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THE ALL-INDIA VILLAGE INDUSTRIES ASSOCIATION

KV-54

BEE KEEPING

KV35

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S. M. CHITRE

Supervisor, Maganvadi Apiary
A. I. V. I. A., WARDHA

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WARDHA

1944

Price, Re. 1-8-0

429

LIST OF BEE KEEPING EQUIPMENT

Bee Keeping Equipment and Live Bee Colonies can be had from us on remittance of their price in advance. Packing and freight will be extra to be paid by the consignee. Prices are subject to fluctuation in the market.

| Articles | | | | Rs. A. P. | | |
|--------------------------------|-----|-----|-----|-----------|---|---|
| Capturing box | ... | ... | ... | 4 | 0 | 0 |
| Bee veil for the face | ... | ... | ... | 2 | 8 | 0 |
| Wire gauze frame | ... | ... | ... | 4 | 0 | 0 |
| Smoker | ... | ... | ... | 3 | 8 | 0 |
| Bee hive | ... | ... | ... | 6 | 0 | 0 |
| Extra super chamber | ... | ... | ... | 3 | 0 | 0 |
| Dummy board | ... | ... | ... | 0 | 8 | 0 |
| Queen gate | ... | ... | ... | 0 | 8 | 0 |
| Queen cage | ... | ... | ... | 0 | 8 | 0 |
| Honey extractor (iron wheel) | | ... | ... | 20 | 0 | 0 |
| „ (wooden wheel) | | ... | ... | 15 | 0 | 0 |
| Double edged knife | ... | ... | ... | 3 | 0 | 0 |
| Swarm capturing bag | ... | ... | ... | 2 | 8 | 0 |
| Nucleus including a hive | | ... | ... | 15 | 0 | 0 |
| Live bee colony with a hive | | ... | ... | 30 | 0 | 0 |

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THE ALL-INDIA VILLAGE INDUSTRIES ASSOCIATION

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கல்லூர் பட்டி P. O.
(மதுரை)

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BEE KEEPING

KV 35

S. M. CHITRE

Supervisor, Maganvadi Apian
A. I. V. I. A., WARDHA

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சாந்தி நிகேதனம்,

சென்னை P.O.

KV35

PREFACE TO FIRST EDITION

When I began to study Bee-keeping, I experienced many difficulties and these latter have induced me to write this booklet. I found of special use ABC & XYX of Bee Culture by A. I. & E. R. Root; Lore of the Honey Bees by Tickner Edwards and Bee Keeping by C. C. Ghosh. I also got into touch with various apiaries and the notes thus compiled have gone to produce this booklet. I am deeply indebted to these sources.

I have tried to give in this booklet relevant matter only and have discarded what seemed unnecessary. My aim has been to provide a hand-book for beginners giving all necessary information in a nutshell.

Maganvadi,
Wardha, 20th Feb., 1939 }

S. M. Chitre

PREFACE TO SECOND EDITION

I have added my experiences during the twelve months in this new edition and also the results of our experiments in queen rearing, artificial dividing, absconding etc.

Maganvadi,
Wardha, 5th March, 1940 }

S. M. Chitre

PREFACE TO THIRD EDITION

In presenting the third edition I am much indebted to all of my friends living in different parts of the country and also to numerous amateurs and bee enthusiasts who have helped me to collect more information on the subject and goaded me on to make more experiments myself by their tireless and anxious enquiries in connection with this industry. Yet I feel I may not have studied the art and industry in its every detail and I shall always look up for further questions and enquiries to enable me to make good what may not be found here.

Maganvadi,
Wardha, 30th May 1944 }

S. M. Chitre

Published by BHARATAN KUMARAPPA

Asst. Secretary

The All India Village Industries Association, Wardha

Printed by W. D. JAJOO, Managing Agent,

Shrikrishna Ptg. Works Ltd., Wardha

INTRODUCTION

Bee keeping is nowadays carried on an extensive and commercial scale in the west, but should we care to trace the history of apiculture or the science as it developed, we find that these strange little creatures, that lived in a society under rigorous and complicated laws and laboured extensively in darkness, first attracted the attention and notice of talented philosophers and literary men like Cato, Aristotle, Varro, Pliny, Columella and Palladius. Aristomachus is said to have studied the bees for forty years but his vast knowledge and experience are denied to us as his writings on the subject are reported to have been lost. The real history of bee keeping however begins in the seventeenth century when the great Dutch learned man Swammerdam discovered some fine laws such as the sole maternity of the Queen Bee. He founded the true methods of scientific investigation. He contrived injections to prevent decay and he first dissected the bee, discovered the ovary and the oviduct and definitely determined the sex of the queen which was till then looked upon as a King. Then came Reaumur who made a vast number of experiments and researches in his garden at Charenton. He understood the formation of swarms and the marvellous architecture of the hive. We owe him the idea of the glass hive.

Huber was born in Geneva and lost his eye-sight in early childhood. He had a faithful servant by name Francois Burnens. With this servant's help Huber devoted his entire life to the study of the bee. In the annals of human suffering and human triumph there is no lesson more praiseworthy and admirable than the story of this patiently studious and energetic person who with his spirit guided the eyes and hands of the other who had the real earthly vision but who with his own eyes had never seen a comb. His writings have remained a treasure-house into which subsequent writers dipped.

Dzierzon discovered the first hive with moveable combs but one of most outstanding improvements was effected by Langstroth who discovered the theory of bee space. Mehring introduced artificial wax foundation for the combs so that bees might be spared the labour of moulding wax and constructing the tiny symmetrical cells which cost them so much honey and so much labour. Major de Hruschka invented the honey extractor by which honey could be extracted without the destruction of combs. In this century, A. I. Root has devoted forty years to modern methods of bee keeping and has given us fuller knowledge on the subject.

We have no definite data before us to ascertain the history of bee keeping in India. It is said that the hive now known as "Newton Hive" was introduced by Rev. Newton a missionary in South India where this industry is now carried on an extensive and commercial scale.

KINDS OF BEES

The collection of honey for purposes of food and medicine is being done in our country since olden days but the method of collection, as was the practice in the whole world centuries ago, has been very crude. Whole families of bees are heavily smoked and killed and their combs destroyed. Western countries have since long adopted the scientific and systematic method of honey collection. We in India have abundant flowers growing wild in forests and fields. Tons and tons of honey are collected and sold in bazars but all that is impure honey full of dirt, wax and propolis.

Villagers usually collect honey from the combs of Rock bees and the Little bees but these are not the bees that can be domesticated. Let us, therefore, understand the different kinds of indigenous bees and the modern scientific method of honey collection.

We have four types of honey bees in our country. They are known as Apis dorsata, Apis indica, Apis florea and Mellipona apicalis. Their English names are Rock bee, Indian bee, Little bee, and Dammer bee respectively. For our purpose we can divide them into two classes, the solitary bees and the social bees. Solitary means living singly. The word is not taken here to convey that sense. The Rock bees and the Little bees are of the first type. They like open, fresh air and build their combs on branches of trees. We prefer to call them solitary bees because they cannot be tamed or domesticated. The Rock bees are the best honey gatherers but they are very furious, and their sting is very sharp. It penetrates into the body like the thorn of a babul tree. They will not brook the least disturbance in their work and if a person merely touches one of the members of their colony the whole flock will attack him, pursue him for miles and may even sting him to death. If he dives into the water, they will hover round in the air and as soon as he puts out his head, they will sting him, they are so revengeful. It is this ferocious nature which puts them beyond the reach of the apiary. The other reason why they are called solitary is that they wander from place to place. They will change their place of abode as they please according to the honey flow season in a particular locality. The Little bees also live in the open air and build single combs hanging from the branch of a tree. They are not as furious as the Rock bees and their sting is not so sharp but they cannot be tamed. We have tried to keep them in our apiary by giving them facilities to build their combs in open air on horizontal wooden frames but they have not responded to our treatment. Most of the honey that is sold in the bazar is from the combs of these wild bees.

The Indian bees and the Dammer bees do not like open air. They make their abode in dark, cool and shady places. The Indian bees live in hollows in tree trunks, walls and rocks. The Dammer bees live in tiny crevices in the bark of trees. They

are very tiny, like ants with wings, and their combs also are tiny-being only the size of big buttons. Their honey is supposed to be of great medicinal value but they gather so little honey in a year that it is not worth while keeping them.

Out of the four kinds of bees, therefore, only the *Apis indica* or Indian bees, as they are commonly known, can be domesticated. They are capable of being easily manipulated. Their sting is not so sharp and they gather good honey. Besides, they do not build a single comb but always a number of parallel ones one behind another, and if they find a hollow somewhere they will stick to it for years unless they are disturbed and ejected from the place. A beginner can recognise them also from their colour. They are brown with thin black stripes over their abdomen. These bees are available all over the country and are the bee keepers' delight.

To help interested persons in distinguishing between different kinds of honey bees, their common Hindi and Marathi names are given here. The Rock bees are known as Sarang, Bhanwar or Agya; the Indian bees as Khaira, Satia, Satode or Satpude; the Little bees as Bhunaga, Jshade or Kanee; and the Dammer bees as Chota Bhunaga, Kotha, etc. All honey bees are generally known as "Mohol" which actually means only a honey comb and does not specify a particular species. The *Apis indica* or Indian bees are found in Mango, Neem, Mahua, Tamarind or such other trees (in Hindi Pole Peda) which have natural hollows in them.

The Rock bees are bright red in colour with thick black lines over their abdomen. They build a single comb varying in size from one foot to several feet. The Indian bees are smaller in size, are brown and have thin black lines over the abdomen. They have on an average seven combs hanging parallel to one another. The Little bees are red and blue in colour; the upper half of the abdomen is red while the lower

half is blue with white lines. They build a single comb measuring 6 to 15 inches. The Dammer bees are ash-grey in colour and look like winged ants. They build tiny and small combs in crevices and holes in wood.

RESIDENTS OF A COLONY

By natural colony we mean not one comb but the whole collection of combs with the occupants. There are three classes of individuals in a colony, the Queen, the Worker and the Drone. The Queen and the Workers are females and the Drones are males. Let us study the growth, development and duties of these three individuals.



Top row-Indian bees, (Queen, Worker, Drone)

Bottom-Rock bee worker

The Queen:

There is only one queen in a colony whether there are 500 bees or 50,000 or whether there is one comb or a number of combs. The queen bee is the mother bee but she does not rule the colony as queen. No doubt she is treated with great respect and love. She is courted, fed and groomed unceasingly by the attendant host around her. She is the teeming mother of over tens of thousands and she carries in her body the seed of all generations to come. But she is the reverse of a monarch both by nature and inclination. She possesses only the merest rudiments of intelligence. She has a magnificent body, great docility, certain almost unrestrainable impulses and passions, a yielding womanish

love of the yoke and she is incapable of action other than that arising from her bodily impulses. Her brain is smaller than that of a worker. In many ways she is inferior to the common worker bees who plan out her entire daily life and use her for the good of the colony as one would use a costly delicate piece of machinery. There is no special palace for her to live in. She lives like the other occupants of the hive on the combs and roams about from one comb to another.

A new queen is produced only when the old queen is diminishing in fertility, when the worker bees want to send out a swarm with the old queen or when the old queen has died or is lost by accident. Whenever a queen is required, at least five or six are raised. The cells are closely guarded by the workers which never allow the existing queen to attack the inmates of the new queen cells built by them. Left free, she would tear open each queen cell and kill its occupant. Though there awakens in her a sounding chord of jealousy, an impassable barrier stops the way — the collective will of the hive. The old queen knows that her fate is in the balance, it may be death or new life in a new home. If the worker bees do not want to send out a swarm, they kill the old queen themselves or allow the young queen after she is mated to exercise her free will to kill her rivals.

In order to rear a queen, the worker bees build big special cells, about an inch long and half an inch thick, generally at the lower end of the comb wherever they find empty space. These cells are conical in shape, tapering at the lower end and are called "Queen cells". They then induce the queen to lay an egg here, of course, a fertile one or if she does not do it, they transfer one such freshly laid egg from the worker's cell to the queen cell.

An egg can be distinguished as a tiny white speck at the bottom of a cell lying flat pointing downwards or erect on one end. It is hatched within three days. After it is hatched,

it is transformed into a larva which is a coiled worm. This larva is now given a special healthy, rich, nitrogenous food called the "royal jelly". The workers secrete a substance in some glands in their heads which mixed with honey makes the royal jelly. The queen larva is given this food freely for five days when it develops into a pupa, and the cell is then closed or sealed from inside by the larva and from the outside by the worker bees. In the pupal stage the young undeveloped bee called the nymph is supposed to go to sleep during which time her organs develop. The fully developed queen then breaks the cell and comes out after seven or eight days more. The effect of the rich generous food given to her is obvious from the first in her rapid growth. A further advantage still is that the queen has free access to the air at all stages of her development as the cell is made of porous material and commonly placed at the edge of a comb where it stands out in the full current of ventilation.

On gaining her liberty 15 or 16 days after the laying of the egg she does not receive an enthusiastic welcome as she might have expected but finds only unregarding strangers about her. Now at this early point in her career she is taught her first lessons in obedience. For three or four days after her release she is a curiously solitary figure. Not a drone glances her way and the worker bees go about their business in seeming unconcern about her. They do not even trouble themselves to feed her and she is left to feed herself on the honey in the combs. This conspiracy of indifference is all part of her education. At last the inner instinctive call comes for which all are anxiously and secretly waiting, and obeying her instinctive impulse irresistibly she presses into the light outside. With a glad flutter of her wings she soars up into the sky. She hovers round and round taking a careful stock of her home and surroundings. This flight of the queen is called her "virgin flight" or "marriage flight". A drone spies her and gives chase. Though they live

in the same hive, nature prevents in-breeding and the act of copulation always takes place in the air. At sight of him she wheels and darts away into the sun-shine. Yet the first drone has hardly stretched a wing before another and then another is after her. Thick and fast from all points they gather for the race. The queen is then mated with the first drone that reaches her. As soon as the act of copulation has taken place, the two whirl round in the air until they drop down when the queen tears herself loose, carrying with her the drone-organs after which the drone dies. It is a cruel fact that when the drone attends his wedding, he also attends his funeral. His queen does not need him further and she thereafter becomes a widow for the rest of her life and a widow that does not mourn. The mated queen then returns to the hive and now she is received with a public ovation. She is lauded, fed and fondled. The drone organs that have been stuck in the act of copulation are removed by the worker bees but the spermatheca where a supply sufficient to last the rest of her life is held. The queen is able to lay fertile eggs from that time that will produce workers and queens, and also unfertile eggs that will produce only drones. If the queen is not mated in her first flight, she goes out again the next day and this she does for about 3 weeks and then gives up the idea altogether. Then she remains and is doomed to live a spinster that can only lay unfertile eggs; such a queen is useless for the growth of the colony but this rarely occurs.

Does the queen get mated with the drone more than once in her life. This problem is engaging the attention of apiarists in the whole world and no definite conclusion has yet been arrived at. The queen diminishes in fertility in the second year of her life. In some months during the year it stops to lay eggs or lays only a few eggs intermittently. This may be explained in two ways. It may be that the slackening was due to want of pollen for the time being and she began to

lay eggs when it was abundant again; or it may be that she went out again for copulation with the male and her fertility increased on that account.

After the queen is mated and has returned to the hive, she has a whole suit of chamber women who attend on her, clean her, comb her and feed her. Throughout her life she is fed on the royal jelly only. This particular kind of nourishment is given to keep up her vigour in the work of non-stop egg-laying and has a stimulating effect. The more food of this kind she receives, the greater will be her prolificacy. In the honey flow season she lays as many as 2000 eggs per day (I have myself noticed her laying two eggs per minute) but in the rainy season when there is not much work for the workers and when the supply is shortened she lays only a few eggs. The queen begins to lay eggs 24 hours after mating and the laying continues till the end of her life. The life of a queen is 2 or 3 years.

The Worker Bee

The cells designed to contain the worker eggs measure one-fifth of an inch across the mouth. The bees in a colony surround the queen on her egg-laying journey. They are actually her guides. They lead her to vacant cells and stop her there. First the queen peers into a cell, examines it, and then thrusts her abdomen into it. She pauses a moment and again mounts the comb. The bees then lead her to another vacant cell and another egg is laid there and so it goes on. Though the process is quick there is no hurry. Though there is complexity there is no confusion. The egg which produces a worker is identical in nature with that from which a queen bee is reared. This can be proved by a simple experiment; if a worker egg is removed into a queen cell, that egg will produce a queen; if on the other hand the egg in a queen cell is removed into a worker's cell, only a worker will come out. The main cause of the difference

in the development of the queen bee is that of treatment in the early stages of her life, the rich food and the big airy cell given to her. The explanation as to how the queen lays a fertile egg in a worker's cell is simple. The gland wherein the male essence is stored can be opened or closed according to circumstances. At the narrow worker's cells, the queen has to straighten up her body, the spermatheca is opened and the egg in passing absorbs some of the germs contained in it. Thus a female bee is born from the union of two parents.

The egg is hatched within 3 days and a small tiny curled worm called grub is seen. For the first three days of its life it is given royal jelly and the next three days, when it is called a larva, bee-bread. This bee-bread is the name given to the pollen-a whitish, yellowish or reddish substance-mixed with a little honey. The less nutritious bee-bread retards the growth and development of the worker and it remains an imperfectly developed female. Besides, the space in which it has to accommodate itself is also limited and does not allow a fresh supply of air which can only reach it from the top of the cell. In the construction of worker cells rigid economy is practised. After six days of feeding the larva which has by now become bigger passes into the final stage of its development. This final stage is called the pupal stage, during which time it sleeps or takes rest. All the organs are now formed and it comes out of the closed or sealed cell at the end of eleven or twelve days after it is capped. A worker takes about 21 days to come to life from the laying of an egg.

These bees are called workers because the whole administration of the colony rests in their hands. The life of a worker bee in a busy season is for a period of six weeks only. There are two kinds of duties they have to perform, field duties and hive duties. During the first half of their life they are given hive duties which are multifarious. Some act as chamber women

to the queen, they guide her, feed her, clean her and also comb her. A large number of them sit close together in clusters and make wax to build combs, some cut new passages between comb and comb if the old ones get blocked up, some act as nurses, rear the brood, feed it properly and seal the cells. Some take upon themselves the work of clearing the debris and dead bees. As the hive needs a certain temperature the workers at times divide into two groups, some fan the air into the hive while others fan it out so that there is a continuous flow of air through the hive. Some are busy taking charge of the loads of pollen and honey that are brought into the hive. The traffic seems to be congested but everything goes on as if mechanically in a systematic way. Then there are the guards who watch all incomers and out-goers. All these are hive duties and young bees have to attend to these during the early part of their life. The last of these is guard duty after which they are allowed to go out in search of pollen, nectar and water. The bees that go out are called foragers. All through the hours of sunshine these foragers are running, flying and charging to and fro but all goes on with regularity like the routine of a well ordered human settlement. It is because of this hard strenuous work that worker bees do not live more than six weeks in a busy season. It is they who work and it is they who govern the colony. If left alone a worker may live for three months or more.

The Drone

The drone cells are larger than worker cells and have about a quarter inch diameter at the top as well as great depth. When the queen is led to these big cells she does not have to straighten up her body, so the spermatheca is not opened and an unfertile egg is laid. The egg hatches in three days, the grub is fed with royal jelly for the first three days, and for 2 or 3 days more with a mixture of bee-bread and royal jelly. The food that is given to a drone grub is richer than that given

to a worker grub because all his organs should fully develop to make him a perfect male. Its larva stage is for six days during which it is fed on bee bread. After that it passes on to the pupa stage and remains in a capped cell for about a fortnight; so a drone requires nearly 28 days to come out of the cell.

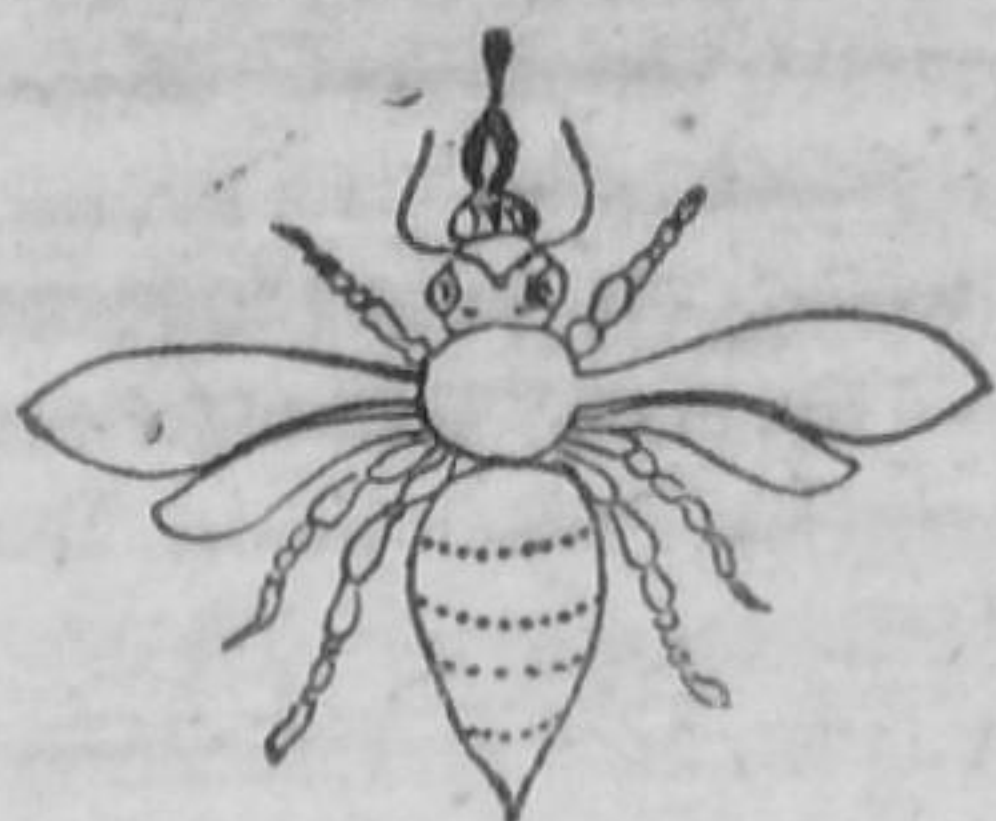
The only function of a drone is to impregnate virgin queens and how this takes place we have already seen. They are generally called into existence at the approach of the swarming season. At the end of summer when the honey flow ceases or when they are no longer needed, food is withheld from them by the workers and they are killed or driven out of the hive to perish. Before driving them out their wings are maimed so they cannot fly back to the hive. They are not allowed to live their normal period of life which is about three months.

It is not possible to detect the worker or the drone in its egg or larva stage. When it passes on to the pupa stage the workers' cells are capped with a thin, flat coating of wax while the drones' cells have a cap-like curtain protruding from their cells.

The table given below shows at a glance the various stages of growth.

| | Queen Days | Worker Days | Drone Days |
|---------------------|---------------|----------------|---------------|
| Time of hatching | 3 | 3 | 3 |
| Grub stage | 0 | 3 | 5 |
| Larva stage | 5 | 3 | 6 |
| Pupal stage | 7 | 12 | 14 |
| | <hr/> 15 | <hr/> 21 | <hr/> 28 |
| Cell capped on | 8 th day | 9 th | 14 th |
| First day of flight | 4 th | 21 st | 24 th |

BODILY STRUCTURE OF A BEE

*Front view**Reverse view*

The black spots show wax plates

The body of a bee is divided into three distinct parts, viz. head, thorax and abdomen. The head consists of (i) two eyes, one on each side, (ii) three small eyes called simple eyes. (iii) two feelers, two jaws and a tongue. With the help of the jaw the bee can cut any hard substance and with the help of the tongue it can suck nectar from flowers. On the thorax there are two wings and three pairs of legs. The bee can both walk and fly. The abdomen is oval in shape and carries a sharp sting at the end. All over the legs there are stiff bristles which help to retain the pollen that falls on them. The pollen is gathered and carried on the thighs of the hind legs, this part of the leg being known as "pollen basket".



(a) *Worker's leg*

(b) *Worker's leg showing how pollen is collected*

Below the abdomen there are four pairs of flat structures called "wax plates". In the worker the abdomen is divided into two parts one of which is a small pouch called "honey sac" in which nectar is stored as it is collected. It passes through a valve into another part below where the nectar is transformed into honey after some chemical changes have taken place. The body of the worker is well fitted with organs for collecting pollen as well as nectar. The tongue is long and furnished with sensitive hair. In the sting the worker has a weapon of offence and defence. But as soon as a worker stings the sting is broken and thereupon it loses its life; so a worker when it stings does so in the interest of its beloved colony and dies the death of a martyr.

In the queen the tongue and the sting are aborted. Her pollen gatherers are not fully developed and she has no wax plates. Her sting is curved and she never uses it unless she wants to kill her rival. She will never sting any one else; she perhaps thinks it below her dignity to sting any one except her royal rival. Generally she uses her sting as an ovipositor. The abdomen of the queen is longer than that of a worker.

The drone has an aborted tongue, he has no pollen gathering organs, no sting and no wax plates. He is an innocent creature altogether.

There is a difference in the outward appearance also of these kinds of individuals. The drone is a blackish creature with flat eyes protruding on both sides of the head. The worker is a lovely creature yellowish in colour with sharp black stripes over the abdomen. The queen is at least one and a half times bigger than a worker and is dark reddish-brown in colour. She is the biggest bee in a colony.

RELATIVE IMPORTANCE OF THE MEMBERS OF A COLONY

The queen bee alone will not be able to run a colony by herself. She can lay eggs but she cannot gather pollen and

nectar, she cannot take care of the eggs and so she and the brood will die of starvation. The drones also cannot do these things and hence alone they are useless. The worker bees alone cannot run a colony. They can bring in pollen, nectar and water but they wear out through hard exertion and there will be nobody to take their place, and the whole colony will be wiped out in about two months time. Therefore each of them is necessary for a colony.

In a normal colony the queen should be prolific with a good laying capacity, with worker bees to look after the various activities in the hive. The greater the number of the worker bees, the greater the success of a colony. The drones are essential. Without them the queen will not mature and though they are idle they cannot be done away with.

BEE PASTURAGE

There is a general impression prevalent among all classes of people that bees when kept in flower gardens will yield good honey, further, that bees ought to be kept only in flower gardens. But this is a mistake. There may be miles and miles of such beautiful gardens with glowing, shiny flowers blooming everywhere and yet the whole district may prove a poor honey district. As a rule, there is more nectar in wild flowers than in cultivated ones and the more the bees are in forest regions or hilly tracts, the more will be the honey that they produce. That is why we hear that in hilly tracts and forest areas bees thrive more than on plains. The ordinary honey gatherers will bear testimony to this fact. Where we do not have such natural pasturage we have to provide artificial pasturage and for this we have to know something of the plant kingdom.

There are three main kinds of plants. Some grow from bulbs like potatoes, garlic, hyacinth, etc. Some are ferns or

creepers while others grow from seeds. It is the last type of plants that the bees make friends with. There is a natural affinity between these plants and the bees. The bees need them and they need the bees. The flowers of these plants have two kinds of cells, the ovule or the female cell, and the pollen or the male cell. To produce seed there must be a union of these two cells. In some flowers the two cells are adjacent to each other and an easy union is possible, but in others these cells are apart and some other agent is necessary to bring about the union. Nature has devised three agents for this purpose, wind, water and insects. The union of the two cells of the same flower is called self-pollination while the union of the cells of different flowers is called cross-pollination. Cross-pollination yields better and more seeds than self-pollination. We have seen that the food of the young brood is bee-bread which is mainly pollen. When the bees go in search of pollen they go from flower to flower and while doing so distribute the pollen of one flower to other flowers and thus cause cross-pollination. They not only want pollen for their young ones but they want nectar also which is the food of the older bees. The nectar is secreted at the base of the flower. So when the bees go in search of pollen and nectar they at times visit the pollen and at other times visit the base of the flower for nectar. Pollen is in the form of dust. Some particles of it stick to the legs of the bees and are conveyed to the ovule when they visit it in search of nectar or pollen.

It is in the interest of the agriculturist, therefore, to keep bees. Those that keep orchards will also benefit by an abundance of fruits. Though there are no definite data before us to show which is the best pasturage for bees, still we can name a few. Careful observation in a particular locality will disclose some other good pasturage. Besides there are so many wild flowers in our country that their nectar is going waste because of lack of bees in sufficient numbers to take advantage of them.

Different kinds of flowers yield different kinds of pollen and nectar. Besides, some flowers are small and small bees only can visit them. In others, the nectar is situated at such a depth that only bees with a long tongue can visit them successfully. So we see there is a natural relationship between plants and bees and these plants often produce multi-coloured bright flowers to entice their bee visitors.

Bee scientists tell us that bees require about 2000 flowers to get 1/9 tola of honey, so we can imagine how many flowers the bees will have to visit when they give us so much honey every year. These scientists also tell us that they go in all directions within a radius of three miles, especially in the direction of the east, but the nearer the pasturage the less is the journey that they have to make. The average production of honey per colony in a year depends upon the local pasturage. In Wardha, a colony produces 10 to 12 lbs. a year, in Bihar 20 to 25 lbs., in Andhra 25 to 30 lbs. and in the Himalayas 40 lbs. or more.

Like farmers in Western countries our agriculturists must be encouraged to take up this industry which will bring them not only extra cash as well as an abundant supply of honey with nothing to pay for it but also a rich harvest.

Below is a list of useful pasturage for bees. Though it is not very exhaustive, it covers the requirements of bee keepers in any province.

Flower plants

Rose ✓
Zinnias ✓
Dahlias ✓
Marigold ✓
Hallianthus ✓

Creepers

Antigonon ✓
Jacquemontia ✓
Bignonia vanesta ✓
Honey suckle ✓

Hedge plants

Justicia ✓
Adhata vasak ✓
Leucacea Glauc ✓
Queen of night ✓
Duranta ✓

Salvia

Poppies

Portulacca

Larkspur

Gailardia

Chrysanthemums

Corn flower

Daisy

Aster

Nastrisiums

Mina knot

✓ Wild rose, as a pollen plant

Vegetable plants

✓ Plantain

✓ Beans

✓ Cucumber

✓ Brinjals

✓ Peas

✓ Raddish

✓ Lady's fingers

✓ Moringa (drum stick)

✓ Horsegram

✓ Chelam

Fruit trees

✓ Apple

✓ Citrus varieties

✓ Guava

✓ Jambul

Chikoo

✓ Mango

Field crops

Jowar Sweet clover

Bajri Lucerne

✓ Maize

Buckwheat

✓ Sweet corn

✓ Gingelly

Sarson

✓ Linseed

✓ Cotton

✓ Corriander

✓ Onions

✓ Chillies

✓ Mustard

✓ Gram

Other useful trees

✓ Soap nut

✓ Neem

Laurel

✓ Ponghai

✓ Tamarind

Shisham

Wood apple
Phalsa

Tun
Amaltas
Australian wattle
Sufeda
Puna
Barberry
Shain
Grahma
Arjun
Karanja
Bichava
Acacia sp.
Vitex Negaunde

LIVE COLONIES

Many persons wishing to rear bees think that if they are able to capture a few bees with their queen or only the queen, more bees will of their own accord come to the hive. It is not their fault. In the school text books there are a few lessons describing bees and their administration, their mode of living and their industrious ways of collecting honey. From the scant knowledge available through such lessons it is commonly believed that the queen bee alone is the most important and if she is taken care of, everything will go on smoothly. In fact capturing a bee colony means getting possession of all the combs forming it with all their occupants.

Live bees are available on sale from some apiaries but there are no transport facilities in our country. Bees need careful handling while in transit, and the hives in which they are being transported must not be thrown about with jerks and jolts. We also sell live bee colonies to help bee enthusiasts and as we aim at selling fully domesticated and fully fledged or developed colonies, we prefer advance booking of orders for such colonies.

We do not however wish to popularise purchase of bee colonies. We expect persons interested in the industry to start the work earnestly by capturing bees from nature. Persons desiring to keep bees as a hobby will find it an extremely exciting pastime to capture natural bee colonies.

HOW TO BEGIN

There may be many methods of capturing a colony but the following is the method resorted to by us in Maganwadi.

Take some carpentry tools consisting of a small sharp axe, a strong sharp chisel and a hammer, as well as a strong rope, the brood chamber mounted on a floor board, a wire gauze frame fitting the top of the brood chamber, a knife, a pair of scissors, loose jute string, some combs and some honey if necessary. Plantain fibre will also do instead of string.

The first thing to do is to observe the colony from outside through the opening of the hollow or some crevice and find out where the combs are. Then climb and stand at a convenient place and slowly begin to chop off the wood and clear the mouth of the hollow so that all the combs inside are clearly seen. The chopping takes a long time and demoralises the bees as they get heavy shocks from the strokes of the axe. Very few bees show a tendency to sting. Care should be taken not to kill or hurt the bees while chopping. The chopping process over, take the knife and slowly insert it at the top of the combs and detach them one at a time from the wood above. After carefully removing all combs intact put them in the wire gauze frame. As already stated, there will be not a single comb but a number of them hanging parallel. At times there may be only two or three. Take out the frames from the brood chamber and tie these combs one in each with jute string or plantain fibre. In the comb there will be honey, eggs and brood. Care should be

taken to see that the honey part of the comb is towards the top of the frame. Tie the combs length-wise as well as cross wise but do not injure the brood inside. Place all these frames in the box you have brought.

The next operation is to transfer the bees from the hollow into your hive or box. You have to handle the bees firmly, never shrinking for a moment for fear of their stinging. Put your hand inside the hollow and take a handful of bees out, put these on the floor board, put your hand inside again, take out a few more bees and so on, do it four or five times. By the inducement of honey, eggs and brood the bees will be attracted by their smell and will go inside. If the bees are beginning to enter the box, wait and see. As regards the position of the box nothing definite can be said. It will differ in each individual case. You have to depend upon your ingenuity and dexterity and hold the box in front, above or below as you think best. When the box is above the hole, remove the floor board, and if below, remove the wire gauze frame. While capturing a colony capture the queen bee; if she goes in, all the bees will follow her. If you happen to see the queen, catch her by the wings and put her inside the hive; or capture her by the wings, enclose in the queen cage and place it in the hive and release her after some time; or hold the box in such a way that she will enter. If the bees hesitate to come out of the hollow use smoke; give a few puffs in the beginning and then a little more. They will be suffocated and will all come out. Sometimes some bees go into the box and the rest settle on some other part of the same tree or some other tree nearby, which shows that the queen has flown there. You have to get down and go to that place.

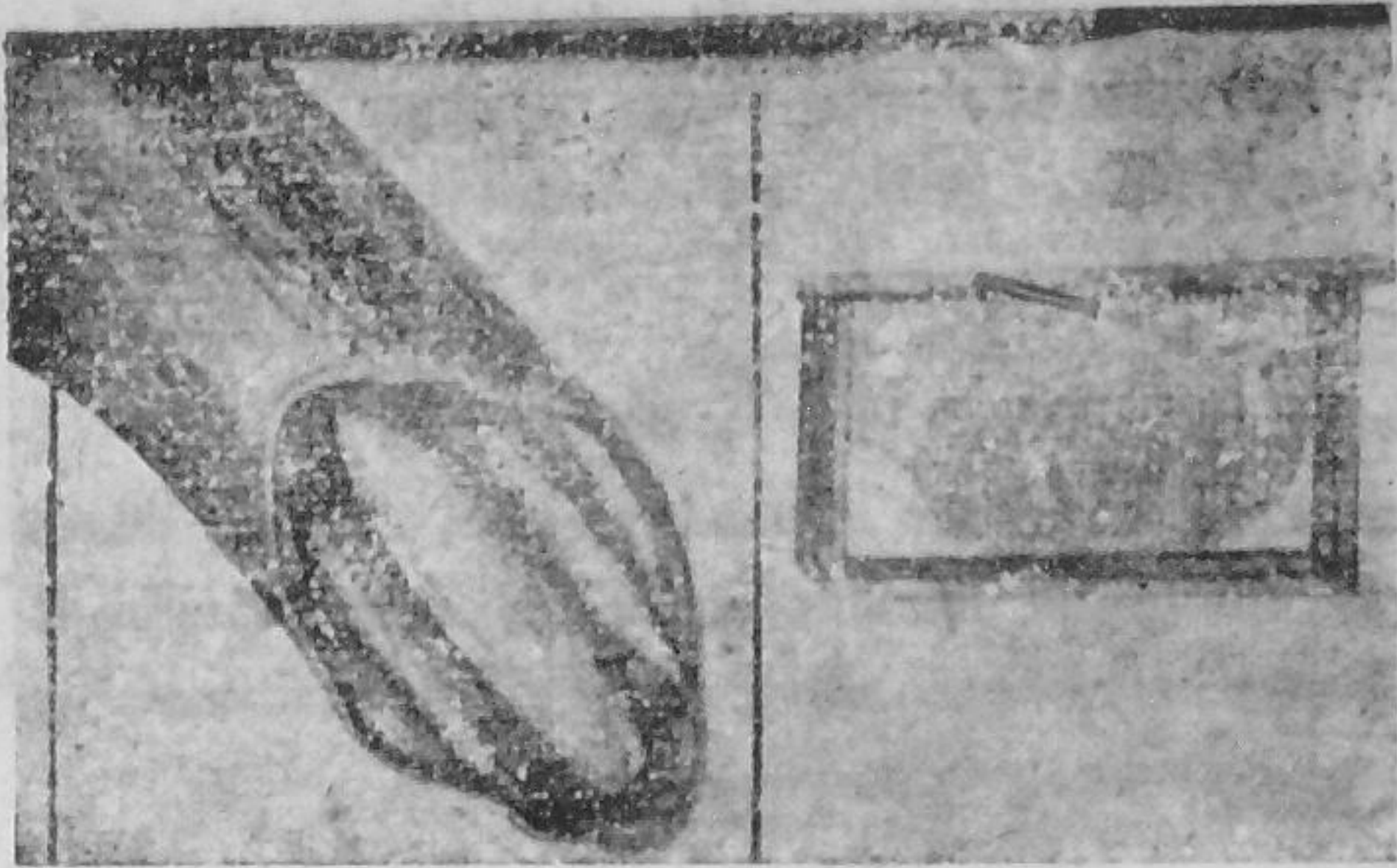
Choose morning hours in the summer or noon hours in the winter. The sun should be mild and not very hot; and the day should not be very cold, or cloudy or windy.

When all the bees together with the queen have gone in, arrange the box properly on the floor board and place the wire gauze frame over it. Close the entrance with a rag or a piece of paper. Place a piece of cloth soaked in water over the wire gauze frame if the weather is hot. Always take care not to injure the brood and the combs. See that no dust and dirt get into the box. If you go in the evening, all the bees that may have gone out for gathering pollen and nectar return home at that time and seeing their friends entering your box will follow them.

The rope is used for lowering the combs from the tree and also for lowering or raising the box up or down the tree. Bring the box to your apiary, and keep it on a stool. Keep the box closed for a fairly long time and then open it by pulling out the rags pushed in at the entrance.

Natural colonies may also be captured in another way. First cut out the opening of the hollow and remove all the combs. After tying the combs to the frames, arrange the box with the roof covering the brood chamber and the floor board beneath and tie it there strongly. Cover it on all sides so that the bees inside have no other exit but into your box. Leave it in that position for two or three days. All the bees will by that time have entered your hive and you can go one evening and bring the box to your apiary. The difficulty in this particular case is that nobody should meddle with the hive and its position so long as it is there. Unless you are sure of that, it is no good trying this method.

While capturing colonies, precaution should be taken not to spoil the brood by rough handling or exposure to wind and weather. The natural combs, as soon as they are cut out of the hollow, should be covered with a piece of cloth so that the brood may not get exposed and may not thus be destroyed. Handle the combs as deftly as possible as the efforts to keep intact the natural combs will be well rewarded later.



1. *Natural combs in
the hollow of a tree*

2. *Comb built in
a wooden frame*

After the hive is taken to the apiary, transfer the frames to another hive and keep it in a place where there is an immediate supply of pollen available. Next morning if the bees are found to be removing debris out of the hive and covering each comb it is a healthy sign but if they are found all sitting in a cluster in a corner, it indicates that they do not like the combs. It is the bee behaviour or bee language to let the keeper know if he has made a mistake and has spoiled the combs. They need now an attraction, otherwise they will desert the hive. A good brood comb from some other old colony and artificial feeding is needed at this time. The brood comb must not be given by day. The bees, if they are preparing to desert, will detect the keeper's attempt to fix them up in the hive by the introduction of a foreign comb, which by instinct they know is not their own. If the comb is given by day, the bees will abscond, hence it should be given in the evening. During the night they will get themselves attached to the brood and will not leave the hive as long as there is sealed brood in it. The new colony has also to be protected from the wax moth. The best way to do this is to close the entrance of the hive with

a piece of wire gauze and open it early next morning and continue this for about a week. If the bees have by now attached the combs to the frames in which they were tied, cut off the strings or plantain fibre and take care not to allow particles of wax to lie on the open ground in the apiary.

Protection of natural combs from wax moth, provision of pollen and honey and introduction of a good brood comb if necessary will go a long way to solve the problem of absconding which a bee keeper generally experiences.

For those who start with a single colony no brood comb is available, so they have to depend upon nature to help them in preventing desertion. The colony has to be stationed in a pollen area. If the queen of the newly captured colony begins to lay eggs and the workers have begun to hatch them and if a few of them have reached the pupal stage, be sure that the bees have now become your property. They have made the hive their permanent abode and if at all they leave such a hive, it is the bee keeper who is at fault. He has mishandled them or worried them by his oft-repeated inspection and unclean methods.

It is always essential to see that there is at least one brood comb in every colony and if there is none, even at the risk of depleting healthy colonies, one brood comb must be transferred where it is needed as stated above. This is a principle a bee keeper must never forget.

In the Maganvadi hive, which is a Newton type model, there are eight frames. If all of these are filled with combs from nature it is all to the good. But if some of them are empty, take these out and wait till those left inside are filled with combs. Whenever a new frame is to be introduced, tie a piece of comb in it as a start or use a comb foundation. Uneven pieces will produce uneven combs. When all the frames in the

brood chamber are filled with combs, the bees have to be induced to work in the super chamber. Select, therefore, one comb from the lower chamber which is mostly filled with honey. Remove this comb from the frame, cut a piece out of it to the size of the super frame and tie it to the frame. Cut the remaining piece into two. Tie one in the brood frame now emptied and the other in another super frame. Place the super frames in their position. The bees will be attracted to the upper chamber by the smell of honey and will begin to work there. Continue to introduce one frame with a starter in the super as the first one is getting filled. In this way both the chambers will be full with bees and combs. A piece of brood comb also may be introduced in the super to attract bees. In an area rich with natural flora, this may happen in about two months period but in a weak area, it may take four months. A bee-keeper need not get disappointed, his efforts will be well rewarded in the end. The bees sometimes will try the patience of their master and if he loves his pets, they will repay his labour in their turn in due time.

It is a sad experience with many amateurs or beginners that bees abscond or desert from the hive. This is due to many causes. Carelessness, negligence or too frequent inspection of colonies especially in the case of newly captured colonies are some of the causes. Some persons buy fully developed bee colonies for the sake of a hobby and inspect the combs in the morning, afternoon and evening every day just to find out how much honey has been collected. Some beginners out of mere curiosity or for gaining more experience inspect their colonies very often and then come to grief. If bees are too much disturbed while under inspection they feel uneasy and sometimes show a tendency to abscond. They need peace for settling down quietly in the hive. It would, therefore, be better if observation hives are used for closer and minute observation by those who are keen on studying the details. In the honey flow field bees

go on collecting honey every day but honey enough for one extraction is collected in about three weeks' or a month's time if the colony is working normally. People know that cows are milked twice daily but it would be impossible for the cow to give milk every hour of the day, so also honey can be extracted at certain intervals only.

Bees also abscond for the reasons given below—

1. If they are much disturbed in the process of capturing and transport.
2. If the combs are spoiled, mishandled or exposed so that the eggs and the brood get injured.
3. If the bees do not like the colour and odour of the wood of their hive.
4. If they suffer from the wax moth caterpillars.
5. If there is scarcity of pollen and nectar in the locality.
6. If the queen gets hurt and dies.
7. If there is not sufficient ventilation and accommodation in the hive.
8. If there is no good brood left in the hive.
9. If they are not protected from heat or cold. There are many other minor causes which the bee-keeper will come to know by experience.

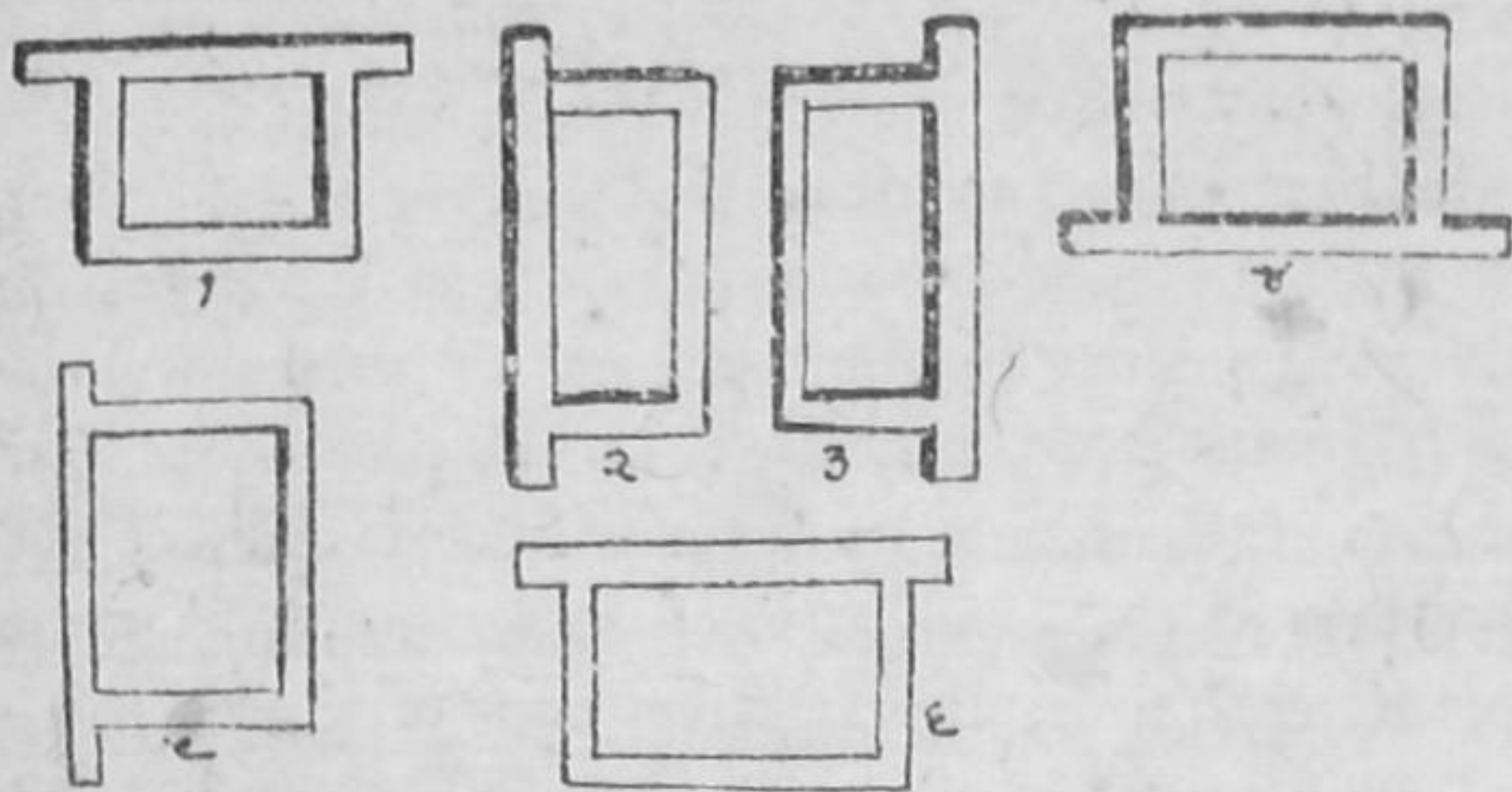
MANIPULATION OF COLONIES

A beginner naturally thinks that bees are harmful creatures and if he handles them, they will surely sting him and that badly. When he has to handle a colony he must discard this fear. Be bold, face the stings and work deliberately. Get to know a little about the bee's psychology, its behaviour and its anger and things will go quite smoothly once you get used to them and to the stings.

Every colony has its own odour. Bees of one colony cannot enter another colony without being grabbed and stung to death. Drones or young bees are, however, allowed but adult ones, adult workers especially, are usually regarded as robbers and are dealt with severely. The queen also has a special odour which is known as the queen odour.

Never open a bee hive violently, jerking the box or the frames. A sudden jerk leads the bees to believe that you are trying to destroy them and steal their honey. The hive must, therefore, be opened gently. You should always be careful not to jam or crush the bees when you lift up the frames or when you put them back in their places. If even in spite of your gentle handling the bees show a tendency to sting, the use of smoke will check it. Smoke frightens them, they forget for the time being their weapon of assault. Bees sting when the weather is chilly or cold. All the members of the colony then are at home and if the colony is opened at this time, the fighting bees or guards will surely sting. A very populous colony is more difficult to handle than a weak colony. So long as the bees are getting sufficient supply of pollen and nectar they are happy, but when a sudden shower of rain washes off the nectar and the supply is stopped the bees become cross; they are generally cross after rains and in hot weather. Bees also sting if you stand in front of the hive and thus hinder their free flight. You must always get out of the way or be prepared for the consequences. To sum up, bees have a tendency to sting (i) if the food supply obtained naturally or otherwise is abruptly stopped, (ii) if the honey flow is strong and then slackens rapidly, (iii) if the bees are pinched or injured, (iv) if they get the smell of crushed sting or crushed bees, and (v) if some sweets are exposed in the neighbourhood of the apiary, this having a tendency to stir up or excite the whole apiary. It is well to choose morning hours when the weather is not cold and not very hot. A beginner should preferably manipulate the hive in the afternoons when most of the bees will have gone out in search of nectar and pollen. It is the foragers that sting more than young bees. When the colony is very populous and the bees want to issue out a swarm then also they sting.

When using a smoker, first give a few puffs at the entrance and then between the brood and super chambers. Then gently lift the super with the roof and place it on a stool. Very gently lift the frames one by one, beginning from one end finishing at the other. Never hold the frame horizontally for the comb inside may fall down by its own weight. The method of manipulating a frame is as follows:—



Different positions of a frame while handling

Hold the frame tight. Do not be afraid if you get a few stings. If the stings are very bad, wash the place with clean water and dry it. Never shake your hands, head or body.

When you inspect the combs you have to see (1) that the queen is there on one of the combs. If colony is very strong, you may not be able to see the queen at times. The presence of eggs, one in each cell and the brood in all its stages (grub, larva and pupa) is positive proof that the queen is there; (2) all the combs should be covered with bees, if not, take out the extra combs and frames. If there are a few bees use a dummy board so that bees can feel that they are in a compact place and will try to thrive to their utmost capacity. Place more frames one by one when needed; (3) there must be honey and pollen in the combs. If there is no honey some food ought to be given immediately; (4) If there are some queen cells find out whether the queen is there. If the colony is strong and you are waiting for a natural division, let the queen cells remain but be prepared for the

issue of a swarm. If your colony is not strong pull down the queen cells. If, however, you do not find a queen let the cells remain and wait till a new queen comes out. Watch the combs after the new queen is born; if you find eggs in about a week's time, you may suppose that the queen is mated. Destroy then the other cells or the new queen will do her work of pulling down her rivals; (5) train your eye to see that there is one egg in each cell; if there are more than one, it shows that the colony has lost its queen. You have to provide a new queen for them; (6) see if there is a caterpillar in any of the combs. If you find any take it out with a big needle and destroy it. If the comb is affected cut out that part of the comb.

After finishing with the brood chamber, place the super with the roof in its position. Inspect the combs in super by removing the roof. If the combs contain honey and if the cells are fully sealed, the honey is ready for extraction. If you see very little honey, take out a comb containing honey from the brood chamber and place it here, cutting it into two and tying it to the frames of the super chamber. By the smell of the honey the bees will be induced upwards and will begin to work there. Even if you have no honey comb you can place a brood comb in the super for some time till the bees begin to work there. Once they have begun to work you can remove it and place it again in the brood chamber. If while inspecting you find that some combs are attached to one another, cut the protruding part by gently pushing the knife between the combs. After inspecting both the chambers lift them up with the roof and place them on the stool. Clean the floor board and destroy caterpillars if any.

It is not necessary to see the colony every day; once a week is quite enough if the colony is in normal condition. If there is abnormality see the colony every alternate day; but on no account delay inspection of any colony for more than a week. A strong colony at times builds queen cells very quickly and before you are able to find them you will find a swarm

issuing. If you see bees running and flying to and fro bringing pollen, that is a sure sign of progress. If on the other hand the bees come out and linger on the floor board and seem hesitant to enter, you should know that there is some thing wrong; inspection is essential then. Loitering, however, does not mean frolicking. Bees often come out late in the afternoon and frolic but this lasts only for a short time, after that they again get inside. So a beginner has to learn from experience what frolicking is and what loitering is. When a swarm is being issued, the bees hover round the colony in large numbers and then settle on a tree nearby. Never disturb the hive at that time, just simply watch and let the bees do what they like.

Bees are clean creatures, so the whole hive should be kept scrupulously clean. Even if no inspection is necessary, weak colonies especially should be examined twice and the floor board kept clean.

Bees show a tendency to abscond for the following reasons:

1. If they are much disturbed in the process of capturing and transport to their apiary after capturing.
2. If the combs are spoilt, roughly handled or exposed so that the eggs and brood get injured.
3. If the bees do not like the colour and odour of the wood of the hive.
4. If they suffer from the wax moth infection.
5. If there is scarcity of pollen and nectar in the locality.
6. If there is no brood left in the hive.
7. If they are protected from heat or cold.

There are many other minor causes which the bee-keeper will come to know by experience.

EQUIPMENT

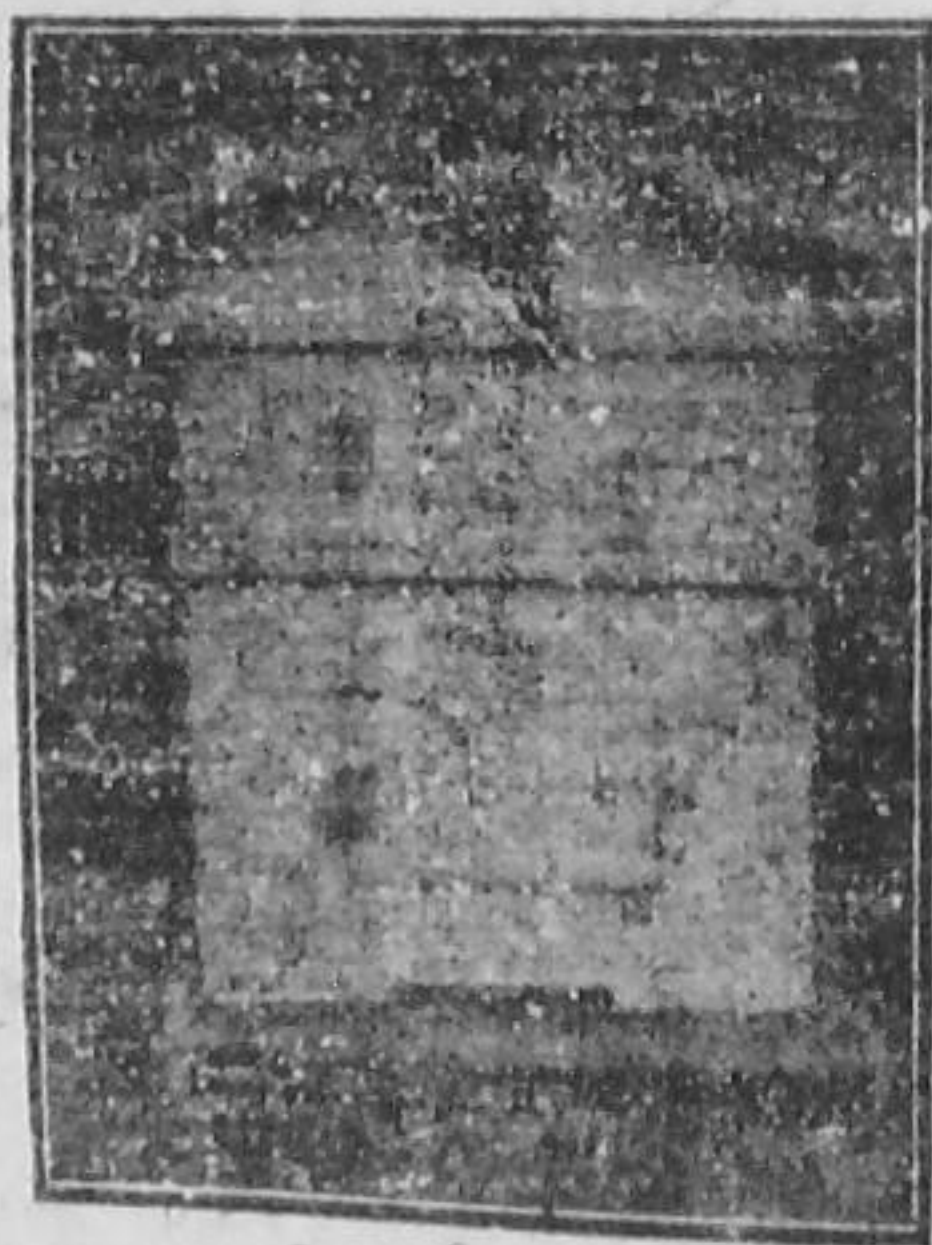
In Maganvadi we have been trying to make simpler and cheaper the equipment necessary for keeping bees. We know that some bee-keepers in other parts of the country and also abroad use a peculiar bee-keeper's dress. They tuck their pyjamas or trousers in their socks, wear long sleeved shirts and gloves to protect their hands, and also a hat with a veil to cover the neck and the head. For some time we used the hat with a veil but even these we have now totally discarded. We have no information of climatic conditions in winter in the north of India and some of this dress may have to be used there where there is piercing cold but it can be well done away with in Central and South India or even some parts of North India. Even during winter we inspect and handle bees with the usual ordinary dress on and with our experience we can positively assure all interested that it is quite possible to keep oneself safe from the bee-sting if one knows when and how to handle them.

We also found no use for the queen excluder; our queens have so far not been seen laying eggs in the supers. We do not use the bee escape to clear the supers of the bees. We hold combs a little slanting near the entrance and tap gently at the other end the bees go into the hive of their own accord. We at times use comb foundations but we do not use wire embedders. We simply press hard the wires passed through three holes each in the horizontal pieces of the comb frames and they get well set into the wax of the foundation. Our honey extractor, knives for scraping off the sealings of ripened honey as well as our extractors, smokers, queen gates, cages, etc. are made by the local blacksmith. Our bee hives, wire gauze frames, dummy boards, etc. can be made by any local carpenter. We do not have any superfluous things. We use ordinary stools to hold hives and no concrete pillars with concrete basins round

them to hold water. Instead of iron basins to hold water we use ordinary earthen basins. We do not have nicely shaped bottles and perforated-cover percolaters for artificial feeding. Ordinary tins or even katoris serve the purpose well. Whenever we have planned equipment, we have always tried to keep it well within the reach of the villager, the village carpenter and blacksmith.

The equipment necessary for an apiary is hives, stool smokers, big needles, knives, scissors, honey extractor, dummy boards, ordinary tins for feeding and some carpentry tools.

THE BEE HIVE



Bee Hive

Formerly people kept bees in grass baskets called skeps. A later improvement was a wooden box or kerosene oil tin. The difficulty about these wooden boxes and tins was that as the bees built their combs directly on the inside of the tin or box the combs were immovable and hence inspection of each comb separately was impossible. Honey extraction also was done by cutting out the combs which could not again be replaced in their places.

The modern hive has eliminated all these difficulties. It has movable frames which can be taken out and placed inside at will. The problem of making a movable frame was not easy either. Bees use gum called propolis to attach their combs to the frames and sometimes two frames are thus attached to each other. Different kinds of frames were in use until the present frame was invented by L. L. Langstroth who discovered the principle of bee space. This space the bees never fill with bee glue and the space is approximately $5/16$ of an inch. In natural combs also bees use these spaces as passages between combs. They are like roads and alleys in the bee colony.

There is a wrong impression in the mind of the public that wild bees have been captured, encaged in a hive and thus deprived of their natural freedom as in the case of parrots and other pet birds. The two cases are not the same. The bees that can be domesticated, as has been already explained, live in hollows in tree trunks and the modern hive is just an imitation of the natural hollow, of course neatly shaped and more decent. Facilities are given to the bees to build combs here as they do in nature. Besides unlike the case of parrots, the hive is never closed or the entrance blocked up. The hive entrance is always kept open and the bees can go out and come in at their will. A restriction on their movements will not only produce a harmful effect on the bees but will also mar the success which the keeper aspires to achieve. Thus there is no premium placed on the free exit and entrance of bees. The keeper keeps them for their sake as well as his. The more free and joyful the bees, the greater his success.

Besides, the advantages of the present day hive are that it is divided into two chambers. The lower chamber is known as the brood chamber, while the upper one the honey or super chamber. After careful examination, inspection and study of natural combs it was ascertained that bees store honey

in the upper one-third of the comb and use the lower two-thirds for rearing their brood. The same principle is followed in the modern hive. The size of the super frames is 3" while that of the brood frames is 6" deep. The modern bee-keeper never robs the bees of their honey in the lower chamber. The bees are by nature prudent and they store food in the form of honey for the future. The super chamber is their bank. It is from here that the keeper gets his supply of honey, so we can say that the brood chamber is meant for bees and the super chamber is meant for the bee-keeper. This also helps extraction of honey without injuring the eggs, grub, larva etc. for which special accommodation is found in the lower chamber. Thus the modern hive has been so made that it will suit the requirements of the keeper as well as the kept.

There are different kinds of bee hives viz. Newton, Langstroth, Standard etc. Our hives are Newton hives and we get satisfactory results from them.

The modern hive is made up of four parts: the roof, the super or honey chamber, the brood chamber and the floor board. The dimensions of our Maganvadi hives are given here; the floor board's 15" x 12"; those of the brood chamber 11" x 10½" x 7", of the super 11" x 10½" x 3½" and of the roof 11" x 10½" with a ridge of 3". The frames in the brood chamber are 8½" x 6½", the top bar 9½", half an inch protruding on each side; while those in the super are 8½" x 3¼", top bar 9½". The tops of the vertical parts of the frames should protrude beyond the horizontal piece by ⅛" so that there will be a gap of ¼" between two frames. The diagram will give an idea of the whole hive and also of the frames. The roof should have a hole in front, another at the back and a third in the bottom for ventilation. They should be closed with wire gauze. The hive should always be placed on a stool about 2½' high and there should be basins for holding water under each leg so that no

ants or other insects can get inside. The floor board should slope slightly towards the front.

We are often asked as to why we do not use Standard, Langstroth or Jumbo hives. The type of the hive has to depend upon the size of natural combs available or noticeable in that locality. Bee-keeping is carried on on an extensive scale in Travancore State where Newton hives are widely used. In the South and North Kanara where a bee-keepers' co-operative society has been recently formed in conjunction with the Department of Agriculture of the Bombay Government, the same type of hives are used. In Orissa also they use Newton hives. In Bengal the Khadi Pratisthan use mostly Newton hives though they also use a few Standard hives. In Bihar, Newton and Standard hives are used. In the Central Provinces and Berar, the size of natural combs has been found to suit the frames of Newton hives and on that account we keep in use that kind of hive though we have no dislike or prejudice against any other type.

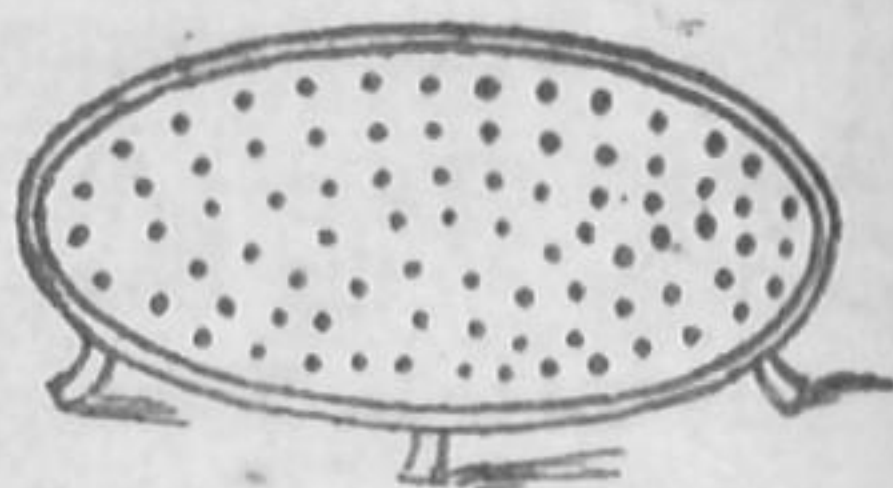
Our object in popularising a particular model hive is with a view to exchange bees and hives among bee-keepers of various provinces so that all can work together and further the cause of the villager. Different types of hives in different provinces will hinder exchange and create rivalries. It would be difficult to exchange and verify opinions and experiences. A bee-keeper from the Central Provinces has a sad experience in regard to the Standard hive. He ordered bees from Bihar and requested that they may be sent by railway parcel. The hive being very heavy and there being many changes of trains in transit, though the colony sent was very populous, only a handful of bees reached him safely and they too absconded to his utter disappointment. The hive received jerks and shocks in transit by rough handling and combs were torn down. Until we learn how to handle bees under transport, it may not be safe

to send bees by rail in Standard hives. Newton or Mysore type are lighter and can be easily handled.

• SMOKER



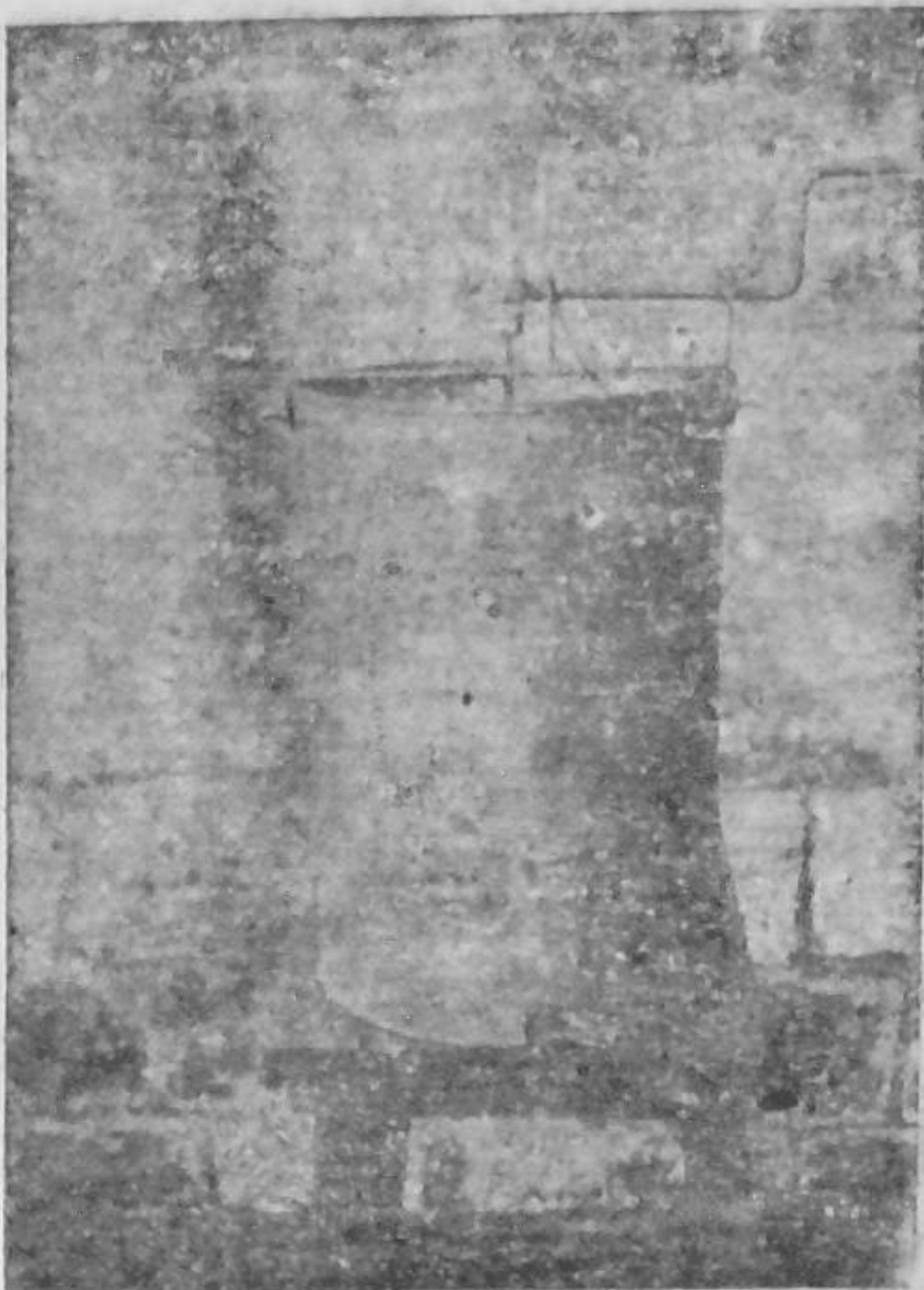
Smoker



Inner stand of the smoker

A smoker is just an ordinary tin about 10" high with a bellows adjustment attached to it and a conical top. When the bellows are worked air is pushed inside. Burn rags, pieces of paper or dry sticks in the smoker. When the smoker is closed with the lid the fire is extinguished and smoke comes out. Work the bellows to give only a few puffs. It is always necessary to make judicious use of the smoker. An idea of how the smoker should be made may be obtained from the sketch.

HONEY EXTRACTOR

*Honey extractor*

The honey extractor is a centrifugal machine with a horizontal iron grooved wheel at the top and another iron grooved wheel adjusted into it vertically to allow smooth and quick rolling. In the drum below the wheel there are adjustments for holding two, four, six or even eight frames. A two frame adjustment is simple and easy to make.

In these days when the price of iron articles has gone up due to war, we are using wooden Charkha wheels instead of the usual iron grooved wheels for making honey extractors. A rod is fixed in the centre as usual and on it the gear of the small Charkha wheel. A few inches on the outer side is the bigger Charkha wheel intact. A string passed round the two wheels as in the Charkha revolves them. This arrangement gives as much efficient service as the iron grooved wheels. At the same time the cost is reduced and it can be made in any

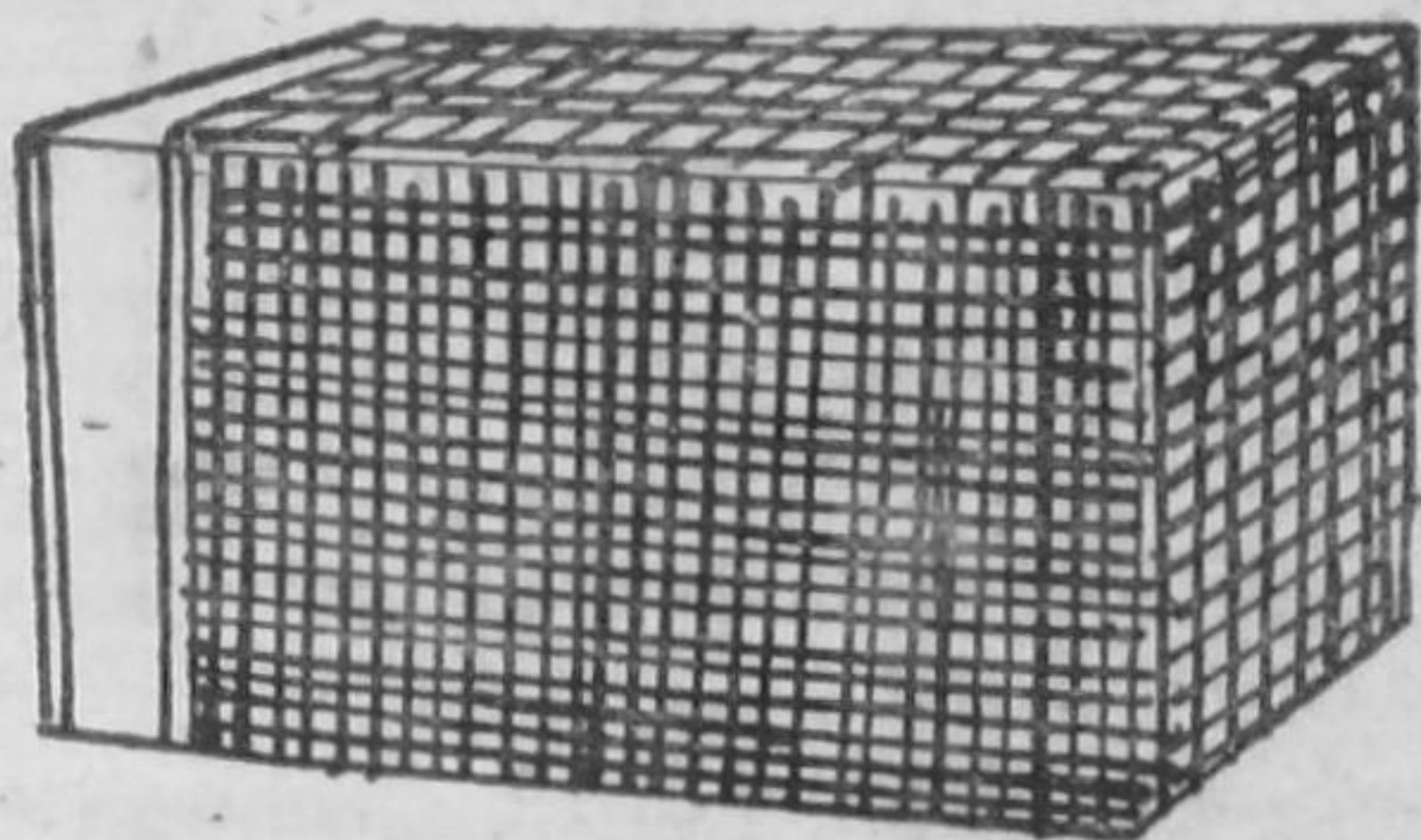
village by the local blacksmith or carpenter. If instead of cotton string, guts are used they will wear longer.

When you want to extract honey choose only those frames in the super which are completely sealed. Remove them and place the roof in position. Brush away gently the bees sitting on the combs near the entrance with a feather or soft brush. If you hold the frame near the entrance and tap gently at the other end the bees will crawl inside. The march of the bees at this time is attractive to watch. When you have thus removed all the bees or most of them from the combs blow the remaining off and they will fly in the air and return to the hive in their ordinary course. Remove the honey extractor to some place



Inner construction of a honey extractor
away from your apiary. Take a bowl of hot water, dip a knife into it and peel off the cappings. A double-edged knife is convenient as it can be moved up and down easily. Two knives

at a time will be still better because when one gets covered with cappings it can be put into the hot water and the other used and so on alternately. When all the cappings of all the combs have been removed place two at a time, one in each receptacle and revolve the machine, first slowly and then quickly. Honey will be thrown out on the sides of the drum inside and will ooze out through the outlet into a pot kept below for the purpose. Bottles for keeping honey should be washed with hot water and dried in the sun. Measured bottles are better when the honey is to be sent out for sale. The sides of the frames should be reversed so that all the honey contained in the combs is extracted.



QUEEN CAGE

Whenever a colony is queenless and a queen is to be introduced there, use a cage. A foreign queen is not easily accepted, she may meet an adverse fate and have to face torture at the hands of her adopted daughters. Each queen has a peculiar odour and until the bees get accustomed to it they may not respect the queen. After encaging her, slowly remove the lid of the cage and thrust it into a comb filled with honey. Keep it overnight. If next morning you find many bees hovering round it, keep it for 24 hours more. By this time the fury of the bees will have subsided and they will have got used to the queen odour. She can then be let loose without fear of molestation.

At times she may have to be encaged for 48 hours. It all depends upon the behaviour of bees in the hive which the bee-keeper will know by experience.

UNITING AND DIVIDING COLONIES

When a colony has lost its queen and there are only a few bees left, it is better to unite it with another colony. For uniting make a perforated sheet of thick card board. The holes should be small and on no account of a size to allow bees to get through. Place this sheet over the brood chamber of a colony with which you want to form union and over this sheet place the brood chamber of another colony which is queenless. Do this generally in the evening and let them remain in that position overnight. The roof should be placed over the upper brood chamber. During the night, air will pass through both the chambers and the smell of the two colonies will get mingled through the holes in the sheet. Besides some bees from both the chambers will try to get through and that will facilitate the mingling of smell. Smoke both the chambers before you remove the sheet next morning and make the two colonies into one by placing the combs in the lower chamber and remove the extra ones.

Another way of uniting is with the help of peppermint. Add one or two drops of peppermint essence to a bowl of water, sprinkle this over all the combs of the two colonies you want to unite. Both the colonies will lose their original smells and be of one smell. Place the combs covered with bees in any brood chamber and remove the rest.

You will find the following an easier and more reliable method than either the card-board or peppermint spray method. Move the two colonies closer two feet every day until they have come together at the finish. Next select the best queen and cage her either on the comb she was found on or

in a cage separately. Place this queen in the centre of an entirely different hive. Place this hive on a new stand in close proximity to the hives that were brought together by stages. Now move the original two hives some distance away, take one comb at a time from each of these hives and smoke the bees off it. These bees will go to the new hive on the new stand as there would be no other hive in sight and will be thoroughly mixed and no fighting will take place as each bee from different hives realises that it is not in its hive but in a strange or new hive and, therefore, has nothing to fight for or guard against and protect, being strangers in a strange land. A couple of days later the queen may be released.

SWARMING

Usually, the term swarming means the issuing of normal swarms when the colony is prosperous, only a part of the bees leaving the hives. Swarming is an act of bees leaving their hive to establish a new home e'sewhere. The migrating family of bees is called a swarm. In the strictest sense, the term swarm applies only during migration. As soon as a swarm establishes itself in its new home it is called a colony.

A colony of prosperous bees increases its brood in the spring, its adult population also increases and all the available brood combs are occupied until the queen reaches the limit of her capacity in egg laying. In the beginning only worker brood is reared but when the colony becomes stronger the rearing of drone brood is begun, thus providing for male bees in anticipation of swarming. Finally, when the brood chamber becomes overcrowded with young bees, several queen cells may be built.

In their natural state, and when neglected or poorly managed, bees generally slow down their work after these queen cells are started in preparation for swarming. Espec-

ally bees are sluggish during a few days just previous to the issue of swarms. Foragers or field workers remain in the hive and do not go out in search of pollen and nectar and thus a crowded condition results. A number of bees hang on the outside of the hive. A more reliable symptom or indication that the colony is preparing for a swarm is the lack of the usual flight at the entrance due to many field bees staying at home. When this is noticed, supers should be looked into and it will be noted that they are crowded with bees, sometimes wedged into every corner and nook. These idle bees are filled with honey which makes them appear unusually large because of their abdomens being filled with honey. When these conditions are present in a honey flow, it is a sure condition that the colony is preparing to swarm. The other certain indication of swarming is the presence of eggs and larvae in the queen cells in the swarming season. When eggs are placed or laid in these swarming cells, the colony has taken definite steps for the issue of the swarm. By noting the advancement of the queen cells it is possible to predict on what day the swarm will issue; queen cells under the swarm impulse are called "swarming cells" This generally issues eight or nine days after the formation of cells and when the more advanced cells are sealed. Normal swarms issue between 10 a. m. and 2 p. m. In hot weather, most of the swarming is over by noon.

When the swarm issues a portion of the adult bees together with old queen fly from the hive, leaving many adult bees, a number of unemerged bees and several unemerged queens. The number of bees accompanying the swarm depends upon the weather. Swarms are smaller when the weather is cool and larger when the weather is hot. The reason why some bees go and others stay is not known. There is no fixed rule for this. Some of the drones accompany the swarm but many of them remain in the hive. Sometimes the queen leaves among the first, but oftener she leaves after half or more of

the swarming bees have left and sometimes she is the last to leave. Occasionally, she does not find her way out at all, in which case the swarm returns unless it unites with another swarm having a queen.

As the swarming bees rush out from the hive, they circle round and round in the air over a wide area but gradually draw together and finally cluster on some convenient support such as the branch of a tree. After an interval varying from 15 minutes to several hours the bees break the cluster and fly away to make a new home. It is always advisable to hive the swarm as soon as it has clustered.

About a week after the prime swarm issues the first of the queens emerges. Instead of destroying the other young queens and permitting her to become the mother of the colony, bees usually swarm again. This after-swarm is accompanied by the first young emerged queen. If the bees are not interfered with, many more swarms will issue.

As a precaution, therefore, after the first swarm issues keep only one or two queen cells and pull down the rest but do not destroy them. Wait till the first queen is mated and begins to lay eggs. The cells may be useful if the first queen fails to fertilise. The cells are removed to prevent further issue of swarms.

Swarming may be prevented if some of the brood in a thickly populated colony is given to a weak colony. This is done by simply lifting a comb, brushing off the adhering bees into the hive and putting in the middle of the combs in the weaker colony. If queen cells are destroyed when they are just commenced or contain only eggs, this goes a long way in the prevention of swarming.

DIVIDING

Some persons divide colonies to keep down swarming but it is detrimental to honey production for which it is essential

to have the strongest colonies for field as well as indoor work to help the queen to continue laying, increasing the strength of workers and assisting in brood rearing. If you divide you have still suffered the loss and set back to your original colony to exactly the same extent as if they naturally swarmed, with the only difference that you have secured the swarm that may otherwise have been lost to you, and now would contribute to increasing the number of colonies at the expense of their working strength. Unless prepared to make this sacrifice only for the object of increasing yield you are advised not to adopt it on any account.

Artificial division also will help to increase the number of colonies if done with proper care but the new colonies thus formed will not help much in the way of production, as they will take time to have a sufficient number of bees to gather honey. To divide a colony artificially you have to rear the queen artificially (this is dealt with later on). Persons who want to make a business of selling live colonies can very well do this if they have sufficient experience.

Choose a strong colony and place it on a stool near its original position. Keep a new hive in the place of the original hive. Open the original colony and choose two good combs with brood in all its stages and transfer them to the new hive. Close both the hives. The bees that go out during the day in search of pollen and honey will return and enter the new hive that you have placed there. This transference should preferably be done in the morning, because by so doing nearly half the number of bees will get into the new hive placed in position of the old one and there will be even division of the number. The next morning remove the original hive bit by bit to another place. It should take eight days to remove a colony 10 feet away. The bees in the new colony will try to rear a new queen from the fresh eggs in the combs, but if they do

not do it you will have to help by giving a new comb or a queen cell.

OTHER METHODS

We now come to artificial feeding, brood rearing and nucleus forming.

Generally during the rainy season there is very little honey in the combs. The bees then have to be fed artificially. This food consists of one part sugar and two parts water. Boil it till the syrup is somewhat sticky. Strain through a piece of cloth and let it cool. Equal parts of honey and warm water may also be mixed together to make syrup. When the sugar or honey syrup is lukewarm, pour it in a small tin or copper or brass bowl and tie a piece of cloth over it. Place your hand tightly over the mouth of the tin and invert. Remove a few frames from the super chamber to make room and place the tin in position. The bees will suck the syrup through the cloth. Feeding should be done continuously for a long time until you see most of the combs filled with brood or honey.

For artificial breeding sugar syrup will help if there is sufficient pollen available in the locality. If, however, there is no pollen, artificial feeding alone will not produce the required result. Artificial pollen has in that case to be provided in the form of wheat meal, pea meal or rye meal. But it is said that it goes hard with bees to digest this artificial pollen and they do not work so vigorously as those bred on natural pollen. However, it is a fact that bees, when they do not get natural pollen themselves at times go in for some substitutes thereof. Judicious use should be made of artificial pollen; too much should not be given at one time. Vigorous egg laying will begin when both pollen and food are available in sufficient quantities.

If the bee-keeper wants to provide for eventualities he should have in stock some combs filled with natural pollen removed and

kept safe in an air tight box and they should be given when there is a scarcity.

If a colony is weak and the queen bee is laying few eggs, you can stimulate brood rearing by artificial feeding if pollen is available. This also has to be done for a long time to get good results. This is known as brood rearing.

Queen rearing is a delicate task. Choose two frames, one with a queen and plenty of brood and another with brood and place them in a new hive. Use a dummy board to make them compact. Place a third quite empty frame with a piece of comb in it. Provide artificial feeding for this new hive. This formation is called nucleus forming. When the bees find that there are only a few of them in their hive and when besides they are getting food and pollen they build the comb quickly to make space available for the queen to lay eggs, and urge her on to lay eggs. When the new comb has been filled with eggs, transfer it to the original colony and place another frame with a piece of comb in the new colony. If bees do not build queen cells in the first comb given from the nucleus, transfer the second comb to the original hive and they will do the needful.

After you have removed the second comb from the nucleus, give it good combs and enough food. If the queen is prolific, you will find a good colony in about two months' time.

What happens in the original colony in the meantime? Missing their queen, they get ready for rearing a new queen, and store enough royal jelly in their glands, and as soon as they get fresh-laid eggs, they rear a queen from the eggs in the first comb given. It takes nearly three weeks from the time a nucleus is formed to get a new queen. After you get a new queen wait and see if she is mated. Pull down the other queen cells if any, use them elsewhere if necessary or destroy them.

Sometimes when you form a nucleus and remove the old queen for the purpose she will have laid some fresh eggs in some combs in the original colony and the bees will rear a new queen from them also. In that case you need not remove any combs from your nucleus for transferring to the original colony. Your purpose of artificial queen rearing is already achieved.

Sometimes after a new queen is born, the bees desert the hive if there is no brood in it. So care has always to be taken to see that there is at least one good brood comb in the nucleus as well as in the original colony. If the old queen does not lay eggs in the nucleus and the new queen follows a swarm, instead of getting two colonies by artificial division or nucleus forming, you may lose both.

If after natural colonies are captured no honey is found in the combs, the first thing as soon as the colony is brought into the apiary will be to provide artificial food. If there are only a few bees at the beginning in such colonies a dummy board is a necessity. A dummy board is a piece of plank of the size of the frames with adjustments to keep it in the hive as an ordinary frame. During cold season a piece of warm cloth may be used over the brood chamber for weak colonies to keep up warmth. If a strong colony is captured in the hot season a super chamber must be given immediately. Compact space in the winter for weak colonies and enough accommodation in the summer for strong colonies are what the bee-keeper has to provide. If there is no pollen or no queen in a newly captured colony, the necessary precautions should be taken by giving them pollen and brood combs from some other colony, as the case may be. So long as the queen is prolific and does not leave the hive, so long as the bees are protected from their enemies, so long as they do not suffer from weather conditions and so long as the worker bees are getting enough pollen and nectar, there will be no difficulty at all for the bee-keeper.

Take care of the bees as you take care of your cows, by giving them shelter, good flora and good treatment and your task becomes very easy.



Enemies of bees

There are some birds, two of them green and known as bee-eaters, and a black one with a forked tail known as king-crow, which eat the bees when they are flying in the air. Wasps also hover near the hives at times, catch the bees and eat them. House and tree lizards, spiders, mice and ants also destroy bees. But the worst enemy of all is the wax moth. It is like a butterfly, enters the hive at night and lays its eggs on particles of wax fallen on the floor board or in crevices in the hive. Caterpillars hatch out of these eggs. They find their way into the combs, make tunnels in them and fill them profusely with silky thread or silken galleries and other dirty matter. The combs

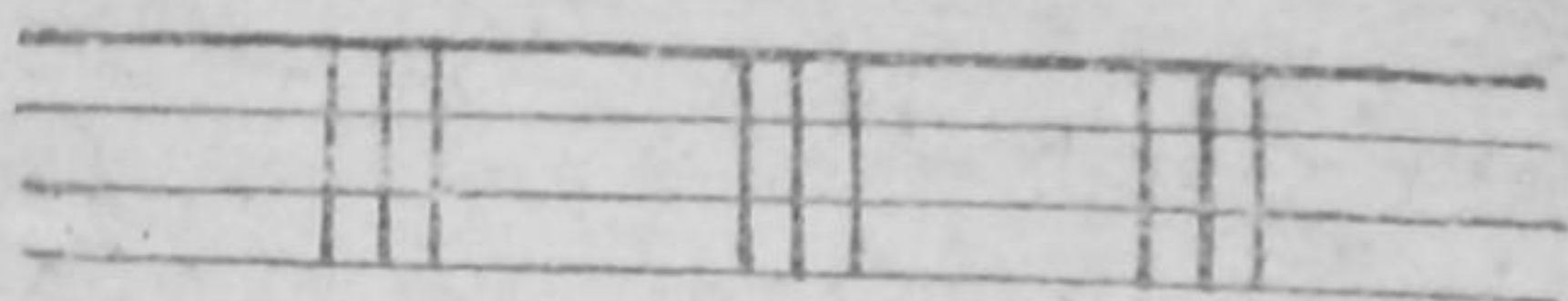
thus become unfit for the bees to live in and they leave the hive altogether.

The remedy against this nuisance and deadly enemy of the bees is to keep the floor board always clean. If you happen to see some small worms on the floor board, remove them, bury them underground or burn them away. Let no particles of wax lie near about the colonies. If you find any silken matter in the combs, you may be sure that the wax moth caterpillar is there, search that part of the comb with a good strong needle, pull it out and destroy it. If the comb is much infected, cut out that part of the comb. These wax moth caterpillars cause a great deal of annoyance to new colonies and to avoid this the entrance of the new hive should always be closed with a piece of wire gauze every evening and opened early next morning. The other enemies of bees are big creatures and you can drive them away once you recognise them as such, but the wax moth enters the hive very stealthily at night and has to be carefully guarded against.

To guard against ants, keep shallow basins of clay or iron under each leg of the stool on which you have placed your hive. Pour water into these and add a few drops of kerosene oil from time to time. Change the water also once or twice a week. Kerosene oil is used to prevent breeding of bacteria.

Arrange your hives facing the morning sun. The bees like it very much. See, however, that the hives are not exposed to scorching heat at midday in summer or to showers in the autumn. We have in Maganvadi a shed with no walls. Its roof is covered with bamboo mats which protect the hives from heat and rain. The mats may be dipped in tar if necessary.

An important precaution a bee-keeper has to take is against a laying queen leaving the colony. There are three ways suggested to shut the queen in.



Queen gate

(i) The use of queen gates. They are made of pieces of good steel wire about six inches long. Take three or four pieces and join them by vertical pieces at a distance of $1\frac{1}{2}$ inches leaving a gap of $3\frac{1}{2}$ mm. between two horizontal pieces. The worker bees will be able to pass through but the queen cannot.

(ii) Use of paste boards. Take a piece of card board and stick it above the entrance in such a way that a gap of $3\frac{1}{2}$ millimetres is left between the paste board and the floor board. This will also prevent the queen from going out.

(iii) The third and the best method is clipping the wing of the queen. Open a hive and catch the queen by her wings. Close the hive. Hold her between the thumb and the second finger of your left hand, and smartly and gently clip off the wings leaving only the stems. This is a very delicate operation. If you press the abdomen of the queen she will die. You have to hold her gently and after the operation is over, put her back in the hive. Clipping the queen does not harm her. Her egg laying capacity is not in the least diminished and she remains as prolific as she was before. A clipped queen cannot fly; she can crawl about on the floor board if she comes out but she is unable to lead a swarm. A beginner should first try this operation on drones and when he is successful, he should carefully and deftly try it on a queen. A clipped queen at times is not accepted by bees, she is killed by them immediately. To provide against this, it is better to enclose her in a queen cage overnight and let her loose next day.

HONEY

Bees collect honey. We have seen that plants have two kinds of cells, ovule and pollen. After pollination has taken

place, there is a rapid growth in the ovule and the plants have a quick supply of food at the base of the flower. But if there were too much food it would damage the ovule (the future seed); bees help to eliminate this danger by removing this extra supply which is a sugary liquid and is called nectar. They suck up this nectar with their tongue and collect in the 'honey sac'. Certain chemical changes take place in their stomach and the nectar is transformed into honey. On arrival at the colony this is disgorged and stored in cells. But this is not the honey we eat. This honey contains water and it has to be ripened. The honey stored in the cells of the super chamber is of two kinds, unripened and ripened. The bees create a certain amount of temperature to evaporate the excess water and when they find the honey is ripe, they cap the cells. The ripened honey is known as 'capped or sealed honey' and it is this capped honey only that the bee-keeper is concerned with.

Honey is recommended as an article of diet because of its food value. It contains water, sucrose, dextrose, levulose, dextrans and gums, and minerals such as iron, copper, calcium, phosphorous, chlorine, magnesium, etc. The use of honey as food for normal individuals and its use as medicine are so closely associated that it is difficult to draw a sharp line of distinction between the two.

Honey also contains certain exceedingly rare sugars known only to nature. Dextrose is known as the sugar of the blood. When sucrose or cane sugar is digested, it splits into two; dextrose, and levulose. In common language dextrose is known as grape sugar and levulose as fruit sugar. Levulose has some interesting features from the standpoint of diet. By some mysterious process it is transformed into dextrose, the sugar of the blood as it passes the alimentary canal. In addition to these natural sugars the mineral elements in honey contribute to give it an important place in our diet. Oranges, lemons and fruits are quite acid to the taste, honey is also slightly acidic in taste.

but as food it is potentially alkaline. If we want to maintain the acid alkaline balance in our diet, a prominent place ought to be given to honey.

| | Indian honey | Foreign honey |
|---------------------|--------------|---------------|
| Levulose | 37.30 | 40.50 |
| Dextrose | 36.01 | 35.01 |
| Sucrose | 2.63 | 1.90 |
| Dextrins | 2.89 | 1.51 |
| Ash | 0.24 | 0.18 |
| Water | 18.96 | 17.70 |
| Nitrogen substances | 1.08 | not known |

Honey is one of the best energy producing foods. Unlike sugars it does not require action by the gastric and intestinal secretions to break it into simple sugar before it could be absorbed into the blood. It is practically a solution of the two simple sugars, dextrose and levulose, in equal proportions with the aroma and flavour imparted to it by the flowers from which it is collected. Because of its easily assimilable nature honey can with advantage be given to persons whose normal digestive activities have been impaired by disease or old age. Athletes can use honey after strenuous exertion in order that the lack of sugar in the blood stream resulting from muscular movement may be quickly rectified. It is said that anaemic children will improve quickly if honey is included in their diet as it possesses the peculiar property of assisting the growth of red corpuscles in the blood. Contrary to popular belief honey never causes constipation. It is recommended for diseases of the heart, kidneys, bladder and of the skin and as an energizing and vitalising agent. Hence honey must be included in the diet of both the young and old.

Various enquiries are often made regarding detection of adulterated honey. A bee-keeper can by experience say from the smell, flavour, colour and viscosity of the honey whether it is pure or not but for general information two tests can be cited, water test and methylated spirit test. Pour one or two

drops of honey in a glass of water. If it darts like an arrow and reaches the bottom before it begins to melt, it is pure honey; but if it begins to melt on the surface of the water, it is adulterated. Pour a little honey in a cup of methylated spirit. If the honey does not get mixed with it, it is pure but if it gets mixed and produces milky liquid, it is adulterated.

REFINING OF HONEY

It is not necessary to refine honey extracted by means of a honey extractor but when produced on a large scale it may need filtration or straining. This can be done in either of the two following ways.

1. Spread two or three thicknesses of cheese cloth over a light frame-work mounted on a receptacle to receive the honey. Let the cloth bag down in the centre and fasten it with a string around the edge of the receptacle. Usually, three thickness of cheese cloth are necessary. They should be wet as it takes longer for the honey to pass through dry cloth. The cloth should, therefore, be immersed in water and wrung nearly dry before straining. It is important to wash it with hot or warm water before using again as it gets clogged. Care should be taken that no air bubbles arise in the strained honey as they make it cloudy. They can be removed by placing the bottles in the hot sun for some days with the caps loose when they will quickly rise to the surface and disappear. The caps should then be screwed down.

2. Allow the honey to settle in tanks or tubs connected with one another by means of pipes. Impurities such as bees' wings, wax, pollen, etc. being lighter than honey float on the top. If allowed sufficient time, pure honey will begin to form beneath this scum and can be taken out through taps fixed to the side of the tanks or tubs. Or the floating impurities can be skimmed off.

If honey contains particles of eggs, dead bees, juice of brood etc. only a chemist may be able to purify it, but all other impurities can be removed as above

If the collected honey is heated in a sand or water bath, foreign matter will form quicker sedimentation. Honey can also be heated by passing into it wire coils through which hot water is allowed to pass.

WAX AND WAX MAKING

Wax is made by bees only when they want to build combs. When they want to make wax they eat honey and sit together in clusters to produce a certain temperature when chemical action takes place in their stomach and the wax oozes or trickles down on the wax plates from which it is scraped off with the legs and moulded into cells by the bees. The bees have six legs and hence the cells have six sides, each leg working separately. It is said that to make one pound of wax, they eat 8 or 10 lbs. of honey. The combs should be preserved as long as possible so that the bees will be saved the trouble of making new combs every time and also that the honey they use up in the process may be saved.

The combs, however, which have been spoiled by wax moths should be used for wax making. There are two ways of extracting wax from the combs.

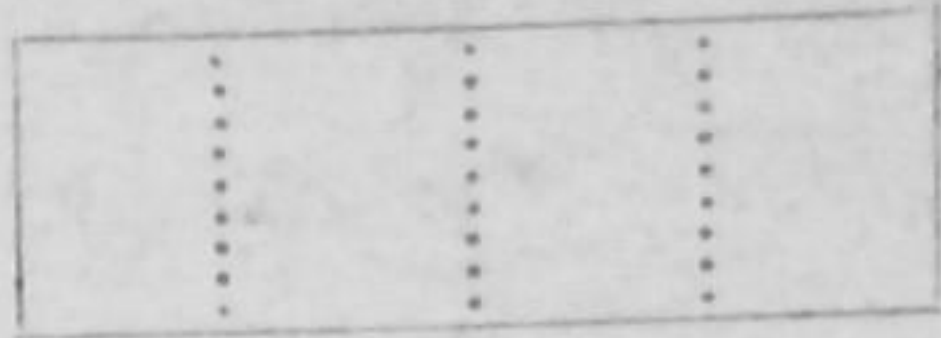
Take a wooden box with slots for two glasses at a distance of one inch. The glasses should be movable in the slots so that they can be pushed in or taken out when desired. Place a vessel covered over with a piece of a cloth and keep spoiled combs over this cloth. The vessel should be placed under the glasses and kept in the sun. By the heat of the sun the wax will melt and settle down in the vessel below.

Another way is to boil the combs in water. Let the water boil till the combs melt and then strain the mixture through a piece of cloth and allow it to cool. A fine slab of wax will float on the surface of the water when cooled. If there is any dirt sticking to the bottom of this wax slab, boil it again with water, strain and cool as before. You will thus get very pure wax.

MISCELLANEOUS

For preserving unused combs, place them in an air tight box so that no ants or wax moths can get inside and spoil them.

At times there are not sufficient combs, and artificial comb foundations are then given for the bees to make a start. The bees can work on them and make a full comb in a short time.



Dotted lines show wires in the frame for comb foundations

For attaching these comb-foundations in the frames, three holes are bored in the horizontal pieces of the frames and a piece of wire is passed through. These foundations are available in any size. Place the frame over the foundation and press with a hard substance over the wires gently, it will get embedded into it.

At times the queen begins to lay eggs in the super chamber; to prevent this use a sheet of tin, called the "queen excluder" between the brood chamber and the super chamber. Workers will be able to pass through but the queen cannot. As far as our experience goes this very rarely occurs and the queen excluder is not very essential.

There is still another trouble which one has to guard against. Sometimes after the queen has died by accident and has left no fresh eggs behind some of the workers begin to lay eggs if the colony remains queenless for a fairly long time. Such workers are called "laying workers." The eggs laid by these laying workers are uneven and numerous in one cell. The presence of many eggs in one cell indicates the presence of laying workers. These eggs are unfertile and hence may produce only drones if there was one egg but being numerous in one cell they produce nothing. This demoralised state of the colony must be set right.

When workers begin to lay eggs they do not leave the colony, and if they are driven out of the colony they will not

find their way back to their colony and will be lost on the way. Foragers go out every day and they can come back safely but these laying workers cannot.

Inspect the frames carefully and if you find any such in the act of laying, pull them out by their wings and destroy them. But this is rather difficult and by itself will not help much. The colony should be united with another weak colony having a queen.

If the queenless colony is strong and is much infested with laying workers, remove all the frames from the hive to a distance of about a furlong and blow the bees off in the air, the ordinary workers will return to their hive but the laying workers will not find their way back and will die. Sometimes the bees, thus blown off, cluster on a branch of a tree near by and you can capture them as you capture a swarm. Remove the spoiled combs and replace them by good ones you have in stock or some good combs from some other colony in your apiary.

There is still another way of eliminating this nuisance. Distribute the laying workers' combs with bees among some strong colonies and exchange good combs from those colonies to the queenless colony. A mixture of peppermint and water as is used in uniting two colonies, will have first to be sprinkled over the combs of all these colonies. The queen and other workers in normal colonies will not allow the presence of these laying workers amongst them and will kill them. When good normal workers are introduced in the queenless colony they will also do the same to the laying workers there. Remember, however, this process is not so easy as it seems to be, it will have an effect on the normal working of the good colonies to whom you have given these spoiled combs and great care is necessary for a few days. The normal workers, if they find good eggs in the combs, will try to rear a queen or you can introduce a queen cell.

If bees are to be transported from one place to another the entrance of the hive may be closed well with cotton wool in the early hours of the morning to prevent bees from getting out and the bottom board, the hive and the top are well secured with ropes. A colony may be transported beyond 150 miles or more in the morning by car or bus. If it is a train journey at night, the entrance should be well secured after all the bees have come back to the hive for the night. The colony may travel the whole night and a part of the next morning. Care must be taken in this case to see that the top of the hive is replaced by a wire gauze frame, that there is good store of honey and that cotton soaked in water is placed (usually in a small tin or katori) in the hive. Queen bees have so far been observed to stand a journey of 72 hours in our country.

Since we announced in the Gram Udyog Patrika that domesticated bee colonies are available for sale from our apiary, we have had enquiries from prospective bee-keepers who wish to buy live colonies and ask whether bees can reach their destination safe, whether owners will be able to keep them at their places and what should be done to multiply the colonies.

As for as our experience goes, bees can stand a journey for twentyfour hours if proper precautions are taken in packing them before they are transported. Domesticated bee colonies will not show any tendency to abscond if they are placed where flora is abundant. Bees begin to work at once in such places, and a little artificial feeding for the first day or two would be helpful.

After colonies are received from the railway station they should be kept in a cool place. The hive should not be opened immediately. This should be done in the evening. If the combs have got broken off from the frames, they should be supported with strings and placed in position. Dead bees if any should be cleared away. The hive must be placed on a stool with a

small basin of water underneath each leg so that no ants may creep inside the hive and kill the bees. If bees are fed artificially care should be taken to see that the syrup does not trickle down over the stool. A piece of cloth should be tightly tied over the mouth of the feeder which should be carefully inverted.

A common inquiry is whether *Apis indica* will take to comb foundations and will they draw out neat combs. If full sheets of foundations made from the wax of their own species are given in the brood chambers as well as in the supers, they will surely accept them.

Bees will not eat honey stored in the supers if there is enough nectar available outside except perhaps when they are swarming or deserting. Bees desert when they do not like the smell of the wood or paint of the hive, when they do not get enough pollen or nectar and when they do not like particular flora in their new locality.

BEE KEEPING AS BUSINESS AND AS HOBBY

Those who want to start bee-keeping as a business proposition should undergo training in an apiary. There are many bee farms run by Provincial Governments and they are mostly attached to Agricultural Colleges and Agricultural Departments. There are some good private apiaries which are trying to popularise this industry, e. g. Y. M. C. A., Martandam, Travancore. The Honey and Wax Producers Co-operative Society, Ltd., Virarajendrapet, Coorg; the Himalayan Bee-keepers, Association, Dehra Dun; Bhupen Apiaries, Jeolicote, U. P. We have an apiary in Maganwadi where we give training in this industry and also sell bee-keeping equipment except comb foundations which are available from the above apiaries. A bee enthusiast may read books on the subject but he may find it a little difficult to start independently without practical training. He has also to see with his own eyes at least for a month or two how bees are captured and how bees are kept. Capturing is an easy operation, but keeping bees requires practical

training and experience. Bee-keeping is both a science and an art. A book on the subject may deal with many problems and probable difficulties, but practice and experience count more than theory. Practice alone will not suffice; a knowledge of theory combined with practice will make for speedy and sure progress. If a person comes across a difficulty and there is nobody on the spot to advise him, the theory he has learnt or books on the subject can help him.

In India bees have so far no diseases ; there are no cases of foul brood; so an Indian bee-keeper's task is rendered easier on that account.

In order to spread this industry in villages, Provincial Governments, or Public Institutions can train a man for each district of their provinces and let him (we may call him a bee-inspector) work in conjunction with the Department of Agriculture. He should tour round the villages in his district, find out localities where Indian bees are commonly found, help the villagers to capture them and induce them to keep them. He should provide them with all equipment on cash payment or on condition that the cost will be recovered in suitable instalments from the honey produced. He should at the very beginning inspect the colonies himself for a few days and ask the villagers simply to watch. As their interest grows, they should be asked to take charge and he should visit them from time to time. He should also carry with him a honey extractor; extract honey in the presence of the owner, note in a book the quantity produced, give the honey to the owner if he wants it for his personal use or collect it if it is for sale. The Department of Agriculture, Public Institutions or Co-operative Societies should pool all the honey produced in the villages and create a market for it by educating the people and convincing them of its use as an article of diet. If the Inspector is paid by Government, Public Institutions or Co-operative Societies, this will become a thriving

industry and go a long way to improve the harvest and to better the economic condition of the farmers who can run it as a subsidiary occupation along with their farming. To the owners of orchards it will prove a boon.

Villagers should be encouraged to make for themselves out of materials easily available to them the simple equipment necessary for bee-keeping. The hives may be kept in the shade under trees or bushes so that no separate shed is required to house the hives; temporary roofing with straw or palm leaves may be provided in the rainy season.

Apart from its business side, bee-keeping is a fascinating hobby and can be well taken up by all classes of people; men, women and children. It affords ample opportunities for complete diversion from the drudgery of life and ordinary routine occupation. It brings the bee-keeper into real, intimate contact with nature. The bees are wonderful engineers, their comb building is an art and outshines the subtlest art of renowned technique. Their organisation provides ample lesson in group co-operative endeavour.

The Commercial Side of Bee-keeping

Many persons have now begun to take interest in this subject and often enquire whether they can earn their livelihood from this industry. It is very difficult to answer this question because it is not always in our power to give the bees as much flora as they need. Unlike human beings, bees refuse to be starved, and if they feel that they do not get sufficient nectar and pollen in the particular locality they are placed in, they will one day inform their master that they want to say good-bye to his hospitality as he is starving them. The number of colonies a person can look after may be thirty, but he has to decide carefully whether the locality which he has chosen is able to feed his bees for all the twelve months. It is not necessary that

there should be an abundance of garden flowers. Any kind of forest flowers, flowers of mango, tamarind, neem, palas, acacia, vasak, etc., flowers from orchards and vegetables, as well as harvest in the fields will do but the bees should have something to feed on throughout the year.

If such facilities are not possible, then the bee-keeper has to resort to seasonal bee-keeping, that is, he should transfer his colonies from place to place according as good flora is available in that season. Of course this will entail much trouble and inconvenience, but if he really intends to make his livelihood out of this industry, it will be necessary to adopt this method.

Let the prospective bee-keeper first start with a few colonies, say half a dozen. If he can domesticate them well let him watch how much honey he gets in the first year. If in the following honey flow, bees show a tendency to swarm out, let him try to capture two or three swarms. If the average yield is on the increase, he may have a few more swarms. If as he goes on increasing his colonies, he finds that the bees are often absconding and the yield is also diminishing, let him stop further increase in the number of his colonies. He will have to decide by his own observations how many colonies his particular locality is able to feed.

The bee-keeper has always to depend upon nature for help. Artificial pasturage will cost him much and will not give a return in proportion to what he spends on it.

Orchard owners and vegetable garden owners can try this industry with profit as an experiment in relation to the size of their fruits and the yield from their harvest.

In Honavar (Kanara) and in Travancore State bee-keepers are reported to be getting a decent income and many villagers have taken up this industry as a side business.

Is Bee-keeping Successful Economically ?

It is difficult to know what exactly is meant by this question. If what is meant is whether bee-keeping can be organised in a commercial way on a large scale so as to bring in profits to an enterpriser who invests in the industry as a business from which he can obtain large profits, all we can say is that so far as we know such an enterprise has not been tried in this country and so there are no data available whereby a definite answer can be given to this question. Nor are we interested in such large scale enterprise which accumulates wealth in the hands of a few. If, on the other hand, what is meant by the question is whether through bee-keeping carried on by an individual as subsidiary to his ordinary occupation in life, he can obtain an appreciable income, we may definitely say yes.

The maximum production of honey from a bee-colony in a year in the Punjab is 30 lbs., but that province is rich in orchards producing the best fruits in our country, and as other places are not so gifted by Providence that figure is not going to help us. The general average production per colony per year in our country is 10 lbs.

The production depends upon the pasturage available in the locality. No definite data are yet available as to what is the best bee pasturage in our country. In America the farmers grow Sweet Clover for miles and in Australia they grow Buck wheat over a very large area. Our farmers do not grow any one particular crop in their fields to such a large extent. A farmer in the Central Provinces, if he owns about 100 acres, will grow cotton, wheat, jowar, gingelly, tur, linseed, gram, etc., each on a few acres, and it is, therefore, difficult to observe on what flowers bees feed most. There is an abundance of Citrus trees in the Central Provinces and it is worth while trying to keep bees in that area and to collect data as regards production of honey and fruit.

From our experience of bee-keeping during the last few years we can safely recommend this industry to farmers. A bee hive with all the accompanying apparatus costs only Rs. 15. If a person can get these made in his own village, the cost will be still further reduced. He need not have the honey extractor but may use the sun process. A bee colony in a rural area if properly maintained will produce in a year 5 lbs. of honey at the minimum and 15 lbs. at the maximum. The price of extracted honey ranges from twelve annas to a rupee a lb., and so in the first two years he gets back his investment, and what he receives in the subsequent years will be a net gain. There is no loss in bee-keeping. It can give one a few coppers without putting an unnecessary strain on one's pocket or energy. It is also a good pastime and hobby.

Bee-keeping at Kalimpong

Kalimpong is a hill station in the district of Darjeeling, Bengal at a height of about 4,000 feet above sea level. Nature has endowed it with forests rich in flora. Besides, gardens attached to houses abound in flowers, fruits and vegetables, and bees are plentiful.

The hill-men keep bees here in the old way. They carve out a hollow in big logs of wood, catch the queen bee with a few more bees, tie them in a piece of cloth, bring them home, and introduce them in their 'Dodas' (log hives). Bees sometimes begin to work there; at other times, however, they swarm away. If the bees remain, the combs are cut every three or four months and squeezed to obtain honey. The bees are smoked before combs are taken out. There is no hut where no Doda is seen. Some persons have more than half a dozen while one rich hill-man has as many as 40 log hives. Thus there is a very great opportunity here to popularise the modern method of bee-keeping.

Work in this direction was begun by us in the summer of 1940 and we distributed about 3 dozen bee hives within a month

among the farmers who were to repay the cost of the hives in suitable instalments. A man with good practical experience of rearing bees can easily earn his livelihood here through this industry. The combs of hill bees are much the same size as those of the plains. The worker bees are also of the same size but the drones are a little longer and more blackish in colour. The queen bee of the hills has a bright black hue and is very docile. The combs easily fit into the frames of the Maganwadi hives, and so there is no need to prepare special hives for these hill bees.

As natural hollows in trees are not easy to find, the bees are always in search of shelter and take to box hives. There is very little swarming. Ginger smoke is used by hill folk to bring furious bees under control. It is very effective, and beginners will do well to use it to save themselves from stings.

The local rate for honey is 6 annas a lb. with combs, and 8 annas a lb. without combs. The honey the hill-men sell is very dirty. The combs are full of dirt and dust, the vessel in which they are brought is also very unclean and the honey unfiltered. It is essential that they should learn the method of extracting honey by means of the honey extractor. This is what we have now begun to teach them.

We hope with a little aid rendered in these various ways to increase the quantity and improve the quality of honey produced in these parts. Once the advantages of the improved method of keeping bees are realised, it is sure to spread even without our assistance.

Import of Foreign Bees

A correspondent who has returned from Australia asks why no foreign bees are imported into our country, as they have been in Australia, when the honey yield of those bees is about 200 lbs. a year. In answer we quote what Sjt. S. R. Narayana Ayyar, an experienced bee-keeper, says about foreign bees:—

"An European gentleman,...could not stand the poor yielding Indian bees, so he imported a number of hives from England at great cost. He even brought some of them along with him when he returned to India himself. After importing English bees, he has constantly had to import queens from England to re-queen his colonies as he had encountered so many difficulties with the original queens. However, I wrote requesting him to let me know his experience of the foreign bees in India, and he replied:—'So far, imported bees have cost me a lot of money and I have had very little return from them'. This is the confession of a practical bee-keeper. He knows his subject thoroughly and carries out the various manipulations of his bees in a manner which an amateur like myself is not capable of. Hence his opinion is entitled to great respect.

"Apart from these difficulties there is a great danger in importing foreign bees as they all suffer from various contagious diseases. Our bees are, at present, entirely free from disease. I may state that this friend told me that one of his hives, while on the high seas, had to be thrown overboard as the bees were found to be suffering from foul-brood, in spite of all the care he had taken before transporting them to the ship from an apiary in England. Hence I earnestly appeal to all those who have an interest in this subject to ask the Government to take immediate steps to prevent the unrestricted import of foreign bees into India. Let us not in the name of increasing the yield of honey introduce contagious diseases and ruin our healthy bees.

"Foreign bees, when they are imported into India do not yield, after sometime, as much as they do in their own lands. There the bees realise that a winter will soon approach and the kingdom of plants will become barren, with snow and frost, which will result in the extinction of nectar and pollen for a few months to come. Hence they have a great instinct to gather as much surplus honey as possible and to store it in

their hives. But when they settle in India, they very soon realise that the genial nature of the land gives them enough of food to live without starvation throughout the year. Therefore, the instinct to store abundance of honey for a winter day vanishes slowly but surely and thus they become idle!" (*Experiments in Bee-Culture* pp. 54 & 55)

Bee Experts from Foreign Lands :

Our correspondent, who has himself, brought a colony of *Apis Mellifica* with him from Australia with the hope of acclimatising it in this country, writes that he has spent much money trying to establish such bees, and that his present small colony may or may not survive. He admits that more than one Agricultural Department has made the attempt unsuccessfully, and warns private individuals from making the experiment, but attributes the failure to Indian ideas about bee-keeping not being enough. He, therefore, suggests that foreign bee experts should, in the first instance, be sent for to establish their bees in India. But even this seems hardly promising. The foreign experts may know all about their bees in their own homes, but as Sjt. Narayana Ayyar points out in the passage cited above, the climate and flora of this country are very different from what they are in England or Australia and, accordingly, foreign bees either die of disease or become idle and collect very little honey in India. Of what use is the foreign expert under the circumstances?

To Inceease the Honey Yield of Indian Bees

The only remedy, then, if our bees yield comparatively little honey, appears to be to discover ways and means of increasing their yield. These depend upon the locality, the number of colonies and bees to the area, and the bee-keeper. Increase of honey yield may be effected in the following ways:

1. By increasing bee-pasturage. The bee-keeper should keep a number of bee plants around his apiary. When a colony has forage within half a mile from its home

naturally the bees will visit the flowers more often than those which have to travel more than a mile to bring pollen and honey. If there is an abundant supply all round, the bees are sufficiently greedy to want to collect and hoard the nectar even though they do not require it for their own use.

2. By doing all that is necessary to keep the hives healthy and strong.
3. By selective breeding. The bee-keeper should carefully watch his colonies, note the honey-yield of each and breed from the queens of those colonies which yield best. A young and vigorous queen is essential for maximum honey-yield of a colony.
4. By extracting the honey before the combs are completely filled. It is best to extract honey even when the comb is only three-fourths filled, for when the bees find most of their comb sealed, they do not trouble to work as vigorously as they do when their stores are exhausted.
5. By carrying on experiments to discover other methods whereby the bees may be induced to collect more honey.

It is along such lines that we should seek to solve the problem of the poor honey yield of the Indian bee, rather than adopt the short-cut of importing foreign bees, which will not only land us in expense but what is worse, introduce amongst our bees diseases of which they are now free, and which can easily ruin them. Let us not, therefore, by our greed, kill the goose which lays the golden egg.

சாந்தி நிசேதனம்,

கல்குடி பட்டி P. O.

(மதுரை ஜில்லா)

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