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## BEES AND THEIR ANATOMY

By T. L. Stephens

(Following is the substance of a presidential address delivered to a meeting of the Tasmanian Field Naturalists Club by Mrs. T. L. Stephens).

BEES belong to the order Hymenoptera (insects with four membraneous wings) of the family Apidae, the group comprising bees in general. The genus *Apis* includes an assemblage of species which agree in one, though possibly a minor, feature, and the species now discussed is *Apis mellifera*, the honey bee, cultivated for honey production.

The honey bee's tools are perfectly designed for nectar gathering and honey-producing, but she also has other implements which serve with equal efficiency in the pollination of flowers. There are many other creatures which assist nature's pollination programme, moths, wasps, flies, etc., but it has been established that the honey bee is the most successful pollinator. For this service she takes the nectar, which is usually greatest in the morning, and could be 25-90 per cent water, according to conditions. Nectar does not seem necessary to a plant's growth, and may be simply a lure to fertilisation.

She also takes pollen, and in doing so transfers the fertilising dust to the waiting stigmas. The honey bee's habits make her visits very desirable. Usually confining herself to one kind of flower on each foraging trip, she so assures cross-fertilisation, which results in healthy plant stock.

Millions of bees are killed annually through careless use of sprays. Fruit-growers realise bees are invaluable, and try and spray when it is not visiting time at the blossoms, or use non-poisonous sprays. Many bees die in the field. Poisoned pollen is taken and given to brood and bees at a later date. Whole hives die out!

The bee's organs are contained in an external skeleton of chitin, a compound forming the principal part of the hard covering of insects and crustaceans, and is very durable. The body is covered with fringes of chitin bristles, mainly used for pollination. The head varies a little in different kinds of bees, and carries two compound eyes, three simple eyes, antennae, and complex organs of the mouth. The compound eye has a wide range of vision, made of hexagonal facets, each giving a separate image. The queen bee has approximately 5,000 facets in each eye, the worker 6,000, the drone 13,000. Double these figures and we can see how vast are their eyes. A simple eye moreover, is on top of the head in the form of a triangle standing on its vertex on the queen and worker, but the drone's is more to the front of the face. It has not been established what the real purpose of this simple eye is, and if it is capable of image. It may be for use in the comparative darkness of cells, or to detect changes in light intensity.

The antennae have a highly important function. They carry organs of smell, touch, and possibly hearing. It is certain they are used for communication. If the antennae are removed, the bee will lose all co-ordination! Placed close to the front of the head, the antennae are cylindrical in section, and can move at great speed in any direction. They are covered with fine hairs, and must be kept free of pollen. Joined to the head by a hemispherical joint, they are controlled by four muscles. The queen and worker have twelve joints while the drone has thirteen.

The mouth is wonderfully designed, having a jaw on each side of the labrum,

(upper lip) which move laterally or sideways, whilst the lip moves up and down. In the queen and drone the jaws are rough and notched, but not so in the worker. Below the lip is the gum flap or epipharynx, which has a white membranous covering, used when liquid is drawn up by the tongue. Then comes a second pair of jaws, hollowed out and supplied with stiff hairs. With the labial palpi they form appendages to the tongue. Attached to the jaws are the maxillary palpi, or feelers. Now comes a third pair of jaws, joined to form the under lip or labium, situated below the opening of the mouth. All this works in conjunction with the tongue, or lingua, which is controlled by two muscles called the protractor and retractor linguae. The tongue has a flattened end, and is covered by a hairy sheath. When liquid is gathered on the hairs of the tongue, the jaws and labial palpi form a tube around it, and the front of the gum flap or epipharynx is lowered to close the remaining space. The queen and drones have shorter tongues, and are not so highly developed.

The thorax includes the first three segments after the head. It is generally covered with long hairs in the worker, and short ones on drones. The queen has very few. Each pair of legs has a special purpose and are constructed accordingly. The first pair has the antennae comb which is formed by a semi-circular recess with a toothed edge. The legs are brought to the front of the head, the antennae fall into the recesses; the legs are then drawn down and outward, so cleansing any pollen etc. from the antennae.

The second pair is provided with a spur to clean the antennae comb on the first pair of legs. The queen and drones also have it, although they don't gather pollen!

The third pair are really amazing. There are nine joints including the foot. The upper joints have stiff bristles for pollen and propolis. These joints are hinged on the inside, allowing the outer edge to open. The lower edge is smooth, while the upper has teeth, used for loading pollen baskets (corbiculae) which are hollow fringed portions of the tibia. This process is done by the opposite leg. Queen and drones have no corbiculae.

The foot has five joints, with two very strong claws on the last one, allowing the bees to hang in clusters. Between the claws there is a pulvillus or pad which secretes a sticky oil so the bee may walk on extremely smooth surfaces.

The wings of the worker are shortest, and the drones the largest. Flight vibrations are in the region of 260 per second. Estimates of speed leaving a hive are 14 - 15 m. p. h. while the return speed is about a quarter of this. An angry bee can travel at possibly 20 m. p. h. There are projections on the front wings to correspond with hooks on the back wings, so forming a single wing in flight.

A bee has no lungs. Spiracles or holes in the side of the body pass air into the trachea, and through numerous extensions in the body. The spiracles can be closed at will. The abdomen is joined to the thorax by a tube called the petiole. A work's abdomen is enclosed by six visible segments, divided into two plates. Those on the back are dorsal, and those underneath ventral plates. Young workers exude wax into pockets at the ventral plates.

The honey sac is in the abdomen, having two connections, one to the mouth, by means of the oesophagus or gullet, and the other with the stomach proper, or ventriculus. Between the honey sac, and the stomach is what is known as the stomach mouth. Nectar for the hive is not allowed to pass into the stomach, and can be regurgitated as honey. To feed itself the bee allows it to pass into the ventriculus for digestion, and no regurgitation can occur.

The sting, which most of us have experienced at some time, is a complex structure, situated in the cavity formed by the infolding eighth, ninth and tenth segments of the abdomen. The sting is straight and barbed. The shaft consists of three parts. A dorsal sheath along which two barbed lancets move. The sheath enlarges into a bulb at the body end and continues into two arms curving outwards, while the lancets have a groove, and slide on ridges on the sheath. These lancets pass along a hollow tube formed by the sheath and the arms of the sheath are attached to two plates which overlap the sides of the sting; to these are joined palpi, white in colour. These palpi are covered with sensitive hairs, to test whether the object to be stung can be penetrated by the sheath and lancets.

When this happens, poison passes down the canal made by the sheath and lancets, even if the sting is torn from the bee's body, poison is still pumped into the wound, until the poison sac is empty, but the sting as a result of muscular action at the lancet's base is continuing to penetrate!

The main sac gives an acid reaction, and a second gland an alkaline one. These two mixed form the venom.

## PLANT REGENERATION ON MT. WELLINGTON

IN the "Tasmanian Naturalist" of February, 1968, is a note on the regeneration of native plants on the high moors of the Mt. Wellington range following the disastrous bushfires of February 1967. The Club's monthly field outing in March 1968 was planned to investigate progress in this direction on the eastern face of Mt. Wellington above Fern Tree.

The weather on this day brought a steady drizzle to the upper parts of the mountain, so the excursion turned its attention to the slopes, between Fern Tree and the Waterworks.

Between Fern Tree Hotel and the top of Gentle Annie track the following species were found to be flourishing :- stringy bark, kangaroo fern (*Phymatodes* sp.) musk, *Bedfordia* sp., Blue Mountain berry, clematis, silver wattle, native currant, coffee berry, kangaroo apple, willow wattle, native cherry and *Pittosporum*. The only plant in flower was a flax flower (*Wahlenbergia* sp.)

As we descended Gentle Annie track in more open country we found many plants in flower - One-day lily, purple daisy, yellow everlasting, trigger-plant (*Stylidium*), native pansy (*Goodenia* sp.), prickly box, *Lobelia* sp. Other plants not in flower included guitar plant, prickly mimosa, cranberry, veronica, blackwood, *Banksia*, tea-trees (*Leptospermum* and *Melaleuca*), *Tetratheca glandulosa*, a casuarina, *Dianella* berry, (*Eriostemon*.)

The amount of regeneration found is most heartening.

- L. E. WALL, Hobart

**ANNUAL SUBSCRIPTIONS** : The annual subscription of 40 cents, due from subscribers to "The Tasmanian Naturalist" who are not full members of the Club, is now payable. The Committee has decided that this should cover the next three issues - May, August and November - so that subscriptions may then be brought into line with normal membership subscriptions which cover a calendar year. If your subscription is outstanding the amount due will be shown in the margin.

## NATURALISTS ON MARIA ISLAND

Maria Van Diemen, wife of the Dutch colonial governor, Anthony Van Diemen, is commemorated by the name of Maria Island, about nine miles off the coast of eastern Tasmania, discovered and named by Tasman in 1642. It is a mountainous island with attractive scenery, and though at one time carrying a population of 500 or 600 people, today has practically none at all. Its history has been a tale of fluctuations. For some years a penal settlement, it witnessed fruit growing and grazing for some time after this had been abandoned, and then a cement industry started up, using the remarkable fossil cliffs at Darlington, in the north. When this industry finally faded from the scene, and people left, it reverted to sheep and cattle grazing, and as such remains more or less today. Most of it is now a wildlife sanctuary.

After many years a party from the Club visited Maria Island at Easter this year. Headquarters for the party was the old weatherboard guest house built in the days of the cement works on foundations of an earlier building dating back to the era when the island was a penal settlement. Indeed, one of the features of the area around Darlington is the many reminders of the past. Much of the original Darlington is still in existence and it is to be hoped that money will be made available to restore the remaining buildings to their original condition. The old barracks, for instance, if fitted with bunks, could be a tourist attraction, providing accommodation for visitors on a par with those to be found in South African National Parks. The remains of the old quarries attracted much attention. These proved to be remarkably extensive, and in one the remains of the underground cells could be distinguished.

Although the area is largely covered with dry sclerophyll of a similar nature to the mainland coast there are some surprising differences in the birdlife. The absence of blue wrens, eastern rosellas and brown thornbills on Maria Island was most noticeable, and for this type of open woodland very few noisy miners were seen or heard. The island is well endowed with endemic species, the elusive forty-spotted pardalote being seen and heard almost everywhere. The other endemics recorded were green rosella, swift parrot, dusky robin, brown scrub-wren, black-headed

honeyeater, strong-billed honeyeater, yellow-throated honey-eater, yellow wattle-bird and the two currawongs.

Fossils, lichens, climbing the Cock's Comb, fishing, skin diving and sketching were other attractions. Despite a misunderstanding with the boatman which gave some members an extra day, the time available was all too short and at least one member is actively canvassing for the Easter Camp next year to be held at Maria Island.

Our thanks are due to the Fauna Board for permission to hold the camp and the use of the boarding house and to Mr. Jack Thwaites, acting game warden, who helped in so many ways.

— DAVID THOMAS, Hobart

#### AN AMATEUR FIELD NAT.

ONE very nice thing about being a member of the Field Naturalists' Club is that the club contains people of all levels of knowledge, from the "Brains" who are highly educated in their chosen field, right down to the humble bod who has no technical training whatever, but has, nevertheless, a great interest in the various facets of nature, and wants to improve his knowledge and experience — or even just to have the opportunity of enjoying the "Outdoors" with a group of likeminded folk.

Lectures and field days keep his interest and whet his appetite. After lectures he can ask questions. On field days he can follow the "Brain" who has the knowledge, and who knows where to find things — and so gathers up the crumbs from the rich man's table. All the interesting snippets of knowledge begin to fall into place, and soon the amateur begins to feel really at home in the out-of-doors — he begins to recognise old friends among the wealth of natural objects in bush, rocks, or on the seashore.

The next step is a realisation that he now has a special interest in a particular section — rocks, birds, plants, sea-life or whatever it may be. Now he wants to put names to all the things which are becoming familiar to him — and with what satisfaction and what fun does he begin to roll off his tongue some of the peculiar names which were once double-dutch to him, but are now falling into place and having a real meaning!

Note the title of this article — "The Amateur Field Nat". Well, he is still an amateur, but now has an absorbing hobby which will lead him to enjoy all that nature provides and, I hope, to realize that these things are worth conserving. As a member of Field Nats he has a voice among the "Powers That Be" and can do his bit to see that there is wise action by his Government to keep our present heritage unspoiled for "Amateur Field Nats" of the future.

—(MISS) M. L. WESTBROOK, Hobart

**FAIRY PRION INSHORE :** In mid-afternoon on February 3, 1968 I was on the beach at Cremorne when my attention was directed to a grey bird which had flown south along the beach and landed in the water inside the small breakers (and near some bathers) just in front of me. I walked down the beach to get a closer view, and as it seemed content to remain there I waded in till I was about 10 yards from it. Its general colouring was soft grey above, darker about the eye, white underparts, bill stout and black, with a very prominent dertrum barely separated from the nasal tubes. It took flight again following the shoreline, and I was then able to see that the primary feathers of the wings were much darker. There was an ill-defined dark grey line at the base of each wing, and a dark-grey band across the end of the tail and covering about half of it. Length of the bird was about 10 inches. There is no doubt that this was a fairy prion, but why was it behaving in this fashion? I understand that a live fairy prion was picked up at Richmond within a few days of this incident.

— L. E. WALL, Hobart

**BLACK WATTLES RECOVER :** The number of black wattles (*Acacia mollissima*) which have recovered from the extensive bushfires about Hobart in February 1967 has been surprising. This species, and most other acacias, have very little resistance to fire though the crop of seedlings following a fire is generally heavy. During the last few months many of the black wattles which appeared to have succumbed to last year's bushfires have produced very healthy foliage from the upper branches, in much the same way as many of the eucalypts do.

— L. E. WALL, Hobart