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## About Bees 1: What are Bees?

Bees are insects; insects which are essential for our continued survival. When we think of bees we think of their delicious product, honey, but they have a far more vital role in food production than mere honey makers. It has been said (allegedly by Albert Einstein, but this is disputed) that if the honeybee were to disappear, human kind would not last more than a few years on the planet. This is because bees' major contribution to the ecology is pollination. A large percentage of our food crops are insect pollinated and the honeybee is a universal pollinator. Thus we may well be alarmed by the threats currently posed to the survival of bees by diseases and pests, and it is fitting that we should learn as much as we can about them.

Most of us automatically relate the word "bee" to the European honeybee, "*Apis mellifera*", but there are many genera and species of bees, including some 1500 species native to Australia which are less well known. They are less obtrusive and not exploitable to produce honey on a commercial scale.

So let us focus on *Apis mellifera*, the honeybee so familiar on the flowers in our gardens. It was given this name by Carl Linnaeus, the founder of the system of biological nomenclature, but it is a misnomer, for it means "carrier of honey" and the bee does not usually carry honey. It carries nectar from flowers and makes honey from it. Someone later tried to rename the bee "*Apis mellifica*" which does mean "maker" of honey. But this name never took on and the name given by Linnaeus persists.

Bees are insects, six legged creatures like flies. Unlike flies which have two wings, honeybees have four, but in health the two on each side are locked together, giving the impression of being one.

There are several sub-species, or races of honeybees. The earliest European honeybees to be successfully transported to Australia was a dark English bee, *Apis mellifera mellifera*, but most common one in Australia now is the golden yellow Italian strain, *Apis mellifera ligustica*, introduced in 1862. Darker bees, Caucasian and Carniolan came from south Eastern Europe.

Being social insects, they live in a colony or swarm; a bee cannot survive alone. In a colony there are three types of bee, a solitary queen, thousands of worker bees and a variable number of drones. The queen is the only fertile female, the mother of all the rest. Her sole job is to lay eggs, and to keep up the numbers in a strong colony she lays over 1000 a day. She cannot even feed herself, relying on young worker bees to feed her. A pheromone (a hormone by smell) she exudes governs the actions

of the workers who seem to make corporate decisions for the whole swarm. The worker bees are all infertile females, and they do all the work; (why do women smile when told this?) They work till they wear out and die, and in busy times this is only about six weeks. Male bees are called drones; their sole function is to fertilise a young queen and only a small percentage achieve this destiny. Those that do die on the spot; those that don't eventually die when no longer needed for they cannot feed themselves either!

## About Bees 2: Life Cycle

Being insects, the honeybee life cycle follows the familiar pattern of egg, larva, pupa and adult. Eggs are laid by the queen who mated with several drones in the first week or so of her life. She stores the sperm for the whole of her reproductive life, several years, never mating again. A bee egg is a tiny white cylinder, visible in a good light in the bottom of a honey comb cell. The young worker bees deposit a dollop of nutritious fluid on it and in three days it hatches to become a larva.

A Larva is a tiny white grub, initially about the size and shape of the letter "c" in newsprint. Growing rapidly it fills the cell after six days when it is sealed over by the workers and become a pupa, which, over the next 12 days undergoes a miraculous transformation into a worker bee. She then chews the cap off her cell and emerges, to begin work right away! Thus, it takes three weeks from egg to bee, who then lives only about six weeks. If we humans followed a comparable timetable we would live only 18 months!

Having commenced work as a fluffy little infant, the worker will progress through a set sequence of duties during its short life. First, there is cleaning to be done, then brood and queen to be fed, wax to produce to make comb, ventilating and guarding the hive, and finally foraging in the field for nectar, pollen and water. Thus, the bees you see in your garden are the oldest, (and often the crankiest). They literally work themselves to death, till their wings wear out and they don't make it home.

So much for the worker, but what about the queen and drones?

There is only one queen in each colony, and she can live for several years. So the bees will breed a queen only when a new one is needed; when she gets old, runs short of sperm and her pheromone production falls. Or, when in spring the colony thrives so well that it begins to run out of room and swarms. Swarming is the process of multiplication of colonies. The bees will breed a new young queen to take over the existing hive while the old queen takes off with half the bees to find a new home and start again. So how do the bees breed a new queen? They can do so any time provided they have one of the old queen's eggs or very young larvae. They build a larger cell around it and stuff it with extra royal jelly, a protein rich nutritious food. Sixteen days later a young virgin queen hatches, and within the next five days she flies out of the hive on mating flights to meet and mate with drones from other colonies, on the wing, twenty feet up in the air! It is a remarkable biological phenomenon that the queen and worker have the same genome, and the vast difference in structure and function is entirely dependent on nutrition in the early stages of development.

Drones are different again and biologically even more fascinating. They develop from an unfertilised egg, and therefore have only half the number of chromosomes; they are nothing more than a flying sperm! Curiously the queen can deliberately lay either a fertilised egg, (to produce a worker) or an unfertilised one for a drone. Drones are only bred in the spring and summer when the bees are multiplying and need them.

## About Bees 3: How do I become a Beekeeper?

Can you keep bees in a suburban backyard? Certainly you can. There is an established Code of Practice which sets out guidelines, the most important of which is to ensure that neighbours are on side. Many people are terrified of bees, some are truly allergic to beestings, but most are cooperative, especially with jar of honey passed over the back fence now and again.

Then how do you get started? It is very easy to get bees and they make good pets; you don't have to put them in an expensive kennel when you go away, they don't make a noise and if well sited, rarely bother visitors or neighbours. But- a lot of learning is required to become a confident, competent beekeeper. The best way to start is to join a beekeeping club or to align yourself with a friendly beekeeper, (all beekeepers are friendly!) One of the functions of the Amateur Beekeeping Association of NSW is teaching and encouraging beginners and there are eight branches in the state. Of course, you must obtain and devour a good book on beekeeping, and there are plenty available from beekeeper suppliers, but guided hands-on practical experience is essential to become competent. Some branches, including the Hunter Valley Branch, run structured courses for beginners at modest cost, and the CB Alexander Agricultural College at Tocal also mounts such courses.

You must remember the first rule of beekeeping: if you play with bees you will get stung! While appropriate equipment, proper training and well bred bees minimise stings and their effects, it is a price you must accept and if you are allergic to stings, don't do it.

There are three ways to get bees. The easiest is to buy an established hive from a beekeeper. Joining a beekeeper's club often provides an opportunity to purchase a "nucleus" colony, a young recently hived swarm not yet productive. This is a good way to start, because you can follow the growth of the colony as you grow in knowledge and confidence. You have to be lucky, and have some experience to acquire bees by the third method. In springtime bees swarm. A colony divides with half the bees flying out to find a new home. They rest a while as a big bunch hanging off a fence or tree branch and with a little experience, an available hive box and luck they can be collected. Unfortunately, you don't know what you are getting by this method; they may be carrying disease and may be of an aggressive strain.

## About Bees 4: Bees in your Backyard

Having acquired your first beehive, you must register as a beekeeper with the Department of Primary Industries, PO Box 108 Gloucester, NSW 2422, phone (02) 6558 1707. Then consider the need for insurance should you be sued because your bees attacked someone, and the best way to cover yourself is to join the Amateur Beekeepers' Association of NSW Inc where your membership subscription provides \$20 million public liability and product insurance.

Then, preferably with the help of an experienced beekeeper, choose an appropriate site for your bees. First consider the neighbours and ensure that the bees' preferred flight path is not over their clothes line, children's play area or swimming pool. Apart from the danger of beestings, bees defaecate outside the hive on the wing and the resultant "brown rain" leaves sticky little spots on cars or washing! High fences that force the bees to fly up immediately they leave the hive will help avoid trouble.

You must also consider temperature and the sun. It is usual to face the hive to the morning sun. In winter full sun all day is desirable, but in summer some shade is necessary to avoid overheating. A deciduous tree is useful, but there are not many of them in backyards, so think of using shade cloth. One of the worst things you can do to a beehive is to bump it with a lawn mower; even the most placid bees will come out like spitfires, so do not put your bees on your lawn.

Why not put your bees up high, on a stand? Good for the bees, but you have to be able to get to them freely to manipulate the hive, and remember that a box of honey is very heavy.

Remember that many people are scared stiff of bees, some (not many) with good reason, so try to put them out of site of passersby and visitors. It is an absolute rule of the regulatory body, the Department of Primary Industries that you have to get rid of your bees if there are substantiated complaints about them; no argument or appeal, they have to go.

In the suburbs you rarely have to worry about the availability of flora for the bees; there is usually plenty about. But you do have to learn so much about preparing them for the different seasons.

Harvesting your honey? Best to rely on your amateur association or that friendly beekeeper.

## About Bees 5: The Hive and Hive Tools

With a glance at an apiary you will notice hives of different height, a different number of decks. But you will also note that they are of standard size and make.

What you can't see is that inside the boxes are hanging wooden frames in which the bees build straight sheets of comb in an orderly manner. It is compulsory to house bees in such hives so they can be inspected and manipulated freely, and honey can be harvested without damaging the colony. Measurements and spaces within the hive have been standard since 1852 when a clergyman in Philadelphia named Langstroth published his studies on the spaces required by bees to work, and designed the hive with removable frames. This for the beekeeper's convenience; as one professional remarked, the bees themselves are "happy in a hollow log!"

The number of upward decks depends upon the strength and productivity of the colony. The lowest deck is a dedicated brood box where the queen lays her eggs and bees develop. The upper decks are for honey only, some for the bees (it is their food) and some for the beekeeper. This is achieved by placing a queen excluder, a grid with spaces too narrow for the larger queen to get through, above the brood box so only worker bees can get into the upper decks, called "supers".

In spring and summer, when there is a honey flow and the bees are busy, the beekeeper will add more decks, but as winter approaches he will remove some upper ones to make it easier for the bees to keep warm. The inside of the hive must be kept at about 35 C degrees for brood to survive.

In addition to properly made hives, the beekeeper needs some basic tools.

First a veil; even the most intrepid beekeeper uses one because nobody likes to get stung on the face. It hurts and you can't see to get the sting out. Though one is suitably impressed by experienced beekeepers who use little else for protection, the beginner is well advised to use the maximum protective gear he can afford lest he become demoralised or disillusioned by getting a wallop by bees that are crankier than they should be.

Then you must have a smoker. How smoke works is a story for another occasion, but it does work and if you have tried to open a hive without it I guarantee you will not do it again!



A hive tool for removing frames completes the essentials to open a hive, but much more is needed to harvest honey. This is where your alignment with a friendly beekeeper or your membership of a club is invaluable.

## About Bees 6: Diseases We Have

Beekeeping would be much easier if we did not have to contend with so many diseases and pests though, compared with other countries, Australia is fortunate for there are two major ones which have not yet reached our shores. But we do have bacterial, viral, protozoal and fungal diseases and insect pests.

Perhaps the most serious is American Foul Brood, an endemic bacterial infection of brood capable of killing the colony. Highly contagious, it is due to a spore bearing bacterium resistant to antibiotics and even heat. Once recognised it must be notified to the Department of Primary Industries, the bees must be destroyed and the hive burned or irradiated. It is one of the main reasons registration of bees is compulsory.

Less catastrophic and more amenable to treatment is another bacterial infection of developing bees called European Foul Brood, while ever-present fungal diseases which afflict weaker colonies provide nuisance value.

Nosema is a serious disease of adult bees which causes diarrhoea, malnutrition, weakness and eventually premature death. It is a suspect as a cause of one of the diseases we have not yet recognised as such in Australia, Colony Collapse Disorder.

Wax moth is a pest which strong colonies can cope with, but can menace weaker ones. The adult moth lays her eggs on the combs and the larvae feed on them weaving a web and creating a mess. They destroy the beekeeper's stored combs unless measures are taken to kill the eggs before storage and prevent access to moths.

A newcomer to Australia, but a formidable enemy is the Small Hive Beetle. It came to us from South Africa, possibly on fruit, its alternative food supply. The little black adult beetle flies long distances and homes in on beehives where it lays myriads of eggs. The hatching larvae feed on honey, pollen and bee brood, cause honey to ferment and creating a slimy mess. A weak colony will succumb. Though the beetle is vulnerable to insecticides, management is a major problem because bees are also vulnerable, and honey must not contain residual chemicals.

The aspiring beekeeper has to learn to prevent (where possible), recognise and manage these diseases and pests; just one of the reasons for joining a beekeeping association as a source of learning and support.

## **About Bees 7: Diseases we do not have, and don't want!**

There are two serious problems facing the world beekeeping industry which have not (yet) been recognised in Australia.

The first is a parasitic mite called *Varroa destructor* and its brother *Varroa jacobsoni*. The little mites suck the life blood out of adult bees and so weaken them that they die prematurely with inevitably weakening the colony and eventually destroying it. It is established in America and Europe and recently New Zealand where it is gradually spreading from north to south. Australia is the last remaining continent free of it.

It is amenable to treatment, but it is costly, time consuming and adds another burden and expense to the beekeeper.

It wipes out feral colonies and, of course, their contribution to pollination. Strangely, it was noted in New Zealand that after its arrival, surviving managed colonies were more productive, presumably to reduced competition.

In Australia there is a surveillance system at all ports of entry aimed at detecting its arrival. Amateur beekeepers play key roles in this programme.

The second is a mysterious condition called Colony Collapse Disorder. It is established in Europe and has caused great concern in America. It is a disappearing phenomenon; adult bees on forage just do not return to the hive. Within the hive there is a queen, brood and young bees but no older adults and there is no clue as to their disappearance.

Many causes have been investigated, from the way-out notion of microwaves from mobile phones to the more realistic possibilities of pesticides, parasites and nutritional deficiencies, but so far there is no explanation. It appears to be a syndrome rather than a specific disease. "Multifactorial" causes are invoked, a clear indication that the cause is as yet unknown. At least one respected Australian researcher believes that it is an extreme of a spectrum of conditions which have been with us for a long time and prefers to speak of "colony collapse events".

We may consider ourselves lucky in Australia that we do not have these disasters to contend with, but many believe that it is just a matter of time before they arrive.

## About Bees 8: Beestings

A bee's front end is sweet and kind

But never trust a bee's behind

A bee will sting if it can sit

So always stay in front of it.

From a very old Readers' Digest

The first rule of beekeeping is "if you play with bees, you will get stung". The second is "if you can't take it, or if you are allergic to beestings, don't do it."

Bee venom is a powerful toxin which produces a reaction, the severity and duration varying according to one's sensitivity to it. It hurts, the affected area swells and becomes itchy. If your immune system is healthy, the pain and reaction diminishes with successive stings, but don't let any seasoned beekeeper tell you it doesn't hurt! It does, but the important things are not minding that it hurts and knowing how to minimise the hurt.

The bee sting is barbed and the bee can't pull it out of the skin, so she pulls her bottom off leaving the muscular poison sac pumping venom. It is essential to flick that sting out promptly to decrease the dose, the pain and the reaction. Do not pinch it out; that only squeezes more venom; flick it out with a finger nail. I had a convincing demonstration of how important this is when showing beginners through a hive. When stung on the hand, I showed them the whole process, leaving the sting in to do so. Immediately afterwards I was stung again and flicked the sting out promptly. The second one hurt for a few minutes and did not swell, but the first hurt for an hour or so and swelled for several hours.

If you are allergic to beestings, the opposite occurs; each sting produces a more severe reaction. Stung on the hand, you may swell in the face, or worse, in the respiratory tract with breathing difficulty. The most serious response, called anaphylaxis, demands an immediate life saving injection of adrenaline. People with such an allergy must avoid stings and should consider de-sensitisation by an immunologist.

## About Bees 9: Honey and how they make it.

“My son, eat thou honey, because it is good, and the honeycomb, which is sweet to thy taste.”

Proverbs 24:13

The bees in your garden are foraging for one of three things, nectar, pollen or water.

Nectar from flowers is the sugar sucrose and from this the bees make honey by splitting it into its two components, glucose and fructose. They use some of the glucose for energy, leaving a lot of very sweet fructose. Back in the hive, excess water is removed producing a hypertonic liquid which does not ferment and lasts indefinitely allowing the bees to store it for future use, like through winter. Fortunately for us, a strong colony makes far more than they need, enabling the beekeeper to harvest it and us to enjoy it.

Honey is a good food. It has a low glycaemic index which provides longer satiety than ordinary sugar. It is a good source of antioxidants which hopefully means that it might help delay old age and prevent cancer. It doesn't rot our teeth and is an effective cough medication for children, far better than standard cough syrups. It will keep indefinitely in the cupboard and though it may go candied, turning more solid, this is merely a temperature related physical change with crystallisation of the sugar content. It can be reversed by gently warming it, but avoid overheating it as this spoils the taste.

Honey is more than a food, it is a good antiseptic and its medical use on open sores and ulcers is increasing. Much research is directed to finding the active ingredient and once identified it could prove as great a discovery as penicillin.

Honey is the bees' carbohydrate food, but just like us bees need a balanced diet with protein, fat, minerals and vitamins in addition. Pollen is the source of these, and if you watch bees entering a hive you will see little dollops of coloured pollen on the back legs of some of them. The beekeeper likes to see different coloured pollens, because no single pollen source supplies all the essential amino acid for a complete diet; a variety is needed.

## About Bees 10: My Story

Brought up on a farm at Boambee, on the north coast just south of Coffs Harbour, something sparked an interest in bees at the age of 12 or 13. Farmers on each side had bees and they were most helpful, one giving me a hive box and a homemade hive tool and the other the first swarm out of his hives in spring. And so I had my first beehive! Well may you ask why a boy would spontaneously develop such a passion when neither parent was interested, and I can only answer in words from "South Pacific":

"Who can explain it? Who can tell you why?  
"Fools give their reasons, wise men never try."

My second swarm came shortly after, in very different circumstances. I used to ride a horse to school, and on the way I saw a swarm of bees hanging accessibly on a tree. I was late for school that day! This swarm, however, was very aggressive and I didn't like them much! Being inexperienced and with limited protective gear, I was timid and found the brood box rather daunting. (Now it's the most fun place to explore; it is the engine room of the colony.)

The nearest supplier of beekeeping equipment was Penders in Elgin Street Maitland where they had a factory making all their own hives and tools on site. Penders are still in business, but hives are imported from New Zealand and mechanical equipment from Italy! Prices were stable then and relatively cheap. I used to save up my pennies, order from their catalogue, pay by postal note for delivery by train to Coff's Harbour. At 16 years of age I went off to Sydney University and of course the bees had to go. Some 15 years later, when living in Newcastle a swarm lobbed in my front garden, and of course, I had to have them, but I had to get some gear. Penders was a wonderful firm, for when I rang I was delighted to find that I was still on their record books and my credit was good! And that was long before computerised records!

I've had bees in a suburban backyard ever since, but it is only since retirement 14 years ago that I have been able to exploit the hobby to the full, gain confidence and reap maximum enjoyment from it. That was made possible by joining the Hunter Valley Branch of the Amateur Beekeeping Association of NSW, and I would strongly urge any budding beekeeper to start by joining such an association. There is a lot to learn, support is needed to gain confidence and there is no better source of hands-on education than from other the friendly experienced beekeepers.