THE CHILDREN'S STORY OF THE BEE

S·L·BENSUSAN

Date Due

THE CHILDREN'S STORY OF THE BEE

THE BEGINNINGS OF THE SWARM.

June in the orchard.

THE CHILDREN'S STORY OF THE BEE

BY

S. L. BENSUSAN

AUTHOR OF
"A COUNTRYSIDE CHRONICLE," "WILD-LIFE STORIES,"
"THE HEART OF THE WILD," ETC., ETC.

ILLUSTRATED BY CARTON MOORE PARK

MILLS & BOON, LIMITED
49, WHITCOMB STREET
LONDON, W.C.

Published October 1909

TO

A. J. DAWSON

IN MEMORY OF MANY PLEASANT DAYS

IN COUNTRY NEAR AND FAR

CONTENTS

LIST OF ILLUSTRATIONS

THE CHILDREN'S STORY OF THE BEE

INTRODUCTION

We know something, if not very much, of the world we live in, and have been taught that it is governed by many natural laws of a kind we do not always understand and by other laws that men have made for their own guidance. We read in the Book of Genesis that God gave Adam dominion over the beasts of the field, the birds of the air, and the fish of the sea, and for many hundreds if not thousands of years people have thought that the birds, the beasts, the fishes and the insects live their lives without laws that may be compared in any way with those binding

us. But quite early in the history of mankind our forefathers discovered that certain creatures live by rule almost as much as we do, and one of the first living things to attract their attention was, as far as we can tell, the honey-bee. The Book of Judges contains a reference to the bee. Some of our earliest writers studied the life of the bee or had been taught the story of its habits as far as such a story could be known, and thousands of years have passed since the first man set down in writing all that was known or believed about the wonderful insect that supplies us with our honey. But long before his time the bee-hive had been drawn upon the walls of Egyptian palaces.

In the far-off days our knowledge was neither scientific nor exact. Few people studied the bee for themselves, and those who had the time and patience to do so were always affected by what they had been told, for they could not always see for themselves how far the stories of the hive's

labours were true. The fault was due not only to their own defective observation but to the prevailing belief in miracles. In early days it was not easy to understand the mysterious life of the hive without calling upon something beyond man's ken to account for it in part if not altogether.

The bees could be seen labouring ceaselessly among the flowers and carrying what they had gathered to their homes; at certain seasons of the year it was known that the hive would be full of honey. When the hive was rifled the extraordinary arrangement of the cells roused admiration and wonder among careful observers. Round the labours of the bee many charming stories were woven, some of them so happy that everybody must agree that it is a pity they are not true. Even to-day when the bees are under the closest observation, when inspection hives made with glass windows enable us to see so

much that goes on within, there are certain problems lying far too deep for us, problems that each man seeks to solve in the light of his own beliefs. Many rules exist in the great bee community for which we can find no explanation, but sufficient is known to correct many of the mistakes that obtained in days of old, and to give us a glimpse into one of the best-ordered communities of the world, in which the large majority of the inhabitants work by day and by night. They toil until the span of life is reduced from years to months, so devotedly that no temptation avails to turn the worker bee from her labour, and the worst to be said of her is that she seeks from time to time to lighten it at the expense of her neighbours. No holiday, save in the swarming time, comes to relieve the hard round of duty, neither is there in the hive any reward that we can discover save, perhaps, the consciousness of duty well done.

The bee-hive is a remarkable and splendid organization. Within it we find every class of worker, including architects, builders, masons and servants of every degree, all living, thriving and pursuing their destiny in the smallest space possible, the greater part of them giving all they can and taking as little as they may, and working without any thought for their own comfort or for their own future, but solely for the purpose of leaving the great bee community at least as prosperous as they found it.

There is no community known to us in all the world wherein much more devotion to work prevails, wherein such a high standard of unselfishness is maintained, wherein the reward for a well-spent life is, as far as we can see, so small. Writing as a lover of bees, as one who has kept them in the country for many years and has watched the ordinary incidents of their

life with close attention, I have chosen in parts of this book to set down the story of the hive as it might appear to some of its inhabitants. I do not seek to add to the store of knowledge that experts have collected, my effort is limited to rousing interest in the story of the bee among those who have never yet turned to consider it ; for the bee-hive might be found in many thousands of gardens where at present it has no place, and the store of honey our well-flowered country yields annually is not one hundredth part of what it could and would yield if the study of the bee were taken up by all who have the leisure to consider the remarkable possibilities of the hive. Many books far more comprehensive than this are at the service of the bee-keeper, important questions, merely indicated here, have been dealt with at length and with great skill elsewhere; but all knowledge must have a beginning, and these simple outlines of bee-life may serve

to interest beginners and direct some attention to the authorities on the subject. Their works are best approached by those who have mastered the 'prentice work of the bee-man's craft and have developed the interest that will send them eagerly and gratefully to the books of men who write with more authority and experience than I possess. If we may believe the early historians there was more bee-keeping in these islands some centuries ago, when the printed book was unknown, than there is to-day, when so many counties have their own Bee-keepers' Association, when modern hives have reduced the labour of bee-keeping to a minimum and increased its profits threefold. Here, then, is the best excuse that can be offered for yet another contribution to the subject that has already taxed so many abler pens.

CHAPTER I

A RECOLLECTION

When you went into the orchard for the first time it was as likely as not that the hives would escape your notice. The orchard itself would claim too much attention, for it stood upon a flat elevation commanding the river valley and looking down upon the meadows that sloped to the water. Then too it contained every kind of fruit-tree, and from the month of April, when the early blossoms came to greet the spring, down to November, when the last russet leaves were falling reluctantly to the ground, it boasted some beautiful aspects. Partly because the orchard was of recent growth and partly for the purpose of economy, the space between the trees was occupied ; between

one row and its neighbour there were strawberries, another two rows of trees had an asparagus bed between them, a third sheltered the celery, while between the others there were bush fruits in plenty. But in one corner of the orchard there were half-a-dozen beehives of varying shapes and sizes, for their owner was not greatly concerned with late patterns and modern improvements. Hives new or old had to serve but one purpose, to keep a colony of bees thriving and well content, and to yield just enough honey to justify the trouble and care that went to their keep. The surrounding country was well adapted to the requirements of bees. Fruit-trees were plentiful and apple-trees played a considerable part in the orchards. One could not travel very far without passing clover or sainfoin fields, some meadows held the white clover that the bees love best of all. Then too in several of the most beautiful corners of the countryside

there were gardens carefully tended by skilled men who grew all manner of rare flowers, and these gardens, known only to their owners and their owners' friends, unseen by the rest of the country folk, had no barriers to set up against the bees, who were ever welcome visitors, and gave far more than they took away, by carrying pollen from flower to flower. Very few people troubled about honey in this remote spot many miles from the railway, and, as each swarm was born and went out into the world and lived its little life and died, it knew nothing of want or of lack of store. There was always enough and to spare. Wealth was scattered before the bee colony as it is scattered before settlers who make a new home in a virgin land, and, had the cottage folk known the reward that awaited those who took trouble with their bees, there would doubtless have been one or two hives in every garden. But in the days of which I write, and they have

not passed very long ago, the hard-working farm labourer knew nothing about bees except that they sting if they are touched. He had not learned that some bees will not even do as much as this, the difference between worker and drone had not been revealed to him, and he preferred to keep a pig because he found bacon more to his taste than honey and had never heard of a pig stinging anybody.

Sometimes in the summer when the bees swarmed—that is to say, when the old queen left the hive, attended by thousands of her faithful followers, to seek a new home—the swarm would settle on some bush or tree in a farm labourer's garden, and very often, if it had come from one of the orchard hives, there would be nobody to follow and claim it. The owner of the hives was not always in the country and the old gardener who looked after the place in his absence regarded bees with a certain amount of contempt because they

had never learnt to grow the flowers they rifled. I do not think he knew anything about the good work that the bee does in fertilizing some flowers, and if he did, he would not have thought it worth his while, or even his duty, to leave his beloved garden and hurry up hill, down dale, and over white dusty roads in search of a swarm of bees. Perhaps he would not even have known what to do had he found them. Doubtless swarms perished now and again from exposure, others found some hollow tree in the woods and hived there, while yet others, sending their scouts out for miles around, learned of empty hives in some far off neighbourhood and winged their way thither to the great content of the hive-owner. But in truth the bee colony in the orchard did not fare badly; a clever apiarist, a man who had studied bee culture under an expert, would doubtless have turned his half-dozen hives into a score and would have earned some fair return for his

outlay and his labours. But in this case the owner of the hives had neither the time, the opportunity, nor the inclination to make bee-culture his chief work when he could leave London behind him and spend a quiet week or two in the country. And so it happened that an additional hive was only added at long intervals, and enough honey was left in the combs when winter came round to insure the colony against anxiety about the food supply in the days when the last flowers had faded, and the hives seemed to the undiscerning eye to be deserted by their inhabitants. To be sure there were fine warm days even in the winter months when a few bees would come out to enjoy the sunlight in the immediate neighbourhood of their home, to exercise their bodies and recover from the state of torpor in which they had been living since the cold weather came, before returning to settle on fresh comb. But these excursions were few and far between,

and might not have taken place at all if the hives had not looked out at the south and been well sheltered against all the worst winds of winter. Only when the sun grew warm and blossoming time had come, were the bees seen to shake off their winter lethargy and venture out of the darkness they had known so long, to resume their life's labours. They seemed to know that their span of life was a very short one, not long enough to accomplish the work of the hive, and when once they had started upon the active labours of spring and summer they knew no holiday, no relaxation and no other reward than the knowledge that they had done their best. Of all the hives in the garden, the best and largest was a wooden one, painted brown with a preparation that the bees might have accepted more happily had they known that it kept the wood from rotting, and did not attract any of the creatures that are their enemies. It stood upon a frame under an

old plum-tree that was never tired of yielding fruit in plenty, and the entrance to the hive looked out over a pleasant meadow and to certain farm lands across the valley where never a year passed without seeing some clover or sainfoin between the fields of corn. Year by year this hive would send one or two swarms away to seek their fortunes, but a good stock always remained, and with the close of summer there was never any lack of a few fine sections of golden honey to reward the bee-keeper. It is to this hive that I turned on a fine April morning when the instinct to learn something of its life could no longer be denied. I remember that it was one of the days that give the year's fourth month its good name, mild and warm and sunny, and when the first half-hour had passed I was for all future time, no matter how incompletely or unskilfully, an apiarist.

* * * * *

The road to the hive is a long one, for one does not enter readily into the mysterious world, shrouded from observation by the wooden walls, neither is it even necessary to find out what is happening before becoming conscious of a very busy colony intent upon following its own plans and customs without reference to things lying outside the scope of duty. As you approach the hive, the resemblance to a great city, so often insisted upon by those who have written about the bee, is at once apparent. There is a dull humming noise that tells of activity, and on a very warm day one of the first things to be seen is the double file of bees stretching from the entrance to the hive to some distance in the open and busy working their wings at high pressure. It is easy to see that their business consists in supplying the interior of the hive with fresh air, and it is one of the surest signs of great activity and thriving life

within. While winter suspended the work of the hive, the bees contrived to do without much ventilation. They lived in a state of suspended animation, breathing very little, keeping close to one another for the sake of warmth, and eating as seldom as might be because the limits of their food supply were known to one and all, and they understood that if they indulged their appetite too freely they would die of starvation.

But as soon as the first flowers have come back to the fields, thousands of bees are busily engaged in the unending search for honey and pollen. The activity of the hive has been resumed and with it there comes the increased demand for food and the corresponding supply. All manner of work is going on within, and of this we can get some hint as we wait by the side of the bees' home. The worker-bees who provide the ventilation will be seen to keep quite clear of the entrance,

and here a few bees are stationed apparently on sentry duty, perhaps to expel strangers, for although it is hard, if not impossible, for us to tell the hive to which a bee belongs unless we have distinct breeds of bees in the apiary, the bees themselves know the members of their own family, quite as well as the policemen on duty at the House of Commons know the members. No stranger would be permitted to enter the hive, even a queen-bee would be expelled or perhaps killed if she lighted on the front board. All through the long day the worker-bees are hurrying in from the fields heavily laden with the fruits of their labours, and as soon as they have emptied their precious store they are off again to seek a fresh one. Other bees that do not go afield at all may be seen coming from the hive laden with everything in the way of refuse, which is carefully taken beyond the immediate circle of their home. Now and again a bee comes

staggering out bearing some dead companion who is also taken away for burial to a place that the bees themselves have selected. If the season were well advanced we should see some sign of the drones, the male bees who idle their summer through and are born in hundreds, that one may mate with some queen-bee, the mother of another hive. We know that when the autumn comes, the drones remaining in the hive are killed, consequently, in the early spring days when the young drones are not yet hatched, the worker-bees alone are in evidence. They are going on their long journeys in search of the particular plant they favour, for the experts tell us, and doubtless they know, that one bee never goes to several sorts of flower, but remains constant to its first choice until the changing season calls upon it to make another. While these bees go afield in this fashion, others are guarding the entrance or supplying the air current or

attending to the inner work of the hive, of which we can just see the few signs that have been mentioned. In the first fine days of activity and enthusiasm, many a worker-bee reaches the ledge of the hive so heavily laden that she can hardly manage to reach the store wherein she has to empty her treasure, but there are always helpers whose business would seem to consist in relieving their overladen sisters. They may sometimes be seen in the open taking charge of her store, while she herself, after resting for a few minutes on the ledge, sails away across the fields to resume her work. In the early spring time when the weather is very variable, the pace of life is not very full, and the bees that have gone out so gaily in response to the first sign of fine weather may be compelled to retire again for some little time because a spell of cold wet days suspends their labour. Indeed, it would seem that the spring is a very critical time with the bee colony, particularly if the

food supply has been greatly reduced and no supplies have been put down by the owner of the hives. Many a good stock of bees after weathering the winter quite successfully, fails in the early days of spring, although there is no excuse for the bee-keeper who allows this to happen, since syrup placed above the frames and water set down in shallow pans within easy reach of the hive will generally suffice to tide the colony over a bad time. If the noise, the deep humming noise, that is heard as one approaches the hive is constant, you may be sure that all is well within, but if the droning sound is faint or intermittent there is trouble.

For days together we shall see nothing but the workers. The queen remains invisible, the drones are not yet about and the sounds that greet our approach are maintained throughout day and night, for the worker-bee, though she does not labour in shifts like an ordinary workman, has some means of signalling when she is tired out and her

place is at once taken by another. This would seem to be absolutely necessary where the air supply of the hive is concerned, for it may not be suspended for a moment. As we continue to visit the hives day after day in fine weather, our vision expands, we learn to see a dozen incidents of the hive's daily life that escaped our notice at first, to grasp the real significance of actions hitherto uninteresting, insignificant or obscure. Side by side with enlarging vision comes renewed interest; the hour of the daily pilgrimage to bee land is awaited with anxiety and the old fear of bees, dating from nursery days, is shaken from its niche in our minds, never to be replaced. And through the long winter months the happy thoughts of a summer to come are associated with the knowledge that the bees will bring their wonderful work once more within the scope of our observation.

CHAPTER II

THE HIVE AND ITS ARRANGEMENT

To many of us who see a hive set in some sunny garden corner well away from the trees whose shade might chill it, the home of the bees is an abode of mystery. To our grandfathers and their forbears, the mystery was deeper still, for they had no accurate knowledge of the work that went on within, and the embroidery of fancy that they wove round the few facts in their possession excites our kindly laughter now. In the old days the bee-keeper was concerned with nothing more than the honey-store ; as soon as the summer was over, he suffocated his bees by burning sulphur under the skep and took their spoils with a good conscience. Now-a-days a very different

method is in vogue. In place of the straw skep where the swarm did its best in face of many difficulties, we have hives so cleverly contrived that, while the greater part of the bees' labour is rendered easy and rapid, the bee-master can deal with it at any point. He can open his hive and find out exactly the amount of progress the bees are making from day to day ; he can enlarge or contract the space at their command, can regulate the number of cells in which worker-bees and drones are born ; he can even limit the number of queen-cells and can do something, though not yet enough, to keep the colony from splitting itself up in swarming-time. He has learned, too, the meaning of the various sounds that may be heard in the hive, although the notes of the bee are far too shrill for the human ear to catch their full significance. But the bee-keeper has gathered enough to distinguish between the sound that tells of content-

ment and progress, the tumult that issues from a queenless hive and the excitement that precedes swarming, and this little knowledge is invaluable to him.

The old-fashioned skep to which many a bee-keeper who started work half-a-century ago still pays allegiance, is in many respects as inconvenient a construction as one could meet in a summer's day. That it has certain advantages is undeniable. Bee-keepers old and young are quick to admit that it preserves heat and keeps the brood-cells thriving. On the other hand, the bees themselves have an infinite amount of labour when their home is a skep. It is their business to make the comb as best they can without direction or assistance, to fix it securely to the walls of the roof and to preserve the parallel lines with no outside aid of the kind afforded by the modern hive. The comb cannot be adjusted, and doubtless a great deal is wasted every year after the

bees have been destroyed, for the honey is always to be found near the roof and the lower parts of the comb are used for brood.

The destruction of his bees was one of the regular autumn tasks of the bee-man in remote districts, but after a time a new figure sprang up in the countryside, and, in the autumn, cottagers would receive a friendly call from an itinerant who would offer to collect the honey for them in return for the bees it had been their custom to destroy. Naturally the offer was accepted and the bee-man would turn the old skep upside down, fix an empty one against it in quite an ingenious fashion with the aid of skewers, and then, by gentle drumming on the sides of the full skep, drive every bee into the new one. He would of course be careful to see that the queen did not stray to the right or to the left, but went straight to her appointed place. If she went right the others would

follow, and it was his task to watch for her and see that she moved along the line followed by the workers in front. When the last of the swarm was in the new skep, the bee-man would cover it up and put it in a cart ; then with a sharp knife he would cut out the contents of the old skep and present its owners with the honey. Doubtless there were and still are many occasions when the bees carried away are worth more than the honey recovered for the hive's owners.

This practice still obtains in some parts of the country, but the introduction of hives with movable frames has revolutionized the bee-industry. The frames are interchangeable, and consequently the bee-keeper can strengthen weak hives, regulate the balance between drones and worker-bees, change queens, control the breeding of the queen or queens, and in every way fill the *rôle* of guide, philosopher and friend. He can tell, too, exactly what progress his

colonies are making, and in the few weeks of the year when the honey-flow is at its greatest he can enlarge the quarters of his colonies and give them freshly prepared frames or boxes in which to store their honey. When these frames are filled they can be replaced without disturbance or damage, and so it happens that the bees can be kept working at full pressure and have their work devoted to the best end, *i. e.* to the accumulation of honey. If they were left to fill up all the available accommodation they would be forced to swarm, but the arrangement of the modern bee-hive enables the bees to work all through the season of the honey-flow.

We know now that the making of the wax gives far more trouble to the bee than the gathering of nectar, pollen and propolis. It is also far more expensive, for in order to make a pound of wax bees require very many pounds of honey. In another place we will deal with the

methods by which wax is made in the hive; it is only necessary now to make this passing reference to a problem that many bee-keepers elect to solve.

Now-a-days the bee-keeper is intent upon saving the time and labour of his colonies to the fullest possible extent. So he has taken advantage of a device as novel and ingenious in theory as it has proved successful in practice. He fills his frames with a long thin strip of prepared wax marked out in the size and shape of the ordinary brood-cell. Aided by this the bees can set to work at once; their architects are faced by no difficulty; indeed it may be that in years to come bees will lose their architects because man will have reduced the need for their employment well-nigh to vanishing point. The work of cell building aided by a frame foundation is plain, straightforward and simplified to a very great extent. Time and honey are saved, and yet the

combs are the best that have ever been seen—straight, true and reliable, and carrying a minimum of drone-cells. When the time of the honey-flow is upon the land and the bees have filled the lower tier of frames with brood, a new range can be put on giving the hive a further storey. This will probably be filled with honey in a very little time, if the season be favourable and the hive a strong one, while, just because every part of the modern hive is interchangeable, a super that has been filled can be removed, another one put in its place, and the work continued until the honey-flow has come to an end. Then the last supers are taken off, the hive shrinks to its winter size and is packed round in some one of many fashions to keep it warm. Sufficient honey is left to provide for the use of the stock, and arrangements are made to give a little artificial food from time to time if necessary. Within the hive there is

abiding peace and a silence that contrasts oddly with the sounds of summer. The fanners have ceased from their labours, the fruitfulness of the queen is at an end, and, no longer courted by her attendants, she wanders at her will over the comb, feeding as the others feed, from the common store. Her subjects would seem to have allowed their loyalty to shrink to nothing under the contracting influence of wintry weather. To us it seems but a little space of time has elapsed between the period of the honey-flow—when the hive was humming with the labour of fifty thousand workers—and the present hour, when silence reigns supreme and an attenuated stock lives very sparingly upon the stores that the bee-master has left in the hive. For the bees themselves the seasons have been long enough, and of the thousands that congregate round the frames there is not one save the queen herself who saw the coming of the spring.

Of the vast multitude that laboured unceasingly through the summer all save the queen have died. Two months or less of the hard labour of honey-making and hive-tending are sufficient to work the strongest honey-bee to death. Only when we remember this, can we hope to understand why nature has imposed upon the queen the heavy task of laying from two to three thousand eggs in a single day, and keeping up this effort until the brood-cells are filled. Save for such giant labours the hive must needs dwindle. Even when thousands of eggs have been laid it may be that the queen swarms, seeks a new home, and resumes her labours there. As long as the worker-bees continue to feed and stimulate her she seems able and anxious to continue her task, and it is in this connection that the modern frame-hive demonstrates its superiority over the old straw skep. As soon as the skep was filled, the queen would swarm, the bee-keeper could do nothing to control her.

Now he can examine the frames, and, if those in one hive seem much stronger than others, he can substitute empty ones for full ones. If the bees have made too much drone-comb, he can remove it, while should he wish to postpone or prevent swarming, he can search for the queen-cells and destroy them. If the much-dreaded wax moth has succeeded in gaining admission to the hive, he can remove the frames affected by it, and should foul brood have appeared he can deal with the trouble at once, in fashion to be explained later on. He can also save the bees a very considerable amount of time and trouble by keeping the hive sweet and clean. The old-time skep had to be left to itself, only the edges of the comb could be seen.

In the days of the skep the mysteries of the hive were well-nigh unfathomable. To-day we can at least see them in the working and do our little best to account for them, though we must needs approach the hive with reverence, seeing that it

stands for a civilization much older than our own. In the days when the early Briton ran wild in these islands, when wolves lived in the forests and our marshes hid strange birds and beasts unknown to us now, the bee community was probably established on its present basis—the outcome, as far as we can tell, of certain powers of adaptation to a new environment. For in times when even a skep was still unthought of—and the skep dates from the dawn of recorded history—we may believe that the honey-bee, then a native of tropical or sub-tropical countries, lived the ordinary life associated with domesticity and was able to gather honey as required throughout the year. Then it may be that every honey-bee had her mate and raised her own family, and that the handsome male bee, now comparatively useless, took his share in all the family labours. A colder climate, a season, steadily recurrent, when the flowers faded and neither nectar nor pollen was to be

obtained, brought about the necessity, first, for storing honey against the bad times, and then for making a common store. Out of this development in the course of long centuries, the existing economy of the hive was evolved, so that Aristotle writing more than two thousand years ago, and Virgil writing a century or two later, found the bees living as they live to-day. Neither author describes the life accurately. Virgil reproduces Aristotle's errors, but even when these are allowed for we can see quite clearly that the bee community was established on its present footing, and the many mistakes arose through the necessary lack of facilities for close and accurate observation. To-day the hive has no secret left to reveal, the latest and perhaps most remarkable among recent inventions being an inspection hive with a glass frame through which the bees can be seen at their labours. But this hive and the wonder it reveals must claim a separate chapter.

CHAPTER III

THE HONEY-BEE

It may be doubted whether in all the insect world there is any creation known to man more highly developed, more delicately contrived than the honey-bee. At first sight as it wends its way to and from the hive or struggles to the alighting-board laden with pollen or nectar, or buzzes angrily around the hive when the peace of the community has been disturbed, the honey-bee is commonplace enough. We know that it has six legs, and are perhaps a little surprised to find that it owns four wings as well, for in flight each pair is joined, so that the bee appears to have no more than one wing on either side.

Only under the microscope does the

bee reveal possession of a highly specialized set of organs. The full significance of some of these baffles our understanding to this day, and gives the scientists no little trouble and brain searching. The closer our examination the more clearly we can see that every part of the bee's wonderful body is adapted to one end, and that end the best and most efficient service of the hive. The work of thousands of years, during which the most useful type must have been the one to persist and survive, has failed to produce the worker-bee that can labour for more than eight weeks in the active service of the community. But while the work is being done it is impossible for us to imagine any design better adapted to the labour required for the hive's prosperity.

The gift of sight with which the worker-bee is endowed well-nigh baffles our understanding. Her two compound eyes have been found to possess many

thousands of facets, so that when she ventures abroad to fields that may lie miles away from home, she carries with her gifts of vision quite beyond the range of our comprehension. For the dusk and gloom of the hive the brilliant eyes that could guide her so far afield and carry her with a splendid precision to the flower desired, become quite unnecessary, and it is probable that, for the work that must be carried on in comparative darkness, she uses the three small eyes that are fixed between the two large ones. For communicating with one another in the hive, the bees depend upon the two antennæ, one on either side of the mouth. The full function of these mysterious appendages yet remains to be discovered. Under the microscope they show extraordinary development of a kind that has suggested to scientists that they stand at least for the senses of touch and hearing, and there are observers of bee-life who believe

OUT AND HOME.
A sketch in blossoming time.

with a perfect faith that they are the organ of some further sense unknown to us, some sixth sense with which lovers of dogs would endow their pets, some subtle instinct akin to prescience. It would be perhaps more reasonable to suggest that the antennæ stand for touch and hearing in a highly specialized form, for we know that though the sounds of the hive seem few enough even to the best-trained human ear, the bee has a range of utterance extending well over an octave, but pitched so high that its varied tones cannot reach us in their entirety. Bees communicate with one another by means of these antennæ, and the loss of even one of them is fatal to a bee. In the delicate mechanism of the bee's fore-legs there is something curiously like a brush and comb, with which these antennæ are kept clean, so it is clearly of the first importance that these mysterious avenues of sense should be free from anything in

the nature of an obstruction. Some day, no doubt, the developments of science will reveal the ultimate aim and scope of these appendages, but at present the best of us stand on the threshold of the House of Knowledge and realize in all humility that there are more things in heaven and earth than are dreamt of in our philosophy. The most powerful microscope applied to the bee's antennæ reveals a fabric of nerves and cells that only the scientific eye can hope to appreciate; to the uninitiated it looks like a compound Chinese puzzle.

The tongue of the bee is another marvel of intricate arrangement—intricate and yet simple. It has certain functions to perform and for the full exercise of these functions many conditions must be observed. Under the microscope the bee's tongue resolves itself into five distinct parts: two upper sheaths, two lower sheaths, and the tongue itself, which terminates in something

like a cup. When this strange apparatus is not required it folds up and is lost to sight under the bee's head, while when it has to be cleaned—and no insect cleaner than the bee is known to us—the four sheaths can be pulled apart and the whole organ thoroughly scoured.

As we have said already there are two pairs of wings, transparent, iridescent things which seem too slight to support the comparatively heavy body that may fly for a mile or more from the hive in search of nectar or pollen. When the bee is at rest the larger wings lie folded over the smaller ones, while, when it rises in flight, the upper edge of the lower wing fits into a groove on the lower edge of the upper one, adding greatly to the strength and flexibility of the movements. To this flexibility the bee owes much of its immunity from capture, for there are many birds who desire nothing better than to dine freely and frequently on a diet of bees, and

if the worker were not able to turn with extraordinary rapidity, her days in the land would be fewer than they are now, when every day of her summer life is as a year in the life of a man. In the passage to and from the hive the bee traverses its own aërial roads, and these do not follow a straight line but have many angles, while the thousands of facets in the bee's greater eyes give it an immense advantage over all enemies, by enabling it to see danger coming from afar. But, when all is said and done, the wings would seem to be the weakest part of the bee's equipment. From six to eight weeks of tiring work is all that the summer-bee knows, and the first few days of this short period are spent within the hive, so the whole time of the labour in the field rarely reaches eight weeks. By the day when this period has elapsed, sometimes before, the bee's wings are frayed and worn and ragged. If she does not die at her labours the tired wings

just serve to carry her as far as the burial-ground of the hive, some ditch to which she has helped in weeks past to carry bees that died at birth or others that fell on the alighting-board to rise no more. If the worker's wings were stronger it seems at least probable that her life would be prolonged, for the power and not the will to work fails her in the end, and certainly the wings are the first part of the worker to succumb to the strain.

We have dealt now with the bee's compound and simple eyes—of which the two former possess over six thousand facets apiece,—with the strange antennæ of whose full uses we cannot speak with certainty, of the complicated tongue, and the curious wings. But still more wonderful limbs and structures remain to be described. The legs of the bee are six in number and are modelled upon Nature's most elaborate plans. The strongest microscope is required to reveal their intricate mechanism,

and description cannot pretend to do justice to the countless devices that have arisen to aid the honey-bee in the work she has made her own. It may be pointed out in this place that the difference between honey-bee, queen and drone is most strongly marked in the legs. Every bee's leg has nine joints, four claws—of which two are large and two are small—and a little pad in the centre or ball of the foot, capable of exuding some resinous substance by which the bee can cling to any surface, however slippery. The legs are fitted with devices that may almost be called brushes and combs, by which the most cleanly insects known to us are enabled to keep themselves free from dirt and dust. But at this point the resemblance between honey-bee, drone and queen may be said to cease. For the special work of the honey-maker, Nature has provided her special endowments. Some have been discussed already when dealing with the

tongue, but the mechanism of the legs is much more specialized, elaborate and involved. Starting with the hind-legs and numbering the ten joints from the top, one finds a pollen basket on the top of the fourth joint of each. On the under part of the leg are certain fine hairs that serve as brushes to sweep the pollen into the baskets ; a microscope is necessary to see these brushes properly, a good magnifying glass will serve for other purposes. On the middle pair of legs, between the fourth and fifth joint, there is a curious prong that serves to keep the wings clean. The bee can pass her wing through this prong and remove every obstruction therefrom in so doing. At the same point on the two fore-legs there are other two prongs, and these are used for keeping the antennæ clean. It would be easy and interesting to deal at greater length with the strange and varied equipment of the legs of the worker-bee, but in a book that is intended to lead

beginners to take an interest in the hive, it is not necessary to indicate more than the most obvious points in the bee's anatomy. Suffice it to say that every need of the honey-bee seems to find fulfilment in the smallest compass and under the conditions that render the work as simple and effective as possible. The worker-bee lacks nothing to aid her in the accomplishment of the largest measure of work in the smallest possible time and in the most effective fashion.

For those who wish to study the anatomy of the bee at great length there are several sound works of reference, none better perhaps than the two volumes entitled *Bees and Bee-keeping*, by Mr. F. R. Cheshire. The first of these volumes deals with the practice and the second with the science of bee-keeping.

When you look carefully at a bee you will see at once how all the parts described down to the present belong to the head and

thorax. The thorax is joined to the abdomen by the bee's slender waist, and this abdomen has now to be considered, for no part of the bee's body fails to serve some great purpose. At the termination of the abdomen comes the sting, the best known if not the most popular development of the honey-bee. Development may seem a curious term in this connection, but it is justified, for scientific observers are of the opinion that in years long past the sting of the bee was an ovipositor, that is to say, it was the instrument by which the female bee deposited its eggs in the cells made for them. Then the constitution of the bee colony was altogether different from what it is to-day ; every female is supposed to have had her share in egg-producing, and to have enjoyed the rights and responsibilities of motherhood. As the hive developed and the duties of egg-producing were handed over to one bee—the queen—the rest of the females ceased to have any

need for an ovipositor, and gradually it became a weapon of offence and defence, perhaps, in relation to its size, the most terrible weapon in nature. The microscope shows it to us in all its ugliness : a barbed sheath serves as a covering to two little spears with ten points apiece, and ten of these points, five on each spear, serve to convey to the wound they inflict a small quantity of highly irritant poison. Happily perhaps, the bee can only use her sting once, and the price of using is often nothing less than her life. The experienced bee-keeper soon becomes immune against stings ; his system absorbs a sufficient quantity of the poison to neutralize the effect of further applications, and it is interesting to note that homœopathic doctors cure the inflammation arising from the bee's sting by giving the sufferer a medicine consisting of the bee itself, in the form of an essence. Another interesting point is that the presence of the bee-sting

poison in the system is said by very practical bee-keepers to act as an antidote to rheumatism. In attending to the hives the careful bee-keeper wears what is called a bee-veil, consisting of gauze fixed to a frame that goes over the hat and can be tucked into the coat, and in this fashion secures his face from attack, but very few wear gloves for fear lest they should be unable to handle their subjects with sufficient care and delicacy.

There are seasons in the summer when bees are very irritable and resent even the most careful handling. When there is thunder in the air they are highly nervous and sensitive, so it is well that a few stings serve to make the apiarist indifferent, for he never knows how his subjects will receive him, even though he does know the best way of reassuring and handling them.

The abdomen of the worker-bee has another curious function : it provides the hive with wax. Here we touch, in more

detail than was possible before, upon a point that is of more than common interest. To make a pound of wax the bees must eat a very considerable quantity of honey. Experts say that nothing less than a dozen pounds of honey go to the making of one pound of wax, while this quantity may be increased considerably, and, as the production of honey is the aim and object of the bee-keeper, he has taken the necessary steps to aid the bee in her labours. To this end he places the thin sheets of comb in the portable frames. By so doing, he enables his charges to produce the necessary amount with less labour and much smaller consumption of honey than would be necessary if they were required to do their work unaided as they were in the old days, when the use of the skep was universal and the portable frame was still on the ever diminishing list of undiscovered things. The making of wax would seem to be

the special function of young bees. In the days before they are quite prepared to fulfil their destiny in the fields, they load themselves up with honey and then hang down from the top of the frame, the first ones suspending themselves by their claws which can be moved in any direction, and those below them hanging with their fore-legs on to the hind-legs of those above. The shape they take is that of an inverted cone, and, when their position is secured, they remain motionless for many hours, while the honey they have taken so liberally is suffering certain changes within them, and the temperature of the hive rises quite perceptibly. Then on four of the rings that are seen to be in the external structure of the bee's abdomen, eight little glands open, two on each ring, and from these the wax exudes. Needless to say the worker-bee has a special instrument on two of her legs for removing this wax, which she kneads into proper consistency

with the aid of her own saliva, and she can then take her part in the difficult and delicate work of comb-making. Under existing conditions in the modern hives, the process is much more rapid than it used to be. The amount of honey absorbed by the wax-makers is now comparatively small, for it would seem that the act of wax-making is voluntary, and if no wax is required, the young bees can devote themselves to the collection of pollen and nectar without any trouble or inconvenience.

It is a point worth considering whether, in generations to come, when the supply of wax to the hive is entirely artificial, worker-bees will retain the capacity for making this wax. It may well happen that the organs used for the task to-day will become atrophied through lack of exercise, and the capacity to make wax will be retained only by the bees that have not been domesticated. In dealing with bees

as with other things, mankind's one object is to work at a profit. Nature, on the other hand, as far as we can understand, seems to have little or no concern with this side of the question ; she is lavish, well-nigh prodigal in the pursuit of her ends, and pursues her own programme as though commercial interests played no part in them. It may well be that our present attitude towards the hive will involve the bee-keepers of future generations in trouble, but of course business men will meet this objection in two ways : first, they will remark it is purely a theoretical one, and, in the second place, they will point out that posterity has done nothing for them, and consequently they owe nothing to posterity.

Some bee-keepers tell us that the possibilities of bee-keeping so far from being exhausted are not yet within reasonable distance of realization. The devices by which labour is saved and honey-produc-

tion increased are, they declare, still in their infancy, though they seem so considerable to us. When the bee-masters can realize their ambitions, they expect to increase to a very considerable extent the numbers and the production of the hive, and to extract from the flowers, in the brief season of their productiveness, a far greater proportion of the nectar than is obtained to-day. To this end they must seek to reduce to a minimum all the unremunerative labour of the hive. But what will Nature have to say? Will the new race of bees that a changed environment brings into being, have the same qualities as those that serve us now? Will they develop new diseases—old time apiarists declare that the frame hive has brought some in its train. Within the competence of the present generation there is no answer to these questions.

CHAPTER IV

THE BEE AT WORK

EVEN in the depth of winter a fine sunny day will bring a few bees to the open air. Certain impurities gradually collected in the hive can only be removed during moments of active exercise on the wing, and it would seem to be on this account that they venture into the air for a little while to enjoy the much-needed activity before they return to the silence and darkness within. When the weather is bad for weeks on end, the bees are likely to die rapidly. In other chapters it has been pointed out that the life of the honey-bee is of short duration and eight or nine weeks were set down as the limit. But this statement does not apply to bees born to the hive in late autumn, when the

honey-flow is at an end and the drones have been destroyed, when the supers have been taken off and the careful bee-keeper has protected his hives against the coming of the bad season. Bees born in the autumn live well into the following spring ; the cause of their early death at other seasons is hard work and nothing more, work extended beyond the limits of their endurance. They could not work in winter if they would, because neither pollen nor nectar is to be had, and, at the same time, the bees' community must not be depleted too seriously or there would not be enough left to fulfil the duties of the hive when April wakes it to renewed activity and the earliest flowers are coming back to the fields they have left so long. As soon as nectar and pollen can be procured the bees are out and about. The larches are among the first trees to greet the spring, the anemones follow on the ground, the wild cherry, the Easter palm,

the marigolds are not far behind. Then the orchards spread their blooms on every side and the lengthening day is no longer sufficient for the worker-bee's ambition. Her labours as far as they do not apply to the hive itself, and are not concerned with her service to the world of flower and blossom, may be divided roughly into three sections : the collection of nectar, pollen and propolis. The nectar is for making honey, the pollen is food that ekes out the honey-store and forms the richest nourishment for the young, and the propolis is the glue that serves to unite the various parts of the hive when building is going on, and to give the comb the varnish that adds so much to its strength. But in collecting pollen bees do more than serve themselves : they work to aid Nature. For the pollen that comes from the ripened anthers of various flowers is necessary to fertilize others ; in many cases a plant could not exist, or rather could not

persist, without this fertilization, and when the bee coming from one bloom lights upon another, it deposits some of the pollen on its way to the hidden place of the nectar. The pollen is promptly conducted by the flower to its seed-cells which are at once fertilized. But for the bees, countless plants would fail and our orchards would disappoint us in seasons quite favourable to the growth of fruit.

Scientific observers declare that for the proper consideration of bees we must regard them as a link in the great chain of Nature's work, a work which the least of us help perhaps to accomplish in ways unknown to science. They take and they give, and while the hive owes so much of its prosperity to blossoms in hedgerow and orchard, both flowers and fruit owe a heavy debt to the bees, and the best orchards are those in which the bees have been most active. Much of the fruit that falls unripe and ill-formed has come from

THE SERVICE OF FLOWERS AND HIVE.

the few branches the bees have overlooked, for it is the new life they bring to the blossom that helps the fruit to be strong and vigorous. This phenomenon had been noticed by intelligent country-folk long before men of science explained its significance to the world at large. We see, as we look at meadows and orchards a-flower, how the pageant of late spring and summer is displayed to tempt the insect world to carry on the fertilizing work upon which the productiveness of flower depends. Speaking in general terms, it may be said that Nature dislikes inbreeding and in the great majority of cases labours to render it ineffective. She does not wish any flower to reproduce its species quite unaided, a very elementary study of botany will make this clear, and she tempts the insect world to its great work by means of the double attraction of colour and perfume. These are irresistible to insects, not only to bees,

but to butterflies and many other creatures that seem to us to rank lower in the scale of life. But few work harder than the honey-bee, for whom it would seem that the path to the hidden nectar is clearly traced by lines in the flowers themselves. These lines the honey-bee is quick to recognize and to follow, in fact, one hears them spoken of as " bee-guides " or " bee-lines." And while the industrious hive-worker pursues her labours she is working for ends other than her own though she knows it not ; and so from the study of the bee we can get a glimpse into the higher working of natural law and the hint already expressed that we ourselves may fulfil certain designs in the universal scheme of things, though they are unsuspected and unknown to ourselves. It is the larger application of the lessons the hive has to teach that makes its study ever fresh and pleasing, helping us to understand how what we know is as nothing to what

we still have to learn. There is no one of us who ponders over the work of the hive without the possibility of the great reward of adding something to the sum of human knowledge ; the simplest incident of Nature's work may yield a secret of the very first importance to the observant mind. The fall of an apple from its branch, the effect of steam in lifting the lid of a kettle are two simple matters that must have been noticed on thousands of occasions before they were noted by eyes that saw a sudden revelation of their significance and turned it to the world's account.

One of the most remarkable points about the pollen gatherers is that the bee that starts in pursuit of this work to gather from one flower never turns to another kind. If it did the fertilizing process could hardly be a success, but when you watch a bee at work you will not fail to find it leaves one flower to go to another

of the same kind, and the expert can tell without much difficulty the flower selected by the pollen seekers because pollen varies in colour. Apple pollen is pale-yellow, poppy pollen is black, the clovers have a variety of russet shades, charlock and dandelion are orange and gold, convolvulus is white, and the tiger-lily has pollen of an ochre colour. The uses of this pollen are single but its varieties are many, and it is through the bee's method of collection that we are able to see for ourselves that the bee is not working for herself. For when the pollen is taken back to the hive it is not selected, pollen of all colours may be seen in one cell ; the bee's discrimination is limited to useful purposes, a point offering much food for thought.

The nectar received by the bee from flowers is taken into a special honey-sac where it can be retained at will. This sac, which holds less than a drop, takes

nectar as well as pollen, but the pollen passes into the stomach, while even if a little of the nectar gets there it can be forced back into the sac by the action of certain muscles. Some changes occur to the nectar while it is in the bee's body, and, as soon as the bee reaches the hive again, it is able to force the honey from its sac through its mouth and into the vat that lies open to receive it. Shortly after the vat is filled it is sealed up and the next empty one comes into use. Some little of the nectar that the bee gathers is used to mix the pollen into a paste presumably that it may be carried more conveniently to the hive and, when there, may be stored without loss. Of the cells which receive the honey, their material, shape and special adaptability for the work in hand, some account will be given in another place, when the qualities and properties of honey are considered.

Propolis, the third object of the bee's

search, serves to complete the work that the most skilled maker of hives cannot yet accomplish. All trees that exude resin yield propolis, and bees regard it as something of the greatest value, and will show considerable ingenuity in providing themselves with some substitute when the hives are not within reach of resinous trees. Where we have willows, firs, poplars and others of the same kind, the workers have little trouble, and towards the close of the summer they will gather the sticky stuff in quantities that are the despair of the bee-keeper, who finds very great difficulty in cleaning his fingers after they have come in contact with it. Perhaps they fear the approach of the cold season with its burdens of draughts. Nothing could be more skilful than the way in which bees use this propolis, not only as a varnish, but as a means of closing the hive against all the assaults of the weather, and for all its stickiness they appear to handle it without inconvenience to themselves. If

it were not for their own unaided efforts the labours of the bee-keeper would be magnified to a very considerable extent. To understand the full value of propolis it is only necessary to compare an old skep, from which the comb has been removed, with a new one fresh from the maker. If you turn them both upside down and fill them with water, the new one will soon be emptied ; the old one, with its thick lining of propolis, will carry all the water you care to put in without losing a drop. In the old days, before the frame-hive and artificial foundation were known, the need of propolis for the bees was of course far greater than it is to-day, but even now it is invaluable, and will probably continue to be necessary until the time comes when man in his wisdom devises some means by which the greater part of the labour of its gathering will be avoided, and the honey-bee will be able to give her undivided attention to the pursuit of nectar. As far as pollen is

concerned, substitutes have already been supplied to the hive. Ground oats and rye in the form of a fine meal are used extensively in America, where it is said that the bees have been known to extract pollen from fresh sawdust and from the fine dust that has accumulated in the store-room of a cheese factory—dust that may be supposed to have been nothing more than cheese-mites in embryo ! It is always well to remember in connection with this extraordinary story that the enthusiasm of certain Western bee-keepers never lags behind facts, and is even suspected from time to time of running slightly in advance of them.

We have seen in this brief survey the full extent of the bees' labour beyond the hive, and how the bee-keeper seeks to direct or to control them in such fashion as will enable him to reduce to a minimum the work that he regards as of secondary importance, while doing what he can to stimulate the workers in the pursuit of

nectar. For while the amateur is quite at liberty to take all the pleasure he can from contemplation of the wonderful work accomplished by the bee community, the professional bee-keeper is concerned with little more than the material results of the bee's labours. It must not be forgotten that even half-a-dozen straw skeps handled with skill and judgment may yield considerable annual profit to the cottage garden, while the well-conducted apiary, established on a large scale, carefully treated and rejoicing in the most modern appliances, is a full-fledged commercial undertaking. It may be maintained, without fear of contradiction, that the hive is better understood, better cared for, and more productive to-day than at any period in the life of the present generation, but, at the same time, where there are ten hives in the country now, there might well be a hundred. Miles of fertile territory are yet unexplored; tons of nectar remain ungathered, while much honey is lost to the

rural bee-keeper, and many swarms perish for lack of a little rudimentary knowledge about the bee and its ways. In his rambles through remote districts, the writer has found several agricultural labourers who contrive to pay half their rent, or the greater part of it, from the proceeds of a few hives, though they have never heard of anything more advanced than the straw skep, and work at considerable pains without modern appliances of any sort. They leave their bees to carry on work as best they can, and cheerfully give strong stocks in autumn to those who come and take them away. This is unbusiness-like procedure enough, but is an improvement on the old method of putting the bees on the sulphur pit and gathering the honey at the cost of killing its makers.

The various bee-keeping associations that pursue their splendid labours in so many country districts, are gradually reaching the yokel, and although they can hardly hope to succeed with those whose ideas

have been fixed for the greater part of a lifetime, they may achieve good results in the case of the younger generation. The young bring more enthusiasm and more open minds to the consideration of the work, and are greatly stimulated by the prizes that are offered for the best honey. The price of the simple frame hive is within the reach of most bee-keepers, and for those who cling resolutely to the skep, an improved pattern has been devised enabling the bee-keeper, by means of the straw super, to obtain his honey and preserve his bees alive. Such a skep costs five or six shillings, and a reliable frame hive can be purchased for half-a-sovereign.

Some people make their own hives, but they can hardly hope to do so as cheaply or as well as the experienced maker, who buys his well-seasoned wood by the load, and cuts his frames by the aid of machinery in fashion that ensures a perfect fit.

CHAPTER V

THE MAKING OF THE COMB

We are all apt to take things as we find them without being troubled very much by thoughts about the work that has gone to the making, and when we see the interior of a bee-hive for the first time, or purchase a section of honey, we accept the bees' arrangement for storage without comment or curiosity, or at most with very little of either. But when we have the luck to find ourselves in the company of an enthusiast who understands something of the science and the significance of the bees' labours, we learn to look upon the building achievements with wonder that will never pass as long as the capacity for understanding is left. There is nothing more interesting in all the work

of the bee than this preparation of comb ; nothing more striking than the scientific accuracy with which the home within the hive is planned and made. Human ingenuity could not devise any plan by which space can be economized more rigidly without limiting in any way the results to be achieved.

We know now that the bees build their cells, whether for brood, pollen or honey, with the wax they themselves secrete, and we have seen that this secretion is secured by certain changes which take place in the body of the bee after it has fed very freely upon honey, and remained stationary for a considerable period in the highest temperature known to the hive. It is the action of heat upon the food taken in such generous quantities that brings the wax through the scales on the abdomen of the bee. By the aid of a nipper on the third leg of the worker-bee (drones and queens are not wax

producers, and consequently lack this development), the wax is removed from the scales and conveyed to the bee's mouth where it is masticated, and so prepared to serve the purposes of the hive. When there is sufficient building material ready, the wax is applied to the roof of the hive, if it be a skep, or to the top of the frame if the hive be a modern one, and the comb is built on a middle wall which forms the end of a layer of cells on either side. These are hexagonal in shape and nearly half-an-inch long. In building work a bee depends largely upon her mouth, using the jaws for shaping and hollowing the cells, and the value of wax to the bee may be best gathered from the fact that one pound of it will make between thirty and fifty thousand cells. This wax is seldom pure, as the bees cannot keep their cells quite free from pollen, and if they are building fresh comb in an old hive, will even use the caps that sealed

the larva, and were bitten through by the new-born bees when the first hour of active life had arrived. When comb wax is refined, its natural purity is seen for the first time.

The closer our examination of the comb, the more surely can we discover evidences of economy in working. The object of the workers is to use the least possible material that may be consistent with the necessary strength, while the shape is seemingly determined by the conditions that will need to be fulfilled when the cells come into use. They must be deep enough to hold the larva at the moment of its greatest growth, strong enough to bear the weight of the worker-bee when she goes right inside to feed the newly-awakened life at the far end, or pauses for awhile in an empty cell to gather fresh strength for further labours. As far as the honey-cells are concerned, they must not only be built strong enough to hold

their precious burden, but placed at such an angle as will enable the honey secreted there to rest beyond danger of spilling. To this end the cells have a slight tilt that serves the purpose without any sacrifice of space. The relation of reduced space to increased warmth is too simple and direct to need detailed comment, and warmth is of course one of the first essentials of the hive. When the cells have been constructed, they may not be strong enough at first to bear all future burdens, but the propolis secreted by the bees in fashion already referred to, comes to the assistance of the worker. We have already seen that she uses it as a varnish, and it gives the necessary strength to the comb. A brood-comb is used over and over again. The community seems to be well aware of the costliness of wax-making, and as soon as a new-born bee leaves the cell, a worker proceeds to clean it for further use, though it is not scoured in very

complete fashion. In course of time brood-cells lose their generous early proportion by reason of the steady accumulation of cocoon and other matters. The economy of the bees shows itself in other ways. The young queen larva is fed so generously that it may almost be said to swim in bee-milk, and as soon as the queen is hatched out, a dozen hungry workers eat what is left of the food that was supplied to her. Even when the elected queen of the hive has worked her will on rivals, and they have been dragged from the cell that was at once their birthplace and their tomb, there is no waste. All that was eatable is promptly eaten, the fact that murder has been committed has no effect upon the bee's appetite.

The workers are prompt to support the comb in every direction ; they glue it with propolis to three sides of the frame, and examination of a skep shows a very generous and sometimes disconcerting use

of the sticky stuff in all directions. It will be seen, too, that the system of building upon a centre wall effects a considerable economy, inasmuch as a single sheet of wax serves as a base for the double range of cells. Left to themselves as they are in a skep, the bees choose for brood the very centre of the hive where the warmth is greatest, and the honey is stored in the upper part. In the ordinary frame hive the lower frame serves chiefly for brood, and the honey is stored in the supers that the bee-master places in the hive in spring. He is careful to watch the progress of honey-making and to replace full supers by empty ones as occasion arises. If he should have several stocks, of which one is considerably stronger than another, he will not hesitate to remove some of the brood-combs from a full hive, and place them in one that is not full enough ; he then puts frames with wax foundation in the prosperous hive, and by so doing gives the busy bee

sufficient work to do to keep her fully occupied. This procedure has some effect, though less than the bee-master would desire, in delaying the appearance of a swarm. For although the causes of swarming are not yet fully understood, in spite of the research that goes on year after year, it cannot be disputed that one of the most frequent causes of the annual disturbance in the hive is lack of accommodation. This applies to skeps more than to frame hives, for the skep cannot be taken to pieces and the frame hive can. Those who say that swarming is due to the birth of young queens are probably mixing cause and effect. When the hive is so full that the queen can no longer find room for her eggs, and the honey-store is swollen to the full capacity of the cells, queens are raised, and the birth of a young queen would seem to be the signal for the old one to leave for fresh fields and pastures new.

Harking back to the business of comb-

making, it should be pointed out that queen-cells form no part of the regular construction of the comb. The workers build cells for their own kind, honey-cells and drone-cells, but queen-cells are built afterwards. Sometimes they hang down from the ends of the comb in shape that has been aptly compared to that of an acorn, but the most observant apiarists have yet to see the queen-bee lay an egg in one. She will do nothing to bring a potential rival in the world, and is clearly excited and angry if her courtiers—or are they task-masters?—lead her into the neighbourhood of one of the little acorn cells that they have built at the edge of a comb. It seems clear that the workers themselves decide when queen-cells are to come into use, and that, having decided that the time is ripe for the introduction of a queen, they take an egg from one of the worker-cells and place it in a queen-cell. These are the largest cells they make and admit more air. If for any reason it is

not convenient to build one, they will enlarge an ordinary worker-cell until it is big enough to serve for queen raising. In this way the mother of the hive remains in ignorance of impending trouble until the shrill piping of a new-born queen awakes her to sudden consciousness of a rival. Then, if she be not allowed to kill her child or children, she makes haste to swarm and seek some new home in which her motherhood will be undisputed for another year.

There are many points about the construction of bee-cells that do not call for attention in a book that seeks to do no more than interest beginners in the rudiments of apiculture. But it may be pointed out as an instance of the strength of the bee's work, that one pound of wax will hold more than twenty pounds of honey in cell formation, and it is calculated from this that the upper cells of the comb can support rather more than a thousand times their own weight. The whole arrange-

ment of the bee-comb is made with the strictest regard to ventilation, so that no cell in the house of birth is beyond the reach of the life-giving air-current without which the silence of the brood-comb would be the silence of the tomb. The extraordinary strength of the comb is very largely due to the varnish of propolis that the bees apply.

Examine a hundred hives and the same construction, the same arrangement, the same architectural ingenuity will be apparent. Bees have standardized their work as definitely as modern bee-keepers have standardized their hives, and, as far as we can tell by looking into the earliest records that show any measure of accurate observation of bee life, the work of the bee builders has not varied within the memory of man. Here we have a remarkable tribute to the antiquity of the hive and to the countless generations that must have elapsed since the bee community

was formed. Such perfection as has been attained in the hive could only have resulted from many centuries of experimental work. If we look round at our own civilization, we shall not find it easy to point to any aspect that has not suffered and is not still suffering modification. With us everything is in a state of flux: the perfect method of to-day applied to any art or science within our ken, may become obsolete among the next generation without exciting any comment; we know that we have not reached the final means to any end. With the bees, on the other hand, the case is different. They have passed out of the region of uncertainty and doubt. As far as they are concerned, their system is perfected. Given a favourable environment their adaptation is complete, and the only hazard on their lives is associated with their own success. If their internal economy were less complete, there would not be so many occasions when the sense

of accomplishment, and aims fulfilled, urged them to seek new homes and make new history. The swarming trouble would not exist, though, of course, the hive would yield less honey, and even now a very little change of circumstances finds an immediate response in a change of plans. It is not hard to see that although the instinct of swarming is so strong it is not irresistible. Should any accident befall the hive at the time when the familiar sound of impending action is heard, teaching the bee-master that swarming has been decided upon, and is to take place within twenty-four hours, the bees are prepared instantly to reverse their policy. A sudden change of weather is sufficient ; a quick fall in the barometer, a cold wind, some heavy rain, and the bees will destroy their queen-cells, suffer the old queen to fight her rival and pursue their ordinary tasks, until a more favourable season shall arise. They can do more than this. If the

weather should remain unfavourable and the force of the honey flow be checked, they will see to it that the queen ceases at once from her labours. They will even destroy the half-developed life in the brood-cells and carry the dead larvæ from the hive. Theirs is a wisdom that knows nothing of sentiment; they appear to labour for the hive as for a State, and individual sacrifices count for nothing. Nowhere is their practical wisdom seen more clearly than in the making of the comb. It is constructed on principles that the most critical find wholly admirable. Composed of the very slightest material, it can be used for years until the memory of those that made it has passed and even the queen whose labours filled it has reached the full limit of her laborious life, while her children's children to the third and fourth generation have passed beyond the history of the hive.

CHAPTER VI

MAY IN A CITY BEE-HIVE

(A Note from a London Study)

THE lover of bees is no longer limited to residence in the country for the proper pursuit of his observations. Even if he be no more than a dweller in a London flat, where the only gardens are public gardens and no ordinary hive would be safe, he may yet keep bees and watch their varied life in its most interesting aspects whenever he has a few moments to spare. As I write, on a fine morning in May, the bulk of the bees that would call me master were they polite enough, or had the capacity, or were in the habit of acknowledging authority, are more than fifty miles away, but some hundreds labour before me, clearly to be seen through the

glass frame of that wonderful invention, an inspection hive. I saw one for the first time in the apiary at Southall in Middlesex, established by Messrs. Abbott Brothers, who have done much and are still doing much to promote the interests of apiculture in this country, and was so interested that I asked the firm to set up one for me in my chambers in the Temple, that I might become, if not the only bee-keeper in the City of London, at least one of the very few. Very quickly the hive became a source of constant recreation and delight; there is no hour of the day at which it does not repay close attention.

The inspection hive has three tiers of comb frames, ranged one on the top of the other in a neat mahogany case with glass sides. There are shutters on both wings to protect the delicate wax against the sun, which would not be long in melting it on a fine summer's day, and the hive revolves upon a metal pivot so that it can

be turned in any direction without disturbing the bees at all, their exit and entrance remaining unmoved by any change in the position of the hive. A small hole cut through the window-frame gives them access to the historic gardens in which we are told the great protagonists of the Wars of the Roses selected the emblems by which they are known. The two upper combs are full of brood and the lowest serves for the honey-store, while above them all, on the outer edge of the frame, I have placed an inverted jar full of syrup that spreads a few drops over a wire frame to which the bees come to feed—for at present the flowers in the gardens are few and far between, and although there is plenty of material for propolis, the bees stand in no need of any.

On the morning following their arrival, very few of my little visitors seemed anxious to venture abroad, although the bright sun of midday tempted some half-

a-dozen into the open, where they could be seen flying for a little way, but keeping their heads towards the hive as though to take their bearings. By the second morning they had gathered confidence, and now there must be scores abroad, so tempted by the strong sun that they are almost indifferent to the high wind. One and all of those that are afield are workers ; the few drones prefer the comb and will not go outside the hive until the days are very warm as well as sunny.

Although the frames were placed in the hive with all possible care, a few unfortunate bees were crushed to death, and the first task placed upon the workers was the removal of the dead bodies. The labour must have been exceedingly difficult, for the dead, some six or eight in all, were crushed between the comb and the glass. But the sanitary needs of the community were imperative, and three days after the hive had been established on my writing-

table, only two dead bees were to be seen and they remain, quite unapproachable. At first the bodies were taken to the alighting-board on the broad window-ledge ; then, as soon as the wind dropped a little, they were carried away to some quiet corner that is destined doubtless to serve as the burial-ground of the community. With the end of the summer it will no longer be advisable to keep the inspection hive at work, the protection of such a shallow case will not ensure the necessary warmth. But it will be quite a simple matter to take the frames out, put them in a travelling-box and take them down to the country, where, with a little judicious arrangement, they can be put in another hive and left there for the winter.

The work of uniting these bees with those of one of my other hives will not prove difficult. In the first place, when the top of the hive has been removed, a little smoke is puffed over each comb by

the aid of the smoker. This alarms the bees and they rush at once to their store to fill themselves with honey, for they do not know what is going to happen next and wish to be prepared for any emergency. When they are full of honey, they are more contented, easier to handle, and less likely to sting. The frames are then taken out, flour is dredged lightly over all the bees that have to be united and the frames are then rearranged. One of the new frames is placed next to one of the old ones, but rather more widely apart than is usual under ordinary circumstances in order that the bees may not be too close to each other during the first few hours of their union. The elder of the two queens must be removed, for our most expert bee-men have not yet been able to reconcile the hive to the presence of two mothers. This precaution taken, the case may be put on and the bees will unite peaceably, partly because they are too full

of food to feel very quarrelsome, and partly because they are busy getting rid of the flour which has been dusted over them. It has been pointed out by all apiarists that there is no cleaner insect than the bee.

This method of uniting colonies is not limited to cases where an inspection hive has been in summer use. The careful bee-keeper goes through his hives at the close of every summer for the purpose of strengthening his stocks in this fashion. He knows that he cannot have them too strong, while it is quite easy to have them too weak to face the bad weather in security.

Returning to the inspection hive let us look for a moment at the varied labours now being pursued. Move the case on its pivot so that it catches the light without receiving the full force of the sun—it is easy to see the queen-bee pursuing her path over the comb. This is not the period of her greatest activity and she is

not working at a very great pace, but she proceeds in a leisurely fashion surrounded by her personal attendants, who guide her over the hexagonal cells with a dozen little directions that are apparently unmistakable. About four parts of the upper frame are composed of worker-cells, while down below in one corner are the drone-cells, easily to be recognized because they are considerably larger. The workers are not content with merely directing the mother of the hive ; they are seen to be grooming, caressing and feeding her at the same time, and indeed it is to this stimulation that she owes the capacity to proceed with her great task. Every now and again one of the workers will put her tongue in the queen's mouth and feed her with the special combination of pre-digested pollen and honey which seems to be the summer food of queens. In winter they must eat at the common store. Only a few of the bees are engaged

in feeding the queen, less than a dozen in all, but for the others there is no lack of employment. Some are busy clearing out the cells that the queen will soon be requiring; two are struggling with an unhappy caterpillar that must have dropped from the plane-tree whose branches, just breaking into leaf, shadow my window; others, so completely hidden that only the end of their abdomen is visible, are feeding the young life that is just waking from eggs laid three days ago. In some cells the larvæ are growing apace, and can be seen quite clearly, from the point at which they are seen curled up right at the bottom of the foundation wall, down to the nymph period at which the feeding has ceased, and they are ready to spin the cocoon from which they will emerge as bees. The eggs take three days in hatching. The larva is fed for six days, and then the bees seal up the mouth of the cell from which the com-

plete bee will eat her way three weeks after the egg was laid. The drones take a little longer before they emerge, and the queens not so long, but as I write the drone-cells are for the most part untenanted.

Here and there one can see a few bees that have just eaten their way through the cap that the workers placed over them when the time of feeding the larva was at an end. Some have managed to emerge unaided. One or two seem to demand and receive the assistance of the bee-nurses, who groom them and feed them for a little while and then leave them to wander at will over the comb, until some instinct tells them they ought to be at work, whereupon they range the comb in search of other opening cells, and proceed to help the nurses. Soon after the young bee comes out of its cell, one of the nurses can be seen making her way in, presumably to clean and prepare it

for another egg. The new-born are much lighter in colour than their elders and receive a certain amount of consideration from all save the drones, who will not hesitate to come between a nurse-bee and her charge, as though anxious to receive the food that is not intended for them.

Happily there are few drones in this inspection hive, and this is as well, for they are a clumsy, careless, greedy company, intent upon nothing save their own comfort and determined to get as much attention as they can, while they are quite incapable of doing anything in return for it. The workers tolerate them quite kindly, recognizing that they too have their part to play in the economy of the hive, though quite unconscious that in this little community they will have no work to do. No drone may become the father of the hive in which it is born, and I fear that one will need to travel far

through the City of London to find another queen taking her nuptial flight.

The instinct that teaches young bees to wait upon the queen must come very early in life. As I write a bee that cannot have been born more than forty-eight hours ago, has joined the circle of courtiers and is caressing the queen, who for the time being has ceased from her toil and is resting on some sealed brood-comb. Clearly she is not to rest for very long; nine of the attendant workers are caressing her, one has just finished feeding her, and now she moves along to some empty comb to pursue the fruitful labour of her life. A little persuasion was required—I cannot help thinking that she would enjoy a half-holiday, but the workers have never heard of such a thing and do not intend to grant any more repose than is indispensable, unless the weather should turn cold. Then her Majesty will cease at once from her

labours. If this were the season of the full honey-flow doubtless she would be content to work as hard as they do.

In the later summer it will be necessary to destroy queen-cells and perhaps to replace a full brood-comb by an empty one in order to avoid a swarm. Certainly a wandering colony could find no suitable home in the immediate neighbourhood and would be bound to perish miserably, even if it did not take up quarters in some corner where its presence would be distinctly unwelcome to its neighbours.

All around clocks are striking the midday hour. The hum of the City is faintly audible, with rattle of tram on the Embankment, and roar of motor-omnibuses on the Fleet Street side, but the bees are pursuing their labours as happily as though they were back in the orchard from which I brought them for their brief sojourn in the great metropolis "whereunto the tribes of men assemble."

CHAPTER VII

THE QUEEN'S FLIGHT

(A Countryside Study)

Consciousness had hardly been hers in the five days that were passed in the form of a grub. Such little recognition as came her way was no more than the pleasant sense of wants supplied. She was in a cell depending solitary from the edge of the comb, larger than the ordinary cells and shaped roughly like an acorn. Into the mouth of the cell in those brief days of waking life, the nurse-bees were busy emptying a rich store of bee-milk made up of pollen and honey which they themselves had digested before they gave it up to their nursling. There was more than the young grub could assimilate. It overflowed into the cell where she was spinning the silken shroud that was to wrap

her for more than a fortnight's sleep. The nurse-bees sealed down the mouth of the cell, but there was a generous allowance of space and air, and in the still blind depths which no human eye can picture, the queen-bee grew and woke to a sense of anger and excitement that expressed itself in a shrill cry.

"Let me out," she shrilled, "I am a queen-bee and there are others in this hive. Let me go that I may do battle with them."

All round her the guard was stationed, she remained a prisoner. But far above, in a corner of the hive, came an answer to her challenge, the cry of the old queen-bee, her mother.

"I have kept my sword for you, and for all your sisters," cried the mother queen; "there shall be but one mother in this hive."

Then there was a sound of scuffling and remonstrance, a shrill cry of rage repeated over and over again, while a sense of

excitement and turmoil seemed to pass almost physically over the hive. It communicated itself to the worker-bees as they came laden with pollen and nectar, and to the drones as they lumbered heavily home from the fields, careless of everything save abundance of sweets and long hours of rest. A few moments later the outcry died away, the Mother bee had been appeased.

Of food the young queen found plenty, but her liberty was yet to come, for as soon as one of her guards went off duty, another came to take the place. At times the old queen could be heard making a fresh effort to break through the living wall round her and work her will upon her helpless children. From three other parts of the hive the challenge of the queens was answered. The workers had made four queen-cells, had taken eggs to them from the worker-cells, and in each, a bee, equipped to become a mother of more than two hundred and fifty thousand

children, was calling for liberty and battle. Towards noon on the following day after long hours of extraordinary turmoil followed by a few minutes of complete silence, there was a rush of as many thousands leaving the hive. It was altogether different from the noise made by the few hundred drones at midday. The old queen had swarmed and gone her way, the guard about the young queen's cell was removed, and she was at liberty to move about the hive.

Three days later, after one or two preliminary journeys into the air, she had taken nuptial flight and returned safe and sound to the hive, bearing with her the trophies of brief converse with the drone who had just died in the hour of his victory. She rested awhile from her fatigue and then for one day she laboured over the brood-cells, guarded and groomed and fed and flattered by the worker-bees who had congregated round the cell in

which she was born. But the cry of three of her imprisoned sisters, challenging her supremacy, roused her to ungovernable wrath, and this time the workers did not attempt to stand between her and her anger. Sight and smell and hearing all served to direct her to the queen-cells where her imprisoned sisters were still confined in fashion that left the lower part of their body exposed. The long sharp sword that was part of her equipment was used by the newly elected queen with deadly effect upon the hapless prisoners, and the worker-bees dragged out each murdered body from its cell and passed them over to the undertakers of the hive, who bore their burdens as best they could to the ditch that was the common burial-ground. A few of the workers round each queen-cell greedily devoured what remained there of the bee-milk, and then the cell was scoured and nothing remained save the cocoon to tell of the tragedy so recently enacted.

Thereafter her rule had not been disputed, though it was directed by the worker-bees, who had led her over the cells, determining for themselves how many eggs she should lay and of what kind. They were conscious of their ability to increase or limit the number of drones, and raise more queens if they should wish to, by isolating a worker-cell and feeding the new-born grub with the richest food in generous fashion.

Two years had passed since then. Another summer was at its brightest and countless fields of flowers offered their nectar to the bees. The hive was full and prosperous, but the queen-bee knew that a crisis in her life had come. Quite without her knowledge, the workers had prepared queen-cells, the first signs of life were audible there, and she knew that the hour was approaching when she must face rivals and possibly meet her death. Friends she had none, for in the hive friendship is

unknown, duty has taken its place. Very bitterly she had rebuked her courtiers, the workers who had fed her with the richest food as long as it was necessary for her to lay eggs, but had left her, when the cold weather came, to fare on simple honey along with the rest. She had begged and threatened, but all to no purpose. Just as she had been cared for in the years that had passed, so the young queen-bees were being guarded now, and at last, in an agony of rage and resentment, she had cried—

"To-morrow I will leave the hive and all who care may follow me."

In a few moments this threat had penetrated to every corner of the citadel, stirring the lazy drones to consciousness of some other interest in life than food or play. The various committees that direct the operations of the hive, supervising the labours of the bees that supply the air current, the sentries, the nurses, the wax-makers, the builders, the undertakers, the

scavengers, and the drones, held excited and noisy councils. In place of the regular subdued murmur of the hive that told of the even tenor of work, there were countless jarring sounds in different keys and of varying intensity. Among the laws of the hive known to every worker, was the one that said : a queen-bee may swarm if she cares to, while, if it be the will of the community to supersede her, and she does not swarm, she may be put to death.

Very quickly the vast numbers gave their decision and divided themselves up. More than twenty thousand decided to swarm, while the rest elected to remain where they were and appoint the strongest of the young queens to take the old queen's place. All through the hot summer night various plans were discussed. Only the fanners upon whose labours the air of the hive depended remained constant to their task, while, with the break of day, those who had decided to follow the old queen to

exile, sent scouts out—north, south, east and west—to look for a new home. After deciding where the swarm would light, the queen-bee waited anxiously for the midday. The cries of her imprisoned daughters in their guarded cells awoke in her every now and then short, sharp fits of frenzy, and but for the restraining guards she would have put the need for swarming beyond further discussion. The spirit of unrest ruled the hive from the honey-cells at the top to the brood-cells below, and to the alighting-board beyond which the bees responsible for the air current still laboured as though they alone were unaffected by the coming change. Whatever happened, the pure air must flow through the hive, and so they worked their tireless wings while their fellow-workers inside the hive —save the few who were busy generating a contrary draught—seemed to have forgotten the call to the fields and all the wealth that awaited their garnering. The morning waxed bright and glorious, the

song of birds and insects penetrated to the heart of the hive, summer called the workers to the field, but for once her summons was ignored by the most of those it reached.

"Prepare yourselves," cried the old queen at last, "it is time to go."

Scarcely had this signal been given, when the clamour died down as though some spirit of peace had descended upon the population. During the next few minutes every bee that had decided to follow the queen filled herself with as much of the hive's store as she could carry. None knew when or where the next meal would be taken or what fortune would follow departure from home. Yet again the old queen called.

"Forward!" she cried, and with a mighty rush some thousands of workers left the hive and circled in the air with a great noise of wings and many shrill cries of excitement, pitched too high for any human ear. Seeing her huge cohort

leading the way, the queen moved steadily to the alighting-board, stretched her wings that had been unused for so long, and rose into the sunny air, followed almost immediately by the retainers who had not left her for a moment.

Behind her came the rest of the swarm, and soon these many thousands of sober workers were playing in the sunlight as though they had never known the meaning of toil. They moved in large sweeping flights much greater than those which served them when they came to and from the fields. As they went round, they sang their own shrill summer song as though they knew that this was for them the one holiday of their life, and that when it was at an end, there would be no further respite from labour until work was ended for all time. At the far end of the orchard a young mulberry-tree had allowed one branch to stretch out beyond all the others, and the gardener had permitted it to remain for reasons best known to himself.

Hither the old queen made her way, the dense swarm moving in large circles round and round her at a pace that made the air as full of sound as sunshine. Gradually the flight of the bees took a circular shape, a living wheel seemed to go round the tree, very large at first, but contracting gradually until in a few moments it had disappeared. In its place there was one long cluster of bees hanging down in some mysterious fashion from the branch of the mulberry-tree itself. The ardour of the swarm had proved of short duration. Once again intelligence had taken the place of emotion, the original problems of life had taken their place in the bees' consciousness. Now they hung round their beloved queen, almost motionless, waiting upon events. Gradually the scouts, absent since early morning, might have been seen following their aërial roads to where the swarm was stationed, and they shrilled the news of their traffic and discoveries in fashion that communi-

cated the intelligence to the stationary swarm.

From the flower garden where he was at work, the old gardener had watched the exodus, and greatly pleased to see that the truants had settled within reach, was moving in leisurely fashion to find a skep in which to hold the swarm. But the skep was at the back of the tool house, and the gardener was no longer active. Many odds and ends had been piled upon the skep, much dust had accumulated in its crevices. So he took up a brush and in most leisurely fashion cleaned it, and then went to the herb garden to gather a few leaves of thyme and other herbs with which to freshen and sweeten the straw, for it was his theory that even a skep should be made attractive and pleasant to the bees. His work completed, he moved at last in the direction of the mulberry-tree. But before he could get within thirty yards of it, there was a sudden commotion. The outer circle of bees began

to fall off and fly around. The circle enlarged again rapidly, the whole swarm was on the wing, and a moment later was heading off across the valley, leaving the gardener to sit down upon a wheelbarrow and wonder audibly. There was no occasion for surprise. While the bees were in their cluster under the mulberry shade, the last of the old queen's scouts had come bringing news of a hive—clean, sweet-scented and empty—in a garden across the valley. She shrilled her tidings of flowers full of fragrance, of a wealth of pollen and nectar inexhaustible, and told how beyond the garden there was a field full of ripening white clover. Such a prospect removed all need for further consideration. Perhaps some shrewd but unscrupulous bee-keeper, knowing that swarming time had come, had made his own preparations for it, and now the swarm was across the river and over the plantation that intervened between their old home and the new.

CHAPTER VIII

THE LIFE-STORY OF A WORKER-BEE

It is interesting and perhaps instructive to turn aside from the discussion of isolated incidents in the bee's life and work and consider the whole life of the worker-bee. We can follow it from the earliest moment of existence as an egg, down to the hour when, with polished thorax and frayed wings, it feels and perhaps welcomes the coming of unbroken rest, the sleep that no call to labour can disturb. As I write I have come to my summer-house with a dead worker-bee picked up in the ditch leading to the river in the valley below. All the organs that contributed in such marvellous fashion to the progress of the community are worn and dried. The splendid organism has fulfilled its service,

and yet I know that less than four months have passed—perhaps little more than three—since the egg from which this bee was born was laid in the hive that stands by the side of the great crab-apple-tree. If you ask me how I know whence the worker came, I would point out the three yellow rings on its abdomen. They are the marks of the true Ligurian bee, and there is but one hive of Italian bees in the garden, the rest of my stocks consisting of the true English breed. Perhaps I never saw this one before ; even if I did of course I could not have recognized her. But I will tell you her life-story without fear of error in any important particular, for I can see that it has not varied in any essential particular from the lives around her. Not knowing her name, we will call her Liguria, after that pleasant country, of rather indifferent repute among the ancients, from which she took her name.

Some three months ago, when the April sunshine was at its brightest and best, the Ligurian queen-bee, guided over the newly prepared cells by her fawning courtiers, dropped the egg carefully into the bottom of the cell, where it remained glued to its place by the aid of some solution with which the queen had covered it. For three days the egg suffered no change. Then it hatched into a small grub, and almost as soon as this transformation was complete, one of the nurse-bees labouring on the face of the comb made her way into the cell and fed the pale, worm-like thing with a thick white fluid known as bee-milk, some wonderful combination of pollen and honey that stimulated all the growing capacity of the larva. For five days, perhaps for six, this feeding went on, not in any haphazard fashion, but according to a fixed plan by which the quantity of food given to each unborn worker is regulated. Moved into a larger

cell and fed on what is known as royal jelly, this same larva would have made a queen-bee, but the food supplied to her in the worker cell, though sufficient to sustain life, was not given in very generous quantities, and so the special organs of the queen were not called into being. By the eighth or ninth day the larva had become a nymph. The top of the cell was sealed; the nymph spun a cocoon and enjoyed rest. Then some twenty-one days after the egg had been laid, Liguria bit through the waxen covering that had kept her warm and snug, while giving her all the necessary air, and emerged on to the face of the comb, a perfect worker-bee, able to no inconsiderable extent to help herself. She was lighter in colour than the rest of her sisters born before her, unsteady on her feet, and uncertain in her movements. But there were nurses at hand to give a few moments to groom and to feed her, and then, because fresh bees were emerging at every hour of

the day, she was left to her own devices. There was food in plenty. Among the brood-cells on the comb, quite close to the cell that had hidden her while she travelled towards maturity, there were open vats of pollen and honey, and of these she took her fill, perhaps retiring to some empty cell when she did not feel quite strong enough to ramble any further over the comb. There was so much work in progress round her that she often found herself brushed aside in those early days, and perhaps became even a little confused by the ceaseless activity on the comb's surface. In a little while her brain began to whisper the secrets of the hive, the instinct to start work came irresistibly upon her and strength came with it ; she joined the nurses and helped the young bees as she herself had been helped so recently, feeding them in the early moments of their extreme helplessness. A few days later some of the full combs

were removed from the hive by the bee-master and two or three frames with a thin sheet of foundation were put in their place. Then she joined the cluster that was busy making wax. The temperature of the hive rose and she found that the rich food of which she was allowed to take such a generous store, was being given back to the hive in the form of wax. For reasons possibly beyond her own understanding, the whole of the wax required was secreted by herself and others of the youngest working-bees in the hive. When at last the supply was sufficient, the temperature of the hive went down and the flow ceased. This part of her life-task was accomplished.

Then her labours took another form. She joined some of her companions in charge of the open stores. She fed the burly drones who could only tire themselves by thrusting their heads into the uncovered vats and greatly preferred to take their food from the worker's tongue.

It was tedious work, but she went through her duties without complaint. Then she passed down to the base of the hive near the alighting-board and welcomed the tired workers as they came in laden with pollen or honey. She would receive the contents of the pollen baskets and place them in the cells, and would even venture a little way into the light to help some tired straggler whose strength was exhausted. So a fortnight or more passed before the instructions of the hive came to her in some form unknown to us and she knew that the hour had come to venture abroad. She made her way into the bright sunlight, and for the first time in her life the twelve thousand facets of her compound eyes were exercised to the fullest extent ; in the dusk of the hive the three simple eyes between the other pair had served all her purposes. It was a startling experience, a fresh revelation, a hint of greater duties to be accomplished.

Now she took a few short flights, always

keeping her head toward the hive door that she might gain her bearings and be quite sure of home. This was a necessary precaution, for there were other hives within a few yards of hers, and at the entrance of each there were guards stationed to keep out intruders. They would be prompt to punish the mistake that brought a Ligurian to a black bee's hive. At last she felt confident, and sailed up into the air probably to see the bee-roads as clearly as you or I would see the garden path. They zigzagged in strangest fashion, for bees in flight love to follow a twisting path, and owe not a little of their safety to a precaution that keeps at bay the swiftest of their enemies. No bird among those that pursue the honey-bee can turn and twist as quickly as the bee itself, nor is there a bird in the air that can boast of such a superb gift of unerring vision.

Liguria's first work in the days of great-

est strength and activity was, as far as she knew, collecting pollen, but in doing this she was accomplishing one of nature's most important tasks by fertilizing the various flowers that attracted her attention. Without her service many a flower would have been unable to propagate its species, and when she came back to the hive laden with pollen, scores of flowers were the better for her labours. Her task as pollen gatherer at an end, she turned to the pursuit of nectar.

Quite early in the morning the hive would send out scouts to discover the state of the fields within a very considerable radius of the garden, and, according to the season, the workers would sail off to the districts indicated. Very often Liguria would pass the black bees who inhabited the other hives in the garden, but the tastes of the British and Italian nectar-gatherers were not identical and they did not work together, even the flower that

tempted the one would be passed over by the other. Only Liguria herself could say how far she went afield or how many flowers she rifled of their store, bringing them in return the ample gift of another life ; or how many times in the course of the day she returned with a little honey-sac filled to the brim with nectar which she deposited in the open vats. A current of air passed over them continually, carrying away excess of moisture and giving the honey its consistency. Finally the workers sealed down the cell that was full to the brim, after dosing the honey with a little drop of formic acid from their sting, the better to preserve it.

As spring moved hot-foot towards summer, Liguria sometimes changed the manner of her work. She would join the fanners near the entrance to the hive and keep her wings moving in time with those of her companions until they generated a current of air that cooled

the temperature within, while, facing them, but inside the hive, another body of fanners was hard at work creating a contrary draught. So it happened that the stream of pure air passed right through the hive. It brought refreshment to the workers resting from their labours, to the queen still labouring over the comb, and to the young bees preparing to issue from the brood-cells. Liguria would work until her tired wings failed her, and then slip quietly into the hive while another of her sisters took her place.

Sometimes she would be instructed to join the courtiers round the queen-mother, and there she would labour for hours, guiding, instructing, coaxing and feeding the queen, who, as far as the internal economy of the hive concerned, was as clay in the potter's hands. Those who know little or nothing about the hive, imagine the queen is a ruler, but it is likely that Liguria and her companions

regarded her as nothing more than the vassal of their collective will, the medium through which the hive's destiny was to be accomplished. They knew it was for them and not for her to say whether worker or drone cells should be filled, and to decide when, for any reason, the labour of egg-laying should be suspended. To bring this about it was only necessary to cease from stimulating the queen, to withhold the stores of rich food and let her feed upon the simple house store. She would then cease to deposit eggs and move contentedly over the comb, surveying her work with what seemed like satisfaction.

Wax-making was over for the season as far as comb was concerned, but when an ugly snail made its way to the hive to be promptly stung to death, it was found impossible to remove the carcass. Straightway the youngest bees were summoned to the task of wax-making: the temperature of the hive went up

nearly to blood-heat, wax was produced in sufficient quantities to cover the obnoxious mass and keep it from poisoning the hive.

Now and again Liguria would be detailed for investigation work. She would be sent out with the sun to sail along over little-known bee-roads and find out what crops were ripening. For the honey-flow was upon the land by now, and so great was the intake, so large the quantity of honey stored, that several combs had been placed in the extractor by the bee-master. In this clever device, the frames, previously uncapped by the aid of a knife made specially for the purpose, were whirled round and round in a metal cylinder. The honey poured out of them but the comb remained unbroken, and the bees received the empty comb and proceeded to fill it again without apparent resentment. They wanted room for honey storage, given that, they were content,

Then the bees decided to swarm, and perhaps Liguria herself was admitted to the councils of those who carried a worker-egg to a special cell and set it in royal jelly, to which doubtless she herself made frequent contribution. Liguria could not have been among the swarming party, for the swarm went across the valley to a neighbour's empty hive on the far hillside. So she must have remained among those that guarded the young queen from her mother and continued the work of the hive after the new queen had taken her nuptial flight, mated with a black drone, much to the bee-master's regret, and settled down to her duties.

Doubtless Liguria felt the trouble that arose from the bad behaviour of the drones who were now enjoying life at it fullest and all its fruits. Perhaps she still took her share in feeding them ; she may have been among those whose business it was

to clean and clear when they had done their best to sully the home. But whatever the work that engaged her, it is certain that it was strenuous and unremitting, and that she ate no more of the hive's store than sufficed to keep her active body in working order. Every hour of the day would have found her occupied. She at least had not indulged in that brief moment of relaxation associated with swarming, and no other chance of taking a holiday, however brief, was destined to come in her way, for the hive produced none of the after-swarms that are the worry of the bee-master's tranquil life.

She had learned something of the changing spirit of the hive, had seen the population grow at the rate of more than a thousand a day until the hive grew so crowded that it was not even possible for all its children to find accommodation. There were nights when some were forced to remain on the threshold, not always in

safety, for a sharp spell of cold would find them dead at daybreak. She had seen the honey-store swell almost to bursting-point, and had used her sting to place a tiny drop of formic acid in as many honey-vats as she could serve in order to preserve their precious contents. Apart from this task her formidable weapon had not been called upon to fulfil any function. All these labours and many others unknown to us had made each hour a day, each day a period of many months, if her life may be judged by the human standard of time.

Now she could not venture far afield. Her labours were pursued in the immediate neighbourhood of the hive, and doubtless their pace was very considerably reduced. Never eating more than was absolutely necessary, she had no reserve of strength; her wings had proved unequal to the heavy strain she put upon them, nor had she laboured in the fields without

many bruises and scratches that served to diminish still further her powers of active work. Still, it was not necessary to serve the hive afield. She could still do good service at home, and so, for a period that doubtless seemed a long one to her though we should count it no more than a few days, she attended to household duties, going back for a time to her earliest work as bee-nurse and taking her place among the guards near the alighting-board. The work of fanning was beyond her failing strength. Then at last the morning came when her wearied limbs refused this office, and she passed feebly over the comb to the alighting-board and rested there until a strong sun seemed to give her some little measure of renewed strength. Finally she rose again in flight, not seeking the familiar bee-paths over which she had flown so gaily in times past, but winging her way with a certain effort over a road she had not traversed since the far-

off days—for so they seemed to her—when she had carried dead bees or nymphs to the burial-ground, a little ditch fringed with willows and leading to the larger water that flowed toward the river. It was some little way removed from the garden, and in the times of her activity Liguria would have reached it with hardly an effort. But now her strength could not respond to the call made upon it; she sank down slowly upon one of the spreading leaves of the wild parsley. For a minute or two she rested in the sun that reached the plant's leafy crown, and then, without trouble or effort—perhaps without regret—her little life went out to join the countless millions of lives that have peopled the hive since the days whose memory is lost in the mists that the light of history cannot illumine. And here, her labours over and the season of unbroken rest arrived at last, I chanced upon the frail worn body and carried it away to see

the signs of honourable toil under a magnifying-glass before setting down some part of the little that may be known about her life. Doubtless it was fraught with aims beyond our ken, doubtless it had more significance than we may hope to understand, a significance that some future generation of bee-masters will reveal to a wondering world.

CHAPTER IX

THE STORY OF A DRONE

(A Countryside Study)

In the dim depths of the hive the coming of warm April days stirred the old queen-bee to renewed activity. Throughout the winter months she had passed almost unnoticed among the workers, who no longer troubled to caress or groom her, or digest food on her behalf. She walked neglected, taking her share of the honey stores, and living in a subdued, silent fashion that seemed to belong of right to the season when the flowers had faded, and a large part of the honey that summer yielded in the weeks of its most splendid prodigality had been removed by the owner of the hive. Happily, enough had been left to supply the needs of winter, it

had even been supplemented by a feeding-bottle, placed where a rack of supers had stood. Now when the sunshine had called thousands of the workers to the fields, when all the active labours of bee life had been resumed, the queen's attendants remembered their allegiance, and returned to her service. For a day or two they fed her assiduously, no longer with the common food that sufficed them, but with the subtle mixture of honey and pollen that they themselves had partly digested. As soon as this rich food had roused the special activity that had lain latent for so long, she passed, attended by her crowd of courtiers, over the six-sided cells which had been cleared out and put in order for her. Throughout the day she moved slowly and regularly from one cell to the next, and, while she was fed and stimulated and groomed by her attendants, she laid her eggs at a gradually increasing rate, destined as the days grew warmer and longer, and

the food in the fields increased, to reach more than one hundred in the hour. The most of the cells over which she made her way were of uniform size, but after several days devoted to these, she came to a part of the comb in which the cells were larger than those that went before.

On a never-forgotten day in the past summer, the queen-bee, then quite young, had flown forth into the sunshine there to meet the drone who was the father of all the new year's eggs. But those she deposited in the larger cells were not the fruit of her intercourse with the male, for it is the mysterious gift of the queen-bee to be able to fill drone-cells unaided, and it was only in order that the worker-bees may be born that the queen-bee, on whom the future of the hive depends, sought either love or sunlight. Labour was her lot in life as clearly as it was the lot of those who tended her and those who fared afield.

There were three or four hundred of the drone-cells, and when they were filled, in a little more than a couple of hours, the smaller cells were reached again. In these the queen deposited the precious eggs that were to add to the ranks of the workers. Deep in the heart of every cell the spirit of life brooded in the egg that had been placed there. It brooded and grew, and became manifest to the bee-nurses whose duty was to wait for the hour when a little grub should issue from the egg to demand the measure of bee-milk that would develop the young life to full activity. The bee-nurses knew their work thoroughly, the knowledge had come to them with life itself. For the worker-bees there would be very limited supply of food, and not too generous an allowance of the fresh air that circulates through the hive. The drone would demand a little more, while for the cells that were to produce queens in due season, there would

be as much food as their tenants could swallow. In truth there would be more, so much more that when the queens were released from captivity, there would be some store left for the workers. A queen-grub would almost seem to float on bee-milk.

Spring moved on apace, the brood-cells were filled with countless baby bees. Only here and there the nurses would find no signs of life, and would hasten to remove some still-born bee or white larva from its cell, and hand it over to those of their fellow-workers whose duty it was to remove the dead. These undertakers staggering under a heavy load would fly away to a ditch behind the orchard, there to throw their burden down, for in this hive, as in every other, one strict rule obtained. Nothing was to be left for an hour that might corrupt workers or honey, or taint the current of air fanned by the wings of the countless workers on dutv at

the entrance of the hive. Fifty thousand living things had to find their allotted measure of air and food within the wooden frame.

Buzz, the drone, was one of three or four hundred inhabitants of the drone-cells. But perhaps some young inexperienced nurses in their hurry gave him more than the ordinary allowance of honey and pollen, for he was rather a bigger and stronger drone than any of his companions, more greedy and more insistent upon the service of the worker-bees whose business in life it was, in those first weeks of his existence, to see that he lacked for nothing that they could supply. He kept them busily engaged putting honey into his mouth, his work was limited to swallowing it. The bee nursery occupied the most comfortable, central and sheltered portion of the hive, and, in addition to the food that was given to them, the young drones were groomed and brushed and

kept clean, as they grew up. They received far more attention than fell to the lot of the youngest workers, and were never satisfied.

Before they were many days old, the workers took up their several duties, assisting at first in the care and nurture of the bees younger than themselves, and then receiving from the community their several duties, so that they become scavengers, undertakers, architects, masons, comb-builders, air-guiders, sentries, assistants to the workers, or seekers after pollen, propolis or honey. To each and all their several tasks were allotted, and during those early summer days they fulfilled them to the best of their ability, and were entirely devoted to work, and sought no other occupation.

But for Buzz and his companions there seemed to be no duties, and for days after the workers had settled down to their appointed tasks, the drones remained in

the hives, hungry, dirty, and careless, without any sense of responsibility, but completely content so long as they were supplied with food. In size they were larger than the busy worker-bees, their companions, and they differed from them too in the fact that they were unarmed. Every worker-bee carried a sting, the long, three-pointed, barbed weapon with which a poison gland was associated, but of course of this the drones knew nothing, for the sting was never unsheathed in the hive. The queen-mother carried a sting too, which would be used in the hive in due course, though not against the drones. For all that they were fat and jolly and splendidly attired, the drones were quite helpless, and harmless too, in their clumsy, unpleasant fashion.

The weather became warm and still warmer, the drones grew apace. Sometimes they would stray down to try their wings by the entrance of the hive, that part to

which all the Argosies of workers were coming laden with golden gifts from the fields beyond. They would get in the way of the busy workers, brush against the honey-bees laden with honey or pollen, knock over the ugly burden of the undertakers, disturb the sentries on duty at the entrance. But nobody resented their clumsy ways; they were still fed and cared for, and valeted by the tireless worker-bees.

It chanced one morning that a worker staggered to the alighting-board of the hive, and fell down helpless. The heavy load of pollen in which she was smothered was more than she could carry. When the hive's attendants had run forward to her relief and taken away her store to the treasury, she paused awhile to recover strength before returning to her labours. Buzz sidled up to her. As a rule he and the workers held no conversation, they supplied his wants and took no further

notice of him. Duty rather than affection seemed to be the instinct that prompted them to serve their big blundering brothers. Perhaps this one was an exception to the general rule, for she was prepared to exchange a few words while she regathered her strength. It may be his splendid size and handsome appearance awoke in her some far-off thought or feeling belonging to the days when worker-bees enjoyed domestic happiness. Be that as it may, she did not ignore him altogether.

"Where did you get all that powder?" said Buzz curiously.

"From the lane beyond the field where the sainfoin grows," she shrilled in her high-pitched voice, to which the human ear can make no approach and find no clue; "the white thorn, the crab-apple, the orchis and the cowslip are all a-flower. The day is too short to gather the store."

"Is it as warm and pleasant to work as to stay in the hive and be comfortable?"

"I have no leisure," replied the worker, "to think of the warmth and the comfort. But there has never been a time in my life when the work was more pleasant or more profitable to the home and I must not waste my time. Now I must say good-bye."

So saying, she moved swiftly along the board, paused for a moment on the ledge beyond in order to stretch her wings, and flew away quickly across the countryside, as though vexed with herself for having spared a moment or two from her life's work.

Buzz had grown very restless in the past day or two. The inclination to stretch forth broad wings and to test their worth had been growing in him and his companions. More than once they had taken short flights round the entrance, only to return annoyed by the unending labour in which they had no part to play. They knew nothing of the world beyond, their lives

had been bounded by the cells in which they had been left as grubs to emerge as drones, a cell lined with the cocoons of those who had been born there before them, and now scoured and prepared for the service of another generation. Their first glimpse of the hive had come when they broke their chrysalis skin and fought their way through their cell covering, to lie almost helpless over the comb surface and sup the stores that the nurse-bees gathered from the open vats. Now they knew the hive well and were eager to discover what lay beyond.

On the following day, when the sun was midmost in the heavens, when all the land lay bathed in light and even the song-birds sought the shade, the whole company of drones charged down to the entrance and with one accord sought the open air, flying for the first time beyond the immediate approach to the hive. The work of the colony was suspended for a

moment. The long line of fanners at the gates was broken up, the sentries were tumbled over or thrust aside, and, as many as five and six at a time, the drones made their way into the new world that lay beyond them. Buzz was in the first flight and passed with his companions over an orchard and the white dusty road to a field where the fragrant white clover was rising, and here the rest soon joined him, some three hundred or more in all. Each was using his four wings with keen joy in their strength and all followed the same path in the air, a path with many sharp angles, but one that would lead them back when they were tired of play. High above them their keen eyes, enlarged with thousands of facets, could see long files of their working sisters passing to and from the hive. Those that went and those that came followed the same road, within a few yards of one another, as surely as the traveller follows the path from village

to village, or the train travels over its rails, or the lark pursues his spirals to the point at which he will hang almost motionless in the air and sing his song to the earth that he finds so beautiful. Gay butterflies fluttered over the field, insects of a hundred shapes and sizes added their note to the deep hum of the drones. The hour was given to the mirth and ease of which the worker-bees knew nothing. The drones thrust their helpless heads among the sweets of newly-opened flowers, seeking in vain to enjoy them, or played hide-and-seek among the leaves. A few sat motionless on some spot where the sun could warm them, and gossiped after the fashion of their kind, wondering lazily why the workers sought no advantage for themselves from the flowers they rifled and were content to hurry to and from the hive, as if one of the loveliest afternoons in summer had nothing better to offer the world than work.

Two or three hours passed. The sun was still high in the heavens but its rays were no longer vertical, nor was the warmth so welcome as it had been. Suddenly, with the same unanimity that had taken them from their corner of the hive, the drones rose and flew over the path they had chosen, back to their home. They entered helter-skelter, once more disturbing every worker in their way as they rushed headlong to the open honey-vats, and demanded food in plenty. Then they sought their corner and clustered round the comb and slept right through what was left of the afternoon and through the long night that followed. The labours of the hive continued undisturbed, every honey-bee working as though conscious that its days on the earth were few and its task beyond the possibility of final accomplishment. Neither day nor night offered an hour in which all the toilers of the hive might rest. What did

they think of the few hundred lusty males for whom they must work and clean and be patient and long-suffering as long as summer lasted? Doubtless they knew that the drones were with them for a definite purpose, perhaps they had some glimmering sense of what that purpose might be. Their own little hour was given to labour that left no time for a thought that was not directed to the service of home. Nothing more was theirs than leisure in which to take just as much of the food they collected so industriously as would suffice to give them the strength with which to remain industrious. Summer had no charm with which to abate their passionate industry.

Day after day when the sun was highest, Buzz would lead his companions across the fields, and soon, when the novelty of the first flights began to wear off, he would travel over long distances exploring the countryside in every direction,

while never losing sight of the aërial road that led to home. Sometimes he and his companions indulged in horseplay of the roughest description, sometimes Buzz would follow the huge bumble-bee who lived a solitary life and was well-nigh as harmless as himself, though he lived on nectar and often destroyed flowers in order to reach it. Sometimes he would sail along by the side of some beautiful butterfly and spend an idle hour in vain flirtation, or, down among the flags by the river, he would sit delicately by the sparkling water, or find a seat in the highest branch of some willow-tree while the lark sang high above his head, and countless insects shrilled their little song beneath him. Always before the afternoon was far advanced, or earlier still if a cloud obscured the sun, he returned home again and forced a way through the busy workers, careless of the disturbance he caused, to seek the food they had laboured so hard to collect.

The homeward way was pleasant, over gardens where the guelder rose was in full bloom, over plantations where the wild cherry flowered, across fields starred with eye-bright and buck bean.

One afternoon as he returned to the hive, Buzz found the accustomed peace of the place strangely disturbed, and in the place of the small committees of worker-bees that administered the affairs of the hive, there were companies of excited insects all talking at once in every different mood and key known to the hive. Their voices ranged over a long scale of which every note expressed its own emotion, although to the bee-keeper who listened to the commotion and understood its ultimate significance well enough, the variety of tones was lost —they were all too shrill to reach the dull human ear. Very soon the question under discussion was explained to those of the drones who had been away from the

hive since midday. The queen-bee had discovered that the workers had shifted some of her eggs to queen-cells, and, greatly alarmed and indignant, had summoned those who desired to live in her service to prepare for flight in search of a new home. Some thousands of the workers had responded to the invitation. Others had decided to remain and rear a new queen from one of the cells in which the nurse-bees were feeding the young grubs with all the bee-milk which they could imbibe, and were keeping watch and ward over their young charges lest the queen in her frenzy should destroy them.

Some few drones, fond of adventure, declared that they were ready to share the new home with their mother, but the majority decided at once that they could not be better off anywhere than in the hive, and among those who declined to swarm was Buzz. When on the following morning the discussion increased,

almost becoming a riot, Buzz took no part in it. When at a given signal the bees that had decided to leave the hive drank their fill at the open vats in order that they might have enough to sustain them between the time of leaving the old home and finding a new one, Buzz joined them because he was inclined to be a glutton. But when they all streamed out of the hive with the queen between the front and the rear guard, he remained where he was, completely unconcerned, as though realizing that the swarm had left a store, upon which even his appetite and the appetite of his fellows could make little or no impression. He looked on with complete indifference when the new queen, after returning from some mysterious flight in the upper air and laying a few hundred eggs in the worker-cells two or three days later, was permitted to kill the young queens her sisters who had not yet emerged from the chrysalis. He had

no understanding of the work or policy of the hive, nor any wish to understand. It was sufficient for him that the meadows were warm and sunny, that the games in which he played a prominent part amused him, and that there was no lack of food when he returned hungry home.

Only one afternoon did he receive something like a shock. A big butcher-bird snapped at him as he passed over the willow tops on the plantation by the riverside, and though he escaped through the skill with which he twisted his flight along one of the bee-roads, the attack was alarming, and he flew in a direction he had not followed before, along another of the aërial tracks that only the bee's eye can see. It sloped down to a narrow ditch leading to a broader one that drained the meadow into the river, and as he alighted on the top leaf of some crane's bill to seek what shelter it might offer, he instantly recognized a very old worker-bee

whose appearance seemed familiar ; it was the one with whom he had chatted in times past.

" What are you doing here ? " he said ; " this isn't a nice place. I only came to get away from a big, hungry bird."

" Look," said the worker, directing his gaze to the bank.

He looked as directed and saw a number of bees dead on the ground ; some were still-born, but the most of them were worn thin with labour ; some had even reduced their wings to comparative uselessness by over-work. They had been cast down to rot or be eaten by any creature that cared to devour them.

" How ugly," said Buzz. " Why don't you come out of the shade and fly back to the hive with me ? I am only staying to rest myself."

" I have left the hive for the last time," replied the worker-bee, speaking slowly and painfully ; " I can work no more and

I have come here to die. I could not fly back if I would, and would not if I could, for my work is ended. Leave me and return to your brethren. You have some days yet to live."

"What do you mean," asked Buzz, "by saying that? I am big and strong and happy; I don't work, I have no pollen baskets to carry, I don't make wax for the hive, my tongue can gather no nectar, and yet I am stronger than you workers. My wings are larger, and my eyes are larger, and my voice is louder and more clear."

"It is all one," said the worker-bee. "Live and enjoy your useless life as long as you may, but let me warn you that, as soon as the flowers fade, even before the nights grow cold, and the honey supply begins to fall off, you and all your brothers will die, and your death will not be so easy as mine."

"Who is the enemy?" asked Buzz anxiously. "Is it a bird like the one that

followed me to-day across the water meadows?"

The worker-bee shook her head. "No, it is no bird," she said, "and I don't know that I ought to tell you, for it is one of the secrets of the hive. But I have left it for ever, and if I do tell you, you will not be able to help yourself. There is no escape. Those who will kill every male bee in the hive are their own——"

She rolled over on to her side, dead, the sentence uncompleted, the secret unrevealed. Buzz, greatly disturbed, followed the bee-line to the hive, and did not leave his corner until he had slept the long night through.

By the following morning the memory of his dead sister had faded from his little brain, he fed as greedily as ever and sought his playing grounds without fear.

Midsummer day dawned, bringing the sun to a cloudless sky, after the passing of a few light showers that had cooled the earth some hours earlier. The sights and

scents and sounds of full-blown summer were to be met on every side, and when the drones emerged a little earlier than usual from their seclusion, only the fanners and guards were around the hive. Every worker seemed to be in the fields, though the usual company was passing along the road, laden with pollen and nectar, eager only to yield its store to the hive and return again to rejoice in the wonderful harvest that June had spread before them.

Buzz and his companions took a longer flight than usual, the sunshine seemed to invite to fresh adventures. The road lay across the clover fields that were waiting for the scythe, and Buzz looked in all directions at once—a feat that his magnificent eyes made quite an easy accomplishment. Suddenly a queen-bee, radiant beyond the dreams of any drone, passed swiftly above him, thrilling him through with some strange new sense of the joy of life.

"Follow who dare!" she shrilled as she headed her flight skywards, and Buzz,

with some hundreds of his companions, responded to the challenge and dashed after in pursuit.

Another company of drones was playing in a field beyond them ; the queen's shrill challenge reached them as she passed, and they responded too. Then a third company was roused, and this swarm of drones made a little cloud in the air, as they went in wild pursuit of the queen. Her powers of flight seemed extraordinary to drones quite unused to sustained endeavour of any sort. Within a couple of minutes some of the companies had given up the chase and returned to their play, others followed suit until only a few of the strongest and most determined kept it up. Buzz was among them. He was conscious for the first time in his little life of a sustained power of flight, while a passion that had never wakened till now, dominated him. The queen-bee in his own hive had not roused his interest though he had passed her on the comb a hundred

times. The world below became strangely insignificant and of no account. Rest and ease were past all thought. The one idea that mastered and stimulated him was to outrace his companions and to capture this splendid queen who seemed to keep well in front without effort. One by one his fellows dropped off, beaten, into the void ; of the score that remained in the first two minutes, only five were left, then three, then two—Buzz and another—and these strained every muscle in their body to reduce the distance between them and their desire. The queen mounted higher and higher, as though she sought to make the sun himself her bridegroom. The effort to continue the struggle was telling slowly upon her pursuers, and soon Buzz saw his competitor, after one desperate struggle, sink slowly downward, and he knew that victory was his, while the queen, seeing that only one of all who followed her remained, slackened her pace.

"Welcome, victor!" she shrilled, as

THE CLOSE OF THE DRONE'S CAREER.
In pursuit of the queen.

Buzz sailed to her side. "You have won me from all pursuers, and I am yours if you are prepared to pay the penalty. If you are not, there is yet time: go down while you may to where the hive is waiting for you. I am not to be lightly won."

"I don't understand you," cried Buzz. "This is our own world, I have won you, and you are mine!"

* * * * *

The dead body of a drone fell through space, and a widowed queen-bee sailed back to the distant hive, where she was welcomed with acclamation by thousands of workers who had watched her nuptial flight. In the hive to which Buzz belonged the work went on all undisturbed, there was none to note or care that his place was vacant. But he alone of all the hundreds of drones in the colony had fulfilled the purpose for which the drones were reared.

CHAPTER X

THE AMATEUR BEE-KEEPER

It is time to leave the dangerous realms of fancy and return to the safer grounds of practical bee-keeping, for the romance of bee-land appeals to the few, and seldom to beginners. I have often been asked by friends who have taken up residence in the country for the first time in their life, and are seeking to justify the change in their pursuits, whether they should keep bees, and whether there is a fair sporting chance that the enterprise will prove profitable. They also wish to know *inter alia* whether it is necessary to have any special training to enable them to join the ranks of the apiarists, this last question being generally put in a tone suggesting that if such training is indispensable, they will

seek some other pursuit. In reply I have invariably stated that I do not answer in any way for the qualifications of an expert apiarist. For ten years or more I have kept bees, and for some time was quite content to leave the handling of them to others. Slowly but surely the fascination of the hive mastered me and I began to make attempts, more or less clumsy, to handle the bees myself. Gradually a very important truth became apparent. It is that a very little attention indeed will enable anybody to keep bees on a small scale, though of course the prizes attached to the work can fall only to those who have skill, patience and experience. The experts may hope to derive a substantial profit from their hives in years favourable to the honey-flow, while the amateur must be content to regard his colony as a source of great interest, and a source of sufficient honey for himself and his friends in two seasons out of three. Many bee-keepers

have started work in the rather careless fashion followed by the writer, and have acquired skill with experience, while, year by year, the time they have given to the bee-hive has increased, and the results have been commensurate with the labour. They have discovered a certain sympathy with the hive and its inhabitants, their eyes are quick to read the true story of the colony, their hands acquire a strong, light, steady touch, bees do not resent their approach.

It is one of the charms of bee-keeping that a complete equipment costs very little money. Ten pounds will start the novice with several modern hives and the necessary appliances, and this expenditure can be cut down to half, or even a third, if need be.

Bee-keepers are surely to be reckoned among the kindest people in the world. I have yet to meet the one who, courteously approached, refuses to impart information or give advice. From the old cottager with his straw skep or two in a sunny corner of the garden-patch, up to the

practical apiarist with his scores of modern hives, one and all seem animated by the same idea, and anxious to afford assistance to the man or woman who wishes to join the ranks of bee-keepers, to add to the number of apiarists and the country's supply of honey. To be sure some of the theorists will contradict themselves as though they were expert witnesses giving evidence at a trial. But they all hold certain opinions in common, and these will generally be found to deal quite adequately with the simple troubles that beset the amateur. For the first few years he will be unable quite adequately to deal with the problems of swarming, "casts," queen-transference and disease, and several minor tasks will trouble him greatly from time to time. But happily bees are healthy folk, and it is not often, save in weather of prolonged severity, that the stock will suffer serious diminution through sickness. The bee's sting, though not quite a negligible quantity, will hardly

trouble the manipulator of the hive who wears a good veil and gloves, and uses a smoker. Indeed, when he has learned to move the frames slowly and steadily and to conquer any early nervousness that besets him, gloves may be laid aside and sooner or later the veil will be donned only on rare occasions. If a man is pleasing to bees they will let the hives be handled without seeking to sting, if bees dislike a man he will never enjoy the apiarist's work.

We know now that the bee is quick to respond to the change it regards as inevitable. Slow steady movements, though they seem to disturb a hive to its foundation, alarm the fiercest workers without rousing their anger. When alarmed, they make haste to turn to their honey-store and take their fill, since compulsory migration would seem to be the contingency they have most in mind. In order to face this they must be independent, for some little

time, of the need for food. Well fed, and satisfied that nothing untoward has happened to their well-beloved mother, they show little inclination to attack the careful handler of their hive, although at times, when the weather is stormy, they will sting without provocation. The most experienced bee-man who goes among them then, if he be without veil or gloves, will have ample reason to regret his carelessness. Their action cannot fairly be set down to inherent viciousness ; they are merely "under the weather," and the bee-man who does not care to be hampered with means of defence against attack, has probably learned to find the antidote best suited to his system, for it should be mentioned that, where cures for bee-sting are concerned, one man's cure is another man's irritant. The sting must be extracted, and arnica, ammonia, soda or an application of cold water to the part affected may serve as remedies. Cross-

bred bees are always more angry than the pure-bred ones, and as the queen-bee always mates with the drone from another hive which may be a mile or more away from her own, half-bred bees are more common than pure ones. Another curious fact accepted by most bee-keepers is that a sting from bees in the same hive will affect two people quite differently: one will cease to feel pain in a few moments, while on the other a certain amount of inflammation will be set up. Homœopathic doctors have a medicine for stings: it is called Ledum Palustre; there is an apifuge (Grimshaw's), and there is a modern remedy (Resa) that is applied like caustic. But when all is said and done the gloves and veil are the best things to use, and the amateur must remember always to stand behind the entrance to the hive, never in front of it. In this way the bees will have free access to their home and will remain far less alarmed than they

would if the entrance were obstructed. A bee only stings when she feels there is nothing else to do for the assertion of her rights, and, in the majority of cases, the bee that stings signs her own death-warrant, for the loss of her solitary weapon of offence is very often fatal. It was thought that no bee lived after losing her sting, but modern opinion is opposed to this theory, and reasonably. When a clumsy intruder like a snail makes its way into the hive, the workers kill it with their sting, but I do not think that this action is fatal to them, although the peculiar shape of their weapon with its many barbs would seemingly render it impossible for them to withdraw it without hurt.

Turning now to the necessary equipment of the amateur, he can start with three hives that can be purchased at prices varying from fifteen to thirty shillings. One pound is a good average price for hives

with supers. These will be modern hives with standard interchangeable frames. The straw skeps are of course much cheaper, but are not so useful, though special section racks for use in the time of the honey-flow are now made to be put above them. Gloves and veil can be purchased for half-a-sovereign or less according to the quality of the gloves. Good swarms can generally be bought locally at prices varying from eight to twelve shillings, according to the time of year, or purchased direct from some apiary at a rather higher figure. May is the month in which swarms command the highest price. A book of instructions should be studied, and of these books there are plenty on the market. That helpful and excellent institution, the British Bee-keepers' Association, publishes a useful little guide at the modest price of sixpence, while those who study Mr. T. W. Cowan's *British Bee-keeper's Guide-book*, now in the neighbourhood of its twentieth edition,

will find all the information they are likely to require clearly set out and admirably illustrated, for the modest sum of eighteenpence. When the bee-keeper has become an enthusiast he will turn with delight to Maurice Maeterlinck's *The Life of the Bee* and to Mr. Tickner Edwards' works, *The Lore of the Honey Bee* and *The Bee-master of Warrilow*. There are many other delightful works within reach of the subscriber to a good library, indeed the seventy years that the psalmist allots to man for his span of life will hardly prove sufficient to exhaust the books which have been written round the bee since the days of Virgil's *Georgics*, even if other reading were banned. But, for all practical purposes, modern works are required, since the science of bee-keeping made its greatest strides in the second half of the last century, and many of the theories received before then are now discarded. This truth limits the range a little, but

does not necessarily remove several works of rare interest in which there is much that is true.

Our amateur is now in possession of his hives and of his bees, but unless the summer be well advanced, he must not expect them to provide for themselves. Many a young bee-keeper has started out with every equipment save an artificial feeder, and for lack of this his new swarms have died. We may take it that he will have had the good sense to buy his hive with sheets of foundation in every frame in order that the work of comb-making may be facilitated. But when the hive is empty and the flowers are few, it is impossible for the new colonies to thrive without his aid. A few cans of feeding syrup or some cakes of sugar meal placed above the frames so that the bees can find all the nourishment they may require, will hasten the work of comb-making materially, and will cost only a trifle.

THE SMOKER AT WORK.
Uniting swarms.

No trouble is involved in the feeding, for the feeders may be regulated and made to work automatically, but care must be taken to see that the syrup does not dry on the lid and choke the exit. A Bingham smoker which can burn anything, will assist the amateur in his manipulations, but he must needs remember to use it sparingly, for a very little smoke suffices to send bees to their store. Brown paper will serve very well in the smoker. For placing supers above the frames, small practice is needed, but for the removal of honey from the frames where frames take the place of sections some care is required, and an extractor is one of the most expensive parts of the equipment. A cheap one can be bought for about fifteen shillings, while the best will cost nearly two pounds. But an extractor is not a necessity and will hardly be regarded as an essential part of the first equipment. A knife to uncap the frames is best bought from

one of the firms that make bee-keeping appliances. The late Mr. Broughton Carr's knife is the best. A little set of lenses, which can be bought in a neat frame for three-and-sixpence, adds greatly to the interest of one's observations, and a few glass preserving bottles with tin caps and rims will serve to hold the honey if it is to be sold. For home storage these bottles may be superfluous. Strong stands for the bee-hives can be bought for a couple of shillings apiece, though the hives on the following lists have stands with them, and neat tables for carrying on the work out of doors are cheap enough.

Here then we have all the indispensable equipment of the bee-keeper, and he will have travelled far along the road to progress and prosperity before he is called upon to add to it. He might do well with two or even three spare hives to house swarms, but allowing for them to be modern frame hives as good as the first lot, the original

estimated expenditure of ten pounds will not be exceeded should an extractor not be required. A swarm, if it come in May or early in June, before the season of the full honey-flow, is a considerable asset and worth the added expense of a hive. It should pay for the greater part of the hive's cost in the first season. For the benefit of the reader who cares to accept my estimates for an equipment (I have submitted them to Messrs. Abbott Brothers of Southall, Middlesex, for their approval), I will append to this chapter detailed lists of everything mentioned above, in three divisions, the first for a ten pound expenditure, the second and third for a considerably smaller outlay.

As the bee-keeper moves steadily along the road that will make him a bee-master, he will find other problems presenting themselves to him, only to discover that most of them have been solved by those who have gone before, and that countless

little devices, practical and inexpensive, are within his reach. But it is well to start without too many incumbrances. Experienced apiarists speak smilingly about what they call "bee-fever," an expensive mania that drives the amateur to procure every conceivable article in the apiarist's store and to experiment with it long before he has discovered the proper use. This is a very dangerous proceeding and leads many a man to tire of his hobby almost as rapidly as he became enthusiastic about it. Equipment should keep pace with progress; it should not be allowed to run before it, for the use of delicate appliances is not easy, their misuse may set a whole hive in a ferment and reduce a prosperous colony to despair or bad habits. *Festina lente* should be the motto of the amateur, who should be more concerned with keeping a small equipment in good order than collecting a large and useless one to sell at knock-out prices

NEGLECT.

A cottager's garden in June 1909.

when things go wrong with his colonies and he finds his sanguine hopes have been dashed.

In the arrangement of his hives the beginner must always be careful to see they are not placed in a cold or draughty position, or under overhanging trees from which the rain can drip on to the roof in cold weather. Many apiarists are of opinion that it is well to paint the hives with different colours in order to direct the workers to their homes on their return from the fields. In cases where all the hives in a crowded apiary were of the same colour, young queen-bees returning from their nuptial flight upon which so much depends, have been known to alight on the wrong premises, where they have been promptly put to death by the guards, who would never admit a second queen to the hive. Red and yellow and blue may seem rather aggressive colours to scatter about garden or orchard, but if

delicate tints be chosen the eye will not be hurt and the bees will not be liable to make mistakes even in moments of extreme agitation.

Great care must be taken to see that no vermin can find its way to the hive. Last year the writer hived a swarm in a straw skep ; it prospered for a little time and then attracted the attention of mice, with the result that the comb was eaten during the early part of the winter. When the skep was examined in the spring nothing was left but a few indications of the cause of disaster.

Only one more warning need be given to the amateur bee-keeper in this place: be careful to keep the bees removed from the immediate neighbourhood of the high-road. The man who has several colonies of ill-tempered hybrids within a few yards of the high-road is asking for trouble and is not likely to ask in vain. For reasons quite beyond his ken and his control, something

will occur to disturb the serenity of a colony, which may proceed to attack strangers or horses and do more damage in a few minutes than the entire apiary could pay for in a year of unexampled prosperity. Even stingless bees are dangerous, for they endeavour to atone, by much angry buzzing, for incapacity to hurt, and such a swarm might readily drive a nervous horse to a state of uncontrollable excitement.

The lists following have been revised by Messrs. Abbott Brothers, who are inclined to the opinion that the first one, although it contains nothing superfluous, errs in giving the novice too much to do. They point out that it is well for the beginner to start with one hive and let his outfit grow with his capacity to handle it; in this way he is not committed to a great expenditure, and for his guidance they suggest Outfits 2 and 3 as sufficient for the first season. At the same

time, an additional hive may be required in each case in order to give a home to the swarm that will probably leave the first hive in May or June. If it cannot be hived it may of course be sold locally to some bee-master, who will give from eight to twelve shillings for it, but it will be necessary to complete the arrangements before the bees swarm, and to notify the intending purchaser as soon as swarming takes place. On this basis the cost will be reduced to about two pounds for the second outfit and three pounds for the third, while if the additional hive be purchased in either case, the prices will go up to about £3 10*s.* and £4 10*s.* respectively, but the bee-keeper will have two colonies instead of one. The price of the original swarm is put down at a pound, but this is for one swarm ordered from a leading apiary; if several are ordered the price is less, and if half-a-dozen hives were bought it is probable

that the hive-maker would include some comb foundation without extra charge.

It will be seen that the expenditure of ten pounds will give an equipment capable of yielding three times as much as the outlay of either £3 10*s.* or £4 10*s.* Inasmuch as a full week's practical work in an apiary under expert guidance will give the veriest tyro a working acquaintance with the essential task before him, the amateur who is as prepared to spend ten pounds as five upon the pursuit of a fascinating hobby, should have no reason to regret the extra expenditure. The price quoted does not in any case include the painting of the outer walls of the bees' citadel, but paint is cheap, and it is not necessary to be an artist in order to put two or three coats of colour upon a bee-hive. It is needless to add that the paint must be quite dry and must have lost its original aggressive fragrance before bees will consent to regard it without suspicion

or annoyance. For the scent of bees is very keen, and if they regard a hive as ill-smelling, they will be very prompt to leave it for the use of some other order of creation that is less particular. Many generations have passed since bee-keepers first realized the sensitiveness of bees to evil odours. Old bee-masters writing in days when smoker, veil and gloves were alike unknown, recommend their friends to wash themselves carefully before they approach the hive and to abstain, if they wish to thrive unstung, from strong drink which taints the breath. For the further encouragement of a swarm they recommend that the skep destined to receive it should be carefully cleaned and then rubbed with sweet-scented herbs. This is probably an unnecessary precaution, but is at least a pleasant one, and is followed by many country apiarists to this day. As a matter of fact the bees are quite satisfied with a clean hive and do not demand a scented one.

A LIST OF PRICES

Estimate No. 1.

	£	s.	d.
6 Hives with Supers at £1 . . .	6	0	0
Gloves and Veil	0	10	0
3 Swarms at 15/-	2	5	0
British Bee-keeper's Guide-book, by Mr. T. W. Cowan	0	1	6
3 Artificial Feeders at 1/6 . . .	0	4	6
Bingham Smoker	0	3	6
Knife (Mr. Broughton Carr's) . . .	0	3	9
Set of Lenses	0	3	6
Table	0	5	0
	£9	16	9

Estimate No. 2.

	£	s.	d.
1 Sandringham Hive complete with Stand and Section Rack	0	16	0
1½ lb. Brood Foundation	0	3	9
1 lb. Super „	0	2	10
1 Bee Smoker	0	2	6
1 Veil	0	1	6
1 Feeder	0	1	3
1 Swarm of Bees	1	0	0
1 *Modern Bee-keeping*	0	0	6
	£2	8	4

ESTIMATE No. 3.

	£	s.	d.
1 W.B.C. Hive complete with Stand and Section Rack	1	11	6
Comb Foundation fitted throughout	0	9	6
1 Bee Smoker	0	3	6
1 Wire Veil	0	2	6
1 Feeder	0	1	3
1 Super Clearer	0	2	0
1 Swarm of Bees	1	0	0
1 *Guide-book* (Cowan's)	0	1	6
	£3	11	9

CHAPTER XI

THE DIARY OF A BEE-KEEPER

It becomes advisable now to consider the essential work to be accomplished by the amateur, and the changing season of the work's accomplishment. No attempt will be made to go into elaborate and unnecessary details, and the following hints are for those who, like the writer, have no more than a few hives and a few ambitions with regard to them, who, whatever the yield in golden sections, regard the hive as a medium for study rather than a means of profit. Doubtless the owner or manager of a large apiary would find these hints woefully incomplete, but he will never look to anything like this little work for guidance, for his problems are of far greater magnitude

than those that beset us. He has to make a commercial success out of his undertaking, while we ask no more from the gods than happy, healthy colonies, and a fair store of honey at the summer's end. Although the year is supposed to end with January, it seems better to treat the bee-keeper's year as though it began with April, for not until March has gone, and the first warm days arrive, will the colonies show signs of renewed activity ; the winter silence of the hive is long and deep and seldom broken.

The first thing to remember when the new season opens is that the colonies will have passed through a bad time and will be now at their weakest. While winter ruled, they fed steadily on the stores left for them, coming out for a few minutes when the sun was as warm as it can be in the worst season of the year, for no other purpose than to clean themselves before settling on a piece of new honey-comb. The spirit of prudence which has its

dwelling in the brain of the worker-bee dictated economy. Throughout the long winter the children of the hive took no more of the precious store than was necessary to sustain life in a condition of inactivity—that is, of course, less than would be needed to keep them well and vigorous in working season. Now, in the days of their renewed activity, when the spirit is very willing but the flesh is very weak, liberal feeding is indicated. Sugar meal or syrup must be supplied generously. A large, flat bowl of water filled with cork-chips on which the bees can alight to drink in safety, should be placed within their reach, for it may be that the honey in the comb has crystallized and the colony will be suffering from all the horrors of thirst. Hundreds of bees perish in the spring by braving the rigours of the keen air in an endeavour to bring water to the hive. As the bees will need pollen in considerable quantities and very little is available at present, pea-flour

or wheat-flour may be supplied. The result of stimulating the bees in April is soon seen in the increased activity of the queen-mother, who is filling the brood-comb quite rapidly in a carefully tended hive at a time when her sisters in less favoured quarters can hardly be said to have resumed their active labours. April's work is very short, and there will be plenty of time for the bee-keeper to go carefully through his stores, to see he has all the necessary appliances to hand and that they are in good order. If the weather should prove warm enough it is no bad plan to remove all bees from old hives into new ones in order that the winter hives may be thoroughly cleaned and receive any necessary repairs ; they will then be ready to receive the swarms which will make their appearance in due season. It must never be forgotten that the period of the honey-flow in this country is very brief ; it comes year by

year with a rush, and the bee-keeper who is not prepared to cope with it must needs lose a considerable proportion of his possible profits.

May.—If May be fine and warm—and there is a tradition among men of great age and experience that such a phenomenon as a fine warm May has been encountered in England—syrup, sugar meal and flour can be safely withdrawn and the bees may be left to work out their own salvation. If one of the hives shows several queen-cells—and it is well to inspect the frames twice a week at this season—it may be possible to stock an empty one by means of a simple little operation. Take a comb or two of brood from a prosperous hive, leaving the attendant bees upon it, and put it in an empty hive with a frame of honey on either side. On the following day a ripe queen-cell can be introduced, or a young queen can be put in who will be accepted at once by the bees. The

methods of introducing the queen-cell or queen are rather delicate, and not to be attempted by the amateur without some small measure of expert guidance. But there is a great temptation to make the attempt in May because most of the hives are overcrowded and the bee-keeper is faced with all the dangers of impending swarms. The supers will now be put on the hive and a certain amount of examination must be directed to seeing that overcrowding does not take place. When the queen has been laying thousands of eggs without rest, it stands to reason that the accommodation of the hive will soon be exhausted. It is no uncommon sight to find dead bees on the alighting-board in the May morning, when the hives are very full indeed. When they came back from their work there was no room for them in their home because of the number of bees that were hatched out during the day; so they were compelled to remain outside and the

cold night air was too much for their frail bodies. The removal of full combs of brood or honey and the substitution of frames with wax foundation will often delay a swarm, while the appearance of the acorn-shaped queen-cells must warn the bee-keeper that swarming time is close at hand. Some bee-keepers destroy these cells in order to check or delay the appearance of young queens.

In connection with swarming there are many fallacies accepted by amateurs, who believe that bees are never so fierce and intractable as in the brief hour when they forget their labours, and eddy round in great circles rejoicing in a holiday. Truth to tell, bees are never so harmless as when they are swarming. They can be handled with comparative impunity, you can pick them up as you might pick up raisins so long as you are careful not to squeeze any. The one necessity of the situation from the bee-keeper's standpoint

is that he should be close at hand when swarming takes place. The bees will not go far away at first. They will probably alight on some branch or bush close at hand, but it must not be forgotten that they have sent scouts to spy out the land as Joshua did in days of old, and are merely waiting for news of another home as they cling, thousands upon thousands, round the queen-mother. It is necessary to gather them before these scouts return, and this is an easy task. They can be shaken into a straw skep without difficulty and without danger to the operator, and once in it, can be taken to the hive prepared for them. It is well to put down a white cloth in front of the alighting-board and to turn the new company on to it. If they do not see their way to the entrance immediately, you can take some up in a spoon and put them around the entrance ; you can even take them up in your hand and do the same. As long as

you are careful not to crush them and not to shrink from them as though you are afraid, they will make no attempt to harm you. Be very careful to see that the queen goes in to the new home with the colony ; if anything should happen to her the bees will lose heart, and the bee-master will lose his bees. A swarm has been known to refuse a new hive and to leave it after a few hours, but if the apiarist be a careful worker there is no need to apprehend such a trouble. He has but to see that the hive is clean and in good repair. Then let him take a comb of brood from one of the other hives and put it among the frames with a mere comb foundation, after he has brushed off near the hive the bees that were stationed upon it. When the new swarm finds a clean hive with some brood in it, there is no risk of their desertion. They recognize the duties the brood-comb imposes upon them, duties that nothing would lead

them to evade. It is probable that they would remain in an uncomfortable or dirty hive rather than leave a frame of brood to be deserted. So strong are the poor remains of maternal instinct, or love for the future, in the worker-bee.

Here we have in simplest form a brief account of the method of taking a swarm, and we have presumed that the swarm was an easy one to take, *i. e.* that it had chosen a low branch or bush from which it could readily be dislodged. This is hardly an unreasonable assumption, but the young bee-keeper would be well advised to go and see a swarm or two hived before he undertakes the work without assistance. There is at first a certain amount of nervousness from which experience alone serves to redeem those who handle bees, and haste or clumsiness is fatal to the best intentions. Happily there is no need to go very far in any part of the country to find a bee-keeper ready and willing to give

assistance to the serious student, and even if it should happen that one is not available, the County Bee Association can give all the information required to enable the beginner to get a little practical experience. At swarming time the local handy man who understands bees is always in great demand.

Bee-keeping is now a recognized branch of woman's work, and perhaps the same gifts that make women successful nurses serve them when they turn their attention to the hive. Tact, sympathy and a light, sure touch; calm, resolute movements: these are gifts that are needed in hospital, nursery and apiary alike; and all the agricultural colleges to which women go to learn gardening, dairy-work and the special branches of flower-culture seem to have an apiary to-day, and to find it thriving under the care of the students.

June.—The month of June offers no fresh problems to the bee-keeper. His

vigilance must not be relaxed, and a certain amount of manipulation is necessary to keep the stocks balanced and to guard against overcrowding. No artificial feeding is required save in the case of the new swarms that have yet to make provision for themselves. As soon as a new swarm is hived, the feeding-bottles or the cakes of sugar meal are required. For, although the bees might manage to exist without them, and are frequently called upon to do so by careless bee-masters, they cannot store honey in large quantities, or take fullest advantage of the brief season of the honey-flow if they are compelled to work hard for a bare subsistence, and the honey they will store in one hive is worth a great deal more than the food that will serve a dozen. It may well be, too, that the presence of food store in their own new home will help to satisfy the bees and make them pleased with their new quarters. The labours of wax-making

will certainly be reduced by this artificial feeding, a very important consideration, though one often overlooked.

July.—Now we come to the season of the full honey-flow. It is sad to think that the patient little workers who issued from the comb when April began to fulfil her traditional promises, are all dead. It is no exaggeration to say that in any county of England wherein apiculture is not neglected, those that have fallen by the way and have been forgotten may be numbered by millions. Beyond doubt, every section of honey taken from the store represents the labour of thousands of workers who did not cease from their activity until their frail bodies succumbed to the strain and ceaseless toil. There are no labours in nature for which a heavier tax is demanded as the price of reward, and the honey-bees do not relax their efforts even with a full knowledge —if they possess it—that they will have

no share of its fruits. How many of us would do as much work under the same conditions?

August.—In the south the honey-flow now shows signs of coming to an end, though north of Derbyshire the heather is purpling, and the careful bee-keeper takes full advantage of the brief flowering-time of the heather, the bilberry and the ling, carrying his hives out to the moor-land and leaving them there until the purple glow has passed. South of the heather border and beyond the southern and western areas of the heather, the bees are quick to recognize the impending change. If it is desirable to keep them in full work, liberal artificial feeding must be resumed. If they are left to their own devices, the bees, recognizing a coming change of which no one of them save the queen has any experience, will destroy their own queen-cells, suffer their mother to cease from her labours, and begin to

prepare for the annual onslaught upon the helpless drones. It is a wonderful instinct that warns the workers of a season unknown to them. So long as the honey was plentiful, so long as the drones might be required for the service of some virgin queen hailing from another hive, the big, dirty, helpless male colony was permitted to live and thrive, to feed largely at the open honey-vats claiming the service of the workers themselves; to live in the warmest corner of the hive and seek the fields, to play and not to labour, through the sunniest hours of the brightest summer days. This was the will of the hive, and it was not founded on fear, for the drones, despite their size, are helpless and stingless, and though perhaps they would not work if they could, it must be remembered that they could not work if they would, for all the wonderful developments that enable the honey-bee to work are denied to the drone. While the food

supply was plentiful they were well fed, but the era of economy is now upon the hive, and the first cold days towards the close of August or in the beginning of September sound the death-knell of them all. Some hold that the drones are stung by the workers, but it seems more probable that they are merely driven out, though, doubtless, if they should struggle to retain their place in the home, the workers will attack and even disable them by biting their wings or legs in order the more easily to drive them forth. Sometimes the drones make a virtue of necessity and sail off to the fields gaily enough on the first onslaught, just as though they thought that the bad temper of their sisters was of no account and would soon pass. But when they come back to the hive towards nightfall, the guards, strongly reinforced, bar their passage, and pleadings are in vain. They must remain outside, and the cold air of the

small hours does the rest. Their dead bodies can be picked up by the score on the following morning, some showing marks of ill-usage, while the most would appear to have died from exposure to unaccustomed cold. It is an ugly sight, and reinforces the bee-keeper's belief that bees in pursuit of their destiny are absolutely callous. But, on the other hand, it must be acknowledged that there is no room for drones in a hive during winter, though a queenless stock will preserve its drones long after the passing of the honey-flow, and where artificial feeding is practised the drones enjoy an extended lease of life. The drones were a nuisance in the hive and a hindrance to its work, but they were suffered to thrive until there was no further need for them. When all has been said, the fact remains that the drones' is a merry life ; they toil not neither do they spin. On their journeys to the field they bring to the enjoyments

of the scenes around them eyes that contain in all more than twenty thousand facets, and if their other senses of appreciation are planned upon an equally generous scale, the quality of their life should atone for its brevity. We, who are not asked to support them, to be overcrowded by them, or to clear up the hive when they have sullied it, are inclined to be a little sorry for the drones ; they stand for the joy of life.

September and October.—There is little to do in the apiary just now and comparatively little activity among the bees themselves. Weak stocks may be united on a fine day with the aid of the smoker, an application of flour to the bees on the various combs, and the removal of the weaker of the two queens. The procedure has been described already in dealing with the inspection hive. Supers are removed and in the modern hive the outer case will be found so made that it can fit over the lower

one, adding greatly to the warmth of the winter quarters. The space between the inner and the outer walls may be packed with sawdust or chaff, and it is necessary carefully to examine every hive with special attention to the roof in order to see that it does not want repair. The greater the warmth of winter quarters the better will the colony thrive. The hive must be removed from the neighbourhood of over-hanging trees, and should it stand in the line of cold winds a different site must be chosen.

End of October to the beginning of April.—During these five months the bee-keeper may be presumed to follow the example of the queen in the nursery rhyme who sat in her parlour eating bread and honey. The apiary will hardly claim his attention at all, but its summer produce will find a place upon his table. A small wire cage fastened over the entrance to each hive will serve to keep out vermin and to save

the bees from the attacks of hungry birds like certain of the titmice. These cunning foragers are apt to settle on the alighting-board and tap at the entrance to the hive with their beaks. When a bee comes out to answer the door, they promptly snap her up, and in this fashion many a swarm is depleted during the winter months. If a few fine days that would seem to have straggled from the ranks of departed summer come to the countryside, the bees will be astir around their home to clean themselves, and this indication of renewed activity makes it advisable for the bee-master to put a little syrup above the frames. He must see that water is within reach of the bees in the very early days of spring, but it may be doubted whether in the five months under discussion the work required for the maintenance of a dozen hives will occupy half-an-hour a week. It is of course unnecessary to remind the bee-keeper that he must leave a proper supply

PICKING UP SENTRIES.

A tit-mouse on the alighting-board in winter.

of honey in the hive for winter feeding, that he must not uncover hives in very cold weather, and that the cloths covering the top of the frames must be thick and well fitting. Life moves slowly and painfully within the hive, for the bees have reduced their intake to a minimum, and even the queen feeds herself quite unnoticed and uncaressed. Do the workers know that they must live as best they can on short commons until winter has passed, and must die before the spring is at its best? The autumn-born bee sees nothing of the joy of life, is it well content? Some day we may be in a position to understand.

CHAPTER XII

THE WELFARE OF THE HIVE

If the amateur bee-keeper should be favoured by fortune he may chance to deserve the title of bee-master before he is called upon to face sickness in the colonies under his charge. If, on the other hand, fortune is not disposed to smile upon him, he will have occasion to realize, and to regret, some of the troubles that beset the paths of apiculture. In spite of the fact that bees, from the very nature of their life and work, incur a certain liability to contageous diseases, a good colony housed in a clean hive and living under favourable conditions preserves good health for generations. Sickness is emphatically the exception, good health the rule. This is not so large a term as it might appear to be

until we take into consideration how brief a period is allotted to the worker for her life-work, but it is not without significance when we remember the liabilities incurred at every hour of the day and the practical certainty that contagion must spread. A bad winter will induce disease. Artificial feeding may be attended with disastrous results if the food be badly chosen or its constituents should chance to be unsuitable or impure ; five minutes' carelessness may doom a whole colony to extinction. By the time a measure of experience has been gained, the young bee-keeper will be able to treat troubles as they arise, but for the first season or two of his experience as an apiarist, he will be bound to deal in very drastic fashion with unhealthy stocks, to do things to which his humanitarian instincts take serious exception. The greatest good of the greatest number must be his sole concern, and it may be doubted whether the bee community itself, as represented by

the entire apiary would desire any different treatment for the tenants of a stricken hive. When a worker is useless she must leave the hive, which, for all its elaborate economy, has no provisions for a hospital. Should she not leave of her own accord she will be driven out ruthlessly. Old age pensions are unknown in Beeland. As soon as disease has infected a hive it is best that it should be condemned, and that the unfortunate inhabitants should be treated as country bee-keepers, in the old days when the use of the skep was universal, used to treat their best and strongest stocks at the end of the season : the hive must be carried to the sulphur pit. Nobody who loves bees will condemn a colony without genuine regret—or refrain from condemning it in the larger interests of the bees themselves. For, when we remember how the work of the hive is divided among its inhabitants, it must be at once apparent that the disease affecting

one is more than likely to affect all. The bee-keeper who passes thoughtlessly from an unhealthy hive to a sound one, bearing the same implements with him or even handling the frames with unwashed hands, may spread the disease, whatever its kind, from one hive to another, and sacrifice hundreds of thousands of lives without being able to cure the few thousand sufferers within the stricken area. Sometimes the disease comes from the queen and is inherent in the eggs that she lays ; at other times a chill may bring the trouble about. But there is no time to be lost, for when a colony is diseased and becomes weak, it is liable to be robbed by the bees of another hive. Those of a large healthy stock will make haste to get rich without labour, and this act of robbery is at once liable to demoralize the whole apiary, as well as to carry disease to other hives. Bees like human beings have their faults, though they do not appear to be so richly

endowed with them. They labour to accumulate honey but not out of love of endless journeys and much hard work, and if they can get their honey without labour, they will not go afield for it. The robber-bees know better than to attack a full and prosperous hive, where their shrift would be short and the profits nil ; they prefer to go where the resistance, if any, will be small. Consequently the strickened colony whose ranks have been depleted by sickness invites attack, and the robbers carry off with the honey the contagion that made their victims powerless to resist the invasion. That is why the amateur who finds a colony of bees suffering from dysentery, foul brood, paralysis, or any troubles of which the cause is obscure but the results are unmistakable, would be well advised to sacrifice it in the interests of the healthy communities. Even the comb must go, and when the hive has been quite cleared, it must be scrubbed with water in which

a disinfectant has been put, then placed in the sun to dry and not used again until all chance of infection has passed. It is not always easy to see the signs of disease in the bees themselves, for in the early stages of bee-keeping the owner of the hives combines a certain measure of solicitude with a rather larger measure of respect, and if the bees will leave him alone he is quite content to return the compliment. But a brood frame into which disease has made its appearance may be recognized at once, either by the deeply-shrunken appearance of the cell covers that should screen healthy larvæ, or by the peculiarly unpleasant smell which emanates from the comb. Such remedies as exist at present are difficult of application, and uncertain in result. Only a skilled bee-keeper can apply them with any hope of effecting a cure ; the unskilled practitioner cannot cure, so he must kill, unpleasant though the task will be.

The scientific bee-keeper has learned all it is possible to know down to the present about the pathology of the bee ; his diagnosis and prognosis are alike correct and often interesting. But even he, when faced with the question of a cure, is not very far removed from the scientific gentlemen who sit in receipt of two-guinea custom in the immediate neighbourhood of Cavendish Square, and, though grave and polite, are very often unable to do more for us than explain the nature of our trouble in words of splendid length, fine sonority and meaning that is to us quite obscure.

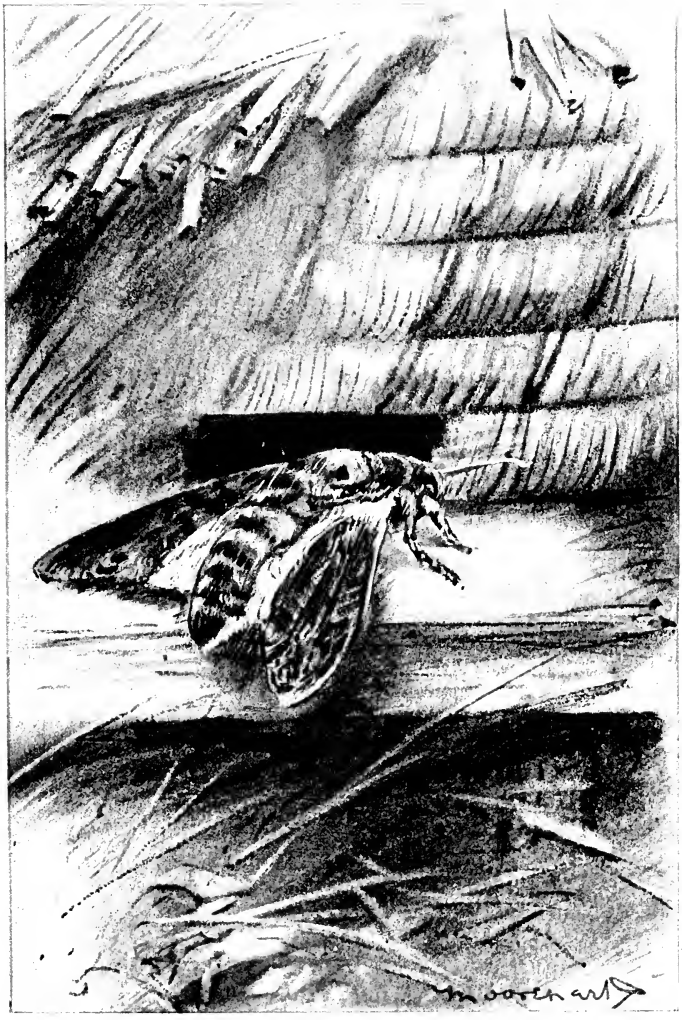
The problem of the robber-bee, hinted at in the preceding pages, is a very difficult one to handle. The hasty bee-keeper who handles his feeding bottles carelessly can demoralize an apiary in a few hours merely by spilling the sweet stuff on or round some hive. Syrup will attract bees from all parts, while if the hive round which it has been spilt should

be a prosperous one, battles royal will ensue, and the alighting-board will be strewn with the dead. To make matters worse, these civil wars spread dissension into every corner of the apiary, they turn the most patient and industrious colony from pursuing the even tenor of its way, and the bee-keeper who ventures among his flock anticipating no evil may find himself surrounded by scores of angry workers ready and even anxious to sting him. These will be the sufferers, robber bees seldom sting.

Although it can hardly be said that anybody has found a cure for robbery, certain things can be done to diminish it, and among the remedies suggested two at least are simple and practical. The first is greatly to reduce the size of the entrance to the hive; this, without greatly hindering the labours of the colony, makes it difficult for robbers to intrude in large numbers. Another plan is to hang in

front of the hive that is suffering from the attack of thieves, a sheet of linen or canvas dipped in a disinfectant : carbolic acid or creosote being the most effective because the bees entertain a great dislike for the smell of both. There are more complicated devices by which robber-bees can be isolated, and any modern reference work will be found to deal at quite sufficient length with one and all. But they are beyond the reach of the amateur. He has yet to learn to handle his flock with confidence, and so it is best that he should be content with the simpler methods. These, while they make no great demand upon his skill, effect an appreciable measure of improvement upon the bad conditions that have arisen.

Disease and robbery are the chief troubles that beset the hive, but it is always necessary to keep a watchful eye on all the houses in turn in order that moth may not intrude, or, if it intrudes, may be promptly removed. The wax



THE ENEMY AT THE GATES.

moth is the worst offender, and she is hardly likely to gain admittance to the hive whose tenants are vigilant and prosperous. Earwigs, snails and wasps, to say nothing of ants, are all to be reckoned among the bees' enemies, and, in the days when the writer kept his first hive, he was interested to find that a toad, well fed and of prosperous appearance, was nearly always to be seen squatting under the alighting-board. Suspecting no evil, he was content to wonder at what looked like some friendship between toad and bees, but one of his neighbours who kept a thriving colony in skeps that looked half-a-century old, happened to come along one evening, and was only restrained with difficulty from immediately dismissing the prosperous toad to kingdom come.

"Do ye don't keep the likes o' they," said the old farmer in his broadest Essex, "do (*i.e.* if you do) they'll eat most all the bees you've got. There ain't nothin' so mischieful no where, an' that's th' truth."

There was no possibility of ignoring such a warning, and not being anxious to face the risk indicated, I picked up the fat toad and dropped him over the hedge at the far end of the garden. But on the following afternoon he was back in his old place, puffing like an alderman after a civic banquet. Three times I removed him and as many times he returned, and then I carried him away, down to the far end of the lane, and dropped him into an orchard where there were no hives. Either the new home pleased him or he was unlike the famous Balbus of the Latin exercise book, who jumped over a wall, apparently to give trouble to schoolboys ; suffice it that the place of the fat toad knew him no more.

Sometimes the magnifying-glass and the inspection hive reveal the presence of a little parasite that troubles bees. But it does not appear to do much harm though it is an unpleasant thing to look upon, and in any case the individual bee stands

A SNAPPER-UP OF UNCONSIDERED TRIFLES.

right beyond the scope of our polite attentions. The safe, sound rule for the beginner, is to keep his hives clean—not as easy a job as it might appear to be, for the propolis so dear to the honey-bee is a very difficult thing to remove. But if we persist and shift the stocks from winter quarters into clean hives in the spring, cleaning the spring hives before they are required for swarms, many of the troubles apt to come in the way of the careless bee-keeper will be avoided, and those that cannot be avoided will be less serious than they would if they found a dirty hive awaiting them.

It must not be supposed that every trouble besetting the hive is at once apparent to the bee-master. For no reason within his knowledge a swarm will dwindle, the sounds which betoken contentment and steady work will fail, and the spirit of the hive will be depressed for no very obvious reason. Dead bees will be found on the alighting-board, the

brood-combs will not make their accustomed progress, and the conscientious bee-keeper will be perplexed. In such a case he will do well to satisfy himself, in the first place, that the hive itself is in a sound condition, that the entrance is clear, and that no vermin can gain admission. Then he should see that the hive is not in the line of any cold wind, that it looks to the south or south-west, and is not unduly shaded by trees. He must examine the frames to see if the queen is pursuing her labours, and should he have reason to suspect that her fertility is exhausted, he should replace her by a younger and more vigorous one. If he has been unable to raise his own queen he can always buy one from a good apiarist, and it is well to change the queen stock from time to time in order to introduce new blood, though it is well to remember that half-bred bees are inclined to be unruly and quarrelsome. He must remember that when a young

queen takes her marriage flight she may meet with some accident on her journey, and unless she can fulfil her mission successfully, the strength of the hive will dwindle. It happens often in the early spring that the stocks are very weak and the workers cannot face their labours in cold weather, though there may be plenty of nectar and pollen to reward them in the fields round the hive. Artificial feeding may reasonably be kept up until the weather is quite warm, and at very little trouble and trifling expense the hive should remain healthy and prosperous. Some bee-keepers will remove the frames from a weak hive to a strong one. But this is a risky proceeding, for if the weakness is due to some incipient sickness, the strong hive will be infected. The beginner would do better to consult an experienced bee-keeper in his neighbourhood and content himself, pending developments, with seeing that the surroundings of the hive are as

healthy as possible. If only one colony is affected it is safe to presume that the trouble is a local one ; if all his stocks are weak and the work of the bee garden is not thriving, it may be economy to send for an expert from the nearest reliable firm of apiarists. Those who have lived among bees for years have a certain instinct to help them. They can go right to the root of the trouble, suggest the necessary remedy and, if necessary, carry it out. Prompt attention will often avail to restore the colonies to health and put the amateur in the way of solving some of his more difficult problems for himself when next they arise.

The bee-keeper must strive to find the happy medium between too much attention and neglect. He must not treat his hives as though they were toys to be played with in and out of season, for the bee community is doing serious work and must not be made restless by frequent

disturbance. On the other hand, it is very necessary to know what is going on in the hive, to see that the bees do not build or at least do not fill too much drone-comb, that they do not rear too many queens, and that the hive does not get overcrowded when swarming time approaches. If there are one or two spare hives in the apiary a very simple device will avail to postpone swarming.

Choose a warm, sunny day when thousands of workers are in the fields. Remove from the overcrowded hive three-quarters of the brood-cells, being careful to see that a queen-cell or two attaches to them, and put them in the spare hive with their attendant bees upon them. Fill up both hives with new frames, each with its sheet of comb foundation. There will be sufficient workers in the new colony to carry on the work and raise a new queen, and in the evening when the toilers come back from the field, they will help to fill

the depleted hive that has been their home since birth, and, secure in the presence of the mother bee, will continue their work, deputing a sufficient number to make new cells. They will not feel strong enough to swarm, for the cells must be made before the queen can lay her eggs in them and three weeks must elapse before young bees are born. A careful watch must be kept upon the other hive filled with the old brood-comb, in order that the bee-keeper may satisfy himself that the young queen born to the new colony takes a successful flight and returns home ready to fulfil her great task in providing the hive with hundreds and thousands of workers in the years to come. If the new queen does not thrive he must remove her, send for another and place her on the brood-comb in a little wire cage. As soon as the bees realize that their old mother is no longer with them they will receive the stranger with due attention and good-will.

CHAPTER XIII

HOURS IN THE BEE-GARDEN

We have dealt hitherto with bee-keeping on what have seemed rather practical lines, bearing in mind the claims of profit and loss and considering, as far as we have been able, the business side of the bee-master's work. Now let it be confessed at once that the profits of bee-keeping are the least attractive side of the pursuit to all save the professional apiarist, who runs his flourishing colonies with one eye on the bees and another on his balance-sheet. Thousands of people in these islands keep bees without thinking of profit or loss. They do their best by their colonies and are quite satisfied if sufficient honey is forthcoming for their own needs and for gifts to friends who cannot keep bees for

themselves. They take at least as much pleasure in making the gift as the recipients can hope to gain from eating the honey which will never have for them the same mysterious quality it has for the apiarist to whose successful work it is such a charming tribute. When you come to know those who own a few hives and run them in practical fashion but without troubling about the cost, you will probably be told that the owners have passed some of the happiest hours of the year in the service of their pets, that they regard bee-keeping as the most fascinating pursuit within the reach of simple lives. The apiary, however small, however modest in its equipment, adds largely to the pleasures of late spring and summer. The work that must be done is always full of interest and often associated with some little reward for the observant eye. It has the additional charm of solitude: you cannot take a company of friends among your hives, or

the most of them will retire hurt and will regard honey with suspicion or dislike for the rest of their lives. You have the added sense of grave responsibility; to the bee world under your care you are playing the part of a minor Providence. If you work skilfully and conscientiously, the colony will be a happy one; if you are careless, you will throw them into a confusion from which they will not recover. He who has half-a-dozen hives in his charge may be exercising control over more than a quarter of a million living things, and surely it is no small achievement so to handle this mass of life that it fulfils its destiny under the most favourable conditions. The bee-keeper will doubtless have read a certain number of books that have a practical value and some that have a fine quality of tempered imagination, but, though such works may have stirred him deeply, he will find that the reality is far more fascinating than any descrip-

tion of it. Words are poor substitutes for facts, as even we who live by setting words down must be prompt to admit, and even a Maeterlinck can hardly thrill the devoted bee-keeper as the hive itself will thrill him. Nature has decreed that our work in Beeland shall be carried on for the most part under the best conditions that the year knows. In the first place, the season of the bee-master's activity is spring or summer; secondly, he is required to choose the happiest hours. Cold wind or driving rain, close thundery weather or those seasons of sudden chills in which the English spring loves to indulge, may all serve useful purposes, but they are a warning to leave the hive alone. Only when Nature is at her best, when the sun is shining and winds are warm, when field and orchard are a-flower and bees are almost as musical as birds, will the bee-keeper devote himself to his pleasant labours with the sense that he at least has

"time and the place and the loved one all together." Not only is the world around him at its best and brightest, but the very essence of the season is stored and in process of storing under his eyes. It seems almost possible that the pleasure with which the enthusiast tends a hive has something of the quality of joy with which a mother tends her children. To those who have never kept bees such a statement may savour of exaggeration, but ask the enthusiast who does keep them, and if he be a truthful man—as every conscientious apiarist must be—it is very doubtful whether he will dismiss the suggestion as unfounded, though he may not have seen his labours in that light before.

The hive brings us into direct touch with Nature. Some of her most mysterious processes are hidden within the frame and will be revealed to the patient observer. At certain seasons of the year life wakes in thousands of cells—literally

in thousands—day after day, and with no less steady hand death presses upon the worker. But for all the ebb and flow, the toil continues, the original intention is pursued, and we find ourselves face to face with the problems of a world in little.

Even as it is with the hive so it is with ourselves. We are controlled by larger destinies. Our hive is a star. We see more of these stars than the eye can count in the heavens above us, and know ours is smaller than most. There are times in the bee-master's life when hive and star are curiously, mysteriously alike.

Surely the hours move nowhere more swiftly or silently than in the bee-garden, and if the human worker have but a little skill and a little patience, he may move for an hour or two among his colonies without creating any disturbance. He may even feel that he plays an accepted part in Beeland. He learns in time to know by the sound that issues from the hive if all is

well within. For although he may not hope to understand all the varied calls that communicate the thoughts of bees to one another, he has mastered the essential cries. He knows the sound that tells of peace, of happiness and prosperity, the sound of distress and alarm, and the shrill note of challenge that tells of rival queens and swarming time near at hand. The peculiar music of Beeland becomes irresistible after a time, and even the most practical apiarist, the man who sells sections by the crate and swarms by the dozen, will be found moving furtively in the direction of garden or orchard on a late summer night merely to hear the sounds of the hive and see the fanners at their ceaseless work under starlight almost too faint to reveal them. People who keep pets—horses, dogs, birds, even cats—will not find it easy to obtain as much in the way of interest from half-a-dozen animals as the bee-man can secure from one

hive, though he will of course obtain from them the personal recognition that the bee extends to none.

The worker-bees may claim to have charmed the world from the very earliest times. From Virgil down to Maeterlinck we can trace the influence of their labours on poets and men of letters, and Virgil is very far from being the first to take the honey-bee seriously. Among the ruins of Karnak in Upper Egypt one may find the skep pictured in the history of the lives of kings, and the date of this pictorial representation is more than a thousand years before the time of Virgil. But apart from those who have set their admiration down, there must be countless thousands who have had the will but lacked the capacity to do so. The lovers of the bee have been legion, and, although there are more books written about bees and the hive than all the books written about the other insects put together, we

probably have not a tithe of the works that would have been written had ability and inclination run in double harness. Those of us who have travelled through the countryside, have met scores of men who can hardly write their own names and have had no education, but are yet able to wax eloquent about the bee. They have acquired a measure of knowledge well worth preserving, and the ability to conduct their operations with the quite unprotected straw skep. They enjoy complete immunity from harm because the bees, as they come and go, recognize them as friends.

The love of mankind for bees is responsible for his wide knowledge of them. It may be doubted whether we know as much of the life of any living thing. Generation after generation has striven to enlarge the boundaries of observation, and though much remains to be accomplished and the path to additional knowledge is a hard one to pursue, the work goes on

quite steadily. Every apiarist is consumed with anxiety to find a solution for one of the problems that puzzle him and his colleagues. To make our interest harder to understand we have but to recognize the undoubted truth that the individual bee, whether queen, worker or drone, is one of the least sympathetic of created things. It is the aggregate that interests, the work that is accomplished, and the manner of its accomplishment. We admire the love and affection the horse and dog bear to their master; no bee seems to have love or affection for anything. Among our own species we acclaim those who help the poor, tend the sick, love their brothers and sisters and honour their parents. Among the bees it may be said with safety that no worker, drone or queen ever saw its own father, and the honouring of the mother ceases as soon as she is of no further service to the hive. Young queen-bees can be heard challeng-

ing their mother almost before they are released from their cells, and no young queen would hesitate to kill her parent if she had the chance. It often happens that the old queen destroys her daughters, and we know that she loves the dreadful task, and frets and fumes until she is permitted to accomplish it. As far as the sick and helpless are concerned, no mercy is shown; the broken-down worker is cast out of the hive if she has not used the poor remains of her strength to fly away in search of her own grave. The drones are tolerated just as long as the food supply is superabundant, and there is a reasonable chance that one will be required for the service of the queen from another hive. As soon as there is any real concern about future food supplies, the drones are murdered by their own sisters, and the most harrowing sights known to the apiarist do not seem to move one of the tireless sisterhood to

compassion. Even the bee-keeper cannot look without pity upon a little crowd of tired drones pleading for admission at the gate of home, and kept out by their well-armed sisters, who know perfectly well that exclusion spells death, and will not shrink from active murder if they get the chance of accomplishing it.

If the workers are not lovable it can hardly be said that the queen-mother herself advances more claims upon our affection. She is perfectly ready to destroy her own offspring, and takes a savage delight in so doing. If she has any sense of compassion she has hidden it from those who watch the hive. She works like a costly machine, with no more perceptible emotion than steel or iron. When she ceases to be the fruitful mother of a hive, she is promptly discarded and sometimes put to death by the workers, who ring her round in living walls and suffocate her. There is something almost

unpleasing about the queen's attitude to the hive and the hive's attitude to her, nor is it easy to find in the one word duty a satisfactory solution to all the problems that are stirred by observation of the life of the queen-bee.

Of the drones much has already been written, and with every effort to be just it is found well-nigh impossible to say a good word for them. Greedy, dirty, careless of the comfort of others, the drone is indifferent to everything save his own food, warmth and play time. Claiming the care of others as a right, and making no return in any shape or form, giving one out of hundreds to perpetuate the life of some distant hive, the male bee, handsome, feckless idler as he is, makes neither appeal nor response to our emotion. We admire his appearance and envy his wonderful gift of sight. We realize that he enjoys the best of the summer in fashion probably unknown to most of the life around him, and we have

a measure of pity for his unhappy ending, the significance of which we find it easy to fathom. But the facts remain: neither queen, worker nor drone has a lovable nature ; each and all do things that offend or pain us, and yet we turn to the bee colony again and again for interest, instruction, refreshment and many varied emotions that the individual bees can do nothing to excite. And we know that these same feelings or similar ones have been aroused among human beings for many thousands of years. They date back at least to the times when Upper Egypt was part of a great and thriving Empire, and the straw skep stood upon its platform in gardens whose owners could see the scarlet ibis walking in security along the banks of Nile.

You may not understand the fascination of the hive at present, but when you have kept one for a month or two and handled its frames half-a-dozen times and seen the

supers filled with their golden store; when you have heard the song of the workers, the buzzing of the drone and the shrill cry of the queen-mother, you will realize that you have discovered a fresh pleasure in life. You will learn to forgive the bees for having a moral code that is not yours, for their seeming cruelty to one another and their apparent indifference to that which we hold most dear. You will become aware of the truth that neither your imagination nor your moral code comprehends every form of vital activity. You will find out a striking resemblance between the life of the hive and the life of humanity that directs it, the resemblance lying in the ceaseless work to no apparent end, and the labour for fruits of which the labourer is not often permitted to enjoy more than a small share. You may see, too, that the hive has solved some of the problems that beset mankind, that it achieves the good

of the greatest number, that the children are the property of the State, that those who do not work are destroyed, and that, if the needs of the unborn generation require it, thousands of workers will leave the home they have built and the riches they have stored, and go afield to find a fresh home and accumulate another store. You may see, too, that the ideals of the hive are carried too far for any race established on this earth to follow, and that before humanity could adopt the theories that rule in the hive, it would need to alter its point of view altogether and admit self-sacrifice to the highest place in its councils.

It has immense value to us, this strange object lesson in ideals and working plans so foreign to our own. We find it hard enough to accommodate our Western minds to the strange idealism of the unchanging East. We find the cultured Englishman brought into contact with

the civilization of Buddha, Confucius or Mohammed, changing his point of view from one of pitying contempt to one of profound reverence, and learning through experience to widen his mind, enlarge his sympathies and develop the saving grace of humility. But some men who have travelled no farther than to the bee-hive in their garden or orchard, have contrived to learn a greater lesson still. They have given up their early ideas, and realize that the forces swaying what they have been accustomed to regard as the lower orders of life are at least as strong, vital, persistent and withal obscure as those that rule their own. It is not the beauty of a summer day and the exquisite accompaniments of the season that create and sustain the bee-keeper's interest ; it is his glimpse into a new and strange order of things ; his revelation of a world within a world, one that admits neither hope nor ambition nor individual achievement to the good things

of life, but replaces them all by a sense of duty, and an unflagging pursuit of labour. We have seen that the spirit of the hive does not end with the accumulation of its golden store. We owe to it no small proportion of the flowers that live their little life in the fields, and the fruit that ripens on the orchard trees. Certainly our debt to the hive is one it were hard to over-estimate.

CHAPTER XIV

THE ROAD TO KNOWLEDGE

MANY centuries have been required to develop our knowledge of the bee to its present imperfect state, and though much remains to be understood we can claim at least that hundreds of old-time errors have been laid aside never to be revived. One of the earliest published statements about bees involves what we are bound to regard as a very serious error. If we turn to the Book of Judges, to the fourteenth chapter and the eighth verse, we read that Samson after going to visit a daughter of the Philistines in Timnah and killing a lion that roared against him in the path, returned along the road. "Then he turned aside to see the carcase of the lion; and, behold, there was a swarm of bees in

the body of the lion, and honey." Samson ate the honey and invited the Philistines to unravel the riddle : "Out of the eater came forth meat, and out of the strong came forth sweetness." This story has puzzled apiarists ever since bee-keeping became a scientific pursuit, for we know that no bee will go near putrefying flesh, and in a hot country like Palestine, as the writer can testify from personal observation, a carnivorous animal left by the roadside becomes unapproachable in a few hours. Corruption treads on the heels of death. It is well-nigh impossible for the most devout believer who chances to know anything about bees to credit the statement that they would accumulate honey on the dead body of a lion, and no apiarist will be surprised to learn that the Philistines, some of whom may have kept bees, were quite unable to solve the problem. It may well be that the original Bible text was obscure and in this way a curious error has

been handed down, for the bees that will store honey under the conditions described in the Book of Judges are unknown to the modern world. At the same time, it may be mentioned that all the early references to bees are couched in the most extravagant and misleading terms, and an element that may almost be termed magical is introduced into bee history. The ancients assured us that bees were born from the influence of the sun on rotting carcases. The early Egyptians are said to have buried oxen in the ground leaving only the tops of their horns showing; the horns were then cut off level with the ground and great swarms of bees were at once forthcoming. The chief of the bee colony was supposed to be a king, not a queen. Honey was not collected by the bees, but fell from heaven as manna fell upon the children of Israel on their journey through the wilderness. Young bees issued fully born from the mouths of parents, as Pallas Athene is said

to have issued from the brain of Zeus or Aphrodite from the foam. There was no union among the bees, love-making was unknown. They did no more than work, though why work should be necessary while honey fell from heaven, the ancients forgot to inform us. Virgil in his *Fourth Georgic* has much to say about bees, and a reference to Gaston Boissier's fascinating volume *The Country of Horace and Virgil* shows us that the villa of the latter poet was established in the heart of the honey land. Even to this day, as the writer can again testify from his own experience, there is no more delicious honey than is yielded by the hives ranged upon the slopes of Vesuvius and Etna, and, if the ancients did not understand any of the truths that later generations have unravelled with so much care and pains, they wrote at least with the keen appreciation for beauty that is such an effective substitute for mere knowledge. Surely one would rather have

written the *Fourth Georgic* with all its errors than any dull treatise through whose pages the patient reader is pelted with hard facts.

Long centuries added their quota to the errors that Aristotle, Varro, Pliny, Virgil and others had accumulated, and the bee-keeper had to wait for the seventeenth century, when a Dutchman named Swammerdamm brought the microscope to the service of the hive and established the fact that the ruler, or rather the living force, is a queen and not a king. Réaumur followed, and towards the latter end of the eighteenth century François Huber, a blind man, did what is perhaps the greatest work in the history of discoveries that pertained to the hive. To a German clergyman we owe the first movable combs; then came the famous Langstroth hive and the discovery by a German scientist that bees would welcome an artificial comb foundation. These developments brought profitable bee-keeping within the reach of all,

and gave the lie to many of the accumulated errors that still clung round the path of the apiarist. But improvements, developments and new truths were for the few and not for the many, and in days when the majority of bee-keepers did not add reading to their accomplishments or books to the equipment of their house, progress was necessarily slow. The history of agricultural and horticultural pursuits the world over is one of laboured progress and giant stupidity. Errors manifest a tendency to become hereditary articles of faith, and doubtless those who wish to introduce innovation meet with small favour. It sufficed the old apiarist to rely upon the straw skep that served the ancient Egyptians. He knew that under ordinary circumstances this skep was safe to yield a certain amount of honey, and he would not venture lightly upon improvements that would involve him in work with which he had no familiarity. Hodge

regards the world beyond his ken with suspicion. Then, again, there was no authority to teach him, for nobody leads a more secluded life than the agricultural labourer who, in a remote country district, uses the skeps that served his father before him and sacrifices his best bees annually at the end of the season of the honey-flow. Indeed to-day, when a reliable guide-book may be bought for sixpence and a frame hive for half-a-sovereign, there is still a great difficulty before the various County Bee Associations in reaching the cottagers and the very old-fashioned small holders whose brains belong to the generation before last. It may well be that half-a-century hence there will still remain bee-keepers in this country who rely upon the straw skep and regard the use of the sulphur pit as an annual necessity. Though there will be reason to regret this waste of life and labour, it must be remembered that these old folk will be doing no more than

maintain a very old tradition. For we know that these islands have been recognized as a great home of honey from times long prior to Julius Cæsar's invasion, and in the early Anglo-Saxon days there were at least three national drinks in which honey played a prominent part. They were mead, morat and pigment. The first is made by adding water to comb from which most of the honey has been pressed, and may still be obtained in rural England ; the second is made of honey, water and mulberry juice, and the third of mixed honey and spices.

It must not be thought that Great Britain has not dealt very liberally with bees through the medium of books. A glance at the catalogues in the British Museum reveals an immense mass of material, but for the most part the proportion of truth to fiction in these early works is that of the bread to the sack in Falstaff's famous tavern bill.

We at least have every reason to believe that future generations will not look with amusement upon our own views of the apiary, for they have been reinforced and confirmed by countless independent observers. The whole practice of bee-keeping has been passing of late years from those who simply regard the hive merely as a honey store, to the better-educated classes of the community that regard the hive as a medium for mental as well as physical refreshment. We can calculate within a little the results of honey-flow upon a given number of hives in good years and bad. We can reduce the unprofitable labours of the worker-bee to a minimum, and guard the colonies against most of the accidents that would have been fatal half-a-century ago. The experienced bee-master knows quite well what he is likely to find when he lifts the cover from a hive. The mysteries of the ancients have been solved, and, oddly enough, the solution has done nothing to

diminish our wonder or our admiration. Years ago a poet wrote some very beautiful but misleading lines—

> "When Science from creation's face
> Enchantment's veil withdraws,
> What lovely visions yield their place
> To cold material laws."

The poet was quite mistaken. We know now that if a humble apiarist could afford to go to the expense of purchasing an ox and burying it under ground, leaving only the horns exposed, he would no longer believe that great swarms of bees would result from cutting off the horn-tips. He knows that honey does not fall from heaven, and stories of the other phenomena regarded with so much sound belief by our forbears do but amuse him. We, who claim more knowledge, understand that most of the wonders of the hive are under our own control. We view with some approach to complacency the various

problems that remain unsolved, happy in the belief that we are rapidly approaching their solution. Perhaps the greatest of all problems before us to-day is concerned with enlarging the scope of the hive, persuading colonies to unite and work under two or more queens, thereby adding very greatly to the strength of the hive and the quantity of honey stored. Year by year the difficulties narrow down, for in a world so full of intelligent apiarists as ours is to-day, the reward attaching to any new invention of great significance would be hard to overestimate. We labour, too, with the knowledge that bee-keeping is only in its infancy. There is ample room in these islands alone for thousands of hives yet unbuilt and millions of bees yet unborn. We know that the food they store over and above what is required for their own need will be of great value to the race, while the lessons that the hive teaches are bound to

have even a better result upon human intelligence than the delightful collection of fairy tales and fables that has played such a considerable part in the old-time history of the honey-bee.

Richard Clay & Sons, Limited, London and Bungay.