

BEE STINGS

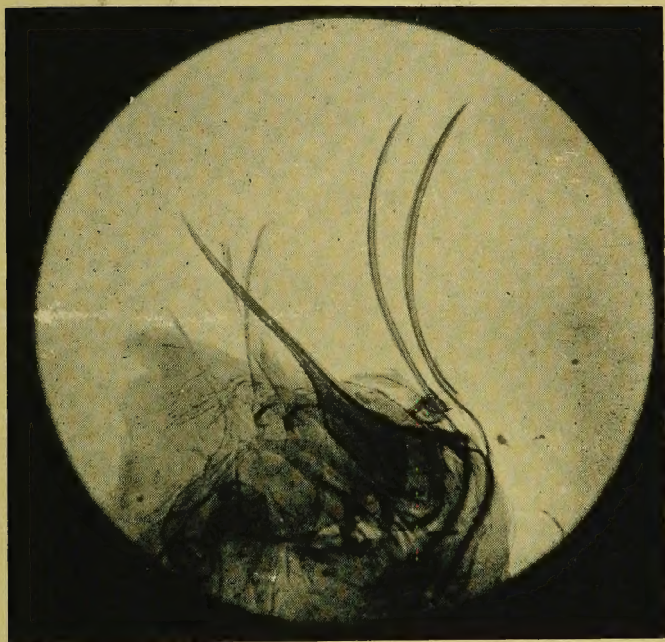
and how to avoid them

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By

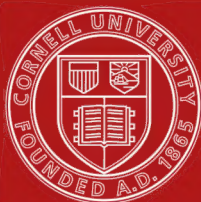
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Bee stings and how to avoid them.



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THE ROYAL STING

(Facing page) The queen's sting, highly magnified, shewing the various parts separated for identification. The two curved lancets are clearly visible springing from a mass of muscles which operate them. To their left is the sheath with the dark mass of the pouch at its base. The tip of the sheath is seen lying across the two palpi.

BEE STINGS

and how to avoid them

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with a FOREWORD by

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FOREWORD

It has been a pleasure to read this little book wherein the Author has assembled much information about bee-stings, and arranged it into such a natural sequence that the knowledge it conveys is driven home as subtly and surely as was ever the venom of the sting itself.

Between the real dangers of stings and the imaginary terrors with which they are enshrouded a nice balance is maintained, and even the most timorous will gain in fortitude as they read and learn that if bee-keeping is not all honey, neither need it be a torment.

The marvellous mechanism of the sting is portrayed in a manner to encourage those owning microscopes, or even strong lenses, to study it for themselves, and a more satisfactory subject would be hard to find: the novice will see enough for pleasure; the skilled will be puzzled to see everything. It is this feeling of wanting to discover more and more about bees which bids welcome to this little monograph.

A. L. GREGG.

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PREFACE

GETTING stung is usually the beginner's worst fear and swarms his biggest worry. All through his bee-keeping life they tend to hamper his enjoyment of what should be a pleasant occupation.

Curiously enough, although the weapon of torture has itself been described in detail by many, yet not much has been written on the subject generally. How to avoid getting stung with the maximum of efficiency and pleasure is the purpose of this little book. My special thanks are due to Dr. A. L. Gregg for his valuable help and suggestions, to Dr. J. S. Faulds for his kind assistance, and to the late Mr. J. Spiller for the photograph which forms the frontispiece.

To my wife, who has suffered so much while nobly grappling with erring swarms and nasty-tempered bees, I gratefully dedicate this book.

INTRODUCTION

MOST beginners find it surprisingly easy to get stung, but on the other hand it is not at all difficult to avoid this painful process with a little thought and care. Usually the dread of a sting, especially the first one, is sometimes sufficient to prevent some folk starting at all. The fear of it, however, is the worst part.

For instance, unless blood is perceived on the hands or elsewhere, it is quite possible to cut oneself, when busy in the kitchen, without knowing it, or even while shaving. Yet a self-inflicted wound of the same calibre would cause intense pain. This is to a certain extent true of bee-stings, for quite often when working with the bees one is stung without being conscious of the fact, or at worst noticing the prick and forgetting it the next instant in the absorption of one's task. To reach this stage, however, one has to become immunised to the venom injected into the body from each sting.

The beginner may begin to feel very dubious at the prospect of being stung, but let him not be deterred at the outset by this possibility, likely though it is. By taking sensible precautions and following the advice of older bee-keepers, the number received will be greatly minimised and soon it will be found that the fascination of the craft grips him as powerfully as it does practically every bee-keeper irrespective of the stings that he will inevitably receive from time to time. In fact, it is not too much to say that reaping the honey harvest is no more to be dreaded by the prospect of being stung than gathering roses through fear of the thorns.

Incredible though it may seem, a certain bee-keeper of many years standing, who possesses several hives of bees, has never yet experienced a single bee-sting. This extreme example is illustrative of what can be achieved by using reasonable care and common-sense precautions.

The purpose of this little book is to show that although for the average bee-keeper, stings are probably inevitable, yet they can with good handling on the lines indicated later, be reduced to a bare minimum.

To be a successful bee-keeper it cannot be too strongly emphasised that the best course is to achieve immunity and to acquire it as soon as possible. For this purpose, the beginner is well advised to allow himself or herself to become stung through the hands, where the skin is not quite so sensitive as in other parts of one's anatomy.

This may sound harsh advice but it is good counsel, and as explained above, the ordeal is nothing like as unpleasant as it is sometimes imagined to be. The first sting is the worst, but when it is then found that it is not so terrifying as was expected, confidence is restored. The new keeper of bees can then go forward into the craft with less trepidation, and with that expectation of pleasure at being able to handle bees dexterously that is the reward of every careful bee-keeper.

1. The sting is necessary for the bee to defend its home.
2. Drones do not possess a sting.
3. The worker's sting is straight, the queen's is curved.
4. The piercing portion of the sting comprises three parts, the sheath and two lancets.
5. The venom is supplied by two glands and has a complex constitution.

CHAPTER I

OF BEE STINGS

EVERYONE knows that the bee possesses a sting, but it is the bee-keeper who is more likely to enjoy intimate contact with her weapon of defence. He should, therefore, endeavour to understand something of its nature, anatomy and its manner of use. More particularly he should learn how to avoid irritating the bee into using her sting.

However much we may deprecate the presence of a sting it should not be overlooked that in its natural state a bee is often hard put to defend its home. This is usually in the hollow of a tree, or possibly an even more exposed situation where robbers of all kinds, from bears to wasps, can gain comparatively easy access. Even under domestication the bee's right to defend its home, and above all, its hardly-won winter stores upon which the survival of the colony itself depends cannot be disputed. It is, in fact, desirable for otherwise the honey harvest would soon become common property among the denizens of the field were the bee to lose her hereditary weapon of defence. It is, therefore, up to man's superior knowledge and mastery over living creatures to circumvent such comparatively light hazards that he may enjoy the fruits of the bees' industry.

Painful though the results of a bee sting may be, they are not harmful to human beings, except in a very few cases only, and recovery is usually quite soon. On the other hand, the bite or sucking of some insects, even though scarcely noticed at the time, may entail serious consequences, as for instance, malaria from the bite of a mosquito.

The sting itself is described and illustrated with great detail in so many of the text books on bees, that the reader who wishes to study its anatomy at greater length should first peruse Cheshire's beautifully written classic¹, followed either by Snodgrass' somewhat scientific treatise² or Herrod-Hempsall's popular works³.

The beginner can, however, with profit, learn much himself by a careful study of the posterior end of a bee. In the first place, it should be remembered that he is studying Nature at close hand—with a realisation of the purpose and meaning of this important organ.

With a little dexterity and practice, a bee may be picked up by its thorax, and the manner of the sting in operation may be observed with safety—try handling drones first, if need be. The outraged creature will not hesitate to use the subject under study and a tiny thin reddish-brown pulsating object will be seen. On closer exami-

¹F. R. Cheshire.

²R. E. Snodgrass.

³W. Herrod-Hempsall.

nation, a wee drop of a clear liquid will be perceived exuding from its tip. This is the poison. If a magnifying glass is available, a more thorough and closer examination of this painful weapon may be undertaken and its action studied.

A microscope is however essential if a more detailed study is desired, either of the sting or any other part of the bee's anatomy. If one is not possessed, resource should be made to the Hon. Microscopist of the local bee-keepers' association. (Every bee-keeper worthy of his name and craft is strongly advised to join the nearest association, for it leads to better kept bees and bigger honey harvests.) It will invariably be found that the microscopist is only too willing to show slides and explain the various functions of the objects examined.

On comparing the sting of the bee with the similar organ of other insects, it will, after consideration, be realised that its location and relation to the internal anatomy of the bee shows it to be the ovipositor. This is the means whereby the egg of the female when laid is guided from the posterior end of the bee to the place where it is to be laid, *i.e.*, the base of a cell. It will, therefore, be evident that for this reason the sting, as found in the queen bee, is almost as Nature originally intended it to be, but in the case of workers whose sex organs are atrophied or useless, the ovipositor as such has been developed into a weapon of pugnacious defence. For the same reason, it will be apparent that neither the drone, nor in fact the male of any insect species, such as wasps for instance, are equipped with a sting. They may therefore be picked up with impunity and studied at leisure. It should be noted that it is only the more highly developed species of the insect world that possess a sting and in the lower orders whose ovipositor is adapted to meet the various requirements of its owner, it is never found in sting form.

The queen's sting is curved and is seldom used either for attack or defensive purposes, except possibly when she is contending in a duel to the death with a rival virgin or queen in defence of her right to be the queen-mother of the colony. A mated queen invariably succumbs to a virgin in such a contest, for reasons given later.

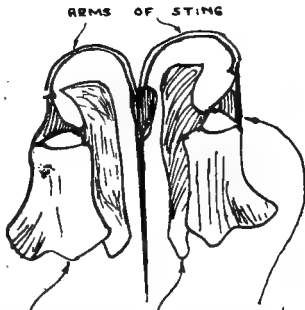
Just as a gun is not composed only of its barrel, but comprises an under-carriage, loading, sighting and firing mechanism as well as the recoil system and other features, so the bee's sting does not consist solely of a single sharp spike which is stuck into her victim when required. Instead, it is a complicated structure composed of a number of beautifully designed members which, working together, form the whole intricate organ.

Broadly speaking, the entire structure is composed of three component parts shown diagrammatically in Figs. 1 and 3, which are as follows:—

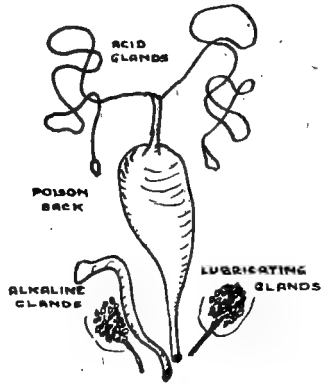
Component parts of sting, Fig. 1.

- (1) The sting proper.
- (2) The operating mechanism.
- (3) The poison supply.

These are the main essentials, but it should not be overlooked



QUADRANT OBLONG, AND TRIANGULAR
PLATES TO WHICH MUSCLES ARE ATTACHED
FOR LEVERING FORWARD ARMS OF STING
OPERATING MECHANISM



GLANDS

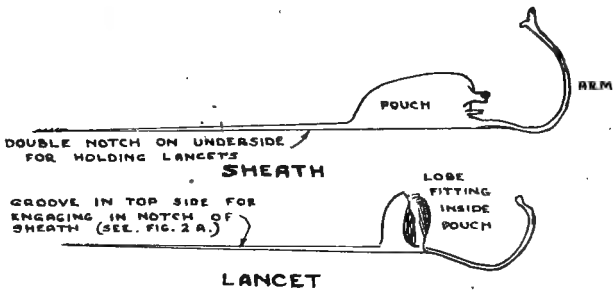


FIG. 1

COMPONENT PARTS OF STING

that the nervous system is also informed, and has a controlling interest in all sting operations. Although the brain is linked through the nerves to this organ, it is problematical as to how much actual control is vested in it directly. Owing to the muscular action of the sting being reflex, this duty is probably entrusted to the fifth abdominal independent nerve centre or ganglion, located at the end of the main nervous column. (The fourth ganglion in the case of the queen.)

In the position of repose, the sting and the palpi, which will be described later, are housed within a cavity known as the sting chamber, in the tip of the abdomen and are projected through the opening in its extremity when brought into action. The anus or bowel opening of the intestines also terminates at the same place, and the tubule forming these organs lies alongside the sting, but is not connected to it except by membranes further inside, so that the latter is able to operate freely.

The worker's sting, which is about 1/16th of an inch long, is very loosely attached by membranes to the inside walls of the abdominal tip within the sting chamber (see Fig. 3), and is therefore quite easily torn out. When the sting is driven into a firm substance, such as human flesh, the barbs on the tip of the sting anchor it, and if the bee is hurriedly brushed aside, as most people do to it when stung, the unfortunate bee is knocked off her sting, which remains behind firmly embedded in flesh. As the membranes surrounding the basal end of the sting also enfold the end portion of the intestinal canal or the lower part of the bowels, the latter are easily severed, and the sting, together with the poison sac and glands, as well as part of the bowels themselves, are all rudely torn away from the sting chamber in the tip of the abdomen. As might be expected, this grievous wound to the bee is fatal, and the unfortunate creature languishes for a while before finally dying of her wounds.

Thus it is not true to say that because a bee stings, she thereby forfeits her life. That this is not so may easily be demonstrated by allowing a bee whose sting has been plunged into human flesh, such as the back of the hand, to remain undisturbed. Occasionally the shock of finding herself firmly anchored is too much for her and she makes frantic endeavours to get away. The membranes of the sting organs are so loosely attached, that they become ruptured by her struggles, and she drags herself to liberty at the ultimate expense of her life.

Generally, however, the bee that finds herself in this predicament is not quite so rash, and she makes efforts to liberate the embedded organ. This she achieves by turning and twisting her body so that the sting is loosened in the wound, and eventually permits the bee to withdraw her sting intact and fly away unharmed to use her weapon again another day.

Sometimes, however, the enemy into which she has plunged her weapon may have a scaly or horny skin, such as another bee. Although she may have slain her adversary by a skilful thrust into

a vulnerable joint with the subsequent administration of a heavy dose of poison, the bee may now find herself securely attached to the body of her victim and be unable to liberate herself. In such circumstances, the victor succumbs to a lingering death, and the vanquished is revenged through her own dead body.

(1) *The Sting*. Coming now to the first of the three main parts mentioned above, we can study the structure of the main shaft itself. The material of which it is composed is a substance, called "chitin" by entomologists (pronounced ky-tin), and is widely used in Nature for a variety of purposes, and especially for the hard parts, in the bodies of all insects. The whole of the bee's hard external casing, its limbs and wings are made of this material as well, for instance, as the wing casing of creatures like beetles, ladybirds, and other kindred forms of life.

The sting when detached from the body of the bee, an easy achievement, and then examined under a magnifying glass or hand lens has the appearance shown in the frontispiece. It will be seen that it is composed of a tapering shaft which at the top or basal end swells out to form a conspicuous lump or projection called the pouch, the purpose of which will be revealed in a moment.

This delicate shaft, so slender and yet so rigid, is most scientifically designed, forming a complex whole so wonderfully contrived and is characteristic of all the working parts in the anatomy of the bee. A careful study of it cannot but make one appreciate the beauty and purpose of Creation, and the realisation that life is not just a haphazard happening of blind chance.

It is constructed of three main portions, each of which contains an internal hollow as shown in Fig. 2A, which is the view, highly magnified, as seen when the sting is cut through at right angles.

The main upper portion is called the sheath, and the two lower ones are known as the lancets. All three are interlocked together by a groove in each lancet which fits a similarly shaped ridge in the sheath, and this arrangement extends along the whole length of the sting, thus enabling each part to slide up and down without coming apart, during the actual operation of stinging.

The sheath and the lancets diminish in size towards the end, and each is equipped with a sharp point armed with a number of little barbs (see Fig. 2C) which project from the side like the tip of an arrow. It is these projections which anchor the sting firmly when it is inserted into the body of an adversary.

It will be seen that the two lancets enclose a space between them which forms a channel down which the poison flows and emerges from a cleft in the tip as well as from minute openings below the barbs. So slender is the sting and so strongly yet delicately proportioned that the finest needle point resembles a hedge-stake by comparison (see Fig. 2B).

It will be realised that the poisonous liquid would have difficulty in flowing unaided through such tiny passages and moreover owing

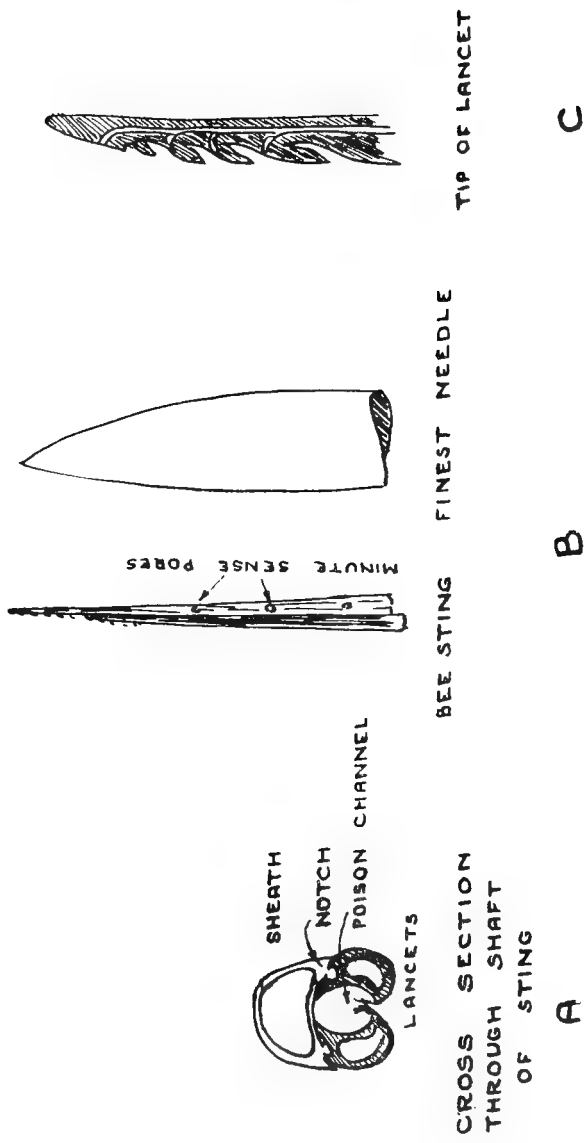


FIG. 2

to the rapidity of the different parts in action it is essential that the venom should flow quickly. It becomes expedient therefore to introduce a pumping force to accelerate the flow. This is the purpose of the pouch already referred to which can be seen so plainly towards the base of the sting. Inside this chamber are two collapsible pouches like lobes, one of which is attached to each lancet. With the movement of the latter, venom is drawn in from the poison sac and swept out into the main duct between the lancets with a reciprocating action in the manner of an ordinary force pump, and from there it is driven into the wound through the openings already mentioned, there to do its fell work.

The reflex character of the operating muscles can be better understood by observing the pulsating movement of the poison sac left on the shaft after receiving a sting on the hand. The body of the bee must, of course, be removed. The poison sac can be clearly seen, even by the unaided human eye, expanding and contracting as it forces venom through the lancets and into the wound. This throbbing movement can go on for quite ten minutes after separation as it is controlled by the independent nerve centre or ganglion which accompanies the sting mechanism when it is torn from the bee's body.

This clearly shows how important it is for the sting to be removed from the wound as soon as possible, and not allowed to remain there a second longer than necessary. The whole action forms an ideal subject for study through a hand lens whose magnification is not too powerful.

So far as the queen's sting is concerned it resembles in general that of the worker bee, but it possesses several marked features of difference. To start with, its main shaft is curved downwards, and it is very securely attached to the abdominal walls. This latter difference has been clearly revealed by P. Rietschell⁴, who stated that a force greater than one-twentieth part of an ounce would tear away the sting of a worker, whereas in the case of a queen, the same organ would withstand a pull equivalent to a weight of about one ounce. (The actual figures given originally in grams are in avoirdupois weight, 0.06 oz. and 1.0 to 1.2 oz. respectively.) The queen's sting is moreover somewhat stouter in build and possesses a slightly greater depth of penetration, while the barbs on the lancets are much less prominent than in the case of the worker's sting.

An excellent illustration of the survival of the fittest is found in the fact that the venom in the poison sac of the queen tends to solidify with age, and her sting as a weapon, therefore, becomes less deadly. Thus in a struggle to the death between two queens, the younger one has the odds heavily in her favour, and her virility will without doubt give her the victory to the ultimate gain of the colony she will head. The life of the colony is of more consequence than the fate of an individual bee—even the queen. The sting's

⁴P. Rietschell in *Deutscher Imkerfuhrer*, Feb. 1938.

chief function, however, is to assist the act of ovipositing, and with the aid of the sting palpi, the egg is guided from the vent down the sting and into the cell. Nowhere is this action more faithfully or clearly indicated than in Herrod-Hempsall's study of the subject, and to whom tribute is due for this contribution to our greater knowledge of the bee's anatomy.

Under a high power microscope tiny pores forming sense organs may be discerned in the shaft of the sting proper.

(2) *The Operating Mechanism.* At the end of the sting furthest from the tip, the sheath and the two lancets are together curved upwards and outwards (see Fig. 3), and at their extremities they are firmly secured to a number of rigid plates which act as levers and as anchorages to the muscles (see Fig. 1). To these are attached the various muscles which acting under the control of the nervous system bring the whole structure into operation when required. All these several parts are neatly folded and packed into the confined space of the sting chamber in the last abdominal segments. One of the most advanced and complete descriptions of the sting mechanism was given some years ago by that able and painstaking investigator, R. E. Snodgrass⁵, of the American Bureau of Entomology.

The sting is manipulated as follows. First of all the tip of the abdomen is bent down. Then, through the operation of the muscles, a lever action on the base of the sheath moves it out of the sting chamber and forward between the lancets enabling it to be inserted a little way into the victim until the barbs at the tip hold it firmly. The two lancets are then also projected down and entering the puncture formed by the point of the sheath, make the hole a little deeper. Their barbs in turn hold them secure while the sheath is again driven forward, the lancets following suit in due course, and being worked alternately. This action continues until the shaft is buried right up to the pouch, a depth of penetration which is, in fact, little more than one-twentieth part of an inch. All the time this rapid movement has been in progress, venom is being pumped down the main channel and diffuses into the wound through the various openings in the tip.

And here should be mentioned another point in the design of the organ. A reference to Fig. 2A will show the intimate contact that occurs between the lancets and sheath, and in view of the great slenderness of the sting it would be exceedingly liable to buckle if excessive friction were to be set up while sliding motion was occurring over such a length. This difficulty also is ingeniously overcome by the provision of a number of microscopically minute studs or projections distributed along the length of the grooves or rails uniting the lancets to the sheath and preventing too intimate a contact. Furthermore, they act as distributing points for an oily liquid from a special gland which is fed into the base of the three main

⁵R. E. Snodgrass. *The Bee World*, Jan., 1933.

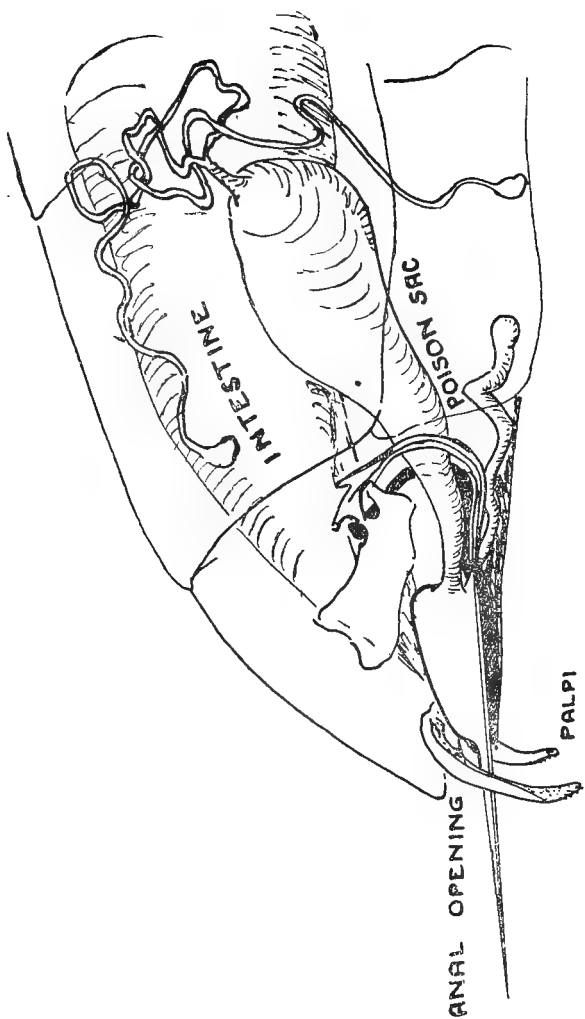


FIG. 3

TIP OF ABDOMEN SHEWING STING IN POSITION

parts of the shaft where they come together above the pouch, thereby ensuring free and easy movement over the long contiguous sliding surfaces.

(3) *The Poison Supply.* Capable though this complicated weapon appears to be in its design to inflict a cruel wound, yet so far as human flesh is concerned the mechanical incision of a sharp point a tiny fraction of an inch into the skin is insufficient to cause more discomfort than a light prick. The painful and unpleasant after effects are due to the poison which is rapidly pumped in as long as the sting remains ensconced in the wound. This is the reason why the sting should be removed as soon as possible afterwards, and not allowed to remain there a second longer than necessary.

The source of venom originates from two organs known as the acid and alkaline glands respectively, which manufacture venom from the blood. The acid gland feeds into the conspicuous poison sac, which acts as a reservoir to hold a large supply for use when required, the mouth opening direct into the pouch from whence it is pumped as already described. The acid gland itself consists of a thin tube which just before it feeds into the poison sac divides into two parts, the ends of which terminate in a well defined lobe (Fig. 1). It must be remembered, of course, that all these parts as well as the structure of the sting itself are all minutely small and a microscope of appreciable magnifying power is required to study all the finer details. In the case of these tubules forming the acid gland, careful dissection shows them to be of great length. They intertwine around the intestinal organs, and even embrace the outside of the stomach. In the case of the worker, this gland is actually $1\frac{1}{4}$ inches in length, and in appearance is like a fine white thread. The same gland in the queen is as much as $1\frac{1}{2}$ inches long.

The other gland secretes a liquid which is alkaline in its reaction, and its shape is quite different. It is comparatively short and takes the form of an opaque white tube with slight surface corrugations, and it feeds direct into the pouch.

The presence of the third set of glands should not be forgotten. These are the lubricating glands already mentioned, which consist of small oblong white cells lying against the quadrant lever plates for manipulating the curved arms at the base of the sting shaft. Their secretion is poured upon these plates and from these it finds its way down into the grooves between the sheath and lancets. Thus the ingredients of all three sets of glands ultimately merge into the venom which is emitted from the bee's sting.

The composition of this venom, so powerful in its action, contains a number of highly complex ingredients the true nature of which still remains to be definitely established. Members of the medical and nursing professions who wish to study bee venom and its treatment in greater detail are referred to F. Thompson's account⁶

⁶F. Thompson. "About Bee Venom," *The Lancet*, August, 1933.

Many learned scientist have investigated the chemical structure of bee venom and its reactions. Of these the best known is by Professor F. Flury of Wurzburg, who in 1920 analysed it as follows:—*

- (1) A nitrogenous compound of the indol series.
- (2) Choline.
- (3) Glycerine.
- (4) Phosphoric acid.
- (5) Palmitic acid.
- (6) A heavy fatty acid.
- (7) A lightweight fatty acid—probably butyric acid.
- (8) A non-nitrogenous portion which represents the active part of the venom and is probably a cyclic acid anhydride causing inflammation and blisters.

Bee venom also contains 1 to 1½ per cent. of histamine.

The origin of these various ingredients with respect to the supplying glands has not been determined, nor the nature of the chemical reactions, if any, which take place when the two poison supplies unite to form venom. The effects of bee venom on the human body will be described presently.

All these constituents combine to form the powerful poison which is the venom of the honey-bee. The amount of each ingredient varies with different kinds of bees and indeed is not even constant in nature throughout the season. It has, for instance, been suggested that the sting of the Italian bee is milder than others. Whether this is so under comparable conditions has yet to be proved. The poison develops with age and in young bees, therefore, very little venom is available until the poison glands mature. This point should be remembered when handling bees. An emerging bee is practically free of poison, but it quickly develops during the next few days. The generation of venom increases until about the fourteenth day. After that it remains constant, but later begins to deteriorate with advancing age. Up till the period when the bee does guard duties it is able to replenish any supply of venom used up in stinging. After that age she is unable to make good any loss.

It will be observed that formic acid which is so often stated to be a constituent part, and according to some experts a major portion of the venom, is in fact entirely absent. This feature also disposes of the attractive story (which can be further disproved by visual observation) that the bees insert their stings through the capping of sealed honey, and inject a drop of formic acid so as to provide a preservative.

In the queen the venom is slightly creamy, and with advancing age becomes thicker and congealed so that it cannot flow. This

*The latest analysis of bee venom, is given in the *E. African Medical Journal*, Vol. XIX, 1942.

explains why, as mentioned earlier, an older queen is usually unable to inflict a mortal wound on a more youthful adversary, although this is not always the case and occasionally age triumphs over youth.

The venom as it emerges from the worker's sting is quite clear and colourless, possesses a pungent odour, and has an acid reaction. The amount actually injected is very variable, as for one thing it depends on how long the sting is in action, and the time left in the wound. In any case it is exceedingly minute and is probably less than one ten-thousandth part of an ounce. That so small an injection can have such a severe effect on the human body is a measure of its potency.

The Palpi Sense Organs

In conclusion reference must be made to the so-called palpi sense organs. Primarily they consist of two extending objects resembling a couple of hairy tails attached to the oblong plates and in the position of repose they lie snugly in place alongside the sheath, acting as a kind of scabbard to the latter.

The extremities are equipped with sensory hairs, and according to a number of well-known experts, past and present, these organs are used by the bee to ascertain the nature of the surface to be stung before using her sting on a hard object. Having satisfied herself as to its vulnerability she then proceeds to bring her sting into action as described.

In point of fact no such process takes place, as a careful examination of the bee's sting in action will clearly reveal. Moreover, it is common knowledge that an infuriated bee will attack instantly. There is no question of stopping to investigate the suitability of the surface, and angry bees have often been observed to attempt stinging such unyielding material as the nozzle of a smoker.

In seeking an explanation of these facts one must go back to Nature and remember that in the case of the queen she is a fully developed female of the species. So she uses her sting principally as an ovipositor employing the sting palpi like two hairy fingers that grip the egg and impel it forward and down the shaft of the sting towards the base of the cell as mentioned earlier.

Because the worker is not a perfect female her sex organs are atrophied, and the need to use her sting as an ovipositor has waned in favour of developing this organ as a weapon of defence. It is a natural corollary therefore that the use of the palpi in egg laying has also become redundant and they have in consequence no doubt degenerated.

It should not be thought that because the bee does not use her palpi to determine the suitability or otherwise of an object to be attacked, that she is therefore in ignorance of the nature of the material upon which she stands. The hardness or quality of surfaces is indicated to the bee through the legs, and the fore-tarsus, or foot,

is elaborately equipped with various nerves and senses including even taste organs. There are, however, special tactile sensory processes found on the foot, and elsewhere, of course, upon the body, which take the form of short hairs, sensitive to touch, and these supply the bee with the necessary information.

Thus the reader who has followed through the various processes and anatomical features of the sting may perhaps be comforted when next stung, at the thought of the complex organisation which has been brought into play to accomplish the deed.

1. Bee venom increases in its potency towards the height of the season and possesses marked curative properties for rheumatism.

2. Personal susceptibility to being stung varies among different people. Ninety-eight per cent. of those stung react normally to the effects of bee venom.

3. Body aroma should be reduced as far as possible.

4. Frequent stinging enables the blood to build up anti-venom which in a few years affords complete immunity from normal effects.

5. When stung remove the sting immediately. Apply carbolic lotion later to allay irritation, and in severe cases seek medical aid without delay.

CHAPTER II

OF THE EFFECT OF BEE STINGS

Direct effect of a sting. It is extraordinary that a drop of bee venom so minute in quantity should have so marked an effect on the bulk of the human body when one considers the relative proportions of the two. It is a measure of the potency of the venom. If the insertion of an almost microscopic droplet* into some eleven odd pints of blood can produce great pain and sometimes giddiness, the devastating effect on a creature very much smaller can well be imagined.

Thus other insects such as flies, or bees themselves when stung, perish in most cases almost instantaneously, and a mouse has been known to succumb within a few moments. Bees are not immune to their own venom, but a sting received from a fellow bee is usually delivered through the main nerve chord of the body, thus greatly intensifying the effects.

Normally in human flesh which is not accustomed to bee stings, the result of a single injection of bee venom causes firstly, immediate pain due to the puncture of the skin. This may subside shortly afterwards, and is followed within an hour by a white weal surrounding a red spot marking the actual wound. As the venom spreads, irritating new tissues of the skin in its progress, a burning and excruciating pain may be experienced. The weal gradually diffuses giving rise to a swelling which becomes very irritable and inflamed. The swelling increases, until in 24 hours it has reached its worst, but it may sometimes take very much longer. When the swelling is at its maximum it usually remains in an apparently static condition for two days, and it may then take the same length of time before these conditions finally subside to normal. Immunity reduces the effects and lessens the time over which they are spread according to the degree of protection enjoyed.

The general effects on the human body of bee venom are usually far reaching, and vary enormously according to the condition of the victim and the virulence of the venom at the time of the attack. A poor state of health or the incidence of a heavy meal prior to being stung always aggravates the consequences. Extremely erratic results will therefore be encountered, and no hard and fast symptoms can be laid down. A drop of the venom may produce negligible reactions in one person, but even constitute a lethal dose to another. The more widespread effects are particularly evident in the case of hypersensitive persons or in those allergic to bee venom.

*The average drop of venom as exuded from a sting weighs only about 0.2 to 0.3 mg., or in English units about only a four-thousandth part of a grain.

It is very rarely indeed that a single sting will prove fatal, although such instances have occurred occasionally from time to time, and almost always are confined to those who are allergic to bee venom. Normally the usual sequence of events take their course, as described above, and are soon over. In the case of bee-keepers who have secured immunity, the effects of a few stings are often so trifling that either they are merely ignored or forgotten in a moment.

In view of the variable conditions arising from a bee sting it is quite impossible to give an exact forecast of the duration of the ill effects which follow. Some folk are more susceptible than others and, of course, the amount of venom actually injected also varies. The acuteness of the subsequent symptoms is directly proportional to the length of time the sting remained in the wound and the amount and potency of the venom in the bee's poison at the time.

Naturally some parts of the body are more sensitive than others and the face in particular should be protected, as there the effects are not only more conspicuous but may be more serious. For instance a sting near the eyes may even temporarily affect the vision, or one in the mouth may cause a swelling near the throat producing a suffocating feeling that leads to distress and shock. The effect of a number of stings, will, of course, make the various symptoms even more pronounced.

The effect of a bee sting on those few but unfortunate persons who are hypersensitive to bee venom produces more serious consequences. In a few minutes the action of the venom may set up perspiration, high temperature, dizziness, vomiting, a quickening of the pulse, rash and many other effects. Low blood pressure may also occur with possible collapse and more rarely a state of coma. During consciousness the symptoms are usually accompanied by mental distress with difficulties in breathing and kindred effects. Naturally a doctor should be summoned at once in such a case, stating the nature of the emergency, in the message so that he may come prepared.

Undue concern should not be attached to these disturbing features as they are unlikely to affect the average person, and it has been stated that the more serious consequences are found in only about 2 per cent. of human beings. In the normal individual the effects will be no more serious than those first mentioned, and as soon as the immunity has been achieved even these will be absent.

Bee-keepers frequently discuss among themselves as to what times of the year bee stings are more potent than at others, and some say the spring and some say the autumn. During the winter months it is possible that the venom increases in strength through lack of use, and so is more potent in the spring. It is doubtful however if this is so. In considering this point, one must not overlook the bee herself. The health of the bee varies, and weak bees as well as the old and very young ones contain less fluid venom in their

poison sacs than virile and active middle-aged bees. Moreover, the strength of the venom itself varies through the season, and is obviously affected by the nature and quality of the pollen upon which the bees feed. The degree of virulence of the venom, as might be expected, is most intense during the summer months.

On the bee-keeper's part the absence of stings during the winter lull slightly reduces the degree of immunity in the blood, and the first stings of the season not only may feel more painful, but probably cause more swelling than those received later.

Much depends, of course, where the wound is actually inflicted, as obviously a sting under the fingernails or in the lips or nostrils is much more painful than on the hands, and usually more dangerous. The flexor surfaces of the skin such as the inner side of the joints of one's limbs where the skin is much thinner, and the presence of arteries or veins always give more serious reactions to a bee sting than elsewhere. Even to a bee-keeper possessing immunity, a sting in one of these sensitive places can sometimes be quite excruciating for a few moments. A sting inside the mouth from either a wasp or a bee is dangerous, as the subsequent swelling may cause suffocation, and medical assistance should be procured at once.

Towards the end of summer, as the winter stores begin to accumulate, the need for the bees to defend their hard-won food supplies becomes more imperative, and they tend to develop a more aggressive attitude. As the days shorten so also do tempers. The more potent effects of late season and autumnal stings are the direct consequences of this natural reaction.

While birds can swallow bees with impunity, the effect of bee venom taken internally may occasionally set up distressing conditions, and it is advisable therefore to refrain from sucking a wound due to a bee sting.

Lastly among the direct effects of an unexpected attack from a bee on those to whom the joys of bee-keeping are unknown is a sudden and surprising loss of dignity. Even the threat of one from an angry bee is sufficient to induce this breakdown of composure. Prim and staid old folk have been seen to abandon their reserve with commendable promptness and with a display of agility that they never for one moment suspected themselves of possessing. Even cripples have been known to discard their crutches in their attempts to make greater haste.

The effect on animals varies. Bees occasionally get entrapped in the hairs of animals whose aroma they dislike and stings inevitably follow. Generally, however, the penetration is light and if it is a dog that has been stung it usually dashes home with its tail down. On horses, however, the sting is usually felt more severely, and they may become out of control if badly stung. In fact, a bad attack may cause them to become ill and even die. If horses are at work or grazing close to an apiary it is both thoughtful and kinder to avoid opening up stocks of bees until the line of flight is

reasonably free or a serious mishap may result if the animals are in harness. Goats should not be tethered too close to bees, but fowl usually seem to escape because of their protective coat of feathers and no precautions need be taken. Cases have occurred, though at rare intervals, of fowl and ducks having been stung to death. Some birds are very sensitive to bee stings and others curiously enough are relatively immune. The curiously diverse effects of bee venom is well illustrated by the lack of sensitivity to it by rats, whereas mice are most vulnerable.

Delayed action effects. Apart from the more serious consequences of a bee sting suffered by those unfortunate, but comparatively rare number of people who are super-sensitive or allergic to them, it is, of course, now quite well known that bee venom possesses a marked curative effect on rheumatism. In fact, it is hardly overstating the case to say that in some forms of this painful complaint it is Nature's finest cure.

This feature has frequently been ridiculed and others have asserted with feeling that the cure is worse than the disease. That, however, is a matter of opinion. Anyone who has suffered from the crippling and agonising sufferings of acute rheumatism is only too glad to attempt anything that will afford relief.

It is a well-known fact that the majority of bee-keepers are entirely free of rheumatism. Moreover, there are innumerable cases of people so crippled with the complaint that they could scarcely walk or move ultimately becoming fit and active again as the result of taking up bee-keeping with its inevitable consequences. In such a state was an elderly relative of mine whose hands were distorted by rheumatism, and so crippled that she was obliged to help herself along by the aid of sticks. On the advice of her doctor she took up bee-keeping, and duly became well stung, with the result that before a year had elapsed, she found herself very much better. In due course she became an active woman once again, living to a good old age. There is, however, no need to quote more such incidences for they are legion. In my own case a severe bout of stinging inevitably leads to a feeling of great physical fitness.

The bee is not alone among animals whose venom possesses curative and therapeutic properties. These have been known far down the ages, and it is on record that Hippocrates recommended a mixture of bee venom from crushed bees in honey for the treatment of various ailments including even falling hair and toothache. Bee venom therapy is now a recognised treatment by the medical profession, and although it cannot be claimed to be invaluable in its successful application, yet its effect is most pronounced in cases of acute rheumatism, lumbago, sciatica and fibrositis. Bee venom is stated to be a safe and efficient therapeutic treatment, and leaves in its wake no heart troubles as do certain other cures and pain relievers. Its action is through the blood. It stimulates and intensifies the circulation as well as the blood vessels. In effect it produces exactly the right condition necessary to correct the existing

harmful physical state of the rheumatoid affliction. This aspect of bee venom has been fully covered by an American treatise⁷ on the subject which gives full details.

Treatment takes the form of hypodermic injections made intracutaneously with bee venom refined by a well-known firm of druggists, but the injections can only be administered by a doctor. The prepared venom is available in various selected strengths even to the thousandth part of the amount normally received from natural bee sting. This ensures that no ill-effects result from the treatment even on allergic people as controlled dosage is given from the start and increased in predetermined steps. In fact, so successful has this been that the preparation can now be obtained in the form of an ointment which can be rubbed into the painful areas with beneficial results. The latter is, of course, more local in its action and is not nearly so effective as the injections.

When one considers the expensive course of baths and costly treatments which are the recognised manner of dealing with the various forms of this complaint it is surprising that more do not take up such a pleasant occupation as bee-keeping, affording as it does a complete course of treatment free of charge, which is sometimes effective within a few months.

Personal susceptibility. Some people are in regard to being stung what insurance companies call "accident prone," that is they are more likely to become stung than their fellow bee-keepers. Whereas some people can do just what they like with bees and remain unscathed, others seem to attract them like iron filings to a magnet. This is largely due to their personal aroma being offensive to the bee which has an extraordinarily keen sense of smell. Furthermore, those of a nervous temperament whose actions may be erratic and hasty are very much more vulnerable than placid and easy-going folk. Speaking generally, it would seem that bees are more provoked into stinging women than men.

The body odour if pronounced irritates the bee, and the smell of perspiration is particularly obnoxious to her and arouses her antagonism towards the offending cause. Those who perspire freely should therefore observe the precautions given later, and avoid having intimate proximity with the bees when very hot, or they will be asking for trouble, and will probably not be disappointed.

It should not be overlooked that one's health varies from time to time and that occasionally one is a bit "off colour" without being actually ill or unwell. In these circumstances it is wiser whenever possible to keep away from the bees. Not only is there more likelihood of being stung, but the subsequent symptoms may become more adverse.

Adults are more susceptible than children who, it may be observed, are singularly free of risk, and are in consequence not so often attacked apart from accidental stings. If a bee alights on a child it will not sting unless itself be first attacked, and will presently

⁷Bodog F. Beck. *Bee Venom Therapy.*

fly away contentedly if the child will but keep reasonably still. This is in fact true of adults, though rarely will they allow a bee to remain still upon their person, even though it be merely resting or recovering its breath.

Contact with animals immediately before undertaking manipulations is also unwise as the odour acquired, although perhaps not apparent at the time, is quickly detected by the bee with the usual consequences.

A visit to the hairdresser is also a bad prelude to bee-keeping. The aroma of hair oils and perfumes, while no doubt pleasant enough to oneself is repugnant to the bee, and the odour may persist sufficiently strong for several days to cause the bees intense annoyance, even though the hair be covered by a hat. They dive at the hair if unprotected or charge against the veil if one is being worn. Getting bees entangled in the hair is an unpleasant experience, and unless they are quickly removed may involve stings on the head. Care should be taken not to get panicky in such circumstances, but to go quickly to cover and there to remove the intruder.

These cases are mentioned as examples of the ways in which bees can become irritated and so incited to sting, but it does not follow that they necessarily will do so every time. Odours of any kind are objectionable, but they may not of themselves be sufficiently pungent to affect the bees, particularly if they are busily engaged on a heavy nectar flow and furthermore, of course, depending on one's proximity to the bees, and whether they are vicious or docile in nature.

Persons who take up bee-keeping only to find that they suffer severe consequences as a result of stings and become faint, having to lie down or go to bed, will realise that they are among those who are super-sensitive to bee venom. In such a case, provided the effects are not too serious, they may continue with their bees, but great care should be taken to secure adequate personal protection against the risk of getting stung, and it is unlikely, therefore, that they will enjoy immunity. There are many who do keep bees in these circumstances and are perfectly happy in their enjoyment of the craft. Some people take a long time, even up to 10 or 20 years, to secure permanent immunity, and until then they will, of course, suffer the normal consequences of a bee sting.

If, however, the symptoms consist of extreme giddiness, fainting, palpitations or collapse, medical aid should be obtained immediately. Moreover, if the effects are repeated on a subsequent attack of stinging, there is unfortunately no alternative, but to give up keeping bees altogether. Those who suffer from high blood pressure or heart trouble should in any case seek medical advice before starting to keep bees at all. To all these folk who are sensitive to bee venom, there is now available an artificial means of acquiring immunity which is described below.

Normally, however, the average person is not particularly susceptible to being stung provided that the usual precautions are taken and observed, and once immunity to the effects of a sting is attained, there is nothing to worry about and much to enjoy.

Personal Immunity. Immunity is the *degree* of resistance to infection, or in our case the amount of resistance developed by a bee-keeper against the effects of bee-venom. Since every individual differs in his bodily constitution, his degree of immunity of necessity depends on the ability of his blood, as well as certain of his tissues, to resist the invasion of his body by a foreign protein.

Thus, some persons by virtue of their robust constitution are better equipped to withstand the effects of a bee sting, which may perhaps produce only local disturbances, whereas others, apparently strong, may prove to be extremely vulnerable and will react violently to the venom. Immunity is a lessening of the reactions to a bee sting.

Despite the fact that some people do not suffer from the consequences of a sting to the same extent as others, it does not follow that they are endowed with a natural resistance within their system to bee venom. In every case immunity must be *acquired* either by stings or by injections of venom. As mentioned above, prepared, but pure bee venom, is now available from a leading drug manufacturer ready for injection, and this lends itself admirably for the acquisition of immunity through a short medical treatment. Those who are by nature or family history allergic to hay fever, pollen or other proteins are almost certainly allergic to bee venom, and should seriously consider this form of pre-treatment against the effect of bee stings, if they wish to enjoy their bee-keeping.

The human body very quickly forms an anti-toxin to protein poisons,* and in the case of bee venom it is capable of manufacturing an anti-toxic serum in 12 days, provided that the poison is administered in small amounts, and that the blood is not over-saturated by a single dose. In the latter case, of course, it just breaks down with serious consequences. Although an anti-toxic serum cannot be artificially manufactured from bee venom, in the same way that an anti-snake poison serum can be (at least not with certainty), yet there is no denying the fact that over 80 per cent. of bee-keepers do acquire immunity.

As the amount of venom injected from the bee is normally insufficient to overpower the system, this reaction to venom takes place from the first sting. In this way then, immunity to the venom is gradually built up by the small increment of poison received during the season's bee-keeping, and as immunity is developed, so do the effects of the venom grow less. The rapidity with which this happy state is acquired depends on the condition of the blood, and the quantity of stings received over a given period. It is best, therefore, to avoid getting an overdose of stings all at once in the early stages, but to do so gradually. It seems almost needless, therefore, to warn beginners of the risks of having accidents in their early days, and to exercise care and caution during manipulations with

*These words as used in the text are a simple form of expressing a complicated process. It means, very roughly, that a liquid (called a serum) can be formed, in the blood, which is resistant to any poisons that may enter the tissue of the body.

the bees. A surfeit of stings before becoming accustomed to them can be most unpleasant and occasionally very serious.

The bulk of bee-keepers ultimately achieve immunity, some quickly, some longer. Others gain only partial immunity, and a comparative few never attain any degree of specific protection. Immunisation can only be induced by repeated injections of venom. Quiescent intervals such as the winter or longer periods without being stung only serve to promote sensitive susceptibility, so that the longer one is free from the administration of venom, the more is the degree of immunity lessened. Moreover, immunity is not a permanent possession. It is hardly won, and may easily be lost.

It is impossible, therefore, to give a minimum time in which immunity may be reached. If, however, throughout the first season of bee-keeping an average number of bee stings is received (assuming there is such a thing as an average rate), or possibly up to a dozen or so per month, it will be found that at the end of the season immunity has been almost achieved as well as relief from the normal symptoms.

During the off-seasonal lull this may be partially or almost wholly lost, but by the end of the second season the beginner should have acquired the right amount of bee venom into his system to complete the anti-toxic reaction. This depends, as always, of course, on the number of stings required to meet his own particular constitution. In the third season he will begin to feel quite an old stager. The *average* bee-keeper secures almost complete immunity in from one to five years.

As mentioned above, some portions of the body are more sensitive to the effects of the venom than others, as in fact might be expected. Therefore, even with immunity some parts like the lips or nostrils will swell a little from a sting, but should very quickly subside. For this reason the bee-keeper who seeks immunity by the least painful method is encouraged to do so by leaving the hands exposed. The skin here is harder and tougher than the face, and the covered parts of the body's anatomy, so that the effects of being stung, while admittedly somewhat unpleasant at first, are not so serious or so prolonged as those in the more tender portions.

While in general the bulk of bee-keepers ultimately gain some appreciable degree of immunity, there are a few of their unfortunate fellows in whom the reaction to bee venom produces contrary conditions. This curious effect in which an additional sting may produce increased susceptibility instead of increased resistance, is due to the bee-keeper being allergic to bee venom. Family history is again the only true guide to allergic symptoms.

What happens in allergy is this. The first sting may produce only local effects, but unknown to the recipient, the blood becomes sensitive to bee venom, and when a subsequent sting is received soon after the reactions are considerably magnified and may rapidly develop into serious proportions. It is a somewhat similar process to that in which a grenade is made sensitive by first setting it, or to the previous arming of a bomb being released. Allergy means being

extremely sensitive to something which does not affect a normal person.

Normally a period of ten to twelve days must elapse from the time the first sting is received until the fully sensitised condition is developed. Once this extremely hypersensitive state is attained it may remain active for months or even years. This necessary latent period of ten days suggests an obvious remedy to prevent these conditions by getting stung at short intervals of a week. It is for this reason that inoculations for, say diphtheria, are given at seven-day intervals so that should the patient be allergic to the serum the dangerous conditions are forestalled. When a person allergic to bee venom becomes stung again, the serious harm and disturbances which may follow are then due to the release of a substance known as histamine. Immediately this sets up, what a doctor would call an anaphylactic reaction causing considerable dilation of the capillaries and contraction of the plain or smooth muscle. It can be neutralised by an anti-histamine referred to presently.

There have, however, been cases from time to time, fortunately of great rarity, where a person who happened to be allergic to bee venom has died from anaphylactic shock, due to being stung *more than 10 days* after a previous one. In other words had the individual been stung a second time only seven days after the first one, then death would *not* have resulted. This curious behaviour is known as Theobald Smith phenomenon, and anyone wishing to study it in greater detail should consult a medical book.⁸ Although in such a rare case a sting has been known to cause the death of a person, it would require many more to kill a normal human being. For sufficient venom to cause death, probably over 500 stings delivered simultaneously would be necessary.

It must not be assumed that immunity from bee venom affords similar protection from wasp or other insect stings, as the venom content differs in each case, but of course immunity to wasp stings can be achieved if necessary by undergoing a similar form of treatment as for bee stings.

One curious feature of immunity which occasionally arises, and for which, outside the medical profession at any rate, there is no known cause, sometimes occurs among seasoned bee-keepers who partially lose their immunity. Usually this lapse is confined to those who have kept bees for many years, and it may be due to some deterioration in the quality of the blood with advancing age. It may also quite possibly be due to the fact that in such a case complete immunity had never really been obtained, or that only local immunity had been achieved. Other factors such as a sting in a blood vessel would provide contributory causes or less manipulations among the bees, due to the restrictive influence of old age. It is fortunately only a rare occurrence, and it need not be assumed that this fate ultimately awaits every bee-keeper.

Persons suffering from rheumatic complaints may find that

⁸W. W. C. Topley. *An Outline of Immunity.*

they appear already to enjoy immunity to bee stings at the outset. Such, however, is not really the case, for it is more apparent than real. The more severe the rheumatism the less effect there is of the consequences of a sting. As the dosage of bee venom is increased, the rheumatic symptoms gradually disappear, taking perhaps one or more years to do so, according to the severity of the complaint. This change may be accompanied by increasing sensitivity to the effects of a bee sting, but the reactions will ultimately subside as immunity is finally reached.

Treatment. As might be expected in a craft which has come down through the ages from the earliest times, the number and methods of treatment and remedies for bee stings are almost numberless, but most of them are suggestive rather than curative in their properties.

How far back in ancient times the remedies for bee stings were described is not known, but it is certain that there were recognised means of treatment, and these were passed on by word of mouth and through notes in physicians' manuscripts. Dr. H. Malcolm Fraser, to whom I am indebted for the information, draws my attention to the fact that the great Roman naturalist Pliny mentions a cure for bee stings in his *Natural History*, which commends a foment derived from the juice of mallows or ivy leaves. He also refers me to several other early writers, as well as to Butler's *Feminine Monarchie* of 1609, wherein he writes:—

“ Therefore when you are stung, instantly wipe off the bee, sting and all, and wash the place with your spittle: so shall you prevent both pain and swelling: for the poison is so subtle, that it quickly pierces the flesh and the wound so little, that no antidote can follow after: and yet I have heard commended for a remedy, the juice of House Leek, of rue, of mallows, of ivy, of a marigold leaf, of hollyhock, and vinegar, of salt and vinegar, and divers other things . . . ”

When stung, the sting penetrates the outer skin layer into the true skin, which is underneath and is known as the “dermis,” but it seldom goes much further. The dermis contains many tiny blood vessels and nerve endings in its tissue, and the former when struck or damaged by the sharp tip of the sting, bleed while the pressure and venom act on the nerves, setting up immediate pain. The swelling and irritation follow as the body reacts to the poison.

The most important step in first aid is to remove the sting itself from the wound with all speed, for the longer it remains there the greater will be the quantity of venom injected. Care should be taken when removing the sting not to squeeze it with the fingers lest the contents of the poison sac be let into the already punctured skin. Those who are immune will not of course mind a little extra venom. A pen-knife is the most serviceable instrument to use. Place the blade flat on the flesh, and draw it forward with a scraping movement towards the sting so that it is lifted out. Next squeeze the wound so as to eject as much of the poison as possible.

Of subsequent treatment there is not much that can be regarded

as a specific cure for the real damage has already been done. The mere application of a surface remedy to the skin can have little effect on what is rapidly going on deeper down due to the injection of a virulent poison into the blood stream, and having once been stung, the effect must pursue its normal course. It will be observed that as far back as the 17th century Butler was aware of this as he wrote—"no antidote can follow after."

However, a weak solution of ammonia or the juice of a sliced onion or other herb may be applied. Many other palliatives there are which have been recommended for bee stings, although most of them are helpful only by virtue of auto-suggestion. Bathing the swelling with hot fomentations will often alleviate the discomfort, and the irritation will be relieved by dabbing the affected part with a weak solution of about 1 per cent. carbolic lotion. One excellent remedy which can be recommended for the relief of bee stings is a preparation known as Demore acidulated chloro-iodine.

As mentioned above a bee sting liberates histamine into body tissues in the vicinity of the sting. Modern treatment, therefore, consists in taking internally an anti-histamine in the form of a tablet or solution. Unfortunately these can only be obtained by a doctor's prescription. It is not a bad idea, however, to buy a pot of anti-histamine cream and have it handy. This does not require a prescription and as it produces a local anaesthetic effect it will relieve the pain in the area around the sting.

In dealing with the effects of bee venom we are confronted again and again with the diverse and various manifestations which follow a sting. A number of these relevant causes have already been touched upon, but at times there seems no reasonable or satisfactory explanation. Medical records have abundant cases to quote of hypersensitivity, allergy, idiosyncrasy, and anaphylaxis with all their attendant symptoms and reactions. In the circumstances each case must be treated medically on its own merits.

If the person stung goes into a faint, sal volatile should be given and the normal precautions observed. Whisky or brandy may always be given as an internal dose, for contrary to what has so often been expressed, alcohol is helpful in destroying the effects of venom. Even tea or strong coffee may often prove helpful. In a severe case, the patient should be put to bed and a doctor sent for at once; speed is essential. The best treatment in such cases consists of adrenaline three to ten drops being administered hypodermically and repeated later if necessary. An ephedrine tablet ($\frac{1}{2}$ grain) can be given by mouth, if the victim can swallow, pending the doctor's arrival, when he should be informed of what has been done.

As bees are clean eaters their sting is in consequence antiseptic, and there is therefore no need to disinfect the injury. One experienced bee-keeper when questioned as to a good remedy for a bee sting replied tersely, "Another." This in fact is absolutely true, for the only real relief to bee stings is to acquire immunity.

1. For successful bee-keeping and peace of mind and body, only good tempered bees should be kept.
2. Personal protection is best afforded with sensible clothing, a black veil and the hands bare.
3. Conditions unfavourable to manipulating a stock:
 - (a) When there is excessive wind or rain.
 - (b) When thundery conditions are present.
 - (c) When the temperature is 60° F. or less on a falling thermometer
 - (d) When robbing is prevalent.
4. Be sure there is ample food in the brood chamber when it is opened up.
5. When handling bees avoid nervous erratic movements.
6. Never open up a stock of bees without a pre-considered plan of action.

CHAPTER III

OF AVOIDING BEES' STINGS

THERE are three lines of organised defence against attack from bees, and these are respectively:—

- (1) The keeping of docile bees.
- (2) Personal protection.
- (3) Correct manipulations..

Part One—Docile Bees

*If bees do not respond to smoke,
And handling them is not a joke:
Their mother can't be very nice,
Get rid of her at any price.*

Devizes Doggerel

The docility of bees is given first because it is quite the most important point, and the other two are secondary in their relation to being stung. Careful and correct handling of bees should, of course, be an essential part of every good bee-keeper's character, but the amount of protection required or worn is a measure of the sweetness or otherwise of one's bees. Savage bees do not store more honey than quiet tempered ones, and make bee-keeping an ordeal instead of the pleasure it rightly should be. It is, of course, true that nasty tempered bees do store well, usually those that are black in colour. This may possibly be due to the fact that bees in colder climes, on the whole, tend to lose their brighter hues so that the darker bees are more climatised, and can therefore work out of doors at lower temperatures, though whether a greater store of nectar is gathered is debatable, since a fall in temperature adversely affects the nectar yield. Whatever truth there is in this does not conceal the fact that bee-keepers who possess colonies with this undesirable trait leave their bees alone, with the result that not being interfered with, they get on with the job of storing honey. The more savage they are the less they see of their owner.

Needless to say the retention of such bees is not good practice. Apart from the distasteful reception that greets the opening of their hive, it really is necessary from time to time during the season to examine stocks for various purposes especially during the swarming period. There are many bee-keepers who simply dread the prospect of having to open up a bad-tempered colony during the season, and rely, unfairly so, upon experts or others willing, or unwilling, but good natured enough, to come and help them out. This is not as it should be because the average bee-keeper is extraordinarily good natured, and should not, therefore, be imposed upon. Besides.

bee-keeping teaches one to be self-reliant and develops initiative, so that shelving difficulties for others to tackle, breeds laziness and a lack of self-confidence.

Moreover, it is all wholly unnecessary, for the keeping of quiet and docile bees is, I consider, essential to the successful prosecution of the craft. The owners of bees who do not relish going to them are therefore strongly advised to dispose of such colonies at the earliest possible moment or to change the strain, by re-queening. What pleasure is there for the bee-keeper or his family or for visitors to be greeted at the garden gate by spiteful and vicious insects which attack without provocation? Furthermore, even in comparatively quiet bees there is normally about one in every ten thousand or so that persists, apart from all the rest, in buzzing around the house, and if one is sitting out of doors, in sizzling around one's face and head, with a high pitched irritant buzz that eventually succeeds in driving any but a bee-keeper indoors.

In recommending a good strain of bee, there are a number of other very desirable qualities to be considered as well as docility. These are, quite briefly, good nectar gatherers, non-swarmling, disease resistant, clean white comb builders and, of course, gentleness.

It is unwise to sacrifice all the former in favour of the last. For instance, Carniolan bees are often recommended to beginners for their amiable behaviour and gentleness in handling, but as they are, on the whole, prolific swarmlers, they tend to get beyond all control, and the trouble involved is just not worth while. They are best left alone.

Caucasian bees, if pure, are also quite a good strain of bee, but have failings which make them awkward bees to use. These are chiefly their habits of building brace comb everywhere, and a tendency to gather excess quantities of propolis.

Black bees of various races, as well as such bees as Syrian and Cyprian, are mainly vicious in character, and should be avoided in spite of otherwise attractive features. Cross-breeding invariably produces a deterioration in temper, and mongrel bees are always more vicious than those which are pure in race. It is extremely difficult to acquire, and even more so to maintain a colony of bees in a pure state, and so it happens that the bulk of our bees in this country are cross-bred.

For this reason the best bees should be obtained from a reliable bee-breeder, and the type recommended is the British-bred Italian bee. They have faults, but on the whole they are more tolerable than any of those already mentioned. Having obtained an assurance that a colony of bees are docile, and experience proving that they live up to their reputation, they can then be used to breed from for re-queening other stocks.

It might perhaps be thought that keeping stingless bees would overcome the prejudices of timid persons against the honey-bee. Unfortunately these bees are of little use as honey gatherers and in any case are not indigenous to this country as they are found only

in warm climates. Their inability to sting does not deprive them of the means to outwit their enemies and various methods are adopted to defend their nests and stores. Some species are quite aggressive in habit, and will resolutely attack human beings in spite of their diminutive size. They will bite savagely with their strong jaws, while others spray their victims with powerful fluids which cause nasty burns. So it's not all honey keeping stingless bees.

If docile bees are kept in the apiary, they should, of course, be used for the rearing of new queens. Queen rearing is one of the most interesting phases of bee-keeping, and is so simple that it is within the reach of anyone. In dealing with the characteristics of a good bee, it should not be forgotten that temper is a trait derived from the drone. For this reason it is essential that if a bee-keeper possesses mixed types of bees in his apiary, and desires to breed from one of them, then he must rear his drones from the most gentle colony. This is actually the first step in successful queen rearing, and it should be one's aim to flood the apiary with drones from the most quiet tempered stock early in the season before the drones of vicious colonies are flying in any numbers. The drones do not of necessity require to be reared from the same stock as the queens. The best method of achieving this is to place a frame of drone comb into the middle of the selected stock. Care will, of course, have to be exercised that such a procedure does not tend to promote swarming, but this aspect of bee-keeping should be carefully studied first from any of the best text-books dealing with this subject. Having reared or bought a queen from a docile colony, the savage stock must first be de-queened and the new queen introduced. The assistance of an expert in circumstances such as these, should be sought by the beginner or anyone whose heart flinches at the prospect, for it is a job which can only be done properly or not at all. See Snelgrove's comprehensive book on this subject.⁹

As the clover flow comes to an end, so does the temper of even the best behaved stocks seem to decline. This is due to the bees' natural desire to defend their accumulated winter stores. When the colonies have been robbed of their harvest by the greedy hand of man and there is no nectar about, robbers become evident—and then look out for stings. Tempers are short and attack is swift.

Bad temper in bees may be due to any of the following conditions:—

<i>Permanent</i>	..	Strain of bees.
<i>Temporary</i>	..	Bad weather.
		Hunger.
		Excessive manipulations.
		Outbreak of robbing.
		Disease.
		Constant removal of queen cells.

⁹L. E. Snelgrove. *The Introduction of Queen Bees.*

Immediate

- .. Objectionable odours.
- Interruption to line of flight.
- Undue exposure of brood nest.
- Shaking, jarring or rough handling of any kind.
- Erratic movements.
- Crushing a bee.

Should a colony of normally quiet bees become bad tempered the reason should be sought among the various causes outlined above. Having diagnosed the probable reason, suitable measures can then be taken to remedy the trouble. Starvation is frequently responsible for an outbreak of temper, and in good bee-keeping, a colony should never be allowed to get into this condition.

One other curious feature of seasonal changes is that the bees usually seem to become more vicious in the first few days of a really good nectar flow. This may possibly be due to the demand made on younger bees, such as those on guard duty, for foraging purposes under the influence of a heavy nectar yield. Bees of this age, it will be recalled, possess their maximum efficiency of bee venom.

A swarm that has hung out in the cold or wet for more than three days is an awkward subject to tackle, for the longer it has been without food the more bad tempered will the bees become. Any interference with the cluster is warmly resented, and unless it can be sprayed lightly with thin syrup, a comb of food should be hung in contact with it for at least a day before removal. Failing that, the only safe course of action is to don ample personal protection. Then having decided what to do, the scheme should be put promptly into action, working quickly but gently. The close of the day should be chosen when cooler conditions minimise the incentive for the bees to take wing, and having secured the swarm, it is best to hive it directly over the brood chamber on to combs of food and close down as soon as possible.

Whenever possible a screen of some kind should be provided between the apiary and the house, if they are in close proximity. This lifts the flying bees higher, so that they will be less of a nuisance. For this purpose high-growing flowering shrubs or trees are ideal, or wattle fencing covered with attractive creepers. Consideration should also be given to neighbours, especially if bees are kept in urban or built-up areas, to see that the presence of one's bees do not constitute a nuisance. Careful and adequate screening in such a case is essential. This affords another excellent reason for joining a bee-keeper's association, for among the many advantages to be gained, the insurance against third party risks such as stung neighbours is one of the most valuable. A tactful bee-keeper, however, who has neighbours nearby, may find it to his advantage to bestow a pot of honey upon them once a year, thus sweetening neighbourly relationships.

Part Two—Personal Protection

This of course forms the main armour in defending oneself against bee stings, and just as there are dresses for every occasion and occupation, so also is a certain amount of attention necessary in selecting the right clothes for bee-keeping.

Generally speaking, older clothes are advisable as the bees in flight drop their excreta, and the little droplets, whilst easily removed afterwards, stain light-coloured fabrics. Furthermore, the work of bending and carrying hive parts and supers, or chasing swarms is not fair to good clothes.

For some reason, bees are antipathetic to black, and garments of this colour should, therefore, be avoided. Material whose nature has a smell, such as tweeds, are also undesirable as well as those whose texture is hairy. Material which possesses a smooth surface with the maximum porosity is to be preferred whenever possible.

Loose, flapping, clothes are also inadvisable as they irritate the bees, and provide too ready an access for any wanderers to enter attractive-looking dark cavities. It is their natural instinct to climb upwards, and a sudden movement may catch one of these erring insects in a fold of the clothes with inevitable consequences.

A woman should avoid long loose sleeves, or wear an overall which is close-fitting around the wrists. Skirts are inadvisable, but many women bee-keepers wear them successfully, and provided the bees are docile and the weather not too windy, there is no reason why they should not be worn. If, however, a pair of slacks is possessed, they are undoubtedly the better choice of the two.

For men, almost any form of clothing, except possibly kilts, is suitable, but in hot weather, an open-necked shirt is more pleasant to work in, for it is hard going while lifting and moving heavy supers about. When one is accustomed to working among bees, and they are docile in temperament, a coat can be dispensed with, and the shirt sleeves rolled up above the elbows. This sounds rather alarming at first, but with gaining confidence it will actually be found that one gets stung less this way than with an open-sleeved jacket or shirt, up which the bees crawl when handling combs. There is, incidentally, another point on this aspect. Many bee-keepers do not know when it is too cold to open up their hives. Generally speaking, if one can take off one's coat to work and expose the arms, then equally it is warm enough to open up the brood nest. I hesitate, however, to recommend a similar temperature test for lady bee-keepers.

Whenever trousers or slacks are worn, the bottoms should be secured by cycle clips or elastic bands, or by drawing a pair of men's socks over the lower extremities—particularly advisable with any operation involving shaking the bees or hiving swarms. In these cases, especially when bees are crawling about on the ground

they frequently climb up one's legs under the mistaken impression that they are entering some naturally dark home like a hollow tree, and a quick flexure of the limbs makes the wearer suddenly conscious that a bee is inside his clothing.

Many beginners swathe themselves up in protective clothing which hampers their movements, and is awkward if a bee should find a way in, and it is surprising how easily they do manage to gain access. The best plan considered as a long term policy is to endeavour to acquire immunity, because unless one is super-sensitive, stings are not so terrifying as they are frequently made out to be. Having once gained that superior attitude of mind, when one is not afraid of being stung, and the blood has acquired its anti-toxic virtues, the beginner will really enjoy his bee-keeping and manage it far more efficiently. Not only are his movements unrestricted by clumsy clothing, but his mind is free to concentrate on what he is doing without the dread of being stung.

As for protecting the arms and hands, gloves or gauntlets may be worn at first to secure confidence, but there again the bees do not approve of leather, and, furthermore, gloves are very clumsy to work in. It is frequently difficult to pick up the lugs of frames when wearing thick gloves, particularly if the former become fixed down with propolis, and for the more refined manipulations, such for instance as catching the queen, they are quite useless.

Thin rubber gloves are the best in the circumstances, as they are absolutely sting-proof, but they make the hands very hot. If worn, the hands should be dusted with french chalk or powdered talc to prevent the rubber sticking to the flesh when perspiration takes place.

As mentioned before, the best policy is to work bare-handed, but in that case the hands should preferably be washed before doing any manipulations. This cleans the skin and frees it from any body odours or perspiration, which is always there in hot weather, for even if the bee-keeper cannot himself detect it the bees will. Those who possess a high sting liability (as distinct from people who are super-sensitive to the effects of venom) should always plunge their arms into cold water before going into the apiary.

Coming lastly to the face, a veil should always be worn. An expert can frequently be seen at work without one, but do not be misled by his apparent immunity from attack into thinking that anyone else can do likewise, for one is certain to be quickly and sadly disillusioned. Most experts wear a veil when handling other people's bees, for there is no fun in being stung merely to show off one's skill, and even if he isn't wearing one, an expert either carries it in his pocket for emergencies or wears it round his hat clear of his face. Remember also that an expert can usually detect at once, often before actually opening the hive, whether he is going to have a "rough house" or not, and acts accordingly. This faculty is only attained after many years experience in working among bees.

In spite of what has been said before about black clothing, the veil is best made from a black material. If a white net is worn, it

will be found that the light reflected from the threads dazzle the eyes, particularly in sunlight, and makes it difficult for close work such as examining the brood. If a white veil has been bought, a black strip should be let into the portion across the eyes.

The veil itself should be skirt-shaped, with an elastic top to slide over the crown of the hat or headgear, and should be amply long enough (18 inches at least) to tuck well down inside the coat or overall. Stiff wire-framed veils can be obtained, which keep the netting away from the face. In this they succeed, but they tend to sway about uncomfortably in a disconcerting fashion if it is windy, and they are not therefore recommended.

There is an old maxim* that runs, "whatever thy hand seeketh to do, do it with all they might," or in other words—if you start to do a job, do it properly and don't be slipshod. Now this applies very aptly to the wearing of a veil. If one is going to be worn, it should be put on properly and not half on, *i.e.*, with the tail of it hanging loose over the shoulders. That job with the bees that was only going to take a moment or so turns out to be much more involved than was anticipated, and the carelessly donned veil now becomes an open invitation to all and sundry—and invitations are seldom refused. The moral is...well, follow the old truth and avoid trouble, then there won't be any morals.

Never be too proud to wear a veil. Familiarity should breed respect, not contempt. Remember that a sting on the eyeball may entail permanent injury.

Those bee-keepers who are really scared of their bees, yet have the courage to tackle them without wrapping themselves up completely, should, while taking all the precautions outlined above, rub oil of wintergreen (the methyl-salicylate of the kind used in the treatment of acarine) over their hands or elsewhere if it is likely to be exposed. This will prove very efficacious in keeping the bees at bay. Alternatively, the hands may be wiped with the carbolic cloth before starting operations.

It may be thought that an insect repellent should keep angry bees at bay. There is on the market an excellent insect repellent. This preparation, if used, will, it is true, keep insects and bees from alighting on the skin, but it is not sufficiently strong to prevent an angry worker rushing into attack. To produce an aroma powerful enough to keep a determined bee from inflicting injury would entail the bee-keeper having to go about in a cloud of poison gas!

Occasionally a bee will find its way inside the veil. To the uninitiated this close proximity to an armed intruder is sufficient to cause such chaotic distress that everything is dropped regardless of the consequences, and wild and usually unsuccessful attempts are made to liberate the bee. Such antics are quite unnecessary, for the bee will seldom, if ever, inflict injury, as once it is inside the veil it immediately makes a great effort to get out. Manipulations should, therefore, be continued until they can be safely suspended.

*Ecclesiastes, Ch. 9, v. 10.

Then quietly lift the veil and allow the visitor to escape unharmed, and neither will be the worse.

If one is attacked by bees when in an unprotected condition, do not wave the arms about trying to hit the bees or fend them off. Such wild gesticulations only attract other bees and the matter is made worse. Thrusting one's head among the leaves of a nearby tree or shrub is often helpful, but if nothing else is to hand and provocation is bad, the only remedy is to pocket one's feelings and show a clean pair of heels for the nearest haven.

Part Three—Manipulations

It will be obvious that a careful bee-keeper who carries out all manipulations with bees in the correct manner is not only a good bee-keeper, but is at the same time reducing the risk of attack to a minimum. Good bee-keeping pays handsome dividends in securing ample honey harvests, and enables the bee-keeper to work his bees with the the minimum of trouble and the maximum of pleasure.

Best times for manipulations. The first point to consider is what constitutes the most favourable circumstances, and which are the worst times for carrying out operations among the bees. There are, of course, occasions when emergencies arise and the matter has to be undertaken irrespective of the prevailing conditions.

In the normal way however, when any manipulation is under consideration, it should not be attempted if the weather is really unfavourable, but should be postponed till better conditions prevail. This may at first seem obvious, especially if it is pouring with rain, but there are other occasions also when it is advisable to leave the bees alone.

Opening up the hives in cold weather should always be avoided. Not only are the bees sure to be bad-tempered because of the lack of nectar, but there is the very real risk of chilling the brood. In general, therefore, the bees ought to be left alone if the outside temperature is less than 60° F.

At the other extreme, the bees should not, as a rule, be interfered with while thunder is about, unless it is a matter of some quite small operation, because thundery weather invariably promotes short tempers. In any case it is better, and wiser, to leave the brood-nest undisturbed, for bees are very sensitive to climatic alteration.

Opening up a hive on a windy day is also a risky proceeding, as the bees get blown about by the gusts. Quilts and coverings flap and irritate the flying bees, as well as exposing covered combs. Unless it is important, it is far wiser to refrain from any prolonged operation when there is much wind about. If, however, it is essential that the brood chamber be opened, the risk of attack may be minimised, and the bees protected by retaining in position the first outside lift above the bottom porch lift. While it is true that it makes handling combs a little more difficult, especially where the frames are rather tightly held by propolis, the top of the brood nest is shielded from wind, and the quilt or temporary coverings, such as the carbolic cloth, are not so easily blown up or off. When

folding back this covering to expose further combs, it should be kept weighted by the hive tool or smoker to prevent gusts of wind whipping it off and thus suddenly exposing many combs of bees. This work is greatly facilitated by using the manipulating cloths described later. When working with a single-walled or National hive, stand with your back to the wind, so as to give the bees as much protection as possible.

Apart from the weather there are other occasions during which it is inadvisable to open up stocks. In the spring it is better to err on the late side, especially if in doubt, owing to the risk of disturbing the bees too early in the year. Towards the close of the season, no attempt should be made to open stocks if robbing is in progress, or a number of troubles like those from Pandora's box will be unleashed.

During the latter part of July, as well as the whole of August and September (which are the worst months for robbing), colonies should only be opened for as short a time as possible, and where circumstances permit, it is preferable to choose the latter part of the day, provided it is not too cool.

An important point to watch for, especially during August or just after the supers have been removed, is the amount of food present in the brood chamber. Many a good strain of bee stores heavily in the supers, leaving the brood combs almost entirely at the disposal of the queen for brood rearing. As July and August are the two wettest months in the season, it frequently happens that early in August the brood chamber is bereft of food. This means that a beginner who goes to such a stock (the supers having been lifted) for the purpose of some small task, such as to remove the queen prior to re-queening, is astounded at the vicious reception he is accorded. It leaves him at a loss to know why such hitherto-gentle bees have turned so nasty.

In such an event the best course is to close down the bees without further delay. Put on a rapid feeder at once, and leave them for at least an hour to settle down before attempting any further manipulations. If possible, the proposed operation should be postponed for a few days, during which a bottle feeder should be kept going to restore normal conditions, by providing a little stored food in the brood chamber. This will be available for the bees next time the hive is opened, and is essential if the purpose be to find the queen, as it is an undertaking which may involve having the brood chamber open for some considerable time.

In any case, a slow feeder should always be started as soon as the supers are removed. This enables proper winter stores to be built up, and stimulates the queen to lay. This means that whereas in August, if the preceding weeks have been wet (they usually are after St. Swithun's day); there should be both brood and food in the stock, the queen will be in lay, and is therefore found more easily. Moreover, the bees are contented, and the bee-keeper who then has to operate in the brood nest will find conditions very much more in his favour. His work will be far more pleasant, with the risk of being stung reduced as far as possible to a minimum.

If, however, the queen is a prolific layer, it is better to use a rapid feeder, so as to provide food, but not to over stimulate the stock.

Most of all, the troubles arising from keeping bees in the ordinary hive out-of-doors can be eliminated by the use of a bee-house. A would-be keeper of bees who has not yet purchased his hives, and is contemplating a number of stocks in his apiary, is well advised to consider the prospects of such a bee-house. It is true that the initial outlay probably exceeds the equivalent saving on the outer parts of normal hives, but there is much to be gained, and is indeed well worth while if half-a-dozen or more stocks are to be kept. A spacious fowl-house or garage, suitably adapted, makes an excellent bee-house.

The bee-house may be of any convenient size, and only the interior fittings of the hives are required. During manipulations the bee-keeper works in a half light, so that the bees do not leave the brood-box so readily, and when they do, they fly towards the windows, thus leaving the operator alone. Furthermore, the entrance being outside the building, incoming or flying bees do not molest him, nor is he troubled from the bees of adjoining stocks. Another point is that urgent work can be undertaken in warmer conditions than those prevailing outside, with a greater degree of protection from inclement weather. Thus, not only can the operation be carried out when otherwise it would be impossible, but the risk of being stung is considerably reduced. There are many other advantages of bee-houses, and the reader is referred elsewhere for further details.¹⁰

Handling a stock of bees. In any work among bees, it should be the bee-keeper's constant aim to work *with* Nature, helping and exploiting the natural characters, habits and instincts of the bee to his own advantage. The bee-keeper should, therefore, remember whenever a colony of bees has to be disturbed he is working *against* Nature, and he must be prepared for the consequences. The immediate reaction to opening a hive of bees, is their natural instinct to defend their home. Therefore, they sally forth with their one available method of attack, the recognised means of defence, and proceed to employ it to the best of their abilities, as every bee-keeper knows to his own cost.

As explained previously, do not attempt to open a stock unless it is necessary, and then only for as short a time as possible. This will reduce the risks of attack, and minimise the disturbances to the orderly routine within the hive. For the latter reason, it is best to operate stocks during a nectar flow nearer the close of the day, whenever possible, rather than at mid-day, as it does not hinder the foraging bees in their work, and, moreover, recovery proceeds normally during the night hours. Operations early in the day bring about an upheaval of the hive routine, depending of course on the magnitude of the task, which usually dislocates the bees' work for the remainder of that day, and most of the next. Even where the

¹⁰John Spiller. *The House Apiary*.

brood chamber is untouched, the addition of a super, only if clumsily handled, may seriously dislocate the ordered sequence of events in the bees' working day, and ruffle their normal calm serenity. It is easily done. On the other hand, a novice who has to undertake a major operation in a stock, will experience less provocation if he selects a warm sunny afternoon, starting at about noon when all the older and foraging bees are away in the fields. So the beginner as he becomes accustomed to bees, must not only learn to do the right thing at the right time, but must acquire restraint. He should train himself to act gently and thoughtfully when handling bees and occupied hives, so as to avoid irritating or injuring any of his little friends.

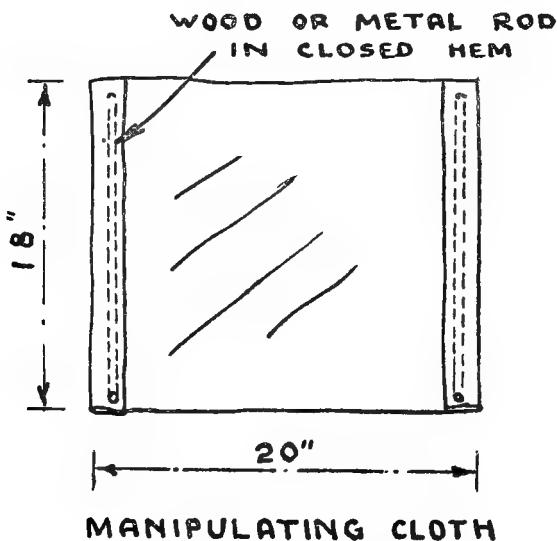


FIG: 4

The first thing to do before starting anything in the apiary is to stop and think. It really is most important, and this initial step should become a habit and precede every major operation. Do not just go straight to a hive and start opening it up right away, but make it a golden rule in all bee-keeping—*Think first*, then act.

Plan out exactly what it is proposed to do and why, satisfying yourself first that what is intended is not only the best course, but that the right time to do it has also been chosen.

Having considered each step of the manipulation, then decide what equipment will require to be readily available, and handy to the stock which is to be the subject of the proposed operation. Otherwise the bee-keeper is liable to find himself in difficulties with the brood-chamber open, the bees buzzing and milling around, and some essential equipment left behind in the house. When this happens

things quite often become even more involved, because the wind seems to spring up or rain threatens. Stings, even if only a few, are then an almost inevitable consequence.

Having made up one's mind exactly what is to be done, carry out all equipment that will be wanted and place it handy. It is also as well to bring a second charge of fuel for the smoker, because if the operation becomes unduly extended, especially if corrugated paper is being used it burns up quickly and the smoker may go out before the job is finished. Actually corrugated paper alone is not the best type of fuel to use, for not only does it burn quickly, but towards the end of the charge the smoke becomes very hot, scorching and distracting to the bees.

The best type of fuel to use in the smoker is tinder, dry well-rotted sacking, or alternatively, cartridges formed of interleaved corrugated paper and sacking, form an excellent substitute.

Two essential things to take with one, are a hive tool and a pair of manipulating cloths. These latter are two pieces of smooth material, such as calico, each the size of the brood chamber with a rod sewn in at two opposite ends, as shown in Fig. 4. A 10 per cent. solution of carbolic lotion (Calverts No. 5, obtainable from any chemist) should be sprinkled over them. They are invaluable for spreading over the brood chamber when exposed, and rolling back gradually to expose the combs in turn. The slight, but pungent, odour of the carbolic keeps the bees down, and the weight of the rods at each end keep the cloth in position when the wind is blowing. Some bee-keepers work with a carbolic cloth only, but the best results are obtained with a smoker supplemented by the carbolic cloth.

Everything having been set ready and being suitably arrayed, the bee-keeper may now put in hand the first process of subduing the bees without further delay.

The gentle art of subjugating the bees is one which, like learning to ride a bicycle, is acquired only by actual experience. Most good books, however, give ample instructions on this as well as the correct way to handle frames of comb and the various hive parts.

Always operate from the back of the hive, keeping the light as far as possible behind one, when examining brood, and use deliberate motions free of flurry or jerky impetuous movements. Keep quite cool, calm and collected, taking little heed if a sting should be accidentally given. This is the right frame of mind, and the only one for deciding what is to be done when the brood-nest is opened. It is seldom indeed that one finds things exactly as anticipated, and complications and the unexpected are more customary than otherwise.

During the removal and replacing of combs in the brood chamber, extreme care must be exercised to avoid crushing the bees. Apart from the cruelty of so doing, even if unintentional, nothing infuriates the bees more and goads them into action, than the smell of a crushed bee. Furthermore, an injured queen will put the whole stock out of action.

Combs must, therefore, be very gently lifted and replaced slowly and carefully. In this connection it is most important to see that the comb goes back in exactly the same way as it was removed. Otherwise the irregularities in the comb will foul those on either side, injuring or crushing the bees, and damaging the face of the comb.

It is often difficult to remember exactly which way round a comb should be replaced in the brood chamber after it has been out for some time under examination. A simple guide is obtained by marking one end of the top bar in the frame, so that all the marks are one side or the other. The easiest way of doing this is to date the lug with indelible pencil or other means whenever a new frame fitted with foundations is inserted in the brood nest. The frames should always then be maintained with the number on either the left

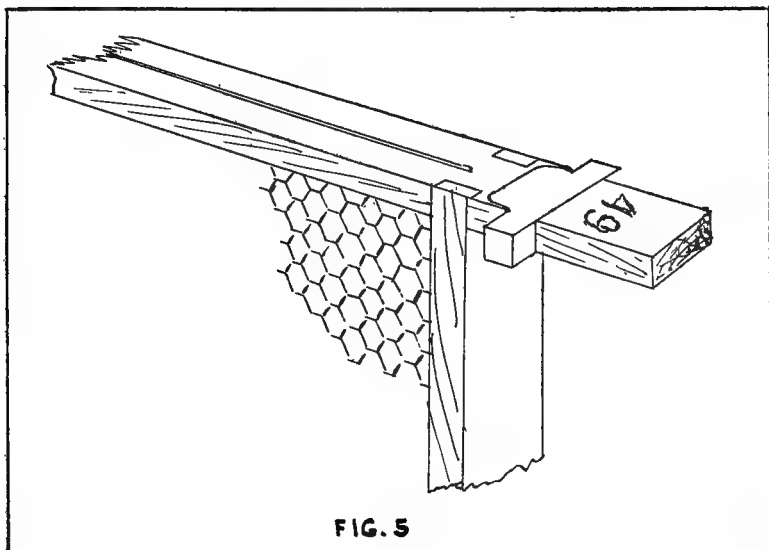


FIG. 5
DATING OF FRAMES

or right side of the chamber, thus ensuring that they are always replaced correctly (see Fig. 5). Moreover, there is the added advantage that a check is kept on retaining combs in use which are over-age.

Much the best way of starting bees for a beginner is with a nucleus of five or six combs. In the first place there is not the same fear in opening up so small a stock, and it promotes confidence, and more is learnt of bee-keeping from such a procedure, than by starting off with a full-sized colony. The beginner who starts in the latter way (unless he is fortunate enough to have "beginner's luck") is usually in trouble before very long with swarms or other complications. Apart from the satisfaction of building up a nucleus

to a full-sized colony by easy stages, one never has quite the same dread of going to it later on. In the mind it is still "that little nucleus."

An excellent method of examining a nasty-tempered colony, especially if it is necessary to find the queen for replacement at the end of the season, is to move it bodily to a fresh site shortly beforehand. This manoeuvre is carried out quite simply in the following manner.

On a day when the weather conditions are favourable, go to the stock to be dealt with, some two or three hours beforehand, and place near it a floor-board with an empty brood box on it, containing a frame or two of drawn comb, or if neither are available, a plain flat board large enough to stand the supers on. Next remove the supers to one side, and then covering the brood chamber over with a temporary quilt, carry it bodily on its floor-board to some secluded corner at the far end of the apiary. See that this quilt is secure with weights, sacking or a spare roof. Now replace the supers on the prepared brood box or the flat board at the original site, so that the flying bees have somewhere to alight in the absence of the brood nest and queen. This first step should be completed some two or three hours before the second stage is undertaken.

During the subsequent interval, most of the flying bees from the original brood chamber will return to the old site, leaving the former occupied only by the queen and the young bees. In due course, when the brood chamber comes to be examined, the task of finding the queen is greatly facilitated, not only because there are few of the elder bees present, who definitely resent interference with their home, but there are considerably less bees on the combs, and so the queen is more visible. This plan can, of course, be adopted for any operation entailing work in the brood chamber, and on completion it is then returned to the original site. It is by far the most pleasant method of examining the brood, especially if the bees tend to be of an unfriendly variety. While the interval of an hour or more is recommended before beginning the main task, the same procedure can still be used with advantage if it is not possible to allow this preliminary period.

Moving the hive back three or four inches has been recommended by some as an effective means of reducing the liability to attack owing to the displacement of the entrance, thus creating a diversion. The ultimate gain, however, is small when the whole brood nest is being disturbed, and in any case it is heavy work, and may involve moving the hive off its stand. It is hardly worth attempting.

And lastly, one important caution. Bees, like ourselves, are variable in temper and feeling for the several reasons already given. If, when opening up a stock, it is found that the bees are displaying a certain amount of viciousness—don't go on. If the hive has been dismantled as far as the brood box, and it is observed that the bees are flying for one good and hard, despite the smoker being in constant use to keep them down, it is only begging for trouble to go on. If persisted in, not only will the operation, whatever it is.

be performed badly under a hail of savage bees, but the temper of that particular colony may be permanently ruined. In such an event, if the hive be closed down immediately, no matter how urgent the need may be to manipulate, it will be found in a few days time, when that stock is again examined under favourable conditions, that the bees are sweet and easy to handle.

If, however, the bees are still bad-tempered when everything else is right, and there are ample stores, then they are obviously nasty vicious creatures that should not be tolerated in a well-ordered apiary. The only alternative is, of course, to re-queen them.

SEVEN GOLDEN RULES TO AVOID BEING STUNG

1. Keep only docile bees that are easy to handle.
 2. Avoid cold, wet, thundery and windy days, especially for manipulations.
 3. Be sure that there is ample food readily accessible for the bees to gorge upon before opening up a stock.
 4. Avoid being over-hot and bearing unpleasant aromas about the body.
 5. Adopt the minimum personal protection necessary to ensure freedom from worry, without hampering operations.
 6. Handle the combs of bees with firm gentle movements, avoiding erratic or sudden gestures.
 7. Tackle the bees with understanding and confidence. Do not keep the hive open longer than is absolutely necessary. Decide beforehand what is to be done, then do not delay further, but get on with the good work.
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A THOUGHT FOR THE APIARY

A successful bee-keeper is one who enjoys being with his bees.

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