THE HONEY BEE (APIS MELLIFERA):

COST BENEFIT RATIO OF THE HONEY BEE

A report in partial fulfillment of the requirements of the 2003 Kelloggs Leadership Course, Lincoln University

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ON SUCCESS

So be sure when you step.
Step with care and great tact
And remember that Life's
A Great Balancing Act.
And will you succeed?
Yes! You will, indeed!
(98 and ¾ percent guaranteed)
KID, YOU'LL MOVE MOUNTAINS!

--Oh, the Places You'll Go
By Dr Seuss

1 INTRODUCTION

I have a personal interest in the Honey Bee which has lead me to writing this paper for my Kellogg's Leadership course. To enhance my own understanding the honeybee and my anaphylactic reaction to the sting of the bee that has sent me to hospital on several occasions and to pass on to other people the facts about the Honey Bee.

We need to understand that it is not the bee that is at fault, we have an immune system that doesn't function in the way other people's immune system's do. And with this understanding realise why the bee has a far bigger benefit to the community and country rather than the down side it causes to people who have similar problems to mine. Human beings can be desensitised or a change of life style can help with their problem.

A Cost-Benefit ratio explanation can be applied to everything in this world and the Honey Bee is no exception. The cost comes in many forms, from health costs for people, to costs associated with running an aviary, to benefits which are derived from the bee, in the way of many products from health to honey.

This paper will give you an overall description of the bee, its origin, anatomy, life cycle and its benefit to man.

2 BEE STING HISTORY

My first known reaction that I had to a bee sting was in December 1974 when cutting hay, the knife board on the mower blocked and I got off the tractor to clean it and got stung by a bee while cleaning the blockage. This was the first bee sting that I can recall.

Although this paper is about bees and my reaction to them I am or was allergic to Yellow Jacket wasps. In the same time as I was allergic to bees I also had two wasp stings which required treatment.

Over a period of time as I had further bee stings the reaction grew worse which according to my specialist Dr Stanley Summerfield happens to some but not to others. The reason for this is so unpredictable as the nature of any reaction depends on two main factors: how allergic you are and the dose of allergen you are exposed to. While a person's level of allergy may vary in either direction over time, the dose of allergen is an even bigger variable. You are not always allergic to something from birth but it develops over a period of time. If you are allergic to something at birth you often grow out of it (pers comm, Dr Stanley Summerfield).

I had a series of skin tests done to determine what allergic I had too and found out that I was allergic to Bees and Yellow Jacket Wasps. The process to find out what you are allergic to involves putting substances on your skin substances containing venoms, pollens and mites and then they prick each site on your skin to see which one you react to.

One of the things that the specialist asked, who in your family was allergic to bee stings and it came about that my father had 2 brothers and a sister and one from each of those families is allergic to bees also. Apparently it sometimes misses one generation of the family but is passed down to the next generation, as my Grandfather was allergic too. None of my children at the moment has an allergy to bee stings - I hope they don't get it either.

The precautions that I took were to wear overalls and boots on the farm and not shorts or sandals. But I never thought of giving up farming as there are people from the city who are allergic to bees also, and some of them have died from this allergy, so it seem if I took precautions I would have as much chance as the next person in living. Most of my stings, after taking these precautions, have been around the neck area.

What happened to me when I was stung was that I had an anaphylactic reaction, which did occur within seconds. The symptoms of anaphylactic reaction, which include losing consciousness, difficulty breathing, confusion, falling blood pressure and vomiting, of which I had all of them except vomiting, could have lead to my death from circulatory and respiratory collapse.

When I had a sting I would lose consciousness but would be aware of what was happening around me but unable to influence anything due to not being able to talk or move as it seemed that I was paralysed. Because it happens very quickly I was not able to inject the adrenaline that I carried around with me and relied on others to give it to me and that was always my wife, Judi.

I found that it is one of the best drugs that you could receive in the way it stops or slows the reaction and also one of the most awful drugs too, in the way it gives you the most horrid shivers, you feel very cold and when it reaches your blood stream your heart feels if it is going to jump right out of you as the heart races and then when it reached your head it felt like your head would split open and then the head aches, but it has saved my life so one should not complain.

In 1974 I tried going through a desensitisation process for my allergy, however this did not succeed and I tried again in 1992. The doctors at Middlemore Hospital said after my sting and subsequent hospital admission on the 10 September 1992, that if I did not get desensitised you might not be here the next time you have a sting. I went through a desensitisation process again for bees and wasps with this treatment being successful.

The desensitisation process went like this. I started off with 1/1000 of a sting, and then weekly with 1/500, 1/250, 1/100, 1/25, 1/50, 1/75 respectively working towards 2 full strength sting over the next four weeks. In all it took me over 3 months of visits to get through this process as there were set backs as I was still having periodic reactions to the treatment. This slowed my treatment as I then had to take only a quarter of a sting until my reactions to the treatment had passed.

At the same as I did the bee desensitisation the wasp desensitisation was done also. The bee desensitisation first if no reaction occurred then I was desensitised for wasps. After I was able to achieve the equivalent of two stings every four weeks, I then when back for bee and wasp sting injection every 4 weeks for 9 and a ½ years. In 1996 something when wrong and I had an anaphylactic reaction to an injection, from either the bee or wasp venom and ended up in hospital for eleven days. I was flown by helicopter from Taukau to Middlemore Hospital and that is the last time I have been to hospital for a reaction. Since I have had numerous bee and wasp stings and not been affected by them while on treatment.

On 6 April 1981 was my first time to be admitted to hospital for a bee sting and then again on the

- 31 October1982

- 30 December 1983
- 5 March 1984 (wasp sting)
- 12 February1985
- 25 January 1986
- 19 March 1987
- 30 November 1987
- 19 February 1989
- 5 February1991
- 4 December 1991 (wasp sting)
- 10 September 1992 (with this sting I was flown from home to hospital in the helicopter and my stay was ten days with a stay in ICU for a night).

In 2002 a study was undertaken in America on people who had stopped having injections for desensitisation of their allergies and they found 99 percent were not getting reactions from their allergies if they had stayed on the course of injections for at least 5 years but under 5 years the percentage dropped (pers comm, Dr Stanley Summerfield. I got advice from my specialist and with his advice I stopped the process in May 2002 after ten years of injections. I have not had a bee or wasp sting since stopping the treatment.

3 THE ORIGIN OF THE HONEY BEE (APIS MELLIFERA)

The bee is essentially a wasp, which abandoned predations in favour of provisioning nests with nectar and pollen where as most of the aculeate (stinging) wasps, which are related to bees, prey on other insects for larval food (Winston, 1991).

While bees have diverged from wasps in many characteristics (Michener, 1974), the most distinctive morphological differences involve specialisations for pollen collection. All bees have at least a few plumose hairs and broadened hind legs, both adaptations for gathering pollen and transporting it back to the nest. Because of their distinctive pollen-collecting structures and habits, bees are classified in there own super family. Apoidea-order: Hymenoptera – (Culliney, 1983).

There are currently 10 or 11 families of bees (Michener, 1974 & Greenberg, 1980 cited in Winstone 1991) with approximately 700 genera (Malyshev, 1968 cited in Winstone 1991 and 20,000 living species (Michener, 1969 cited in Winstone 1991). These can be divided up into two major groups, a more primitive short-tongued bee and a more advanced long-tongued bee. Short-tongued bees probably utilised the shallow flowers characteristics of the earliest angiosperms, where some bee's evolved longer mouthparts as many of the angiosperms develop longer, tubular flowers. With the increasing complexity of advanced angiosperm flowers these adoptions allowed the long-tongued bees to take advantage of these flowers.

Apis Mellifera (the Honey bee) was one of these long-tongued bee species. Its scientific name means “honey-bearing or honey-producing bee” and refers to bees habit of collecting nectar and producing from it copious amounts of honey to allow colonies to survive periods of food scarcity.

Honey Bees have been classified in the family Apidea, and along with their close relations, the orchid bee (Euglossini), the bumble bee (Bombini) and the sting-less bee (Meliponinae), (Winston and Michener, 1977, Kinsey, 1984). All of the Apidae are characterised by the presence of a pollen basket on the outer surface of each hind leg.

The natural habitat of the Honey Bee (Apis Mellifera) is from the tip of Southern Africa to Northern Europe and Southern Scandinavia. With such a variety of habitats, floras and climate conditions, there are numerous subspecies of honey bee, with characteristics adapted for each region. Apis Cerana is the Western most subspecies and that is in India (Winstone 1991).

The Honey Bee (Apis Mellifera) has three members of its family, the Queen who is 18 – 20 mm long, the male Drone which is 15 – 17 mm long and the sterile female Worker which is 10 – 15 mm long. The Drone is more robust with the largest compound eyes. The Queens elongate with the smallest eyes and larger abdomen. The worker is the smallest mostly reddish brown and black with paler usually orange-yellow rings around its abdomen. The head, antennae and legs are almost black with short pale erect hair, being densest on the thorax, with the least on the abdomen. The wings are translucent. The third basket is on the hind tibia (Winstone 1991).

4 THE HONEY BEE ANATOMY

4.1 OVERVIEW

The anatomy of a Honey Bee is a combination of parts integrated into finely tuned organisms that allows the Honey Bee to perform a broad range of athletic, graceful and purposeful tasks (Winstone 1991).

Hardened plates connected by membranes and covered in most region by a dense pile of hair is the make up of a Honey Bee. For protection against predators the Honey Bee has an external skeleton, which also prevents loss of water and serves as a framework for internal muscle attachments. Figure one below illustrates the exoskeleton and internal parts are arrange in three regions, the head, thorax and abdomen, each of which has a number of segments Winstone 1991).

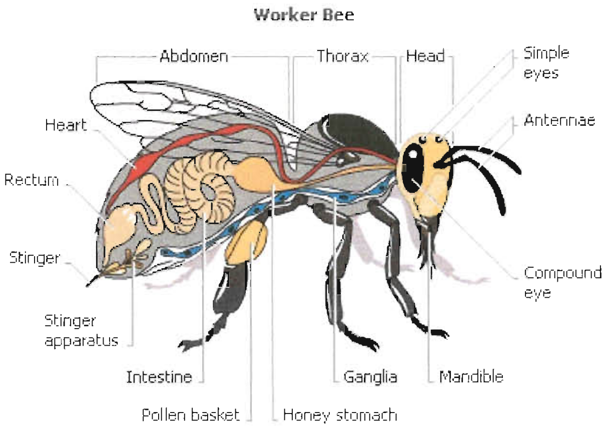

Figure One: Anatomy of the Honey Bee

4.2 THE HEAD

The Honey Bee can be a frightening sight if viewed under a microscope, especially the head as the large eyes and jaws seem particularly menacing. The head in fact is a highly specialised and relatively harmless region of the bee, capable of sensitive perceptions of the environment and manipulation and ingestion of the two major constituents of bee food, nectar and pollen (Seeley 1995). Figure two below shows the head under a microscope.

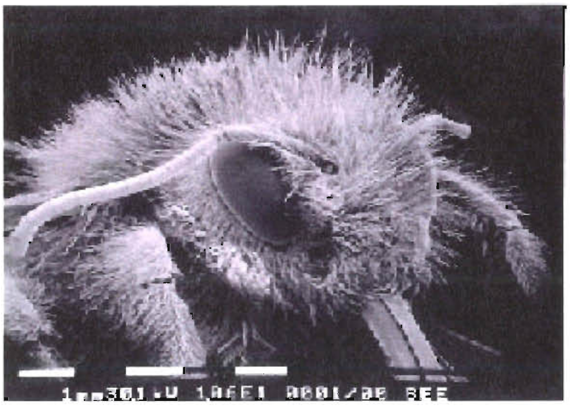

Figure Two: Bee Head under microscope

4.3 SENSORY STRUCTURES

The Honey Bees visual perception occurs through two different types of eyes, the ocelli and compound eyes both found on the facial region of the head. The ocelli are actually three eyes arranged in a triangular pattern and the two compound eyes take up a substantial part of the head and are complex visual organs capable of a wide range of photoreceptive functions. Each compound eye is made of about 6900 hexagonal facets, each containing its own lens to receive light (Seeley 1995).

The antennae are the noses of the bee. Experiments showed that the olfactory acuity of bees is approximately equal to man, although workers are 10 to 100 times more sensitive to wax, flower and other odours biologically significant to bees and in addition to there acute olfactory sensitivity, bees also have a "topochemical olfactory sense". Bees can detect accurately the direction of odour (Seeley 1995).

4.4 THE MOUTH

Mouth parts of Honey Bee's are classified as the chewing and lapping type, meaning that they can lap up liquids and they can manipulate solid material. They consist of a pair of mandibles or jaws attached on the sides of the head and the tongue (Seeley 1995).

The mandibles are spoon-shaped jaws which are concave and ridged on the inner side. They have numerous functions in the workers, from ingesting pollen for food, cutting, shaping and manipulating wax and propolis (plant risens) for nest construction, feeding brood food to larvae and nectar to the Queen, to dragging dead bees and debris out of the nest, fighting and grooming (Seeley 1995).

The proboscis is a complicated structure with its major function the ingestion of liquid materials, primarily nectar, honey and water. It also functions in food exchange between workers as well as between workers and the queen, and the workers and drones.

4.5 THE THORAX

The bee's middle section is called the thorax, which has the legs and the two pairs of wings attached to it. The six legs of the bee are attached to this section and the legs perform a variety of functions including pollen collecting and grooming and the wings are used for flight. Much of the shape and construction of the central thoracic parts can best be understood as adaptations of muscles, which control movement (Seeley 1995).

4.6 THE ABDOMEN

The abdomen segment is at the rear of the bee, which is associated with the worker sting of the reproductive organs of the queen and the drone.

The worker sting is a highly modified ovipositor, which has evolved for its defensive functions. The Honey Bee worker loses its sting after use, resulting in the death of the bee. By losing its sting the victim is injected with addition of venom (Seeley 1995).

5 THE FUNCTION OF THE WORKER, DRONE AND THE QUEEN BEE

5.1 THE WORKER

The primary role of the worker is in servicing the needs of the hive. The roles that the bee performs in order are, cell cleaning, Queen tending and then receiving nectar, handling and packing pollen, building comb and cleaning debris from the nest, then followed by ventilating, guard duty and finally trips for food (Winstone 1991) Below is an illustration of the worker bee .

Figure Three: Worker bee

5.2 THE DRONE

Drones are designed for one significant function, mating. Since the drone performs no work for the colony and is fed by the workers, the drone's work related structures are reduced or absent (Winstone 1991). Below is an illustration of the drone.

Figure Four: The Drone

5.3 THE QUEEN

The Queens primary role is egg laying. She also has a sting, which she uses in battles against rival Queens and the sting can be withdrawn after they have stung their victims. Thus the queen generally does not die after stinging.

The queen's ovaries are enormous because of her egg-producing function. Each of her two ovaries consists of 150 – 180 egg producing ovarioles. The ovarioles can produce an unlimited number of eggs (Winstone 1991). Below is an illustration of the queen bee.

Figure Five: Queen bee

5.4 THE LIFE CYCLE

Development of all three castes involves a transition through four major stages: egg, larva, pupa and adult. The Queen lays eggs in worker or drone cells. Fertilised eggs can develop into either workers or queens; where as unfertilised eggs usually develop into drones.

The whole cycle from egg to adult usually takes 16 days for the Queen, 21 days for the worker and 24 days for the drone. From egg to larval stage usually takes 72 hours. Developing bees undergo six molts. Five of these stages take place during the larval stage and the last occurs when the bee emerges as an adult (Seeley 1995). The lifecycle from egg to adult is illustrated below.

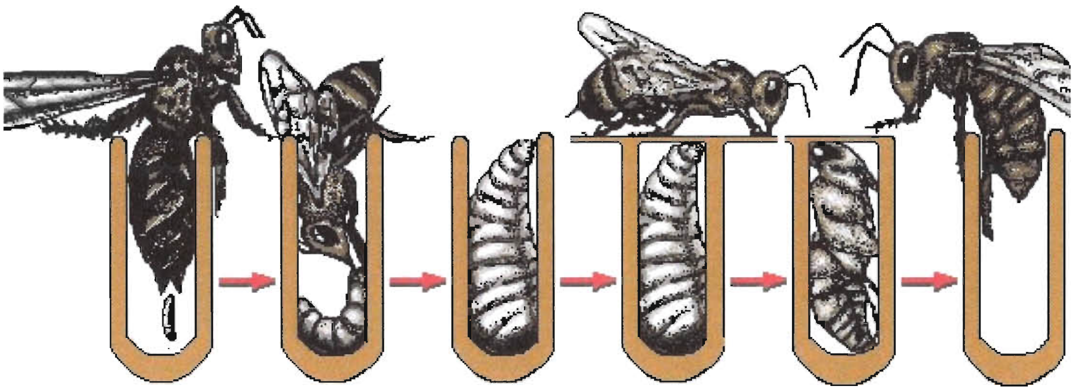

Figure Six: Lifecycle of the honey bee from egg to adult

After emerging, the bee completes its development during the next 8 – 10 days. The emerged bee will harden over the next 12 – 24 hours. Over the next few days internal development is completed, particularly glandular development and growth of fat bodies. They begin consuming pollen with in the first few hours after emergence and reach their maximum consumption level at about 5 days.

6 THE HIVE

6.1 THE NATURAL HIVE

The hive or nest come in many different shapes and sizes in nature. The nest in a natural setting is usually constructed in a cavity with a small easily defended entrance. Inside, the bees construct wax combs with hexagonal cells in which they rear brood and store nectar, honey and pollen. The bees have designed the hive so they can perform various functions like, patrolling the comb surface, performing or following the dances of foraging bees, passing food to each other, fanning to cool the nest and evaporate water from nectar and clustering for warmth among other functions (Seeley, 1995). Figure seven below shows a hive located in a tree.

Figure Seven: Natural Hive

6.2 CHOOSING A NEST SITE

The selection process can take a few hours or up to a week, although generally it takes 1 – 2 days. In some cases scouts may begin looking for nests as early as 3 days before the swarm leaves the old nest but generally they start looking once the swarm have settled. The scouts then leave the swarm cluster and begin to search for appropriate nests.

When the scout has found a cavity, she will spend considerable time examining it as well as doing an examination of the surrounding area by crawling around the outer area and inside the cavity. The scout will also do sporadic returns to the site during the day to evaluate the site under different conditions. When she finds a reasonable site, she returns to the swarm and performs dances, similar to those used by returning foragers, to communicate the location of the new site. The scouts that have gone out to find new sites will all come back to the nest and dance. The workers on the face of the swarm can "read" the location and quality of the nest sites by tempo, angle and duration of the scouts dance, and are recruited by these dancers to investigate the new sites. As the sites are decreased they begin to dance with greater enthusiasm for the better sites. The swarm will reach a consensus when most of the scouts are dancing to the same location. At that point scout bees perform a buzzing run, which causes the swarm to break up and take to the air. The workers then move with the Queen to the new nest site (Seeley, 1995).

6.3 NEST SITE CHARACTERISTICS

Factors for the new nest site are the distance between its nest and the parents nest. The foraging range is important to reduce competition for nectar and pollen from other nests. An important characteristic of nest sites is cavity volume. In a temperate climate a swarm must avoid cavities, which are too small, these would not have sufficient room to store the honey needed to survive winters and would be difficult to cool in the summer. Conversely, colonies might experience difficulty maintaining temperatures in large cavities during winters and oversize nest sites may also be difficult to defend. The average nest has a volume of about 40 litres (Seeley, 1995).

6.4 MAN MADE NEST

The first man made hives were a mixture of small wooden, ceramic or woven containers. Since the comb was fixed to the top and sides of these hives, management was limited and honey could be extracted only by excising the comb (Winstone 1991).

The Reverend L.L. Langstorth of Philadelphia in 1851 designed a hive with moveable frames. Its design is basically a box that holds frames, which keep the comb spaced at intervals of 9.53 mm, this is the distance that the feral bees keep there combs naturally apart. With widths of the frames that far apart the bees will construct combs with out brace and bridge wax between frames (Winstone 1991)..

Beekeepers can remove the frames for examination manipulation and honey extraction and then replace them in the hive. Additional boxes with frames can be stacked on top of full boxes, allowing colonies to grow larger sizes necessary for surplus honey production.

These hives can be moved easily without braking combs, allowing colonies to be transported to where there is a food source. i.e. to pollinate a crop (kiwifruit).

Also developed about the same time as the frame was a comb foundation and the radical honey extractor. The comb foundation is thin sheets of pure beeswax embossed on both sides with proper sized hexagonal cells that the bee makes. These sheets are wired into the frames. When these combs are full they hold between 3 - 5 kgs (Winstone 1991). Figure Eight below shows an example of a honey comb with worker bees

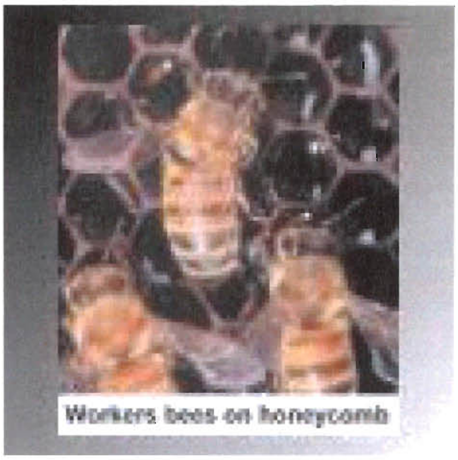

Figure Eight: Honey Comb with worker bees

To remove the honey the wax capping produced by the bee to protect the honey is sliced off by a hot knife over the comb surface and then the frames are placed in the extractor, this spins forcing the honey out of the cells to the extractor walls, finally dropping to the bottom to be processed and bottled. The empty combs can be reused or stored. The wax capping is the source of commercial beeswax and is also producing more foundation (pers comm Warwick Cheyne).

6.5 THE COLLECTION OF FOOD

Nectar and pollen mean food to bees. All the nutritional requirements of the brood and adults are met by these two plant produced substances. There are a staggering number of behaviours at the individual and colony level, which must be co-ordinated for efficient nectar and pollen collection. Winstone (1991) identified a number of individual behaviours including:

- the age at which foraging commences
- flowers visited
- substances collected
- method for working the flower.

At the colony level, forging can be influenced by the proportion of scouts to recruits, information transfer within the nest, allocation of foragers to nectar and pollen collection and the time at which workers change from a poor to a better resource.

6.6 WHERE WORKERS GO

Plants invest energy in nectar production to attract bees to transfer pollen from one plant to another and the bees use the pollen for food. However, in the process of collecting nectar and pollen, sufficient pollen grains are transferred between flowers to effect pollination. The bees choose which pollens to collect not by their nutritive value, age, moisture content, or colour, but on the basis of the odour and physical configuration of the pollen grains (Winstone 1991).

The workers must determine where to search and how far to forage. In areas with a good food supply, the radius of honeybee colonies is only a few hundred metres, with most foraging done in a radius of six kilometres of the colony (Seeley 1995).

6.7 THE ORGANISATION OF FORAGING TRIPS

One of the most important choices for a forager is what to collect and this is partly determined by the availability of flowers in the field. Workers tend to specialise on one type of foraging task at a time whether it is nectar or pollen collection. The foragers will have gained considerable information about the location and nature of the resource from following dances. There can be considerable flexibility in the number of flowers they visit. Both pollen and nectar collectors need anywhere from 1 to 500 flowers to gather a full load, depending on the extent of nectar or pollen production. They usually make between 10 and 15 trips a day for pollen and nectar, although it has been known for nectar foragers to make 150 trips a day (Winstone 1991).

Nectar collection may be energetically more efficient than pollen collection. The energy returns for pollen show approximately an 8:1 ratio on flight energy expended per calorie of pollen collected, but a 10:1 ratio for nectar collection. However workers will travel further for a pollen load than for nectar, possibly because a full load of pollen is lighter in weight and takes less time per flower than a nectar load. Workers returning to the colony are more heavily laden with nectar (30 – 80mg) than with pollen (25 – 40 mg) to their body weight. (Seeley 1985, cited in Winston (1991)).

7 INSECT STING ALLERGY AND TREATMENT

In humans reactions to beestings take place on three levels: local, systemic and anaphylactic. In the first kind of reaction the initial localized swelling is followed by more extensive swelling a few hours later, and the affected area may be red, itchy and tender for 2-3 days but is usually short lived (pers comm, Dr Stanley Summerfield).

The first step in treating a local reaction is to decide whether the insect left its stinger in the skin. Honeybees have a barbed stinger that stays in the skin and continues to pump more venom. If a bee stings you, you should remove the stinger immediately and try not to squeeze the stinger because that releases more venom into the skin. Other insects of the hymenoptera group such as wasps, yellow jackets and hornets do not leave their stingers behind. Ice packs followed by calamine lotion may be used to relieve itching and pain and oral antihistamines can also be used to relieve itching (pers comm, Dr Stanley Summerfield.

A systemic reaction generally occurs within a few minutes of stinging and it may involve a whole body rash, wheezing, nausea, vomiting, abdominal pain and fainting. While a systemic reaction is similar to an anaphylactic reaction, an anaphylactic reaction is more serious.

Winston (1991) summarises the symptoms of an anaphylactic reactions:

- Itchiness and hives over the whole body;
- Nausea, vomiting, diarrhoea;
- Light-headedness;

- Swelling of the eyelids, lips or tongue;
- Difficulty breathing;
- Rapid heart beat;
- Loss of consciousness or seizures.

7.1 HOW TO TREAT AN ANAPHYLACTIC REACTION

For an anaphylactic reaction, take victims to the doctor immediately, as a fatal reaction is possible if appropriate treatment is not given. The appropriate medication to use is antihistamine and adrenaline (Auckland Allergy Clinic).

The adrenaline is a hormone naturally secreted by the medulla (inner portion) of the adrenal gland and was synthesized as a hormone in 1904. The adrenaline will bring about the "flight or fight" response in times of stress, exercise and response to low blood sugar and it prepares the body for strenuous activity or life-threaten situations (Auckland Allergy Clinic)..

Another treatment for these reactions is desensitisation and that involves a series of injections with the venom starting at a very small amount (1/1000) building to the equivalent of two bee stings every 4 weeks. There is research out in America now that if you have been receiving this treatment for more than 5 years you should be desensitised. The efficacy of desensitisation using pure bee or wasp venom is well established and protects against further systemic reactions in about 98% of cases. Therefore all patients with life threatening reactions to insect venom must be offered desensitisation (immunotherapy) (Auckland Allergy Clinic).

7.2 DOSAGE AND ADMINISTRATION IN ANAPHYLAXIS

The Auckland Allergy Clinic recommends the following treatment and dose for an anaphylactic reaction:

- For an adult

Adrenaline 1:1000, 0.3 to 0.5 ml (0.3-0.5mg), administered over 10 minutes. The dose may be repeated every 10 minutes if necessary. In severe reactions the dose can be increased to 1 ml over 10 minutes. It is better to put adrenaline under the skin (intramuscular) rather than in the vain (intravenously). This is due to the pressure the adrenaline puts on the heart. Adrenaline at a dose 1:1000 should never be injected intravenously.

- For children to 12 years of age

Adrenaline 1:1000, 0.01/kg (minimum 0.1ml 1:1000)

7.3 HISTAMINE

Histamine is a hormone/chemical transmitter involved in local immune responses, regulating stomach acid production and in allergic reactions as a mediator of immediate Hypersensitivity When released from mast cells, histamine causes an increase in permeability of blood vessel walls which in turn cause the familiar symptoms of allergy including a runny nose and watering eyes. When released in the lungs, histamine causes the airways to swell shut in an attempt to close the door on offending allergens and keep them out. Unfortunately, the ultimate result of this response is an occasionally deadly allergic complication which kills (Auckland Allergy Clinic).

Antihistamine is a drug that blocks the action of histamine, thus preventing or alleviating the major symptoms of an allergic response. Reaction to stings can occur at any age and reaction to stings can become acute for no apparent reason and those who are extremely sensitive may die from a single sting. Yet there is a case that has been reported of a man receiving 2243 stings and surviving. (Murray 1964. cited in Winston 1991))

8 ECONOMICS OF BEEKEEPING (APICULTURE)

8.1 REGISTERED BEEKEEPERS

There are currently 3,790 registered beekeepers owning 300,177 hives on 20,391 apiaries for the 2003-2004 season compared with the previous season of 4,080 registered beekeepers, which is a decrease of 290 beekeepers. In the 2001-2002 season there were 4,550 registered beekeepers and 470 beekeepers left the industry in that season (Ministry of Agriculture and Forestry 2003).

With the decrease in numbers of registered beekeepers the honey crop of 12,252 tonnes was the best on record for the 2002-2003 season which was a much needed turn around from the 4,682 tonnes of honey produced in the 2001-2002 season which was a record low. The 6-year average is 8,806 tonnes of honey. Of the 12,252 tonnes of honey, New Zealand consumes about 5,000 tonnes of honey/year, leaving the rest to be exported (Ministry of Agriculture and Forestry 2003).

8.2 INCOMES FROM BEES

Pollination fees have averaged around $115/hive for Kiwifruit, with prices going as high as $138/hive being reported in the Bay of Plenty. With the introduction of ZESPRI GOLD variety, the growers have found that they have had to increase there per hectare hive rate for maturing areas of that variety. There was a short fall of hives for the 2002-2003 pollination season and an estimated 2,000 hives were imported from the South Island for pollination services. For the pip fruit, stone fruit and berry fruit sectors, the cost of pollination averaged $53.00/hive (Ministry of Agriculture and Forestry 2003).

The average price of bulk honey is $4.50/kg, with the range of 30cents/kg being paid for bulk honey either side of the $4.50/kg. With a spot price of $5.00/kg being paid when there was a short fall. For Manuka honey an average of $10.00/kg was being paid and with Manuka honey being used more and more for medicinal purposes there is a trend to pay $1.00 per point for antibacterial activity as determined by an accredited laboratory and on this basis some beekeepers achieved prices up to $27.00/kg for Manuka honey (Ministry of Agriculture and Forestry 2003).

For nucleus hives for the local market, they were selling between $35.00-$50.00, which consisted of four frames with bees, a Queen bee, brood and honey. Queen bees sold on the local market for between $16-$22/ Queen bee and on the export market they sold for between $18-$30/Queen bee. Bulk bees are sold to exporters for between $18-$20/kg of live bees delivered and then are repacked in 1-1.5kg packages with a Queen bee and a food supply and then these packages are exported to Canada, Japan and Germany. There were 10,780 Queen bees and 18,028 packages of bees exported in the 2002-2003 season (Ministry of Agriculture and Forestry 2003).

Propolis and Royal Jelly are two other products that are produced by bees. Propolis is a gum or resin that is exuded by trees and shrubs and collected by bees. It is a antibiotic and is made into therapeutic products after extraction and refining and sells for $160/kg and this translates to around $90/kgof raw product. Royal Jelly is a product that commands a price around $4,000/kg after it has been processed (Ministry of Agriculture and Forestry 2003).

8.3 COSTS FOR BEEKEEPERS

The Varroa mite has caused major costs for the Beekeeper with loss of production from infected hives to monitoring and treating the mite. Treating infected varroa hives with (Apistan and Bayvarol) are significant and can reach $26-$50/hive/year or more depending on severity of reinfestation. Two organic acids have been registered for varroa control with a third undergoing the registration process now. These products are cheaper but more expensive to apply. In the North Island the major influence will continue to be the varroa mite, leading to regular monitoring in spring, mid summer and autumn and treating at least 2-3 times a year (Ministry of Agriculture and Forestry 2003).

In times of shortages a feed supplement has to be put out to feed the bee and that is usually sugar. Increased amounts of sugar were fed out in the 2002-2003 season after a short honey crop the season before and a difficult spring.

With more silage and hay being cut with conditioners in Canterbury, the beekeepers there are concerned that these machines are killing field bees. This is being noticed by the beekeepers that have hives adjacent to these fields with their hive strength being noticeably depleted when there is major silage or hay activity.

Beekeepers in Canterbury are concerned that farmers are starting to use grass conditioners when making hay and these are killing field bees with hive strength being noticeably depleted.

9 THE IMPACT OF VARROA ON THE APICULTURE INDUSTRY

The varroa mite (Varroa destructor, formerly known as Varroa jacobsoni) is an external parasite of adult and developing stages of the honeybee (Apis Mellifera). Infested colonies are weakened by a decline in the number of adult bees produced and emerging bees may be less active. Varroa may also act as a vector for a number of bee viruses (Ministry of Agriculture and Forestry, 2000). Figure nine below shows the varroa mite under a microscope

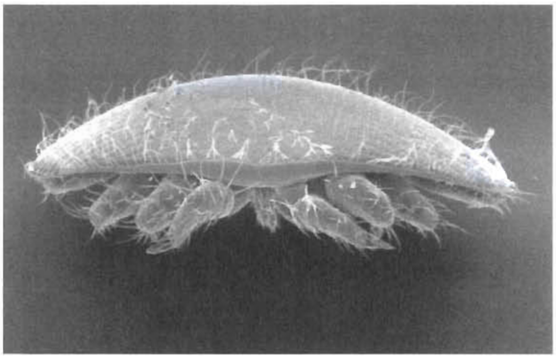

Figure Nine: Varroa Mite under a microscope

Varroa may impact upon New Zealand agriculture in two ways (Ministry of Agriculture and Forestry, 2000):

- Directly, on the beekeeping sector; and
- Indirectly, on sectors that benefit from honeybee pollination.

The crops that are most dependent on the honeybee for pollination are the major horticultural crops; pasture clovers and small seed and vegetable crops.

For some of these crops, there may be minimal crop set without adequate pollination. For others, production may take place but crop yield, size, quality and/or seed development may be adversely affected and/or the season may be delayed.

Ministry for Agriculture and Forestry (MAF) released an Economic Impact Assessment on Varroa in New Zealand (November 2000) and it found that varroa at best would cost the horticultural, pastoral and beekeeping sectors around $400 million and at worst around $900 million, in present value terms, over the next 35 years. Additional to these impacts are effects on employment in agriculture, potential secondary effects on agricultural land, property and business values and multiplier effects on related industries. The full impact of varroa will be seen in the upcoming few years. Table one below shows the likely timeframe for the full impact of the varroa mite to the New Zealand economy.

When further data on the effects of varroa in New Zealand become available, it should be possible to refine these assumptions and develop more sophisticated models.

	Varroa Established	Economic impacts commence	Full economic impacts from
Best Case			
Northland	2001	2002	2006
Auckland, Waikato and Bay of Plenty	2000	2001	2001
Lower North Island	2003	2004	2008
South Island	2004	2005	2011
Middle Case			
Northland	2001	2002	2005
Auckland, Waikato and Bay of Plenty	2000	2001	2004
Lower North Island	2003	2004	2007
South Island	2004	2005	2010
Worst Case			
Northland	2001	2002	2005
Auckland, Waikato and Bay of Plenty	2000	2001	2004
Lower North Island	2003	2004	2007
South Island	2004	2005	2009

Table One: Rate of spread of Varroa and its effect on the horticultural, arable and beekeeping sectors.

10 CONCLUSION

As I am a person who was allergic to the sting of the honeybee and have had some major reactions to there stings and ended up in hospitals on more than a few a occasions, I would not want to see the bee penalised because of my reaction but then I would not want the people who are allergic to be penalised either for the cost of treatment. You don't know when and if you will ever be allergic to something.

There are more benefits for New Zealand than costs for having bees in this country. If it were not for the bee, agriculture/horticulture sector would not be performing as efficiently and economically as it does and the country would not have the standard of living that it now enjoys.

So the philosophy of "KISS" Keep It Simple Stupid is the right way to go, and as long as we all take responsibility for ourselves, we will be all right.

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