारक किंवा छोटे शेतकरी आहेत. त्यातच महाराष्ट्रातील जवळजवळ ५० टक्के क्षेत्र अवर्षण प्रवण असल्याने अल्पभूधारक आणि छोटे शेतकरी यांच्या डोक्यावर सतत टांगती तलवार असते. अशा शेतकऱ्यात आत्महत्येचे प्रमाण वाढत चालले आहे.

शेतकऱ्याच्या आत्महत्या थांबाव्यात म्हणून महाराष्ट्र शासनाने शेती शास्त्रज्ञ डॉ. स्वामीनाथन यांच्या अध्यक्षतेखाली समिती स्थापन केली होती. या समितीचा अहवाल वास्तवतेचे दर्शन घडवणारा आहे. डॉ. स्वामीनाथन म्हणतात" भारतातील ६० कोटी लोक कृषीक्षेत्रात आहेत. परंतू कृषी व्यवसाय हा भारतातील सर्वात मोठा खाजगी उद्योग आहे याची शासन आणि जनता पुर्णपणे दखल घेत नाही. दुसरा एक विरोधाभास म्हणजे देशातील ६० कोटींपेक्षा जास्त लोक कृषी व्यवसायात असताना त्यातील ४० कोटी लोक हे भूमीहीन शेतमजूर आहेत. मी जेव्हा कृषी व्यवसाय म्हणतो तेंव्हा तो पिके,

पशुधन, मत्स्यपालन, मधमाश्यापालन, वनसंरक्षण, कृषीमालावारील प्रक्रिया असा सर्वकष असतो. संपूर्ण जलस्त्रोत, जलाशय आणि जमीन आधारित उद्योग म्हणजे कृषीउद्योगह्ण पिकांचे घटणाऱ्या किंवा अल्प उत्पादनांवर ते म्हणतात "पहिल्या हरित क्रांतीनंतर धान्याने कोठारे भरली आणि आमच्यात आत्मसंतुष्टता आली. आम्ही आत्मनिर्भर झालो अशी भावना झाली. परंतु कोठारात धान्याच्या राशी आणि लक्षावधी लोक उपाशी अशी परिस्थिती निर्माण झाली आहे." अन्नधान्याच्या आयातीवर ते म्हणतात, "अन्नधान्याची आणि अन्नधान्यावर प्रक्रिया केलेल्या मालाची कृषीप्रधान भारताने आयात करणे म्हणजे बेरोजगारी आयात करण्यासारखे आहे."

महाराष्ट्रात तेलबियांचे सरासरी उत्पादन हेक्टरी ८११ किलो आहे आणि कडधान्यांचे उत्पादन हेक्टरी ५३७ किलो आहे. ही कृषी उत्पादकता जागतीक कृषी उत्पादकेच्या ४० ते ५० टक्केच आहे. तेलबिया आणि डाळी यांची आयात दरवर्षी वाढत आहे. येत्या दहा वर्षात कृषीउत्पादकता दुप्पट होणे काळाची गरज आहे. कृषी उत्पादन दर २.२ वरुन ४.० टक्क्यावर नेण्याचे कृषी खात्याचे उदिष्ट आहे. यांत पारंपारिक निविष्ठा, विस्तार, प्रशिक्षण, आधुनिक शेती-पध्दती यांचबरोबर परागीभवनासाठी मधमाश्या ही गोष्ट नजरेआड करुन चालणार नाही.

१८)मधमाश्यापालनाचे फायदे: स्वयंरोजगार, मधोत्पादन आणि कृषी उत्पादनात वाढ:

आपल्या सुदैवाने महाराष्ट्रात सह्याद्रीच्या पर्वतरांगातील सदापर्णी, निमसदापर्णी वने आणि गडचिरोली, चंद्रपूर, अल्लापल्ली येथील दमट पानझडीची वने ही भारतीय सातेरी मधमाश्यांची कायमची वसतीस्थाने आहेत आणि तेथे भरपूर नैसर्गिक मधमाश्यांच्या वसाहती उपलब्ध आहेत. हा विभाग मधमाश्यांच्या वसाहतींचा कायमचा स्त्रोत आहे. ह्या वनांतून आणि त्या भोवतालच्या खात्रीशीर पावसाच्या कृषीक्षेत्रात भारतीय सातेरी मधमाश्यापालनाचा प्रसार, सिंचनाखाली असलेल्या मैदानी कृषीक्षेत्रांत युरोपिय सातेरी मधमाश्यापालनाचा प्रसार आणि कोरडवाहू कृषी क्षेत्रात स्थलांतर आधारित भारतीय आणि युरोपिय मधमाश्यापालनाचा प्रसार अशा तिहेरी रणनितीने महाराष्ट्रांत मधमाश्यापालन व्यवसाय वाढून सध्याच्या १० हजार मधमाश्यांच्या वसाहतींवरुन येत्या दहा वर्षात मधमाश्यांच्या वसाहतींची संख्या दोन लाखांवर नेणे अशक्य नाही. आणि खालील फायद्यासाठी काहीही करुन हे उदिष्ट गाठावयास सर्वकष प्रयत्न करावयास हवेत.

१) सुमारे १ लाख अल्पभूधारक, भूमिहीन शेतमजूर, आदिवासी इ. दुर्बल घटकास स्वयंरोजगार.

२) एरवी फुलातून सुकून वाया जाणारा मकरंद, पराग मधमाश्यांतर्फे गोळा करुन कोट्यावधी रुपये किमतीच्या लाखो किलो मधाची, मेणाची आणि परागाची निर्मिती.

३) सुशिक्षित तरुण बेरोजगारांना, मध, मेण आणि इतर पदार्थांचे संकलन त्यावरील प्रक्रीया त्यापासून मुल्यवर्धित पदार्थांची निर्मिती असा रोजगार.

४) परपरागफलित पिकांमध्ये परागीभवन करुन पिकांचे हेक्टरी उत्पादनात भरघोस वाढ.

५) मधमाश्यापालन हा स्वयंरोजगार निर्माण करणारा मध-मेण इ. पदार्थांचे उत्पादन करणारा, शेतीपिकांचे उत्पादन वाढविणारा, शेतकऱ्यांना घरच्या घरी फावल्या वेळांत सुरु करता येण्यासारखा, स्त्रिया, प्रौढ मुले, वयस्क माणसे यांनीही करता येण्यासारखा पर्यावरणाशी मैत्री राखणारा एक उत्तम जोडधंदा आहे.

१९)कृती व कार्यक्रम:

वरील उदिष्ट साध्य करण्यासाठी पुढील ५-१० वर्षासाठी विस्तार योजना आणि कृती कार्यक्रम निश्चित करावा लागेल. कृती कार्यक्रमांत खालील गोष्टींना प्राधान्य द्यावे लागेल.

अ) **मधुपेट्या निर्मिती -** मधमाश्यांच्या वसाहतींची संख्या वाढविण्यासाठी मूळ गरज मधु-पेट्यांची असते. मधु-पेट्या लघु मधु-पेट्यांची निर्मिती, साठवण आणि पुरवठा याबाबत कार्यवाही करणे. नवीन मधपाळांसाठी जनता मधुपेटी तयार करावी.

ब) **जुने मधपाळ** : महाराष्ट्रात सुमारे २५०० मधपाळ असून ते पाळत असलेल्या १०००० वसाहती आहेत. हे मधपाळ आणि त्याच्या वसाहती ही महाराष्ट्राची संपत्ती आहे. हे मधपाळ सध्या सरासरीने ४-५ वसाहती पाळत आहेत. या मधपाळांजवळ तंत्रज्ञान आहे. त्यांना प्रोत्साहन देऊन त्यांनी सरासरी ८ ते १० वसाहती पाळल्या तर महाराष्ट्रातील वसाहतींची संख्या त्वरीत आणि कमी खर्चात दुप्पट करणे अशक्य नाही. त्यासाठी १) मधपाळांचे तांत्रिक कौशल्य वाढविणे २) त्यांना मधु-पेट्या सहज सवलतीचे दराने उपलब्ध करुन देणे ३) मध-मेण-पराग प्रापालिस इ. पदार्थांचे उत्पादन करणे आणि ४) वनविभाग आणि नजीकच्या शेती विभाग यांत स्थलांतर करण्यास प्रोत्साहन देणे या गोष्टी करणे आवश्यक आहे.

क) **नवीन मधपाळ** : सध्याचे दहा हजारावरुन वसाहातींची संख्या १-२ लाखांपर्यंत नेण्यासाठी नवीन मधपाळ तयार करणे जरुर आहे. वन आणि कृषी विभागाकडे उपलब्ध असलेल्या पायाभूत सोयी वापरुन ही गोष्ट साध्य करणे शक्य आहे. यासाठी १) महाराष्ट्रात सुमारे ८० शेतकी शाळा आहेत. त्यांच्या अभ्यासक्रमांना मधमाश्यापालन हा विषय असावा. २) महाराष्ट्रात कृषी विज्ञान केंद्रे आहेत. या केद्रांचे माध्यामातून मधमाश्यापालनाची उपयुक्तता आधुनिक तंत्रज्ञान, कीटकनाशकांचे दुष्परीणाम इ. माहिती शेतकऱ्यांपर्यंत पोहचविता येईल. ३) शेतकी महाविदयालयातून मधमाश्या आणि परागिभवन या विषयाचा शिक्षणक्रमांत अन्तर्भाव करावा. तंत्रज्ञ, संशोधक आणि शास्त्रज्ञांची भावी काळांतील गरज हे कृषी पदवीधर भागवू शकतील. ४) वसाहत-पुरवठा केंद्राची स्थापना.

ड) **मधुमक्षिकापालन शिक्षण:**

१. **कृषी क्षेत्र:** महाराष्ट्रात चार कृषी विद्यापीठे, २० कृषी महाविद्यालये आणि ८० कृषी विद्यालये आहेत. कृषी विद्यालयांचे शिक्षणक्रमांत "मधमाश्यापालन" विषयाचा समावेश करावयास हवा. यामध्ये प्रात्यक्षिक शिक्षणावर भर द्यावयास हवा. कृषी महाविद्यालयाचे शिक्षणक्रमांत मधुमक्षिकापालनाचे विविध पैलू उदा. मधुवनस्पतीशास्त्र, अनुवंश - जननशास्त्र, रोगशास्त्र, राणी पैदास, जीवनक्रम, मधमाश्यांपासून मिळणारे पदार्थ, त्यांची शुध्दता याविषयी प्राथमिक माहिती असावी. विद्यापीठाचे स्तरावर श. एम.साठीं ज्म्ल्त्द्भल्ठ्ऽ हा खास विषय असावा. या पध्दतीमुळे नवीन मधपाळ तयार होतील तसेच मधुमक्षिकापालन व्यवसायास भावी काळात लागणारे तंत्रज्ञ, संशोधक आणि शास्त्रज्ञही तयार होतील.

२. **वनक्षेत्र**: वनखात्याचीही महाविद्यालये आणि रेंजरर्स विद्यालये आहेत. तेथेही शिक्षणक्रमांत मधमाश्या आणि फुलणाऱ्या वनस्पती यांचे परस्परावलंबित्व, वननिर्मिती, वनपुनर्निर्मिती मध्ये मधमाश्यांचे महत्व हा विषय असावा.

३. **महाराष्ट्र राज्य खादी ग्रामोद्योग मंडळ**: वरीलप्रमाणे वन आणि कृषी खात्यांच्या शिक्षणक्रमांत बदल करण्यासाठी महाराष्ट्र राज्य खादी ग्रामोद्योग मंडळाने पुढाकार घेवून शिक्षणक्रम तयार करणे आणि महाबळेश्वर येथे कृषी आणि वन विद्यालयांतील शिक्षकांना १ ते २ आठवड्यांचे शिक्षण देणे महत्वाचे आहे. या कार्यक्रमांत खादी ग्रामोद्योग आयोगाची पुणे येथील सेन्ट्रल बी रिसर्च ॲण्ड ट्रेनिंग इन्स्टिट्यूट या संस्थेसही सहभागी करुन घ्यावे.

२०)ववविध खात्यात समन्वय:

गेली हजारो वर्षे फुलणाऱ्या वनस्पतींमध्ये परागीभवन करुन त्यांचे पृथ्वीवरील अस्तित्व टिकविण्याचे महान कार्य मधमाश्या शांतपणे करीत आहेत. परंतु मधमाश्यांमुळे कृषी उत्पादनांत आणि वननिर्मितीसाठी होत असलेला फायदा दुर्लक्षिला जात आहे. दरवर्षी हजारो आग्या मधमाश्यांच्या वसाहती जाळून त्यांच्या पोकड्या पिळून क्रूर पध्दतीने मध काढला जात आहे. असा मध काढण्यास लिलाव करुन परवानगी देणे म्हणजे आपल्याच पायावर आपण कुऱ्हाड मारण्यासारखे आहे. वनसंरक्षण आणि पिकांचे उत्पादन वाढीसाठी सर्वच जातीच्या मधमाश्या उपयुक्त आहेत आणि त्यांचे संरक्षण करणे मानवाच्या हिताचे आहे. जगातील अनेक शास्त्रज्ञ आणि पर्यावरण तज्ञ धोक्याची घंटा वाजवून सांगत आहेत की प्रदुषण, कीटकनाशकांचा स्वैर वापर, एक - वनस्पती लागवड, पिक पध्दतीत बदल इ. मुळे उपयुक्त कीटकांचा नाश होत आहे आणि त्यामुळे जगातील कृषी उत्पादन ३० ते ३५ टक्क्याने घटण्याची भिती निर्माण झाली आहे. २० व्या शतकातील सर्वात थोर शास्त्रज्ञ अल्बर्ट आइनस्टाइन यांनी म्हंटले आहे कि जगातील सर्व मधमाश्यांचा नायनाट होईल तेंव्हा केवळ ४ वर्षात पृथ्वीवरील मानवाचे अस्तित्व संपुष्टात येईल. हि थोडी आतिशयोक्ती असे जरी गृहित धरले तरी वनांतील वनस्पतींचे पुनर्जीवन आनि शेतीपिकांमध्ये संख्यात्मक आणि गुणात्मक बीज – फलधारणा यामध्ये मधमाश्यांचे अन्यन्यसाधारण महत्व आहे.

मधमाश्या आणि फुलणाऱ्या वनस्पती आपल्या अस्तित्वासाठी एकमेकांवर अवलंबून असतात. म्हणजेच मधमाश्यापालन व्यवसाय आणि कृषी व्यवसाय एकमेकांवर अवलंबून आहेत. एकमेकांच्या सहकार्य-समन्वयाने या दोन्ही उद्योगाची प्रगती होणार आहेत. महाराष्ट्र राज्य खादी ग्रमोद्योग मंडळ गेली ५० वर्षे या व्यवसायाचा प्रसार करीत आहे. मंडळाची महाबळेश्वर येथे स्वत:ची संस्था आहे. पुण्यात खादी ग्रामोद्योग आयोगाची मधमाश्यापालन संशोधन आणि प्रशिक्षण संस्था आहे. महाराष्ट्र राज्य खादी ग्रामोद्योग मंडळाने पुढाकार घेऊन कृषी, वन, जलसिंचन, सामाजिक वनीकरण, आदिवासी विकास मंडळ, खादी ग्रामोद्योग आयोग या सरकारी तसेच मधोत्पादक सहकारी सोसायट्या ग्रामीण भागात काम करण्याच्या बिगर सरकारी संस्था या सर्वांच्या सहकार्याने, महाराष्ट्रातील मधमाश्यापालनास एक नवी दिशा दाखवावी.